KNOWLEDGE AND UTILIZATION OF INSECTICIDE TREATED NETS TO PREVENT MALARIA IN CAMEROON

(A CASE OF THE MOUNT FAKO REGION)

by

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DECLARATION OF ORIGINALITY

I, TERENCE BENGYELA NWANA, hereby declare that this thesis is a true discourse of my own original investigations and any other supportive information derived from published and unpublished articles have been acknowledged and cited appropriately. I therefore summit this thesis to the Graduate School of Asia Pacific Studies (GSAM), Ritsumeikan Asia Pacific University, Japan for the partial fulfillment of the requirements for the acquisition of the Degree of Master of Science in International Cooperation Policy (ICP); specialization: Public Health Management (PHM).

DEDICATION

I wish to dedicate this research thesis which represents the hard work and outcome of my entire stay in Japan and APU in particular to my father, Nwana Joseph Nwana and mother, Victorine Andin. Their unwavering love, compassion and care nurtured and gave me the sense of direction and the ability to focus in life, inasmuch as their sacrifices and confidence entrusted in me strengthened and gave me the motivation to acquire as much knowledge as I could. May the almighty God continue to guide, protect and bless them for their immersed contributions to what has become of me today.

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ACMS	Association Camerounaise pour le Marketing Social
ACT	Artemisinin Based Treatment
AIDS	Acquire Immune Deficiency Syndrome
APU	Asia Pacific University
AWARE-RE	Action for West Africa Region- Reproductive Health
CCAM	Cameroon Coalition against Malaria
CDC	Cameroon Development Corporation
DALYs	DisabilityAdjusted Life Years
DDT	Dichlorodiphenyl-trichloroethane
GDP	Gross Domestic Product
GNP	Gross National Product
HIPIC	Heavily Indebted Poor Country Initiative
HMO	Health Management Organization
HPI	Human Poverty Index
IEC	Information Education Communication

IPTp	Intermittent Preventive Treatment pregnancy
IRS	Indoor residual Spraying
ITN	Insecticide Treated Net
JJ/WBGSP	Joint Japan/World Bank Graduate Scholarship Program
KAP	Knowledge Attitude and Practice
LBW	Low Birth Weight
LLIN	Long Lasting Insecticidal Net
MDG	Millennium Development Goal
MICS	Multiple Indicator Cluster Survey
MoHE	Ministry of Higher Education
MoNE	Ministry of National Education
MoPH	Ministry of Public Health
MoTVT	Ministry of Technical and Vocational Training
MPI	Multiple Poverty Index
NETMARK	Public Private Partnership for Sustainable Malaria Prevention
NGO	Non-Governmental Organization

NMCP	National Malaria Control Program
PE	Protective Efficiency
PHC	Primary Healthcare Centre
PSI	Population Services International
QVR	Quality Value Regularity
RBM	Roll Back Malaria
SAILD	Service of Support to Local Initiatives of Development
SP	Sulfadoxine Pyrimethamine
SSA	Sub Saharan Africa
STDs	Sexually Transmissible Diseases
UAM	Unite Against Malaria
UN	United Nations
UNDP	United Nations Development Program
UNICEF	United Nations International Children Emergency Fund
USAID	United States Agency for International Development
W.H.O	World Health Organization

ABSTRACT

The purpose of this study was to assess and evaluate the Knowledge, Attitude and Practices (KAP) of households with children under 5 in rural communities of Cameroon regarding malaria. The research was aimed at providing pointer information for further studies and also to draw attention to those involved in policy making, bureaucrats, as a useful advocacy material in better strategizing and strengthening malaria eradication programs in endemic regions.

The study was focused on the Information Education Communication (IEC) package delivery by the National Malaria Control Program (NMCP); and the communities' perceived Knowledge, Attitude and Practices to the use of Insecticide Treated Nets (ITNs) were categorized and assessed in terms of QVR (quality, value, regularity) evaluation model, respectively, while the personal and environmental hygiene were observed.

Restricted to 2 main ecological zones (a highland area in the Buea district mountain vicinity and a lowland area in the Tiko district) within the Fako division, a sample of 10 communities, 5 from each zone were identified and a multistage cluster sampling technique was employed in an "on location" analysis.

Caregivers within households were targeted as primary subjects (n=140) and information was collected using a semi structured questionnaire in an interview

process. The method of cross sectional survey including descriptive and analytical statistics was employed for the analysis of the data.

The results revealed that despite some variation in the knowledge of caregivers regarding individual malaria components, their general level of knowledge of malaria was dominantly good (n=78). Possession of ITN, perception and value of ITN, levels of knowledge of malaria and the principal sources of information for this knowledge, but not the demographic variables of marital status, educational levels, family size, occupation, income and housing type of the respondents, were significantly associated to the utilization patterns of ITN (X^2=139.0, p<0.01; X^2=61.91, p<0.01; X^2=32.56, p <0.01; X^2=23.80, p<0.01; X^2=3.22, P=0.20; X^2=1.703, p=0.94; X^2=3.54, P=0.47; X^2=4.39, P=0.63; X^2=0.661, P=1.00; X^2=7.42, P=0.11) respectively at 1% alpha rate.

Various Attitude and Practices with regards to the possession and patterns of ITN utilization were exhibited. Perceptions of the value of ITN were identified and explicitly manifested through beneficial attributes such as: to prevent malaria, avoid mosquito bites and nuisance. Whereas, regarding the non-beneficial attributes some of which also coincided with barriers associated with the possession and regular use of ITN, subjects often and implicitly perceived ITNs as having toxic effects and associated with illnesses, not cost effective and inconvenient due to hot weather. According to this study, the determinant factors associated with a high incidence and prevalence of malaria within the studied communities involved a lack of

environmental hygiene, and until there is proper understanding of the mode of transmission of the disease and the opportunities to disseminate malaria knowledge are met, widespread adherence to the regular practice of ITN utilization is difficult.

Keywords: Rural community, Households, Caregivers, Assessment and evaluation, Knowledge Attitude and Practice, IEC package delivery.

CHAPTER I:
INTRODUCTION

1.1 GENERAL CHARACTERISTICS OF CAMEROON

1.1.1 History

The modern history of Cameroon can be traced as far back during the colonial era under the German rule from 1884 to 1914. The country witnessed the invasion of its territory by combined French and British forces following the outbreak of World War I, in which the former German colony was later partitioned between the French and the British under the League of Nations mandate in 1919. The French part of the country gained its independence in 1960 and was reunited with the British part in 1961 to become the present republic of Cameroon. Cameroon is divided into 10 administrative provinces (now regions), 8 of which are typically French-Speaking and 2 English speaking. Yaoundé is the Capital city, while Douala is the most populated and economic capital (Ngoh, 1987).

1.1.2 Geography

I. Location

Situated at the end of the Gulf of Guinea, Cameroon forms a bridge between the West and Central part of Africa. The country has a rectangular shape and stretches over an area of 475,400 square kilometers (183,695 square miles). Cameroon has boundaries that extend for a total of 4,591 kilometers (2,853 miles) between Nigeria to the northwest, Chad to the northeast, Central Africa Republic to the east, and by Republic of Congo, Gabon and Equatorial Guinea to the south. 469,440 sq km of the country is

occupied by land and 6,000 sq km is water. It also has 402 kilometers (249 miles) of coastline on the Bight of Biafra, part of the Atlantic Ocean (Neba, 1987).

Figure: 1.1: Map of Cameroon

Source: CIA, World Fact book, 2007

The country is marked by four diverse vegetation and topological landforms. These include: (1.) A Low coastal plain in the southern region having equatorial rain forests and swamp lands along its edges. (2.) Savannah plateau in the center parts also known as Adamaoua Plateau. (3.) Mountainous west and southwestern region covered in forests with an active volcanic Mountain known as Mount Cameroon or Mount Fako. (4.) And a sub-arid savannah in the north. The Logone and Chari rivers in the northern region are drained into the Lake Chad Basin. Other principal rivers include: Wouri, Sanaga, Dibamba and Nyong all of which pass through most of the national territory and flow into the Gulf of Guinea (Cameroon, 2011).

II. Climate

Cameroon has a tropical climate which varies from humid equatorial in the south to increasing dryness towards the Sahel savanna in the north. The Sahel climate in the north has a short wet season that lasts between April and September while the rest of the year is dry, with an average temperature of about 21degrees Celsius in the plateau and 32 degrees Celsius in the sub arid. Average annual precipitation for this region is between 1,000 and 1,750 mm (39 to 69 inches). The southern equatorial region has two wet and two dry seasons with each of these seasons having peaks of wetness and dryness. Here the average temperature ranges from 18 to 29 degrees Celsius (64 to 84 degrees Fahrenheit) with an average annual precipitation of 4,030 mm (159 inches). Along the coastal regions, the average annual rainfall is about 4,060 mm while on the

slopes of Cameroon Mountain and other peaks of the west, rainfall is almost constant (Cameroon, 2011).

1.1.3 Demography

I. Socio-demographic characteristics

Table 1.1 Cameroon demographic indicators

Statistics	2011	1995	2005	2015	2025
Population					
Midyear population (000)	19,711	13,603	17,261	21,387	25,522
Growth rate (%)	2.1	2.5	2.3	2.0	1.6
Fertility					
Total fertility rate (births per woman)	4.2	5.2	4.7	3.8	3.2
Crude birth rate (per 1,000 population)	33	38	36	31	26
Births (in thousands)	651	518	622	659	665
Mortality					
Life expectancy at birth (years)	54	52	52	56	59
Infant mortality rate (per 1,000 births)	61	81	69	56	45
Under 5 mortality rate (per 1,000 births)	104	147	120	94	72
Crude death rate (per 1,000 population)	12	13	13	11	10
Deaths (in thousands)	233	182	230	240	259

Source: (U.S. Census Bureau, Population Division 2011)

According to the US census bureau 2011 report, Cameroon has a population estimate of about 19.7 million inhabitants and a corresponding annual growth rate of 2.121%. With figures of growth rate expected to decrease within the nearest decade, the

population forecast for 2025 is estimated to reach 25.5 million. As of 2010, the urban population was estimated to constitute 58% of the total population with an urbanization rate of 3.3% (CIA fact book, 2010). The total fertility rate currently stands at 4.2 and the life expectancy at birth is 52. Between 1995 and 2011, under-5 mortality has reduced from 147 per 1000 to 104 per 1000. As of 2001, the total population leaving below the poverty line moved from 40.2% to 39.9% in 2007 (The World Bank, 2011). Cameroon has a remarkably diverse society with over 250 tribes or ethnic groups speaking about 270 local dialects (Cameroon, 2011), but English and French are the two main official languages. There are three major religious beliefs. Christianity (40%) is the main religion while Islam constitutes 20% of the population. The rest of the population (40%) either has indigenous beliefs or no religion at all (CIA fact book, 2010).

II. Human development profile

a. Education

Table: 1.2 Cameroon Educational Profiles

Indicator	Notes/Year	Values
Adult literacy rate (both sexes aged 15 and above)	**2010 (refers to 2001 national household survey)**	**67.9 %**
Combined gross enrolment ratio in education (both sexes)	**2010**	**52.3 %**
Expenditure on education (% of GDP)	**2008**	**2.9 %**
Internet users (per 100 people)	**2008**	**3.8 %**
Mean years of schooling (of adults - in years)	**2010**	**5.9**

Source: United Nations Development Program (UNDP), 2010

The educational system of Cameroon comprises of 2 separated (Anglophone and Francophone) systems inherited from the former British and French colonial masters respectively. Formal education in the country has been divided and run by three ministries: i.e. Ministry of National Education (MoNE) for (kindergarten to secondary), Ministry of Technical and Vocational Training (MoTVT) and the Ministry of Higher Education (MoHE) in charge of education at the tertiary level. Though the administrative system is centralized with endorsement and disbursement from the central government, educational policies are developed by various ministries with incorporated feedback from the provincial, divisional and district levels. The civil society therefore plays a very limited role in the educational policy making process. School attendance rate has consistently dropped over the years with figures close from 100% in the 1980s to about 70% in 1995, especially at the north and extreme north parts of the country (Common Wealth Education Fund, n.d.).

The adult literacy rate stands at 67.9 % but figures show that men (77%) are more educated than women (59.8%) (Situation of Education, n.d.). Gross school enrolment rate as of 2010 was 52.3%. With the growing concerns about decreased school enrolment and increased inequality in education, studies show that the lack of finances, growing challenges in employment rate and school pregnancies among females have accounted for some of the over 46% estimated dropouts (Eloundou et al., n.d.). The country adopted free basic education policy in 1999/2000 in an attempt

to enable the poor to have access to education. Since then, enrolment at the basic level has been increasing steadily (from 87% in 1999 to 100% as was recorded in 2002) (Raja, 2006). The proportion of the government expenditure on education (2.9% of GDP) is very minimal and is related to problems from inadequate infrastructures to insufficiency in the teaching personnel (UNDP, 2010).

b. Economy:

Table: 1.3 Cameroon Economic profiles

Statistic		**% or N0.**	**Year**
GDP: - per Capita		**US$ 2,300**	**2010**
-real growth rate		**2.8 %**	**2010**
GDP: (Composition by sector)	**Agriculture**	**20 %**	**2009**
	Industry	**30.1 %**	
	Services	**49.1 %**	
Labor force		**7,836,000**	**2009**
Labor force: (by occupation)	**Agriculture**	**70 %**	**2001**
	Industry	**13 %**	
	Services	**17 %**	
Unemployment rate		**30 %**	**2001**
Population living below poverty line		**48%**	**2000**
Agricultural products		coffee, cocoa, cotton, rubber, bananas, oilseed, grains, root starches; livestock; timber	
Industries		petroleum production and refining, aluminum production, food processing, light consumer goods, textiles, lumber, ship repair	

Source: CIA world fact book. Cameroon economy 2011

Cameroon's economy for the past two and a half decade has been very fragile because of the alterations in world prices on commodity exports in which the country

depends on for its development. In addition to this, foreign and local investments have been hampered following economic mismanagement, massive corruption and an unfavorable business scenario. Even though the country is commercially and economically leading in the central African sub-region, its eventual trading expansion with other African sub regions has been limited. The country is rich in natural resources especially in agriculture, mining, forestry and petroleum sectors. Despite the growth in GDP (2%-3%) over the past 3 years, socio-economic indicators such as health and education remain low compared to other countries of about same growth; and according to World Bank statistics, more than 39% of the population still lives in absolute poverty. 70% of the total labor force of about 7,836,000 individuals, are engaged in the agricultural sector in which production is mostly on subsistence basis (CIA world Fact book, 2011). The global recession has impacted on Cameroons exports such as timber, rubber, cotton, oil etc. The main trading partners include countries within the European Union especially France, USA and China (Travel Document System, 2011).

c. **Poverty:**

Table: 1.4 Cameroon Poverty index

Indicator	**Note /Year**	**Value**
Multidimensional poverty index	**Not all indicators were available for this classification (2008)**	**0.229**
MPI: headcount, population in poverty (%)	**2008**	**54.6%**

Source: United Nations Development Program (UNDP), 2010

Report on human development portrays the Human Poverty Index (HPI) of the nation. The Multiple Poverty Index (MPI) above shows the level of human development in the areas of education, health and standard of living; each of which could be based on several other indicators.

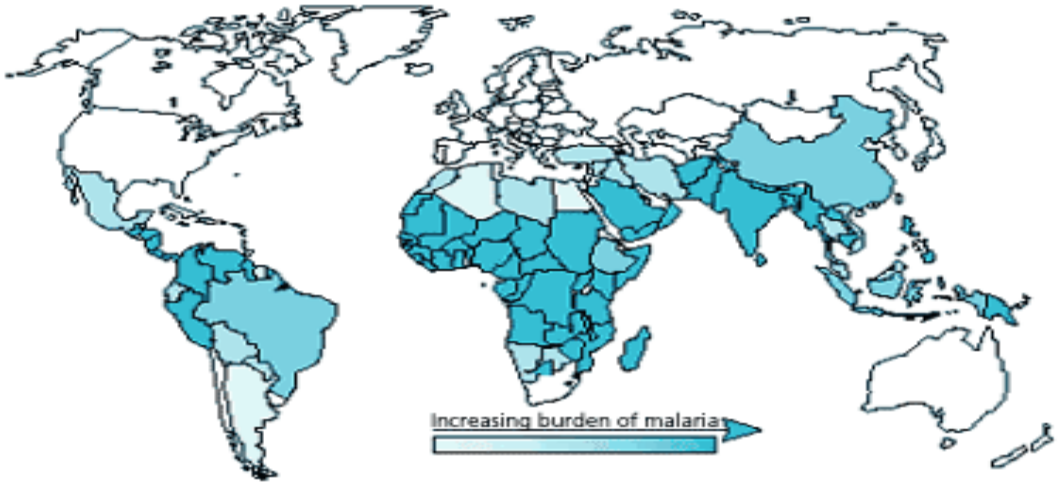
Approximately 55% of Cameroons' population is said to be deprived by multiple indicators and the intensity of the deprivation shared among the multi- dimensionally poor population is 0.299.

The income poverty level (i.e. people living below 1.25 US$ per day) as of 2000 as stated in table (1.3) above was 48%. Given the fact that multi-dimensional poverty index (MPI) gives a clearer picture of the level of deprivation (in this case health, education and income), individuals living above the income poverty level could still be entangled in a situation of low human development (Human Development Record, 2010).

1.2 The Global situation of Malaria

Malaria constitutes approximately 25% of the world's burden of diseases, with an optimum effect of mortality and morbidity in the tropical and sub-tropical regions of the world, regardless of decades of earnest and conscientious activities on prevention and control (World Health Organization, 2002b)

Figure 1.2: Estimate of the World Malaria Burden



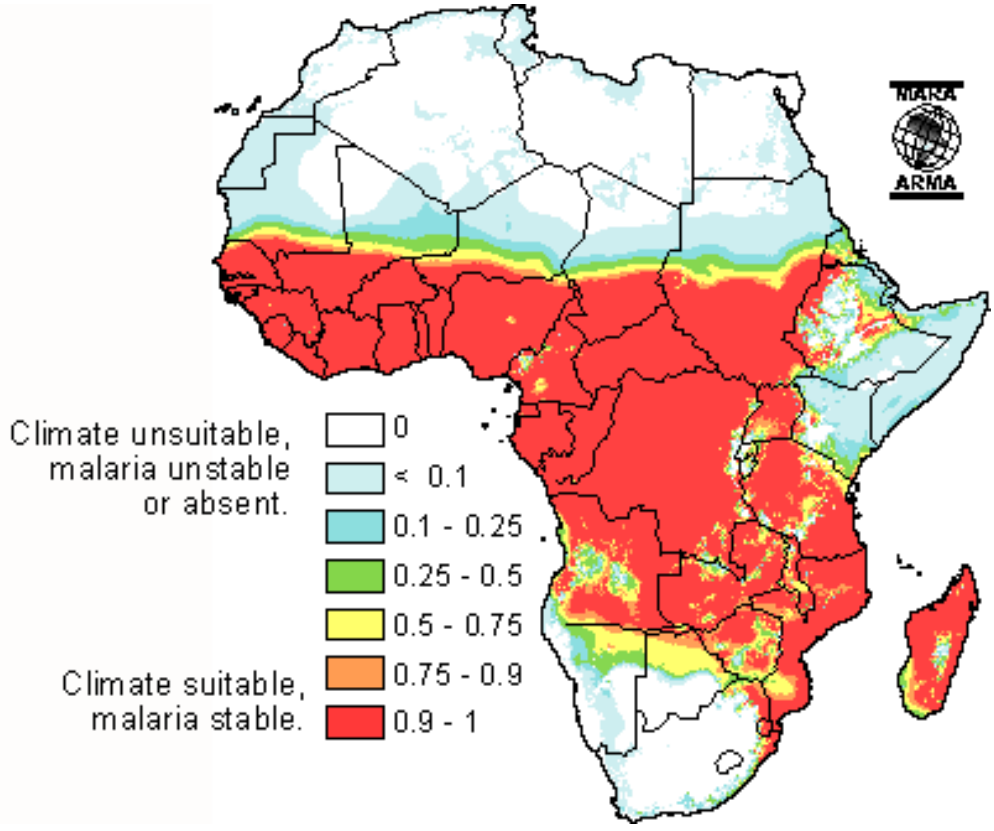
(Source: Roll Back Malaria data/J. Sachs, 1999)

There are approximately 300-600 million clinical episodes annually and about 1.5 to 2.7 million deaths caused by malaria throughout the world, and tropical Africa south of the Sahara accounts for over 90% of the disease burden (Snow et al., 2005), the most affected being young children and pregnant women (Samba, 2001).

Effects of malaria could be long or short termed and the global deaths attributed to the disease largely occur in over 3 billion of the worlds' population that lives in malarious areas (Breman et al., 2004).

The disease has been linked to consequences of broad range some of which include: hearing impairment, visual impairment and epilepsy, in addition to anemia, low birth weight and growth retardation, especially in malaria associated with *Plasmodium falciparum* (Breman et al., 2004); (Snow et al., 2003).

Figure 1.3: Climate suitability for malaria (Map of African)



(Source: http:// www.mara.org.za)

Malaria is a parasitic disease that is transmitted by an infected mosquito. The parasite also called plasmodium is a single cell organism, and transmission from one person to another is through the bite of an infected female anopheles mosquito, which requires blood for development of its eggs (Roll Back Malaria Partnership, 2002). Despite the many species of the Plasmodium genus, those responsible for the causes of human infection include: *Plasmodium falciparum, P. vivax, P. ovale,* and *P. malariae* with *P. falciparum* accounting for most deaths.

1.2.1. Malaria in children under-5 years:

Due to the direct and indirect contributions of the disease to the causes of death, some recent studies, have suggested that malaria accounts for at least 20% of all childhood deaths in children under-5 years of age in Africa (WHO 2003b), with more than three quarter of this figure in the endemic sub Saharan region (RBMP, 2002).

With exception for countries in the southern Africa region that were involved in early Indoor Residual Spraying (IRS) activity complimented by effective case management mechanisms, many countries in Africa even at contemporary period do not have successful malaria control programs partly due to a lack of adequate health infrastructures and competent human resources as well as financial and managerial capabilities (Mabaso et al., 2004).

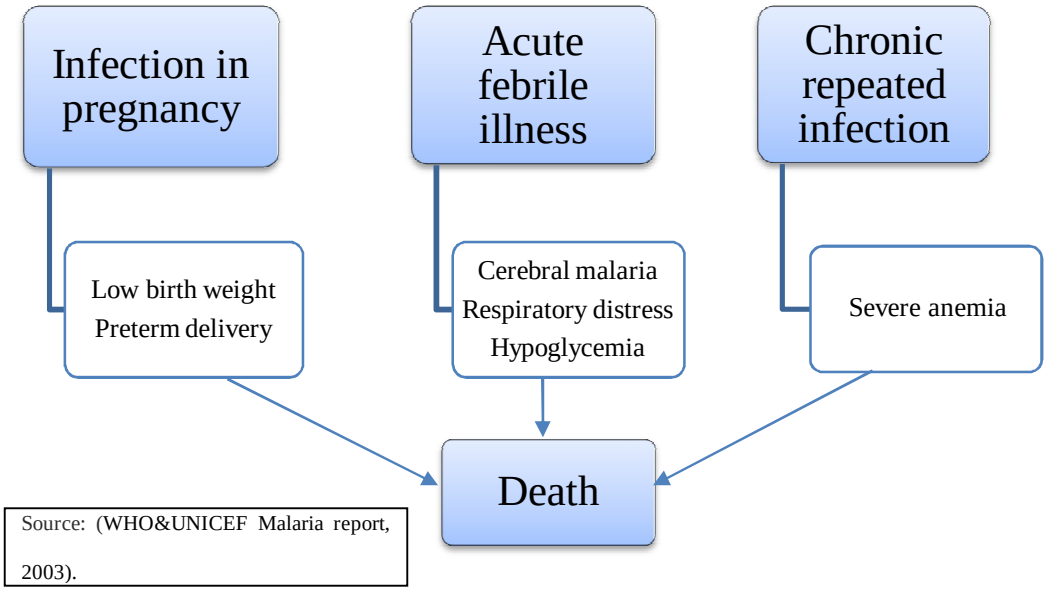
Malaria contributes to the death of children in three main pathways:

(1) Through an acute infection which may end up in a coma (cerebral malaria), and sometimes lead to instantaneous death.

(2) Chronic and repeated infection could lead to severe malaria which is usually characterized by an anemic condition, thus, high risk of death due to susceptibility to other forms of illnesses.

(3) Low birth weight that result from malaria infection in pregnancy and represents the major risk factor for death in the first month of birth (WHO & UNICEF Malaria report, 2003).

Figure 1.4: Pathways through which Malaria kills children.



Source: (WHO&UNICEF Malaria report, 2003).

For those children who survive an acute attack of cerebral malaria, more than 15% are left with neurological problems and a mild degree of brain damage that may impair learning and development if they are not harnessed and managed properly at specialized facilities (Samba, 2001).

Even in the comparison of broad range performances among children survivors of severe malaria, evidence suggests widespread impairment in the development of the ability to initiate, plan and carry out tasks as a result of wide differences in cognitive functioning which can affect educational performances (Holding, 1999).

1.2.2. Malaria in pregnancy

Each year, over 30 million women in Africa become pregnant and the probability of an adverse outcome or a factor that raises this probability (risk), such as malaria infection with *Plasmodium falciparum* is very high especially in endemic areas. The complications of *P. falciparum* infection during pregnancy are of serious healthcare concern in sub-Saharan Africa due to parasitic resistance, immune system suppression in mothers and low birth weight of foetus (Marchesini & Crawley, 2004). Malaria in pregnancy is particularly threatening as it causes severe anemia and reduces a woman's immunity, making her more susceptible to malaria infection and other illnesses, thus, increasing the probability of death. On the part of the foetus, there is an increased risk of spontaneous abortion, stillbirth, premature delivery and low birth weight- a leading cause of the approximately 200,000 newborn deaths each year (WHO, 2003a).

Though some of the causes of Low Birth Weight (LBW) may include maternal STDs (syphilis) and first delivery of mothers, it is however worth noting that the resulting effects from prematurity and umbilical cord blood malaria associated with maternal malaria accounts for 3 to 8 % of child mortality (Steketee et al., 1996).

The episodes of malaria in pregnant women are few in Africa, but the risk or chances of becoming anemic with an increased placental separation is much greater. In low transmission areas of Asia, maternal clinical manifestations are more common because the disease occurs less frequently, but estimates in sub-Saharan Africa indicate that 3.7% or approximately 5,300 maternal deaths are associated to anemia annually following severe infections (Jamison et al., 2006).

Despite the effort to eradicate the disease with prevention and control methods (especially using ITNs) as the pivotal and recommended technique in Africa, survey data showed that approximately 15% of young children slept under bed net, but only about 2% of them used nets treated with insecticide (ITN). "*Untreated nets provide some protection against malaria, but their full protective benefits can be realized only if they are regularly retreated with insecticide*" (WHO, 2003b).

1.3 **Malaria situation in Cameroon and the study area in particular:**

(**Rationale of the study)**

Malaria situation in Cameroon is not different from that of other endemic sub Saharan African countries. Cameroon is a country with vast diversity in vegetation and topological landforms where natural environment covers three ecological and epidemiological zones (i.e. equatorial region in which Malaria is endemic with transmission throughout the year, guinea savannah or tropical region in which

transmission is seasonal between 3-6 months a year and Sahel savannah where the transmission season and duration is less than three months) all of which is 95% endemic to malaria (Edmondson, 2001).

1.3.1 Epidemiological profile:

I. Population and endemicity

Table 1.5: Malaria epidemiological profile of Cameroon

Population (000)	**Year 2008**	**%**
All age groups	19 088	
< 5 years	3 016	16
≥ 5 years	16 072	84
Population by malaria endemicity (in thousands)	**Year 2008**	**%**
High transmission ≥ 1/1000	13 537	71
Low transmission (0- 1/1000)	5 552	29
Malaria-free (0 cases)	0	0
Rural population	8 248	43
Vector and parasite profiles		
Major Anopheles species	*gambiae, arabiensis, funestus, brochieri, coustani, flavicosta, hancocki, hargreavesi, melas, moucheti, nili, palucis, pharoensis*	
Plasmodium species	falciparum, vivax	

Source: WHO. World malaria report 2009.p 84. Cameroon.

The entire country is endemic to malaria but different regions are exposed to varied levels of transmission (13.5 million and 5.5 million individuals are exposed to high and low transmission respectively). About 8.3 million people live in rural areas which form 43% of the total population. Children less than 5 years represent16% (3.1

million) of Cameroon's total population of approximately 19 million and they are the most threatened by malaria. Several anopheles species have been noted and identified as host to mainly *falciparum* and *vivax* species that transmit the disease.

II. Risk of malaria and variety of mosquito species:

Different regions within Cameroon exhibit unique environmental characteristics. The southern part of the country is engraved by the equatorial forest, Guinea savannah at the central and Sahel savannah at the northern region.

The country harbors most of the mosquito species that transmit malaria parasite; each or a collection of which have been associated with different regions or communities in terms of intensities and seasonal duration for transmission. Having a heterogeneous environment, 24 of the 48 anopheles species are known to exist in Cameroon, among which 17 have been found non-randomly distributed within the country and infected with human malaria parasite (Diego et al., 2009). This shows the diversity in terms of transmission across the entire nation. Other studies on anopheles diversity and complexity of malarial vector system in Cameroon include those by (Hervy et al., 1998), (Antonio et al., 2006), (Brunhes et al., 2003) and (Awono et al., 2004).

According to Wanji et al. (2008), the Mount Cameroon region is hyper-endemic for malaria, with *P. falciparum* being the predominant malaria parasite species.

Focusing on three coastal regions (Tiko, Limbe and Idenau) around the mountain region, a 12 month study examined the transmission rates of three mosquito species that carry the malaria parasite: *Anopheles gambiae* was found to be responsible for

the highest rate of infection and transmission; 73% in the region, while *Anopheles funestus* accounted for 23% and *Anopheles nili*, 4% respectively. The number of infective bites per person annually stood at 287, 160 and 149 at Tiko, Limbe and Idenau respectively. A high prevalence of malaria parasitaemia was also recorded especially among children under-5 (41.5% in children <5 years of age, 31.5% in those 5–15 years and 10.5% in those >15 years) (Bigoga et al., 2007).

A study on malaria in pregnancy in Mutengene (a town in the mount Fako region) from 1998–2001 recorded malaria parasitic rates of 32.7%, 33.7% and 7.8% in maternal, placental and cord blood respectively (Achidi et al., 2005a) and within this area, malaria contributed to about 50% of the anemic cases (Achidi et al., 2005b), which in pregnancy could be serious as it also poses substantial risks to the fetus and the newborn.

III. Malaria incidence and prevalence in Cameroon:

Malaria continues to be a disease of public health problem in Cameroon given that averages of over 900,000 clinical cases are registered each year and a threat to the national economy as a whole. It accounts for 40% to 50% of medical consultations, 20 -30% of hospitalizations, 35% - 40 % of hospital deaths and 40% of deaths among children under-five years (Cameroon Grant Performance Report, 2009), (WHO/CAMINFOS, 2002).

In 2006 alone, there were 635, 000 clinically reported malaria cases and a cumulative estimate of 5.6 million malaria cases. Records in 2008 showed an overwhelming

increase from the registered figure in 2006 to approximately 1,650,749 cases and the respective number of inpatients and deaths increased six and four fold (WHO, 2009b, p. 84, 85).

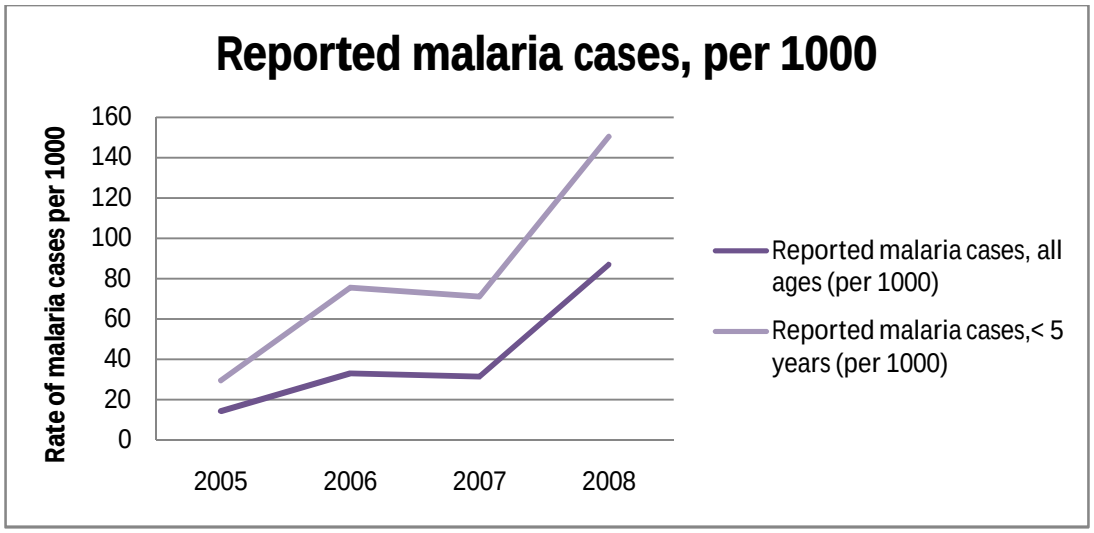
Under five and neonatal mortality as of 2004 stood at 148/1000 and 35/1000 respectively (WHO, 2006a), as a child would typically encounter not less than 6 episodes of malaria each year. The disease constitutes one of the major reasons for children absence from school, in effect, hindering their knowledge, interpersonal and communal development (RBMP, 2002) which could have adverse effects to the nation as a whole.

Table: 1.6 Trends in malaria Mortality and Morbidity

Malaria mortality/morbidity	**Years**			
	2005	**2006**	**2007**	**2008**
Reported malaria admission, all ages	75,738	75,904	42,548	270,038
Reported malaria admissions, < 5	23,418	27,636	34,056	99,286
All cause admissions, all ages	138,617	204,498	239,650	565,754
All cause admissions, < 5	37,928	66,873	43,091	176,984
Reported malaria death, all ages	836	930	1,811	7,673
Reported malaria deaths, < 5	836	930	1,082	4,119
All cause deaths, all ages	254,308	261,175	6093	18034
All cause deaths, < 5	1,203	-	2,726	7,928

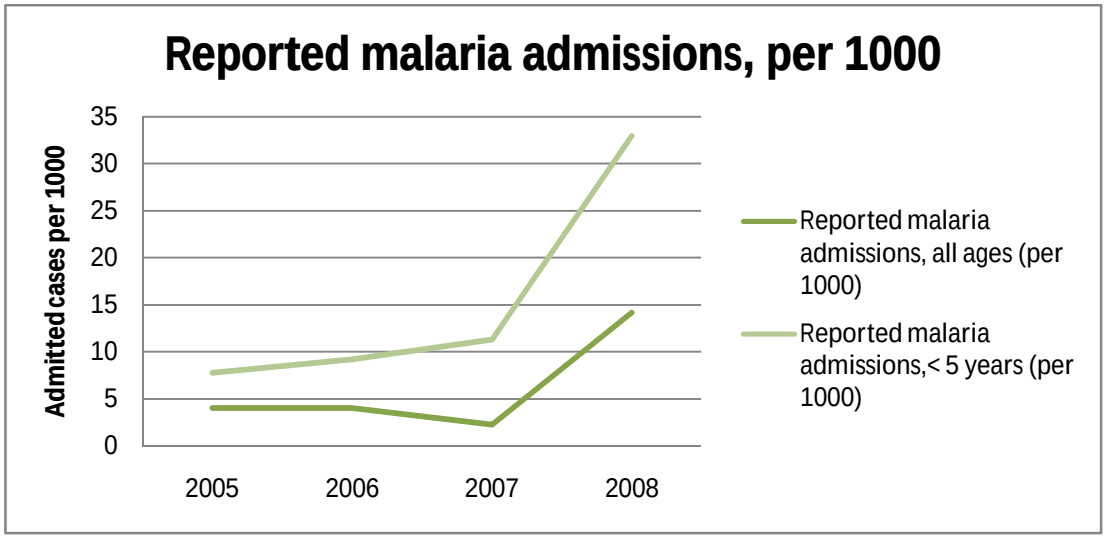
Source: WHO. World malaria report 2009b, p 84, 85. Cameroon.

Figure1.5: Trend of reported malaria cases (From 2005 to 2008)



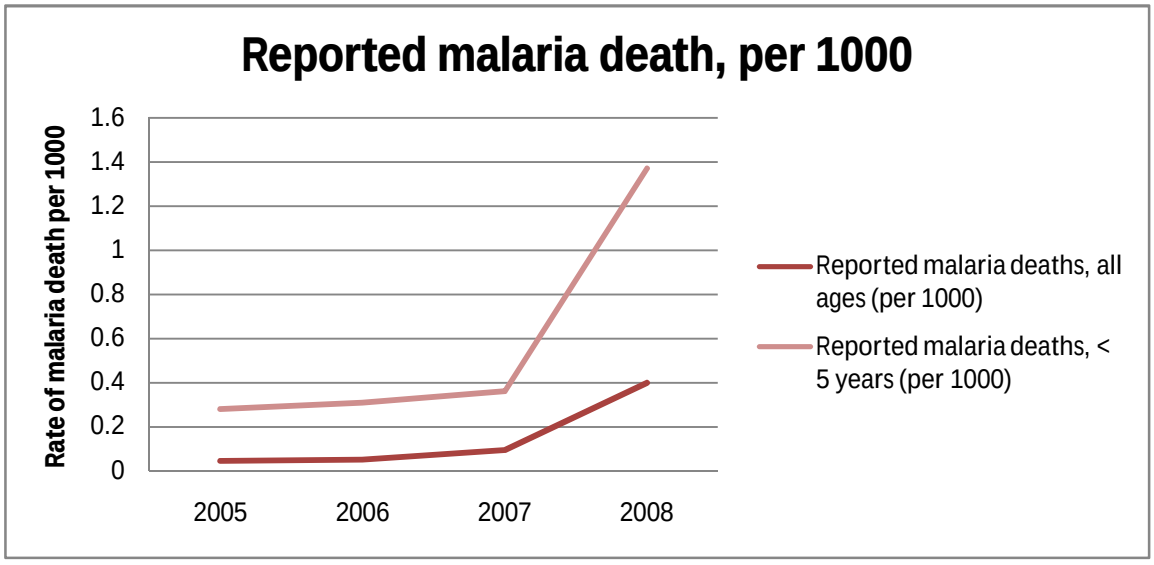
Source: WHO. World malaria report 2009b.p 84, 85. Cameroon.

Figure 1.6: Trend of malaria admissions (From 2005 to 2008)



Source: WHO. World malaria report 2009b.p 84, 85. Cameroon.

Figure1.7: Trend in reported malaria death (From 2005 to 2008)



Source: WHO. World malaria report 2009b.p 84, 85. Cameroon.

Though the national trend in prevalence has been on the rise, the WHO malaria report 2009 showed a dramatic surge in incidence rate, number of admissions and deaths between the years 2007 and 2008.

Figures from the above table and graphs show higher malaria threats in children under 5 than for those of other ages. Comparing the trend for reported malaria cases, admissions and death among children under 5 specifically with those of all other age groups gives an indication to the extent of how vulnerable children under-5 are to the disease.

IV. Situation analysis in different provinces:

With 41% of malaria cases registered among those consulted, the disease remains the leading cause of morbidity in Cameroon with varied incidence rates among the different provinces. From January to June 2008, the number of cases of uncomplicated malaria recorded stood at 451,240 in all provinces. The West and the Far North recorded the highest number of cases of severe malaria, representing 37,311 and 28,239 respectively. The South West province recorded the lowest proportion of patients, while the Adamawa province recorded the highest proportion (National Malaria Control Program Report Cameroon, 2008, pg. 5).

Table 1.7: Malaria-related morbidity in health facilities (from January to June 2008)

Provinces	Number of patients consulted	%of cases of uncomplicated malaria	% of cases of severe malaria
Adamawa	83,935	33%	13%
Centre	222,339	32%	11%
East	90,932	28%	12%
Far North	168,230	37%	17%
Littoral	179,232	22%	12%
North	196,704	30%	10%
North West	215,727	27%	10%
West	239,567	27%	16%
South	35,613	28%	13%
South West	174,290	22%	12%
Total	**1,611,569**	28%	12%

Source: (NMCP Report Cameroon, 2008).

Table 1.8: Malaria related morbidity among children under-5 in health facilities from January –June 2008

Provinces	No. of children under-5 consulted	% of cases of uncomplicated malaria	% of cases of severe malaria
Adamawa	22,235	49%	15%
Centre	63,074	54%	13%
East	25,958	41%	14%
Far North	54,975	45%	18%
Littoral	40,801	31%	18%
North	70,172	40%	11%
North West	45,251	42%	13%
West	64,069	39%	20%
South	9,915	40%	22%
South West	3,8423	34%	17%
Total	**434,873**	42%	16%

Source: (NMCP Report Cameroon, 2008)

Children below 5 years account for 26.98% of patients consulted and 38.25% of patients with Malaria. The Centre province has the highest proportion of children below 5 years suffering from malaria (67%). However cases of severe malaria are lower than those of uncomplicated malaria in various provinces. Thus, about 16% of patients are cases of severe malaria. The West recorded the largest number of cases of severe malaria (12,891), while the South had the highest proportion of cases of severe malaria (22%) (NMCP Report Cameroon, 2008).

Table 1.9: Malaria related morbidity among pregnant women in health facilities from January –June 2008

Provinces	No. of pregnant women consulted for malaria	cases of malaria	% of cases of malaria
Adamawa	8,758	3,231	37%
Centre	16,086	6,484	40%
East	6,537	2,301	35%
Far North	12,573	6,080	48%
Littoral	13,743	3,690	27%
North	13,778	4,721	34%
North West	6,517	2,591	40%
West	12,409	4,631	37%
South	2,420	873	36%
South West	10,429	3,494	34%
Total	**103,250**	35,096	37%

Source: (NMCP Report Cameroon, 2008)

The general coordination by the NMCP in data collection and transmission system especially in some provinces has made it possible to note the vulnerable group of pregnant women, who make up nearly 37% of those consulted and suffer from malaria. As shown in the table above, the Far North province recorded the highest proportion (48%) for pregnant women suffering from malaria.

V. Socio-economic impact:

According to the household survey conducted in 2002, 40.2% of the Cameroonian population lives below the poverty line. "*Poverty reduction involves using the principal asset (human capital) of the poor which largely represent their health and*

strength: Malaria, Aids and Tuberculosis constitute a serious threat to Cameroon's human capital". These diseases swallow up the meager resources of the underprivileged, shutting them up in the vicious cycle of poverty which therefore reflects the slow economic growth of the nation. The socio-economic impact of malaria in Cameroon is tremendous. It is estimated that malaria-related economic loss represents at least 1.3% of GNP per annum. Malaria contributed to poverty by lowering individual productivity (26% of total absenteeism from work is attributed to malaria) and consumes up to 40% of households' health budget (Cameroon Country Coordination Mechanism, 2003: page 28-29).

1.3.2 National Prevention and Control coverage (ITNs and IPTp):

Despite the mobilization of funding (from less than US$ 2 million in 2002 to over US$26 million in 2006) through the "Global Fund" and Government of Cameroon to booster malaria eradication strategy, coverage rates of ITNs especially at the rural communities and an effective treatment remained a problem of public health concern.

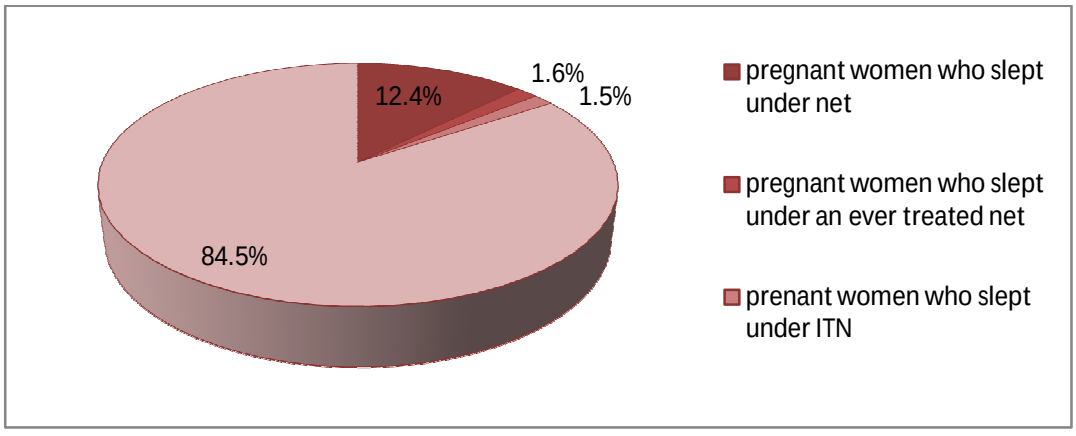
In 2006, a Multiple Indicator Cluster (MIC) survey to evaluate ITN coverage showed that 32% of households owned a mosquito net and 20% an ITN, but only 13% of children slept under an ITN. Though the supply of Artemisinin Based Treatment (ACT) (2.56 million in 2007 and 1.81 million in 2008) was adequate to treat reported cases in the public sector, its uptake in children with fever was 2% as opposed to 58% who received other forms of anti-malarial drugs (WHO, 2009b). This illustrates a far

below 80% target of ITN and treatment therapy anticipated by 2010 and unfortunately, also, IRS has not been adopted as a policy to fight against the disease in Cameroon.

I. Insecticide Treated Net utilization among pregnant women in Cameroon:

The WHO department for making pregnancy safer in Cameroon showed that among pregnant women in Cameroon, about 12.4% are reported to have slept under a net, 1.6% are said to have slept under an ever treated net while just 1.5% slept under an insecticide treated net the night before the survey. Among those interviewed in the survey, approximately 56% of them delivered in rural settings (about 647,000 births) in 2005 alone (UN Department of Economic and Social Affairs, 2007).

Figure 1.8: Use of Insecticide treated nets amongst pregnant women.



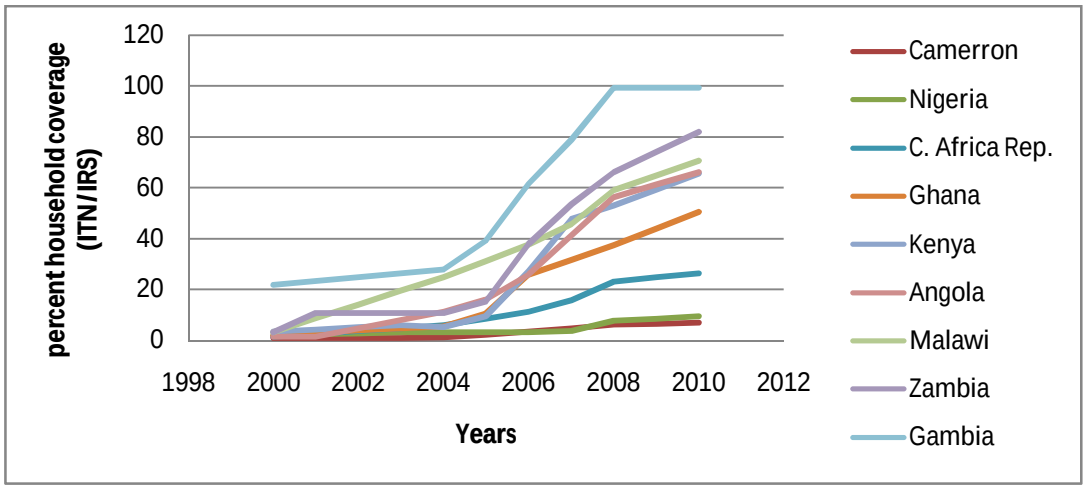
Source: ORG Macro. (2007). MEASURES DHS STAT compiler Http://www.measuredhs.com, December 11 2007

Langerer (2004) showed that untreated nets have little or no effect as "*there was a small non-statistically significant difference in the summary results of protective efficacy in the two comparisons – controls with no nets versus controls with untreated nets: 17% versus 23% reduction in mortality. The summary rate differences in the two comparison groups were virtually identical (5.5 versus 5.6 averted deaths per 1000 per year)*" (Lengeler, 2004, pg. 8).

II. **Prevention and control coverage in rural areas:**

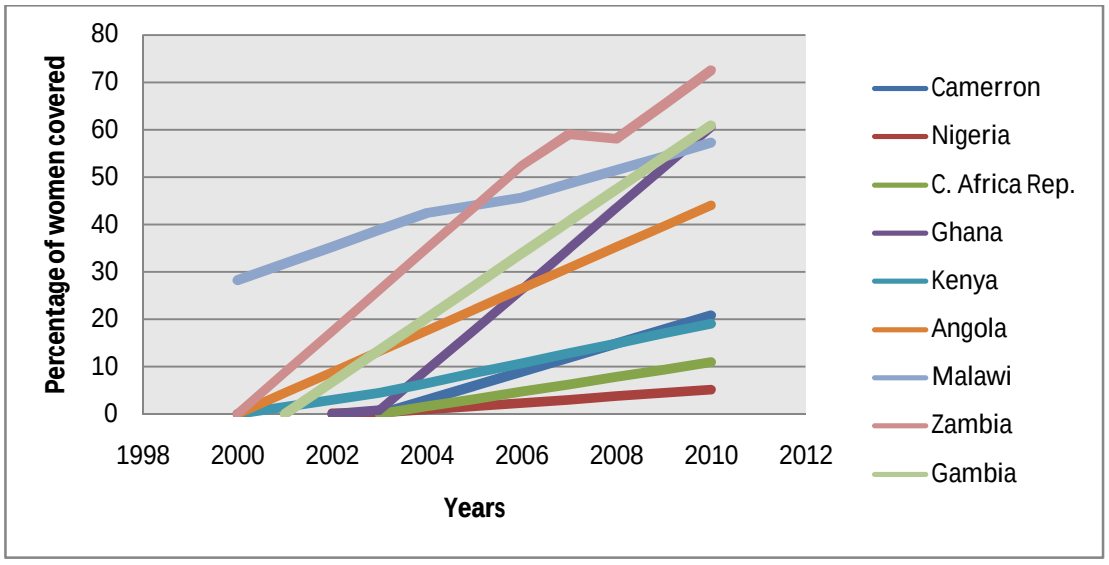
Despite an increased effort to maximize household coverage with ITNs and IPTp (Intermittent Preventive Treatment Pregnancy) in order to control malaria among children under-5 and pregnant women in rural African communities where mosquito vector is of greater nuisance, Cameroon and a few other nations have stayed behind.

Figure1.9: Estimates of vector control (ITNs/IRS) coverage in rural areas of Africa (2000-2010)



Sources: Multiple indicator cluster survey (MICS 2010).

Figure 1.10: Estimates of malaria prevention in pregnancy (IPTp/ITNs) coverage in rural areas of Africa (2000-2010)



Sources: Multiple indicator cluster survey (MICS 2010). Roll Back Malaria partnership. Roll back malaria progress and impact series.

1.4 Statement of the problems and challenges

There is a lot of challenges handling the disease in Cameroon as stated by the Permanent Secretary of the NMCP given that "*just about 40% of malaria patients have access to treatment while only 20% actually go to hospital for medical care*" (Cameroon Coalition Against Malaria, 2008), as why the home-based prevention and control approach is considered worthwhile.

As stated by Wenceslaus (2000), "*several reports show scarcity of malaria research capacity in sub-Saharan Africa; malaria control personnel are even rarer. Many countries have some control personnel in national capitals, but have none at district*

and peripheral levels where control must actually be carried out". Thus, the foundation of any effective malaria control initiative must be coordinated appropriately having referrals and involvement from the rural community level to the national level (Wenceslaus, 2000).

Despite the efforts and devised policies that necessitated the new malaria control strategies in Cameroon, it is yet to be appreciated given that most of these initiatives are still unknown to the population especially at rural communities. Major obstacles to the fight against the disease are the lack of focus, insufficient sensitization and social mobilization of the community, inadequate advocacy work and weak cooperative relationship between the public and the private stakeholders. A more direct loophole exists in the case of:

- **Prevention and control measure**: weak campaign for a broad launching of insecticide treated nets and intermittent presumptive treatment for pregnant women, as well as educating the general population with regard to environmental hygiene and sanitation.
- **With respect to treatment**; the use of combination as the first line treatment in order to prevent parasitic resistance.

Weakness and challenges of NMCP vis-à-vis the Public Health Sector has instilled gaps that remain in the areas of:

• The implementation of malaria prevention (provision of ITNs) for less than 5 years has not been initiated nor included in any current funding scheme.

• Distribution of these nets at rural communities and easy accessibility to centers for retreatment.

• Training of health workers for adequate divulging of malaria knowledge on prevention, clinical management and IPTp to pregnant women.

• Provision of sufficient quantities of drugs to health facilities.

• In view of the change of treatment policy to ACT, a need for orientation of health staff.

• Baseline information on malaria-related mortality and morbidity as well as other epidemiological parameters are yet to be extended to cover the national territory.

• Inadequate social marketing of nets and prepackaged anti-malarial treatment to cover all population groups using all possible commercial outlets.

• Weak National Health management Information System

• Inadequate Operational studies on anti-malarial drugs and insecticides sensitivity.

(CCCM, 2003, pg. 42)

However, with the effort, initiatives and mechanisms already instituted by the WHO alongside the National Malaria Control Program (NMCP) to fight against the disease in the country, how the implementation, delivery and practice in the community

remains a concern given that there have not been significant changes in ITN utilization.

While the challenges to ITN ownership are gradually and eventually being overcome by the national malaria programs as a result of the expansion of large-scale distribution efforts, and social marketing campaigns with increased demand, the question of "who is and who is not using ITN once they are made available" remains unanswered (Macintyre, 2006).

1.5 Significance of the study

- Previous research studies in Cameroon have centered on evaluating and examining the degree of endemicity and burden of the disease; but much is still do be done in the areas of prevention and control measures with special focus in providing knowledge on malaria to caregivers and using ITNs as a principal tool.

- Though the initiatives by the NMCP alongside the government has over the years been concentrated on devising appropriate treatment and maximizing efforts in the distribution of ITNs, little emphasis has been shown in programs that involve dissemination of knowledge (IEC) especially at the grass root level where the burden of the disease is believed to be felt more. Even the coverage rate of ITN amongst such communities is far from optimum.

- This research aims at filling the gap in focusing on the general prevention and control mechanisms with emphasis on ITNs, by first trying to assess and evaluate the populations' general knowledge on malaria and their practices of the utilization of ITN.

- It is also hoped to further determine how the community perceive and value the use of ITN as a prevention and control tool especially for children under-5 and also to ascertain some of the setbacks of its use.

1.6 Research Framework

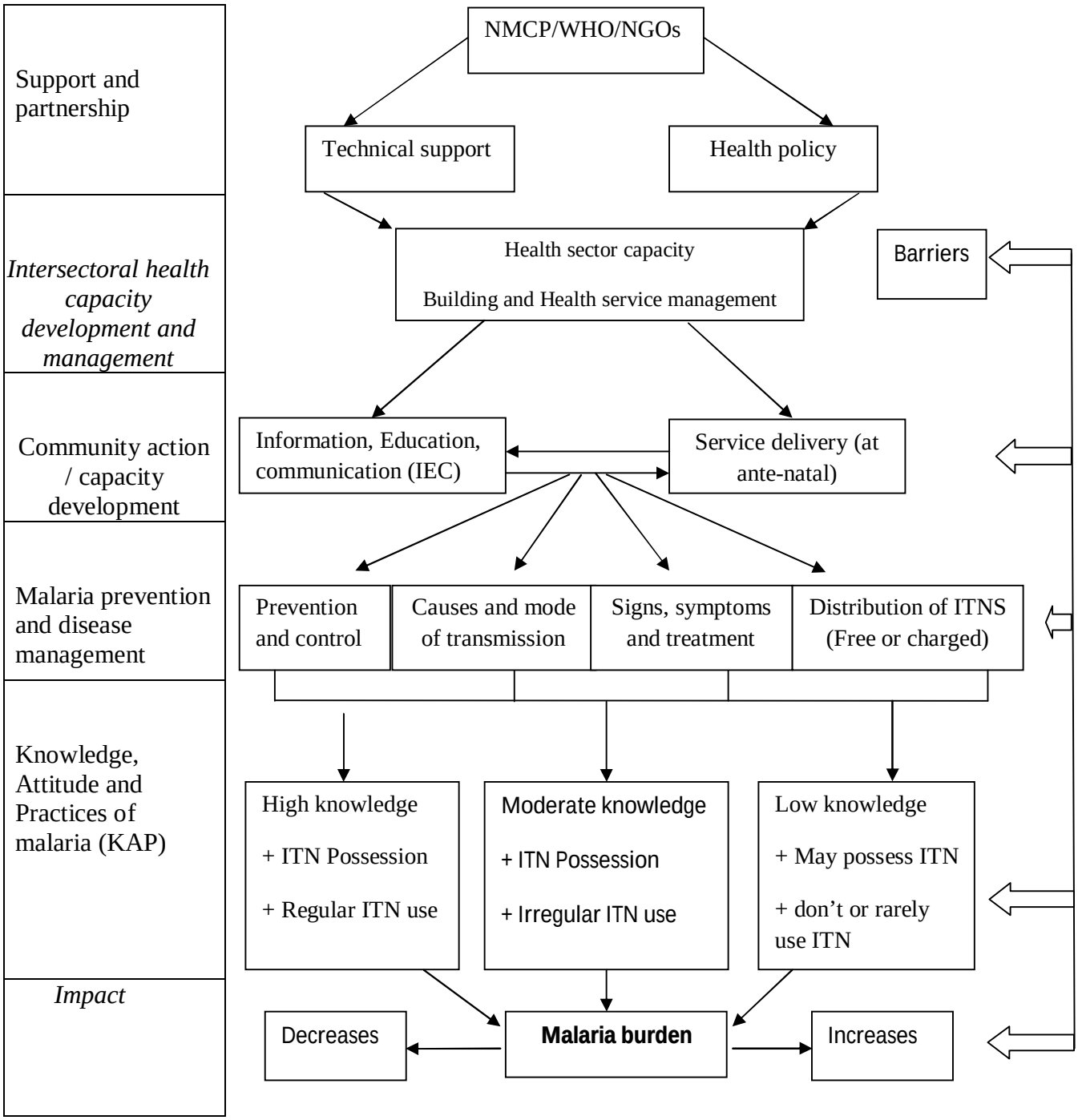


Figure 1.11: Designed by author:

The research framework was conceptualized and developed based on six "critical criteria" for monitoring malaria implementation programs with a proposed outcome and impact on the disease burden. As shown above, the research framework describes the criteria and concept of the study as an implementation strategy to examine and evaluate malaria burden (mortality and morbidity) of the general population.

These criteria are related to the general objectives of "Roll Back Malaria" showing how the disease burden could be decreased if effectively implemented. That is:

- Support and partnership from the National Malaria Control Program (NMCP), World Health Organization and various Non-governmental Organizations (NGOs); which altogether provide the technical support and develop policies that are implemented especially in the health sector.
- Intersectoral health capacity development and management involve training and capacity building of health personnel alongside effective healthcare management and delivery system.
- Community action and capacity development are twofold: it involves provision of healthcare services to the community coupled with dissemination of knowledge on malaria as a package through: Information, Education and Communication (IEC) especially at antenatal units or health fairs.
- Malaria prevention and disease management involve all the aspects of knowledge on malaria such as: disease prevention and control (e.g. prevention of malaria during pregnancy, use of insecticide-treated materials and other

vector control measures), causes and mode of transmission, signs and symptoms (with early diagnosis), and treatment pattern (prompt treatment).

- Knowledge, Attitude and Practices (KAP) is one of the most crucial criteria, since it directly has an impact on the burden of the disease. Here, the population or community is divided into three groups: Firstly, those with high knowledge of malaria will have high probability to possess an ITN and more likely to utilize it regularly; Secondly, those with moderate knowledge could possess ITN but might have tendencies to utilize these ITNs irregularly; and the last group, involves those with low knowledge who might or might not possess ITNs and the chances of utilization could be rare or not at all.
- All of the above criteria together characterize the impact of the disease burden which is either increased or decreased depending on how the implementation is carried out.

However, at each of the levels of implementation, there are certain barriers which are either environmental or non-environmental that influence the overall burden of the disease. Such barriers may include: economic factors, weather conditions, altitude, in-accessibility to health and net retreatment centers and cultural factors etc.

In a summary, the delivery of such interventions requires examining, strengthening by monitoring and evaluating the relevant components of the health sector. These range from infrastructure development to health policy, health systems management, with quality service delivery especially at tertiary health facilities. However, such

intervention would be a sum total of support from international organizations to grass root level with resources mobilized at each stage of implementation.

1.7 Objectives of the study

- **General Objectives:**

- 1) To assess and evaluate the knowledge of malaria, possession and utilization practices of Insecticide Treated Net (ITN) among households with children under-5 in rural communities, in order to design and implement effective intervention programs against malaria.

- **Specific Objectives:**

- 1) To assess the knowledge of malaria among households with children under-5.

- 2) To examine and evaluate how ITNs are been utilized in households.

- 3) To identify barriers to the use of ITN as a prevention and control tool against malaria.

1.8 Research Questions

- 1) How is the perception of knowledge on malaria based on the Information, Education and Communication (IEC) package delivery in communities?
- 2) How common is the utilization of insecticide treated net (ITN) among households with children under 5?
- 3) Are there any barriers to ITN utilization and IEC package delivery in rural communities?

1.9 Hypotheses

- *There is a significant relationship between respondents' attitude to possess ITNs and their practices of Utilization.*
- *There is a significant relationship between respondents' level of knowledge of malaria and the utilization pattern of ITN.*
- *There is a significant relationship between respondents' principal sources of information on malaria and the utilization pattern of ITN.*
- *There is a significant association between respondents' perception and value of ITN and their utilization practices.*
- *There is no association between the levels of education of caregivers (mothers) and the utilization patterns of ITN.*

1.10 Limitations and constrains

The scope of study was limited to two randomly selected communities within the mount Fako region of the South West Province. This region has been selected because previous studies showed a high incidence of malaria with characteristic parasitaemia and higher level anemia in under-5 and pregnant women. However, according to the national data, the entire South West Province showed a relatively lower malaria incidence rate as compared to other provinces. The Fako region in addition is chosen for these studies because of its diverse climatic conditions within the different sub-divisions and districts, cutting across climatic conditions of various parts of the national territory. The region constitutes the main cities of the South West Province, one of which is the administrative headquarter; thus, ease of accessibility and collection of required data.

1.11 Organization of the thesis

The study has been constructed into five chapters. Chapter one introduces the global and country specific burden of malaria. This chapter also illustrates the objectives of the study and how the research has been organized. Chapter two deals with past literatures on malaria and malaria related issues with the emphasis on ITN knowledge, uptake and use. Chapter three describes the research method and analytical processes employed in the study. The findings of the research are documented and discussed in chapter four while in chapter five, conclusions and recommendations are established.

CHAPTER II:

REVIEW OF LITERATURE

This chapter mentions some of the published and unpublished malaria and malaria related articles which are relevant to the context of this research, by addressing various aspects of the disease with respect to human health, alongside initiatives and programs instituted by international and local organizations. The review cuts across research studies that were conducted since 1942 till contemporary period especially on knowledge, Education and Practices (KAP) of the population at risk of malaria. The country health system is also discussed alongside its role and contribution to malaria eradication.

Literature on some theories and facts about malaria burden and incidence in regions of high endemicity such as in Africa south of the Sahara are also cited in order to establish and justify the relevance of the study with much emphasis on health promotion measures that constitute prevention and control.

2.1 Global Malaria initiatives and intervention strategies

The international community has paid attention to malaria over the years in an attempt to control and eventually eradicate the disease, but with little success due to among others, ineffective strategies used and insufficiency in resources. Nevertheless, the “Roll Back Malaria” initiative that was orchestrated in 1998 by the World Health Organization, yielded sources of aid or support based on simplistic and cost

effectiveness mediation, with much attention to the vulnerable (children under 5 and pregnant women) and those at peril. The famous summit meeting that was held on the 25th of April 2000 in Nigeria, assembled all the African head of states who committed themselves to an intensive effort to halve the malaria burden by the year 2010; and targeting within the first five years, the accessibility of the vulnerable to own and sleep under ITNs (WHO Africa Summit on Roll Back Malaria, 2000).

2.1.1 Roll Back Malaria:

As stated by "Roll Back Malaria" framework for monitoring progress and evaluating outcomes and impact report 2007, Roll back malaria (RBM) is a global partnership and initiative of national governments, civil society, non-governmental organizations, research institutions, professional associations, UN and development agencies, development banks, the private sector and the media, against malaria. Its emphasis has been on the fast implementation of malaria control programs in the African region, based on the Regional and Global Strategy for Malaria Control.

Its objective is to reduce the malaria burden in involved countries by half through interventions that are adapted to local needs of the community and through support and assistance provided by the health sector of these nations. The major mechanism for achieving this was through intensified national action at country-level partnerships strategically working together towards common set goals within the context and procedural guidelines of the health sector. The countries were to be supported by partnerships that involved three levels: sub regional, regional and global

which would generate support networks, thus, providing the necessary technical assistance. Roll Back Malaria also encouraged strategic investments in the development of better tools and intervention strategies through focused support for research, including operational research (Roll Back Malaria Framework, 2000).

As stated in the table below, the following targets for specific intervention strategies were established at the Abuja Malaria Summit in April 2000 and this initiative have made substantial progress in some countries by means of deployment and utilization of the available resources for maximum realization of the set objectives.

Table 2.1: Intervention strategies for malaria eradication

Strategy	**Abuja target (by 2005)**
• Prompt access to effective treatment	• 60 percent of those suffering with malaria should have access to and be able to use correct, affordable, and appropriate treatment within 24 hours of the onset of symptoms.
• Provision of ITNs	• 60 percent of those at risk for malaria, particularly children under five and pregnant women, will benefit from a suitable combination of personal and community protective measures, such as ITNs.
• Prevention and control of malaria in pregnant women	• 60 percent of pregnant women at risk of malaria will have access to IPTp.
• Epidemic and emergency response	• 60 percent of epidemics are detected within two weeks of onset. • 60 percent of epidemics are responded to within two weeks of detection.

Source: WHO, 2003b, 2005. The Africa Malaria Report, Geneva: WHO; New York: United Nations Children's Fund.

2.2 Strategy and Components for implementation of program (Effectiveness in interventions):

In the course of implementation of the program, the strategies had to address effectiveness in the intervention as Breman et al., (2006) suggested, thus, targeting components such as: early diagnosis and treatment, insecticide treated nets, vector control, indoor residual Spraying of dwellings with insecticides, home repellant, and health education and counseling, all of which were summarized by (Jamison et al., 2006), and considered crucial if any positive results were to be achieved.

As one of the parameters in achieving the objectives of the program, it was noted that effective malaria intervention could only be realized if there was better accessibility and maximum coverage of the population especially the vulnerable. Healthcare services instituted should be able to provide rapid, accurate diagnosis, prompt and effective patient management (in this case quality diagnosis, treatment, counseling and education, referrals), prudent use of insecticides for killing and repelling the mosquito vector and ultimately the use of ITNs especially for pregnant women and children under 5 (Jamison et al., 2006, pg 463).

2.2.1 Early diagnosis and treatment: In this regard, the use of prescribed drugs was very important and essential in order to prevent resistance to the different strains of the plasmodium parasite. In the developing countries where the health care system is still undergoing re-structuring administratively and policy wise, it remains a great

challenge. Early diagnosis and effective treatment and treatment seeking methods probably would reduce infection rate, prevent morbidity and progression to a severe form of the disease and eventually death. "*This intervention requires timely and accurate diagnosis; use of efficacious drugs; education of patients and their families about the disease, home management, and prevention; and referral to higher levels of the health system*" (Jamison et al., 2006, pg 463).

Though the Abuja declaration recommended chemoprophylaxis especially for travel medicine and non-residents living in endemic areas in short periods (WHO, 1996), it is worth mentioning that the current WHO and Roll Back Malaria policy strongly recommend IPT during pregnancy and infancy in high and stable transmission areas while Combination therapy SP is recommended in areas of high resistance especially associated to Plasmodium falciparum (WHO, 2001).

2.2.2 Insecticide treated nets: One of the highly recommended strategies of "Roll Back Malaria" was the utilization of ITNs as personal protective devices or tools to kill or repel mosquitoes (WHO, 2002a). These nets were used in order to orchestrate a barrier between mosquitoes and humans especially the vulnerable.

There are two types of nets used: **(1)** Insecticide-treated nets (ITNs), which require re-treatment every 6 to 12 months and insecticide can be permethrin or deltamethrin. "*Deltamethrin is effective for a year; thus, re-treatment is annual. Permethrin lasts*

for six months; thus, two treatments per year are assumed if the transmission season is longer than six months" (Jamison et al. 2006, Pg 423).

(2) long-lasting insecticidal nets (LLINs) are also manufactured with insecticide impregnated to last for 4-5 years (Guillet et al., 2001, Pg. 998).

Using Kenya as a sentinel, successful large scale ITNs delivery mechanism was established for endemic sub African countries, as partnership between NETMARK and PSI utilized approaches which involved four methods:

I. For-profit and private channel.

II. Not-for-profit but commercial markets along with social marketing with nets at subsidized rates, an approach largely used by the global health organization, PSI.

III. Free nets distributed at ante-natal clinics to pregnant women and

IV. Free nets distributed as combined national vaccination campaigns.

(Noor et al., 2007).

2.2.3 Vector control: Prevention and control mechanisms with respect to addressing the vector population largely depends on combining different methods such as the use of insecticide, repellents, environmental management by educating the population on the need for environmental and personal hygiene especially in keeping the immediate surrounding clean with proper drainage system, and above all

instigating a change in behavior of the population at risk (Jamison et al., 2006, Pg463).

2.2.4 Indoor residual Spraying of dwellings with insecticides: It involves applying lethal doses of insecticide for at least 6 months on the wall of buildings, thus, repelling the mosquito vector from entering houses, and eventually prevents transmission of malaria (Jamison et al., 2006, pg 463).

Amongst the widely used insecticides, are: organophosphates, carbamates, and pyrethroids, generally accepted because of their property of rapid degradation in the soil. Other types of insecticide (dichlorodiphenyl-trichloroethane, or DDT) belonging to the organochlorines group, have widely been rejected and banned in many developed nations given their persistence in the environment and adverse effects on the health of humans and wildlife, though some countries still rely on them (Robert, 2006). However, the consistent use of IRS would not be cost effective in the endemic areas where transmission is year round due to lack of affordability, acceptance and other political constrains.

2.2.5 Home repellant: Involves the use of mosquito repellent which is generally composed of chemical substances, in order to prevent the bites of mosquitoes. These may include: toxic plant derivatives (pyrethroids), or the use of rudimentary methods of burning herd or plants to produce smoke, thus repelling mosquitoes (Jamison et al., 2006, pg. 463).

Even though several methods have been used to repel mosquito, (Charlwood & Jolly, 1984) in a study at Papua New Guinea showed that the use of ITNs produced more effective results with minimum health implications.

2.2.6 Health Education and Counseling: Health Education involves the provision of knowledge acquired as information through various media while Health Counseling requires interaction between individual with the ability to acquire skills. Given the importance of this component, it was imperative that households should acquire information on ways to prevent malaria especially for populations in endemic communities. In which case, these should include the importance of the population to seek prompt treatment at accessible health facilities with support and in full compliance with the overall health system (Jamison et al., 2006, pg 463).

Usually local affiliated NGOs alongside community's leaders and volunteers play a very active role is disseminating information to the local population. According to Gilles (2002) individuals involved in such activities are an extension of the health system and they work alongside competent health professionals or health non-governmental organizations in accordance with standards established by different governments.

2.3 Overview of the healthcare system in Cameroon

Health care widely comprises of the services that contribute to the health and wellbeing of an individual (Hanken, 1992). Health as defined by WHO involves the "*complete physical, mental and social wellbeing of an individual and not merely the absence of disease or infirmity*" (WHO, 1946). Cook (1995) illustrated that the health policy of nations directly or indirectly affects the health of the population, thus, it is imperative that governments initiate careful and thoughtful procedures prior to its adoption. The wellbeing of individuals entails their ability to be productive which therefore implies a prospective growth of the society. In this regard, international charters have acknowledged the fact that health is a human right that must be protected. Therefore an atmosphere of good health of a country will require satisfactory indications from GDP, per capita income (based on wealth distribution), availability and access to education in both rural and urban settings (Cook, 1995).

The Ministry of Public Health (MoPH) in Cameroon assumed its function and responsibility after the country gained independence in 1960. The various health care policies adopted since then have been aimed at primarily improving the health and wellbeing of the population. This was strengthened by both the "Alma Ata declaration in 1978" (Alma-Ata, 1978) and later the "Ottawa declaration of 1986" on the responsibility of governments and political commitment to provide public health and primary healthcare, in addition to the importance of peoples participation in being responsible for their own and their communities' good health. This approach

was later re-emphasized and elaborated further in the "Bangkok Charter for health promotion in a globalized world" 2005 (Bangkok Charter, 2005).

Healthcare delivery in Cameroon involves the public and the private (established and managed by various religious denominations or lay private) sectors. There are also traditional practitioners that play a great role as far as the provision of health care services is concerned. The healthcare system involves the facilities, the providers, payers, regulators and consumers which are operated mainly by the government or privately, but the government in association with other international organizations acts as the regulatory authorities. The mechanism of regulation involves:

- Ownership and control of health facilities.
- Control and financing of health care programs.
- And legislations that affects healthcare.

Over the years the government adopted comprehensive approaches to healthcare delivery, making it more affordable to the population which was necessary for the common slogan *"Health for all by year 2000"* (McPake, 1993). However the delivering process of health care services to the population is still to be appreciated, due to limited access to health service (especially in rural areas where most of the population lives more than 5 kilometers from the primary health care center); the performance of the health systems themselves is key determinant. "*The resulting unattractiveness of the public system prompts patients to seek care from traditional*

healers, unregulated private practitioners and local drug peddlers. In so doing they frequently pay exorbitant prices for health care services some of which are of questionable quality and the opportunity to provide them with vital preventive services is lost" (UNICEF Bamako Initiative, 1995).

According to Ntangsi (1998), during the 1970s and early 1980s, the country had a relatively good economic performance, thus, experienced a rapid expansion of health infrastructure network. From the summarization of studies of the World Bank in 1996:6, Ministry of Public Health in 1998:7, World Bank op cit, Deschamps 1996,p.2, and Lantum, 1996; it was noted that in the late 1990s, Cameroon had 1,031 health facilities that were comprised of: 1 teaching hospital at the capital city, 2 referral hospitals, 3 central hospitals, 10 provincial hospitals (one in each of the provinces), 38 divisional hospitals, 132 district hospitals, and 847 health centers; all in the public sector, with a corresponding medical staff of 14,292. The role played by private health providers was also reiterated as it complemented the public providers and helped prevent monopolization in the health sector. The private providers consisted of the non-profit religious missions and NGOs, for-profit organizations, and traditional healers, majority of which are operated by the Catholic and Protestant religious bodies. The former operated 179 facilities (including 8 hospitals) with a staff capacity of 1,315 and the latter 122 health facilities (including 24 hospitals) with a staff of 2,633. There were approximately 200 for-profit clinics and thousands of traditional practitioners (Ntangsi, 1998).

However figures in 2002 showed increased health care personnel, approximately 37,752 of whom 3,124 were physicians, 26,042 midwives, and 1,793 laboratory technicians with no community workers (WHO, 2006a).

There were challenges in delivering adequate health care to the public due to setbacks and dissatisfaction by the users in areas of quality, insufficient facilities and health personnel, lack of drugs, and most of all the centralized nature of administration and management which makes it harder for primary healthcare to operate. In 1992, the MoPH re-oriented the health care system with emphasis on:

(i) A decentralized planning system and rationalization of health coverage,

(ii) Government and community co-management and financing of healthcare facilities (Essomba et al., 1993).

In this regard, healthcare burden or cost was shared between the government and the population. The MoPH covered the salary, pre-training and other services of healthcare workers while the various communities took care of all the recurrent charges for the day to day running of the PHCs (McPake, 1993).

2.3.1 Organization of Health system in Cameroon and their roles

Health and the healthcare system in Cameroon are coordinated by the MoPH which receives the 2nd highest budgetary allocation per ministry each year. The ministry has the roles of development, implementation and the continuous evaluation and regulation of the public health system. As such, their activities include:

1) Organizing, managing and developing public-owned health units as well as setting standards and regulating the private medical formation.
2) Controlling the practices of health and medical professionals, and also, to ensure the supervision of the associated professional orders along with hierarchical organization of the public health sector.
3) Initiation and organization of preventive medicine and national health campaigns, and
4) Assist in the training of medical personnel with their periodic recycling (Ministry of Public Health Organization, 2009).

The MoPH is partitioned into various directorates and divisions per specialization as stated: Directorate of human resources, Directorate of finance and infrastructure, Directorate of pharmacy and drugs, Directorate of community health, Directorate of hospital medicine, Division of cooperation, Division of studies, Planning and communication, and Division of maternal mental health. Each directorate or division, assumes the responsibility of coordinating the health care system (from tertiary to

primary) in line with their department, and information is been channeled to the central plan for major decision making (Ako, 2008).

The main organ of the MoPH constitutes the health units, which are divided into categories depending on their level of competency in descending order.

I. **Category one** includes General Hospitals which are three in number including a University Teaching Hospital (tertiary or referral hospitals). They have high quality medical equipment and carry out clinical research and also teaching practice of physicians. This category has different sections for different activities.

II. **Categories two** include Central hospitals, three in number including one Para-public. It is also a tertiary hospital with relatively high quality equipment and also carries out complex surgical operations and minor clinical research.

III. **Category three** constitutes Provincial Hospitals, 10 in number and distributed evenly all over the 10 provinces. This category as secondary hospitals is very instrumental since it coordinates the activities of the other hospitals (district hospitals) within the provincial level. They carry out some major clinical diagnosis and treatment procedures and are also involved in coordinating the over-all health education programs within the province.

IV. **Category four** include the District Hospitals of which there are 136 (secondary hospitals found at divisional levels).

V. **Categories five and six** include Sub-divisional medical centers and Integrated Health Centers. These are Primary Health Clinics (PHC) found either at the sub-divisional levels or district rural communities.

The PHCs or integrated health centers are the most fundamental in the health care sector in Cameroon given their accessibility to more than ¾ of the population especially at the rural levels. The nation has about 1.9 doctors for every 10,000 people, such that most health care personnel providers are nurses (WHO, 2006a). Consultation process involves referral systems beginning from the nurses or trained health counselors up to general physicians or surgeons who eventually carry out the diagnosis and treatment.

The integrated health care centers are focused on mostly preventive medicine and they engage in many community programs with lecture sessions on various topics such as family planning, hygiene, as well as other common medical and health misconceptions due to cultural barriers. The members of a community are mobilized, selected and given training on basic health issues and also embark on sensitization works on common diseases of public health concerns such as polio, onchocerciasis, TB, HIV aids and malaria, etc. Regional health workers assist and act as coordinators in channeling reciprocal information both at the central and grass root levels and also supervision of implemented programs (McAllister, 2009).

The Ministry of Public Health alongside support from international organizations and local NGOs operates subsidiary organizations and national programs such as, National committee of Epidemiology of Cameroon, National AIDS Control Program, National Malaria Control Program, National Tuberculosis Control Program, Tropical Medicine Research Station, and National Immunization Program (MoPH, 2009).

Important issues or events in an attempt to control malaria in Cameroon include the 1997 National Policy declaration and the first plan of action to combat the disease initiated in 1998. Malaria control along with other programs at the central public health ministerial level is the sole responsibility of the Directorate of Community Health. Initiatives taken in 1998 created a "Working Group for Malaria Control" with members including the national coordinator for malaria, the director of pharmacy in the MoPH, and representatives from the MoPH health education unit, WHO, UNICEF, research institutions and pediatricians from the Yaounde central hospital, which meet on irregular basis to evaluate progress of implemented strategies on combating the disease (Edmondson, 2001, pg. 24).

2.3.2 Healthcare Financing in Cameroon

In as much as there are many healthcare providers in Cameroons' health system, there are also multiple actors in terms of financing for health, which involves direct relationship between the financing sources with the provider and in rare instances through intermediaries or a third party. Some of the sources include: government,

public and private enterprises, foreign donors, religious organizations and households (Ntangsi, 1998).

Healthcare financing in terms of paying for health care services involves multiple payers and numerous mechanisms for payment. Payment may be direct i.e. self-pay (out of pocket pay) or indirect (by a third party on behalf of a patient) by insurance company or scheme respectively.

In Cameroon there is no national social health scheme. A large part of the population is not able to access health care as the result of the establishment of user fees and other cost recovery within the health systems, as a way of supplementing public financing of health services. "*While some individuals may be covered by formal private health insurance and other workplace health insurance schemes, the majority of the population that live in the rural areas or work in the informal sector is left with few or no options when it comes to paying for health services*" (Mutual Health Organization, 2007).

However, major moves have been made by both the public and the private sectors in an effort to relieve healthcare cost burden of the population. In this regard, the government has instituted healthcare plans to absorb some of the health cost of its workers; while in the private sector, support from NGO-SAILD in partnership with USAID funded organization – AWARE-RE, together came up with Health Management Organization (HMO) that targets and covers the healthcare needs of the rural and grass root population (Cameroon Health Information, n.d.).

2.4 Overview of National Malaria Control Program (NMCP) in Cameroon

The NMCP in Cameroon alongside the WHO and other international and local organizations have been engaged in methods of fighting the disease within the country and in Africa as a whole.

In response to the malaria burden, the National Policy Statement on Malaria Control was drafted and adopted in 1997 and the Cameroon government signed the Abuja Declaration to Roll Back malaria in Africa. At the national level, the Roll Back Malaria Initiative was launched on 25 July 2000 by the Minister for Public Health alongside international partner representatives. Leading partners involved WHO, UNICEF, UNDP, the World Bank, the European Union. Other agencies included ministries, NGOs, private sector clubs, private sector organizations as funders (in particular Exxon Mobil), universities and research institutes, and the community at large.

Cameroons' malaria situation analysis started in 2000 coordinated by the MoPH whose activities and that of other partners cut across the establishment of regional centers for mosquito net treatment; pilot tests of ITNs in selected districts; import of nets; follow-up of national treatment guidelines; research studies on malaria related issues; media promotions particularly on TV, radio, posters, brochures, and tax relief on nets and insecticides with future policy consideration for malaria control (Edmondson, 2001).

A National Malaria Control Strategic Plan (2002-2006) was drafted and adopted by consensus in April 2002 based on modern and cost effective methods of malaria control designed by the "Roll Back Malaria" initiative. A composed reorganized malaria control in Cameroon was signed in July and August 2002 with the main goal: "*to reduce malaria-related morbidity and mortality by 50% among children under five years and pregnant women by the year 2010*", and objectives:

I. To increase the use of ITNs among under-fives to 60% by the year 2006,

II. To improve malaria case management in households and health facilities,

III. To build the management capacities of NMCP structures and teams at each level.

IV. To increase significantly community access to malaria prevention and household case management information.

The intended activities to achieve the above stated objectives were enormous in a greater effort to scald the disease. It involved equipping health centers, research works, increased drug supply and ITNs, capacity building especially to young graduates, monitoring and evaluation and community involvement in a duration of four years (2004 to 2008).

The expected results as per activities mentioned were: increases in the use of ITNs among children under five years, improved malaria case management in households and health facilities, increased intermittent presumptive treatment coverage for

pregnant women, personnel empowered for malaria cases management, effective epidemiological surveillance of malaria, effective supervision, monitoring and evaluation of malaria control activities and coordination of all partners action, better knowledge of malaria and related current effects. And in all, these components were meant to scale up the fight against malaria in the entire nation which comprises 154 health districts in 1,382 health localities (CCCM, 2003, page 12-13).

The Cameroon government during 2002 – 2003 utilized the funding that was provided by Heavily Indebted Poor Country Initiative (HIPIC) to lunch a massive campaign to distribute 810,000 insecticide treated nets to pregnant women free of charge. This initiative saw the mobilization of competent local community associations at health districts levels by 10 sponsored non-governmental organizations and associations, each at a region, in sensitization activities (Cameroon Grant Performance Report, 2009).

2.4.1 Malaria eradication strategies and malaria burden in vulnerable population

Over the years different strategies have been put in place by the National Malaria Control Program (NMCP) initiated to fight against malaria. The strategy has consistently been modified over time in order to improve its efficiency with emphasis laid more on early diagnosis and treatment, and personal protection especially with

insecticide treated bed nets (ITN). By these means, it was intended to minimize the use of potentially harmful chemical insecticides (DDT).

Shobha (2007) showed how the use of indoor residual spraying has affected the control of malaria in many parts of the world. Though indoor spraying with DDT was useful, it was often difficult to implement on a long term basis as it is necessary in endemic countries which have stable malaria transmission all year round or a long lasting season of transmission. The major disadvantage of these insecticides is the risk of intoxication because of their persistence in the environment since they are lipid soluble and bio-accumulate through foods. Also, there is a high risk of the development of resistance on the part of mosquitoes (Shobha et al., 2007).

Results of a survey carried out in 2004 by the NMCP and CCAM detected no significant change in the disease burden (i.e. under 5 mortality rate =155/1000, neonatal mortality rate =37.2/1000, infant mortality rate =96/1000 and children mortality rate = 79.9/1000) (CCAM, 2008).

For the period between 2007 and 2010, NMCP re-emphasized its target (children under five and pregnant women) to reduce malaria-related morbidity and mortality by 50% given the increased trend in incidence rate. Achieving this goal depends largely on the prevention and management of cases.

During these period, the National Malaria Control Program (NMCP) in association with NGOs and other community foundations re-oriented its strategy for 2007-2010

towards a greater community participation in order to mitigate the difficulties it was having scaling up its interventions with insecticide treated nets, the intermittent preventive treatment (IPT) of pregnant women with Sulfadoxine pyrimethamine (SP), and the use of Artemisinin-based combination therapy (ACT). And also to embark on developing IEC (Information, Education, Communication) package especially at the grassroots level in view of creating awareness on malaria prevention and control methods.

Recommended control strategies for malaria in pregnancy in areas where malaria is endemic include effective case management of clinical episodes of malaria, the use of insecticide treated nets (ITNs), and intermittent preventative treatment (IPT) (WHO, 1998).

Relatively few studies have explored the targeted area and mechanism in implementing an effective case management strategy; in many settings, ante-natal services are seen as the best policy and mechanism to deliver these interventions as Steketee (1996) stated, "*these measures should be implemented along with other interventions such as the use of ITBNs, the systematic treatment of all malaria infections (which includes the use of quinine, mefloquine, or Artemisinin derivatives), and more generally with other prenatal care program, including prevention of maternal anemia and reduction in mother-to-child HIV transmission*" (Steketee et al., 1996)

In as much as different measures have been identified, the use of ITN is outstanding given its protective role and cost effectiveness compared to treatment. However, striking issues related to ITN use at the household and individual levels include determinants of proper net deployment as well as individual adherence.

2.4.2 Distribution of ITN in Cameroon

Prevention is an important focus in the NMCP strategic plan. It is preferable to prevent rather than to cure diseases. It consists of the distribution of insecticide treated nets to the population, intermittent preventive treatment (IPT) of pregnant women, and other methods of prevention (environmental health, in-door spraying, biological etc.). The NMCP was aimed at providing access to effective vector control to at least 80% of the population by 2010 (NMCP Report Cameroon, 2008, pg. 8).

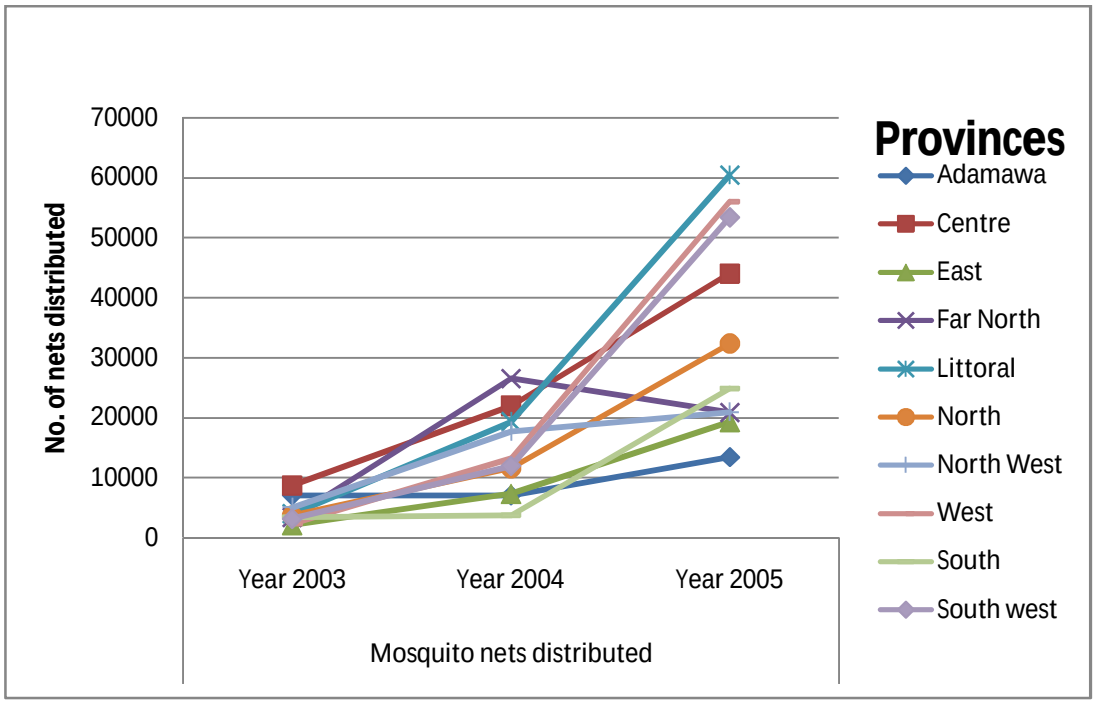
For three years in a row (2003-2005), approximately 533,000 ITNs were delivered to pregnant women. As shown in table 2.2 below, the South and South West Regions attained coverage rates above the targeted 60% of the population of pregnant women.

Table 2.2: National coverage of pregnant women with ITN (2003-2005)

Provinces	Mosquito nets distributed			Rates of coverage
	2003	2004	2005	2005
Adamawa	7,050	7,050	13,409	32.4%
Centre	8,728	22,000	44,014	31.9%
East	2,123	7,324	19,292	44.7%
Far North	3,405	26,540	20,850	13.4%
Littoral	3,961	19,350	60,419	53.5%
North	3,720	11,577	32,363	46.5%
North West	5,030	17,675	20,915	20.5%
West	2,372	13,269	56,048	50.1%
South	3,366	3,654	24,890	79.7%
South west	3,200	12,000	53,340	76.2%
Total	46,955	140,443	345,540	38.4%

Source: NMCP Report Cameroon, 2008

Figure 2.1: Trend in mosquito net distribution within the 10 Regions of Cameroon.



Source: Author (extrapolated from table 2.2)

The national coverage rate of ITN in pregnant women stepped up from 5.7% in 2003 to 16.6% in 2004 and to 38.4% in 2005 respectively. The year 2003 was characterized by relatively low rates in all provinces, while 2004 was characterized by relatively stable coverage rates from one province to another (NMCP Report Cameroon, 2008, pg. 9).

In 2004, Population Services International (PSI) local affiliate along with Association Camerounaise Pour le Marketing Social (ACMS), collaborated with the NMCP and launched a project that was financed by USAID and PSI for the supply of ITNs through private sectors. This attempt was initiated in order to compliment the

Ministry of Public Health's free net distribution campaign uncovered areas. Further expansion of the program to all the 10 regions of the country was achieved using a combination of free distribution and social marketing mechanism funded by Exxon Mobil in 2005. This initiative aided PSI/ACMS in 2005, which until 2008 realized the distribution of about 400,000 ITNs to the entire country. Moreover, in 2006, PSI/ACMS set up a 6-month duration project that provided the opportunity to women of "reproductive age", coupons that supported 60% of the purchase price for an ITN (an equivalent of 3 USD instead of 7 USD) in the two major cities of Yaoundé and Douala. As a result of this, 48,000 ITNs were further distributed potentially preventing 45,552 malaria cases, which correspond to about 10,448 healthy years of life saved or DALYs(United Against Malaria, 2008).

The distribution of insecticide treated bed nets (ITN) targeted mainly children under-5 and pregnant women. Due to the lack of an adequate supply of ITN, the NMCP adopted a distribution strategy based on household. Each household with a child below 5 years received only one ITN regardless of the number of children below 5 years old in the household. According to the NMCP report, more than 1.5 million ITNs were distributed from 2005 - 2008 to households that had at least one child below 5 years, with coverage rates exceeding 100% in the Adamawa, Far North, South and the South West provinces. However, report shows inadequate coverage in the littoral and western provinces (NMCP Report Cameroon, 2008, pg. 8).

2.5 Definition of terms

Standard and operation definitions of some terms besides theories identified by researchers have been addressed in this context in order to give clearer picture and meaning to the study. In particular, the theories of mortality change and the socio-economic determinants of the health of children were cited, and related to the concepts of knowledge and utilization of ITNs to control and prevent malaria.

2.5.1 Public Health: Public health relates to a person's individual health or the health status of a population. It is about the initiatives people can take to prevent risk and to improve a persons or a population health situation, by giving them tools and knowledge to cope within the resources available; *"one of the collective efforts organized by society, to prevent premature death, illness, injury and disability and to promote the population's health"* (Beaglehole & Bonita, 1997). In other words, public health refers to how effective the health status of individuals has been managed. Effective management of an individual's health would obviously demand the acquisition of knowledge which would influence directly or indirectly the behavior and practices of an individual.

2.5.2 Knowledge: In this studies the term knowledge refers to Information, Education and Communication (IEC) delivered as a package by the National Malaria Control Program or various sources as the case may be.

As defined by Fukuzawa (2008), *"knowledge represents mental models stored in a brain as long-term memory, necessary for human understanding and thinking to*

external things", while Information "*representative mental models formed in a brain as working memory by abstraction of stimuli coming from the outside of a body through the five sense organs as well as by using long-term memory stored in the brain, used for understanding and thinking*".

2.5.3 Education: The term education rather seemed to have been defined in many ways. In as much as some people think that education can only be acquired or learned through formal means such as schools, others do believe that education is a broad spectrum that covers a whole range of ideas and subject matter. Whatever the case may be, most definitions of education including that of Wikipedia defines education as involving "*any act or experience that has a formative effect on the mind, character or physical ability of an individual. In its technical sense, education is the process by which society deliberately transmits its accumulative knowledge, skills and values from one generation to another"*. From this definition, we can establish the fact that education can be achieved from various forms depending on an individuals' mind, character or physical abilities.

Many studies on determinants of child survival have been associated with the socio-economic influences of maternal education as evident in different cultural settings. However, much is still to be appreciated on how an improved education might actually affect child survival. Caldwell (1979) examined education as a factor in mortality decline in Nigeria and hypothesized that maternal education has a direct effect on child survival beside father's education and area of residence. Caldwell has

found that children of educated mothers have higher survival chances than those of uneducated mothers. He argued by three pathways, through which maternal education may affect child survival:

1) Education increases health knowledge, and as a consequence, fosters behavior change; 2) Education promotes self-identification and potential of modernization; and 3) Education empowers women within the household (Calgwell, 1979, pg. 410). In a nutshell, Caldwell tried to correlate causal effects of health awareness as mechanisms through which education operates (1979:pg. 396).

Another demographic theory as identified by many researchers is “knowledge of disease etiology” or “health knowledge”. As shown in a study on child mortality in the United State, Preston and Haines (1991) identified health as “know how”; acceptance of the germ theory of disease causality and associated hygienic practices have been important determinants of mortality decline in the U.S.

From the stated theories and definition of education, we can envisage the degree of intertwine to knowledge, skills and values; and whatever method it is acquired (be it through formal, informal education or specifically health knowledge) would actually determine the required impact with respect to the health of individuals.

2.5.4 Communication: As illustrated by the web Wikipedia, communication involves processes whereby meaning is defined and shared between living organisms. It requires an operational medium for conveyance, sender and a

recipient and it can occur across vast distances in time and space. Communication requires that the parties involved share some common attributes and the process becomes complete once understanding has been achieved. From the definition, we can say communication is meaningful from the responses we get back regardless of the method, in which case recipients' understanding is very crucial.

2.6 Results and findings of previous malaria studies:

Knowledge is very fundamental when we wish to assess the ownership of ITN with respect to its utilization. Though some studies carried out on malaria in Africa have focused on knowledge, attitude and practices (KAP), little concern has however been given to address these concepts in regards to how the population has perceived the need to utilize ITN as a preventive tool against the disease. Furthermore, much fewer studies have actually examined the difference between utilization of ITN in relation to ownership and knowledge, alongside other associated factors that may be influencing the use of ITN as malaria indicator. To the best of the authors' ability, no such studies have been carried out in Cameroon.

2.6.1 Efficacy of ITN at different parts of the world

Prior knowledge on malaria is paramount to ownership of ITN, and its eventual utilization and efficacy would require the population to have adherence. According to (Jamison et al., 2006, pg. 463), how effective the use of ITN is, would largely depend on their acceptability and affordability by the population at risk. Other determinant factors may include circumstances of established customs, characteristics of life processes, and susceptibility of the disease vector, the conformation or abidance of the human population, and the concentration of insecticide, which is regularly maintained by re-treatment or by incorporating the insecticide for long periods.

Several studies carried out in different parts of the world have demonstrated the efficacy of Insecticide Treated Bed nets (ITN), most of which were summarized by Langerer (2004). He reviewed published articles from MEDLINE, EMBASE and LILACS in the year 1966 to 2003 with the aim of assessing the impact of insecticide-treated bed nets or curtains on mortality, malarial illness, malaria parasitaemia, anemia, and spleen rates. It was shown that, ITNs provided 17% protective efficacy (PE) compared to no nets and 23% PE compared to untreated nets with about 6 per 1000children rescued in a year for those protected. ITN utilization within regions of steady and constant malaria decreases the cases of uncomplicated malaria sequences up to 50% as in regions with no nets, and also 39% with respect to regions where nets were not treated. When compared to no nets and in areas of stable malaria, ITNs also had an impact on severe malaria (45% PE), parasite prevalence (13% PE), high

parasitaemia (29% PE), splenomegaly (30% PE); and their use improved the average hemoglobin level in children by 1.7% packed cell volume (Lengeler, 2004).

As in the 1980s to the mid-1990s in Asia, ITNs were employed on a large scale in endemic areas to fight against malaria. A study carried by Hung et al. (2002) did not only show a prospective malaria intervention in Vietnam using ITNs and early diagnosis and treatments as tools, but also saw community involvement with health education which successfully brought the disease under control (Hung et al., 2002).

According to Binka (2002), insecticide treated nets should be encouraged especially in areas of high endemicity of Plasmodium falciparum given that a consistent and sustainable 17% mortality reduction was reported among children aged 6 to 59 months in a clustered randomized controlled trial in northern Ghana from 1993 – 1995 even after a follow-up of the randomize intervention until the end of 2000 for those utilizing ITN (Binka, 2002).

With the strong and substantial evidence of the effectiveness of ITN utilization, it was logical to adopt the use of ITNs which constitutes the backbone and till this period is regarded as the most cost effective intervention method of the four “roll back malaria” strategy for the disease control in Africa. Since then, millions of insecticide treated mosquito nets (ITN) have been distributed to pregnant women and children under-5 (WHO, 2003a).

Though ITNs have been shown according to several studies to be effective against malaria, there are however some controversies because of the possibility of acquiring immunity, the controversy that ITN may have no effect, or in some cases instead increases malaria morbidity especially in areas where transmission in high. In this regard, Muller (2006) carried out a randomized controlled trial to assess the long term effects of bed net protection during early infancy. A sub sample of a representative population of 3,387 neonates from 41 villages in Rural Burkina Faso was collected from two main groups (those who received bed nets protection from birth and those who received them after age 6 months); and examined for the primary outcomes of mortality or falciparum incidence. The findings provided additional evidence on protective ability of ITNs amongst children in endemic areas, thus enabling the development of reliable long-lasting insecticide treated nets which are either formulated as impregnated or re-impregnated periodically with insecticides (Muller et al., 2006).

Today, the need for a large scale utilization of ITNs in Sub Saharan Africa (SSA) is well accepted in the international organizations and within the scientific community.

It is however unfortunate that the implementation of ITN program in a large proportion of regions especially in Africa south of the Sahara still remains inadequate due to problems with mismanagement of funds, lack of health personnel coupled with the problem of incompetency and above all the lack of good health organizational structures.

2.6.2 Ownership versus Utilization of ITN

Though net ownership could give an estimate on how effective the malaria implementation program is, it is important to note that, this could just be the first step in combating malaria in areas of high endemicity given that its use represents the most vital practices and with an epidemiological impact on the disease.

As reported by the WHO, *"although most indicators will vary between countries, there are five indicators that are considered so important that they have been selected as global indicators. It is recommended that all RBM countries report on these global indicators wherever they apply. The five global indicators are: Malaria death rate (probable and confirmed cases) among target groups (under-five and other targets groups); Number of malaria cases, severe and uncomplicated (probable and confirmed) among target groups (under-five and other target groups); Proportion of households having at least one treated bed net; Percentage of patients with uncomplicated malaria getting correct treatment at health facility and community levels, according to the national guidelines, within 24 hours of onset of symptoms; and Percentage of health facilities reporting no disruption of stock of anti-malarial drugs (as specified in the national drug policy) for more than one week during the previous three months"*. However, two fundamental and extremely important roll back malaria indicators to observe towards the advancement and accomplishment of its objectives, include differentiation of households' possession of

nets and those that utilize them especially with children under-5 (RBM Framework, 2000).

However, few studies have documented the differences between possession and use, and yet this distinction is central if the scaling up initiative would be effective. Though households may report possession of an ITN, if the nets are not utilized regularly especially during the peak transmission seasons, then the power to produce a desired effect may be zero. Thus, while it is important for national programs to facilitate households possess ITNs for control and prevention and an effective management of malaria, it says little about the likely epidemiological impact of such intervention (Macintyre, 2006).

2.6.3 Determinant of Possession and Use of ITN:

Several studies carried out in different parts of the world have however elaborated factors that influence ITN ownership and use. In many cases, the determinant factors varied from one country to the other depending on their different socio-economic and socio-demographic characteristics.

Possessing a net and its eventual utilization are two aspects which usually contradict when assessing the impact of ITN distribution programs. Although cost and other cultural beliefs have been identified to impair possession, utilization has been found to be influenced by different seasons of the year, ethnicity, gender, alongside some

demographic characteristics such as age, education, size of household which also add to the difficulties in satisfaction with the nets by virtue of its size, vividness and form.

I. Cost of the nets:

Simon et al. (2002) developed an approach in an attempt to analyzing the extent and to determine the effect to which policy reform on tariff and tax would influence ITN purchases in Nigeria. After much consideration on tariffs/ tax reduction, market structure, household responsiveness and preferences, they anticipated that the reduction of tariff on insecticides from 42% to 0% and the tariff on netting materials from 40% to 5% would enhance the purchase of ITN from 9 to 27%, given the stated elasticity (Simon et al., 2002). This explains why most African nations have adopted free ITN distribution to enhance maximum coverage with the support from organizations such as "Public Private Partnership for Sustainable Malaria Prevention" (NETMARK) and PSI.

With ITN distribution and re-treatment being free, Macintyne (2006) illustrated predictors of ITN possession and use within the endemic region of Eritrea. Barriers other than cost were examined in order to access ITN use, and to ascertain other associated influences to its adherence. Utilization of ITN was differentiated between data collected on all households of the survey and households already in possession of nets. It was shown that households' perception of the disease severity and nearness to health centers predicted ITN possession and use. For households in possession of

ITNs, 17% of children under 5 did not sleep under these nets the night prior to the study, and for such households, about half of the residents hardly utilized it either. However, the probability for utilization of ITN was further determined and associated with households possessing multiple ITNs (Macintyre et al., 2006). This study showed the differences that usually exist between ITN possession and use. It also depicted the lack of understanding of malaria transmission and inappropriate mosquito avoidance behavior given that most households had equivalent "net to individual" proportion but showed gaps in utilization.

Schellenberg et al. (2001) assessed coverage and the effect on child survival of a large-scale social marketing program for insecticide-treated nets in two rural districts of southern Tanzania with high perennial malaria transmission. The results demonstrated that Insecticide-treated net coverage of children in the studied area rose from less than 10% at baseline to more than 50% within three years which was also linked to a 27% increase in children survival (95% CI 3-45). He also found that the coverage in such children was greater in areas with longer access to the program, thus, the conclusion that social marketing of insecticide-treated nets has great potential for effective malaria control in rural African settings (Schellenberg et al., 2001).

II. Local perception and acceptability of bed nets and insecticide

Despite the fact that several factors have direct or indirect influence on the correct knowledge and use of insecticide bed nets, the main challenge is how to subdue the

negative influences, foster positive factors and generally motivate the promotion of bed nets use, especially as a long term prevention tool for malaria.

In order to aid in the designing and promotion of sustainable use of nets in Tanzania, Winch et al. (1994) described local perception and seasonal variability of risk of malaria in relation to the acceptability of bed nets possession and use. They showed that large seasonal variations in levels of net usage could severely limit the potential impact of the nets on malaria transmission. It was found that *"both the diagnosis and treatment of febrile illnesses are affected by what season people think it is, by what illnesses they think are common in each season, and also by their perceptions of how abundant mosquitoes are"*. They therefore predicted based on the study that during dry seasons when mosquitoes are scarce and malaria is thought to be unlikely, it would be difficult to attain high rates of net usage; therefore cultural consensus analysis were found to be a particularly valuable tool for understanding the reasons behind large variations in local perceptions of seasonality (Winch et al., 1994).

Binka & Adongo (1997) conducted a districts wide study in Ghana to gauge community reaction to the introduction of net and to identify factors influencing the acceptance and use of insecticide-impregnated bed nets. They found out that the population accepted the use of long lasting bed nets (LLBNs) because they protect man from mosquito bites, but key factors such as seasonal variation, cost of the nets and the patterns of its use were likely to influence the distribution and effectiveness

of the bed nets. It was shown that the use of bed nets was highly seasonal given that 99% of recipients used their nets in the rainy season which corresponds to the period when mosquito density is at the maximum and only 20% used them during the dry season of low mosquito density (Binka & Adongo, 1997).

III. **socio-economic and socio demographic characteristics of households: (**wealth, access to healthcare services, education, age, size and location of household, ethnicity and gender**)**

Heggenhougen et al. (2003) examined the influence of wealth, healthcare and education as important predictors of ITN possession and use. He described the controversy in the acceptance that malaria is associated with poverty given the debate as to the extent of this relationship. There is no doubt about a growing gap between the rich and the poor, the increase in marginalization, and the increasing numbers of people living below an absolute poverty line of $1 per day which is the major cause of concern in as much as it is also recognized that malaria morbidity and mortality may lead to poverty. It is a fact that the health of a growing and flourishing population will not improve unless poverty and expanding inequality are reduced and this includes the effort to control malaria on a large scale. They also mentioned the fact that greater issues of poverty and inequality have to be addressed if the effort to tackle malaria was to be taken seriously, with a proposition to diversify and look at the problem in the socio-economic, political and cultural contexts (Heggenhougen et al., 2003).

Ethnicity, area of residence and gender have also been shown to be factors influencing ITN possession and use, all of which have been demonstrated in studies carried out in Gambia, a country characterized with many ethnic groups.

Thomson et al. (1996) examined the geographical perspective of bed net use and malaria transmission, prior to the introduction of impregnated nets in Gambia. They found that the villagers protected themselves with bed nets in areas of high mosquito bites, and where mosquito density was low; the prevalence rate was relatively high. They further correlated bed nets usage rates and mosquito prevalence to geographical determinants such as ethnic group, area, habitat, and distance from the River Gambia. The result showed that, *"bed net usage was independently associated with area ($P < 0.001$), ethnic group ($P = 0.010$), habitat ($P = 0.006$) and distance from the river ($P = 0.013$)"* while *"Malaria prevalence was not independently associated with area, ethnic group, habitat or distance from the river"* (Thomson et al., 1996).

2.6.4 Factors influencing mosquito abundance and high malaria incidence:

During the 1960s, malaria eradication was highly successful mainly because of the use of DDT. Its application has gradually been stopped in many parts of the world following investigations of its negative effects on the ecosystem in general. This has resulted in a rapid rise in malaria incidence rates and prevalence has followed environmental suitability in many settings along with the development of resistant strain of the parasite which makes it even more complex.

I. Variation of malaria incidence with climatic condition and altitude

Studies carried out in Zimbabwe by Hartman et al. (2002) on climate suitability for stable malaria transmission under different climate change scenarios showed that climate is a major factor that determines malaria transmission. "*Suitability for stable transmission is based on constraints on the survival and development of the Anopheles vector and the Plasmodium falciparum malaria parasite. This depends on climate sensitivity and greenhouse gas emission stabilization, and the variability which depend on the general circulation model working either for or against efforts to control the disease"* (Hartman et al.2002).

Using Zimbabwe as a targeted example, Mabaso et al. (2005) also documented a descriptive study on malaria seasonality within countries of the southern African regions. They described the association between seasonality in order to quantify malaria case load (based on monthly values of rainfall during the peak transmission season) relative to the environment for the period 1988–1999 providing smoothed

mapping in a seasonal trend. Results showed that high temperature and rainfall were suitable conditions for seasonal transmission. Thus, malaria epidemiology is associated with seasonal variation, altitude and associated rainfall and temperature fluctuations (Mabaso et al., 2005). This therefore implies that areas of lengthy wet and favorable climatic conditions are more prone to greater vector abundance.

Githeko et al. (2000) explained how climatic variation was associated with vector abundance especially in countries of the tropical African climate. Vector borne diseases such as malaria, filariasis, trypanosomiasis etc. were favorable to this climate thus experiencing greater transmission with values expected to increase given the predictions for further increase in global temperatures (Githeko et al., 2000).

Teklehaimanot et al. (2007) explained the disparity of results associated with weather and malaria lag incidence as a result of the interaction of the weather factors which affects vector abundance, survival and parasitic maturation; all of which are key determinants of malaria transmission. They showed the relationship between rainfall and delayed increase in malaria cases at cold areas as opposed to relatively shorter lags in hot areas. The results quantitatively showed that at 16°C, metamorphosis of mosquito larva may take greater than 45 days in which case increases the chances for predation, compared to just 10 days at 30°C. Thus, stipulating the linkages between climatic factors and the biological influence on mosquito and parasite life cycle is a

key factor in the association between weather and malaria (Teklehaimanot et al., 2007).

According to Clement (2000), higher altitude areas of Africa are malaria hypo-endemic, because of the climatic conditions which are characterized by low temperatures and relative humidity and are not favorable for metamorphosis to occur.

However studies that were conducted by Tchuinkam et al. (2010) in the western highland region of Cameroon indicated Anopheles species diversity, though the density decreases entirely from lowland to highland. *Anopheles gambiae* was noted to be the most aggressive species found to cut across high and low altitude areas*; thus suggesting that* altitude and climatic variations had no effect on the survivorship and the subsequent life expectancy of the adult stage of these malaria vectors (Tchuinkam *et al, 2010*).

II. Habitat suitability and ecological niche profile of major malaria vector

Given that most researches in conservation ecology require some level of realism, it is important to identify the distribution of species based on the environmental profile of communities' settings. Based on the foundation of Hutchinson's (1957) concept on niche as an "*n-dimensional hyper-volume"* (Hutchinson, 1957), every point

corresponds to a state of the environment which permits a species to exist indefinitely (Hirzel, 2002),

According to Brown et al. (1995), the number and variation of species is important for ecological and bio-geographical studies especially with respect to the pattern of regulation of their abundance over time, the geographic range of existence and the inter-specific variability in abundance within specified localities. As an objective to quantify the magnitude and pattern of spatial variation in local population density within a single species, Brown hypothesized and proofed that *"spatial variation in abundance largely reflects the extent to which local sites satisfy the niche requirements of a species"* (Brown et al., 1995).

With malaria epidemics recorded at various areas in the endemic countries, it is however unfortunate that much emphasis has not been given to the importance and predictive values for the various factors. In a study to examine malaria epidemics risk factors and implication in Ethiopia, Abeku et al. (2003) showed that apart from determinant factors such as weather and other eco-epidemiological characteristics of the area at risk, epidemic risk was a dynamic phenomenon with changing geographic patterns based on temporal variation factors such as high and low minimum temperatures. Thus, there is a need to take into account early warning signals from changing pattern in determining the variation of spatial model of malaria epidemic risk (Abeku et al., 2003).

2.6.5 Case management and treatment

According to the Global Malaria Program (2009), case management involves appropriate practices of NMCP of endemic nations to embark on laid down procedures by WHO to allow for early diagnosis and prompt effective treatment of the disease using Artemisinin based combination treatment (WHO, 2009a).

Effective case management of malaria begins with the promptness to recognize the signs and symptoms of the disease before treatment measures are decided. Mothers are primary caregivers and are usually the first to recognize signs of illness in their children. Kidane et al. (2000) demonstrated in Ethiopia that, educating mothers through training on malaria recognition and treatment can improve the effectiveness of malaria control programs (Kidane et al., 2000).

By examining the impact of health education on knowledge of malaria in Nigeria, Chirdan et al. (2008) showed that home management of illnesses, very common in Africa, forms a fundamental aspect for caregivers (especially mothers) to preventing delays of diagnosis and improve on treatment as it forms the first line of treatment.

Usually, only after the first line of treatment has failed, will most of individuals seek treatment at health facilities. A series of studies including that of Deressa et al. (2003) showed that home management of the disease has usually been in the form of self- treatment after presumed diagnosis, and the medications pertaining to it include anti-malarial, antipyretics and herbs. This unfortunately has mostly resulted in first

line treatment failure at home and in some cases devastating long term effects especially in rural settings, thus the urgency for education on malaria.

2.7 Chapter summary:

Malaria has received a lot of global attention as it contributes significantly to the health burden of over 3 billion individuals. Even though much literature exists concerning the disease burden, the necessary actions for eradicating the disease are still to be appreciated.

Control of malaria is a complex chain of measures that often complement one another. The strategies implemented have been to disrupt the developmental stages of the vector or to reduce or minimize spread of the parasite in the host (man) by: Prevention of malaria in the given individual, thus reducing parasite load and reduction in spread; and by denying blood meal to the mosquito whereby egg laying is also hampered.

According to Wenceslaus (2000), "*Malaria in sub-Saharan Africa is complex because the vectors, parasites, geography, ecology, human behavior, infrastructures and resources available for disease control are all variable and problematical*". He therefore pointed out that, managing the disease in this region depends on answering pertinent questions such as: where ITN would work best, reliable promotion strategies, extent of anti-malaria resistance to malaria control, effect of cost sharing

on treatment and prevention of the disease especially among the poor. In this regard, he stipulated that *"control strategies must therefore be place-specific"* (Wenceslaus, 2000).

However, hope has been revived by the renewed interest following the "Roll Back" malaria initiative in scaling up the implementation of tested and proven interventions across the continent and even elimination of the disease is being targeted in areas where endemicity has been reduced (WHO, 2006b).

CHAPTER III:

RESEARCH METHODOLOGY

The research is an epidemiologic study which employs the concept of positivism; thus, an approach which deals with observable realities rather than the metaphysical speculations without substantial evidence (Leavelle, 1942). The study takes advantage of the natural reality of situations in order to study the occurrence of Malaria as "a disease outcome" in relation to a population at risk. The design of the study is cross sectional survey using structured and semi structured questionnaires for primary data construction and also the use of secondary data collected from several sources, used to build the research validity and reliability. Descriptive and analytical statistics were employed to analyze the data and make comparison between the different localities.

3.1 Research design:

The research is a descriptive and analytical study using a quantitative cross sectional design. Given that this study examines the behavior of individuals, quantitative analysis becomes suitable as Creswell (2003) mentions; "*developing numeric measures of observations and studying the behavior of individuals become paramount for a post-positivist*"."*Quantitative method will bring out the most common co-variation among variables and the subject to be studied in an extensive pattern among many cases*" (Riley et al., 2000). Furthermore, Ragin (1994)

explained that *"an extensive approach is best suited for goals that involves knowledge of broad patterns across many cases"*.

As much as the analytical statistics was necessary to proof the hypotheses, the descriptive design was also appropriate to provide simple descriptive information on the socio-economic characteristics as well as other independent variables of malaria knowledge and ITN usage among households in rural communities. The research was aimed at providing pointer information for further studies and measures that could be undertaken by various NMCP in the future.

A cross sectional survey was employed for this research since the rural communities were examined at a single point in time, thereby addressing the research questions and providing numeric information on the knowledge of malaria , and the perception and value to the use of ITN. Detailed information on the behavior/attitude of respondents as to the way they responded to each question as well as the natural and immediate environment were observed and taken into consideration.

3.2 Study area

This study was within the Fako division which is one of the six divisions of the South West province of Cameroon. The division covers an area of 2,093 km² and as of 2001 had a total population of 534,854 inhabitants. The division is subdivided into four sub-divisions (Limbe, Buea, Tiko and Muyuka) of which the town of Limbe is the divisional and administrative capital and Buea is the provincial capital. Each of these

sub-divisions contains many local districts and rural communities under their jurisdiction. The study was conducted in the Buea subdivision (Bolifamba and Muea) – an outskirt and semi-urban vicinity; and Tiko subdivision (Likomba and Modeka) – a rural settings. Buea (1,085 meters above sea level) is at the foot of mount Fako (4,100 m) while Tiko (28 meters elevation) is situated some 17.89 km from Buea.

Figure 3.1: Map of the South West Region (Province) of Cameroon

Source: MACEFCOOP, Cameroon.

The area is at the extreme south, within the South West Province of Cameroon. It forms part of the rain forest region of Central Africa and holds the largest agro-industrial scheme, the Cameroon Development Corporation (CDC). The population is highly heterogeneous with inhabitants from almost all parts of Cameroon, including foreigners from some parts of Nigeria, Togo and Ghana etc. Most of the residents are either plantation workers of the CDC or are engaged in local activities which center on subsistence farming and petty business.

The Fako division is constituted of localities known to be the wettest places in the world, registering more than 10,160mm of annual rainfall. The mount Cameroon region has an equatorial climate made up of a long rainy season that starts in March and ends in October with maximum rainfall in August and September. The dry season starts in late October and ends in February. The mean value of the minimum temperature varies between 20.0°C in December and 18.0°C in August and the mean value of the maximum temperature ranges between 35.0°C in February and 30.0°C in March (wanji et al., 2003).

Communities in these two sub-divisions have been selected for this study mainly based on similarities or difference in occupation, their exposure and nearness to social amenities, and most importantly climatic condition.

3.3 Sampling technique

The study was restricted to 2 main ecological zones (A highland area in the Buea district mountain vicinity and a lowland area in the Tiko district). A sample frame which consisted of 10 communities, 5 from each zone was identified. Also the study required “on location” analysis, in this case a door to door survey; it was necessary to utilize a sampling technique which is more practical to deal with and to have a representative sample of a large population at the household level. In accordance with the probability theory and given the complexity of deriving the exhaustible list of the elements that constituted the targeted sample population, multistage cluster sampling was therefore employed (Babbie, 2005) (I.e. Clusters or natural groups were sampled initially, with the members of each selected group being sub-sampled afterward).

Because each of these localities has a different characteristic population size, a sampling ratio which represents the proportion of the number of respondents was estimated. The selected subjects all came from rural communities in order to make a comparative analysis based on different indicators or variables.

3.4 Subjects of research:

- **Target population:** The targeted population was caregivers within households having children under-5 in the mount Fako region of Cameroon.
- **Study population:** The study population included caregivers with children under-5 within the Buea highland and Tiko lowland areas in the mount Fako region.
- **Sample population:** A total of 140 caregivers, 70 each from Buea and Tiko sub divisions were recruited. Some criteria were established for recruiting and selecting the subjects of the research.

- **Inclusion criteria**: Since the study targeted households with children less than five years, mothers were chosen to be the primary respondents as they were identified as the main caregivers at homes. Otherwise, the household head was interviewed in the local language using structured questionnaires.

- **Exclusion criteria**: Though family households with children under 5 were the main target, this study was limited to assess Malaria indicators for permanent residents within the mount Cameroon region. In this respect, non-permanent residents and households with children older than 5 were excluded.

3.5. Data collection tools and techniques

3.5.1 Questionnaire design (divided into three sections and observational considerations).

The questionnaire was designed from previous Malaria studies, in this case, with little modifications, to suit the purpose of the research. The questionnaire was divided into three sections;

- The first section asked questions on the socio-demographic and socio-economic status of the households (i.e. marital status, household size, educational level, living conditions, occupation, and housing type).
- The second part involved questions about respondents' understanding (knowledge) and attitude towards malaria cause, mode of transmission, signs and symptoms, and risk perception of the disease.
- The third part mainly examined respondents' practices or attention and value towards prevention and control measures using ITN and other treatment seeking practices.

Mosquito nets are classified as ITNs if they are pre factory impregnated or have been treated with insecticides between the past 6 to 12 months. Awareness of ITN was defined based on: the sensitization from IEC delivery packages, acquired knowledge from other media and also from common traditional concepts on how the use of nets could prevent the incidence of malaria; the utilization of ITN was defined based on the respondents perception or acquired knowledge on Malaria alongside their attitude.

3.5.2 **The interview process**

Cross sectional design targeted households with children under 5 for the construction of primary data. In this study, a structured questionnaire was designed and an interview process carried out in order to obtain information from the respondents. The decision to use interview as the method of primary data construction was because:

- It was assumed that majority of the rural women are not literate enough to fully understand and interpret the questions.
- There was accessibility to recruit, train and equip students from the University of Buea in order to facilitate the process. This study coincided with the period when academic institutions were on vacation, thus more time for students to concentrate on carrying out the interview process by translating to local languages for better understanding of the respondents.
- Furthermore, the interview process allows for the opportunity of the interviewers to observe directly the behavior of respondents when answering the questions and also take into consideration how the immediate and community's surrounding is impacting to the burden of Malaria.

The interview was mostly carried out in the evening when the majority of the respondents were expected to be at home. This is due to the fact that, most of the respondents are farmers or petty traders who spend 3/4 of their day at their various

occupations. The interview proper always started with self-introduction of the interviewer who further stated the objective of the study. Cooperation of the respondents to answer the questions administered by the interviewer was optional. Respondents were therefore selected to be the sample of study if they gave their full consent to participate in the research study. Approximately 15 minutes was used for each respondent. Since four University students were recruited and trained as interviewers, it took 6 days to complete the interview process with relatively little difficulties encountered with respect to understanding of the questions.

3.6. Data processing and analysis

The research survey made use of structured and semi-structured questionnaires which seek precise measurements in order to analyze the targeted concepts. Data from the questionnaires were sorted out and coded accordingly, prior to processing by Microsoft Excel and SPSS software. In this study, the statistical significance level was chosen to be 1% (i.e. p-value ≤ 0.01). Therefore, results that showed a p-value of less than or equal to 0.01 was considered to be statistically significant. Two types of data analysis were employed in the study:

i) Descriptive analysis.

ii) Analytical statistics.

3.6.1. Descriptive analysis: Quantitative data was used to generate simple descriptive information such as proportion and frequencies which were useful in evaluating and making comparisons between the different variables of the study.

3.6.2. Analytical statistics: Involved statistical tests using the SPSS and Microsoft Excel software. As stated by other researchers, "*statistical test permits analysts to determine whether or not some observed phenomena are likely to be true*" (Riley, Clark and Szivas, 2000, p. 198).

Contingency tables were formulated and the chi-square test of independence chosen in testing two tailed hypotheses that involved nominal, dichotomous and ordinal or grouped interval variables. The Chi square test of independence was used to determine relationships between the independent variables of (Possession of ITN, Knowledge of Malaria, Sources of information about malaria, Perception of ITN, Education level and the demographic determinants), and the dependent variable of (ITN utilization), and also to show significant levels where such relationships, if any, could exist.

CHAPTER IV:

FINDINGS AND DISCUSSION

This chapter presents the findings of the research studies. The findings were addressed using both descriptive and analytic statistics in order to provide simple basic and inferential or predictive conclusions, respectively, about the population from a representative sample data. The socio-demographic and socio-economic characteristics of the respondents were also examined and described.

Descriptive analysis was used to describe all the variables of the study by providing simple descriptive information such as proportions and frequencies alongside graphs which aided in evaluating the data of different sub components of the indicators. In order to have a deep understanding of the malaria situation among households in different communities; the results were presented per the two main localities considered for the study.

Analytical statistics was used to test the stated hypotheses by determining significant relationships that are attributed to knowledge of malaria and how ITN are utilized among households.

Finally, the findings of the study were discussed and concluded from reasoning that involved making a logical judgment on the basis of circumstantial evidence alongside inferences made based on other related studies on the same subject matter.

4.1 Socio-demographic and socio economic characteristics of respondents

Here, the socio-demographic and socio-economic findings of the sample have been examined. Given the fact that this study addresses knowledge, attitude and practices (KAP) it was important to understand the demographic characteristics within rural communities of the country and also because they are subject to variables in the descriptive analysis.

Table 4.1: Demographic characteristics of respondents

Indicators	Buea (N=70) %		Tiko (N=70) %		Buea/Tiko (N=140) %	
1) Marital status						
married	48	68.57%	53	75.71%	**101**	72.14%
single	22	31.43%	17	24.29%	**39**	27.86%
2) Number of dependents of the respondents						
b/w 1 to 4	35	50%	60	85.71%	95	67.86%
b/w 5 to 8	26	37.14%	10	14.29%	36	25.71%
b/w 9 and 12	9	12.86%	0	0.00%	9	6.43%
3) Educational level of respondents						
Primary school	34	48.57%	50	71.43%	84	60%
Secondary level	17	24.29%	14	20%	31	22.14%
High school Level	11	15.71%	5	7.14%	16	11.43%
University level	8	11.43%	1	1.43%	9	6.43%

Indicators	Buea	%	Tiko	%	Buea/Tiko	%
4) Respondents occupation						
Housewife	14	20%	26	37%	40	28.47%
farmer	7	10%	12	17.14%	19	13.57%
petty trader	28	40%	21	30.00%	49	35%
others	21	30%	11	15.71%	32	22.86%
5) Distribution of approximate monthly income of respondents (with or without husband)						
Less than or equal to 59USD	37	52.86%	36	51.43%	73	52.14%
60USD - 119 USD	16	22.85%	28	40%	44	31.43%
120 USD - 179USD	7	10%	5	7.14%	12	8.57%
180USD - 239USD	3	4.29%	1	1.43%	4	2.86%
240USD and above	7	10%	0	0.00%	7	5%
6) Distribution of housing and roofing type						
Fire bricks or stone/ zinc	0	0%	3	4.29%	3	2.14%
Cement blocks/ zinc	39	55.71%	26	37.14%	65	46.43%
Wood or plank/ zinc	31	44.29%	41	58.57%	72	51.43%

Source: Author

4.1.1 Marital status:

Examining the marital status of caregivers' within households was considered necessary to assess their individual or collective actions on malaria management and practices. The results showed a wide difference in the marital status of the respondents. 101 in a total of 140 respondents in both communities were married as opposed to 39 singles. There wasn't much difference between the two communities in terms of the marital status.

4.1.2 Dependents of the respondents:

A question on the number of dependents of the respondents was examined in order to identify the household burden and family responsibility of respondents. This was necessary to ascertain expenditure preferences and probability for ITN use. Results showed that most of the respondents (67%) had dependents which ranged from 1 to 4 individuals, followed by those between 5 to 8 (25%), and 9 and above (6%) in that order.

4.1.3 Respondents Education

Since this was a KAP study, examining the level of education of the respondents was considered to be pertinent in order to identify its role towards malaria knowledge acquisition and ITN utilization practices. This study was interested in looking at the level of education and not whether respondents were literate or not because of the inferiority complex of respondents and sensitivity in deriving reliable information.

It was found that, 60% of respondents had their maximum education at the primary school level, 22% at the secondary level, and 11% at the High School level while 9% had University level of education.

Based on individual community, the results were remarkable in Tiko as approximately three quarter (71%) of its sample population had primary school level of education and just 1.5% with university education. Meanwhile in Buea, the number of respondents' decreased as level of education changed from the primary to

university level; at least each of the levels of education was substantially represented with about 11.5% at the university level.

4.1.4 **Respondents occupation**

Occupation was limited to three major categories as most of the rural population was into such activities, coupled with the availability of the giant agro-industrial parastatal (CDC) which offers employment to most of these communities.

From the information collected, the majority of the respondents (35%) said they were into petty trading which included grocery, convenient store, and vendor. Other type of income earning activity (22%) included: teaching, hair dressing, seam stressing and contract works. 13% were involved in agricultural activities which is typically subsistence farming, while 28% were solely engaged in household management as the husband earns the family income.

4.1.5 Respondents' financial status

As indicated in the table above, approximately half of the interviewed respondents (52%) monthly income was less than or equal to $59. The distribution of respondents monthly income consistently decreases to 31%, 8.5%, 2.8% as the income range increases from $60 to $119; $120 to $179; $180 to $239 respectively in that order, except for minor differences in Buea.

4.1.6 Housing

The housing type was typically either cement block or wood plank roofed with zinc. The distribution was as follows: 51% of respondents live in wood built houses, 46% in cement block houses while just 2.14% live in Fire brick buildings. Based on individual locality, 58% of respondents in Tiko live in wood houses while 55.7% of respondents in Buea live in cement houses.

Generally, houses built with wood are cheaper and more affordable than those built with cement block. In as much as cement block houses are more expensive to afford, they generally provide good insulation in a cold environment and also are preferable in areas where robbery is rampant; otherwise wood houses are more preferable in hot and secure environments.

4.2 Results of descriptive statistics:

The research survey included series of questions on Knowledge, Attitude and Practices (KAP) of Malaria and ITNs with regards to the awareness, principal sources of information, mode of transmission, recognition of signs and symptoms, knowledge on whether the disease was preventable, and prevention and control measures, treatment and treatment seeking behavior or attitude, desired information on malaria and its preferred method of communication to respondents, and the possession and utilization of ITN. More so, questions that identified respondents' perception of ITN

as a preventive tool and possible barrier to the use and/or regular use of ITN were also addressed.

All of the above questions were asked only to those respondents who had at some point in time heard about malaria except for the question that required respondents' desired information of the disease and how they prefer it being communicated to them.

4.2.1 **Awareness and the principal source of information about malaria:**

To assess respondents' knowledge on malaria and eventually examine their utilization practices of ITN, it was necessary to first determine if they had heard about the disease and the sources where this information was acquired. Given the multiple sources where malaria information could be acquired, it was logical to classify by grouping into various categories for easy identification of their level of impact in informing and educating the population.

Table 4.2: Knowledge of the awareness of malaria

Question and the response	**Buea**		**Tiko**		**Buea and Tiko**	
Respondents who have heard of Malaria	**(N=70)**	**%**	**(N=70)**	**%**	**(N=140)**	**%**
Yes	70	100%	69	98.57%	139	99.29
No	0	0%	1	1.43%	1	0.71

Source: Author

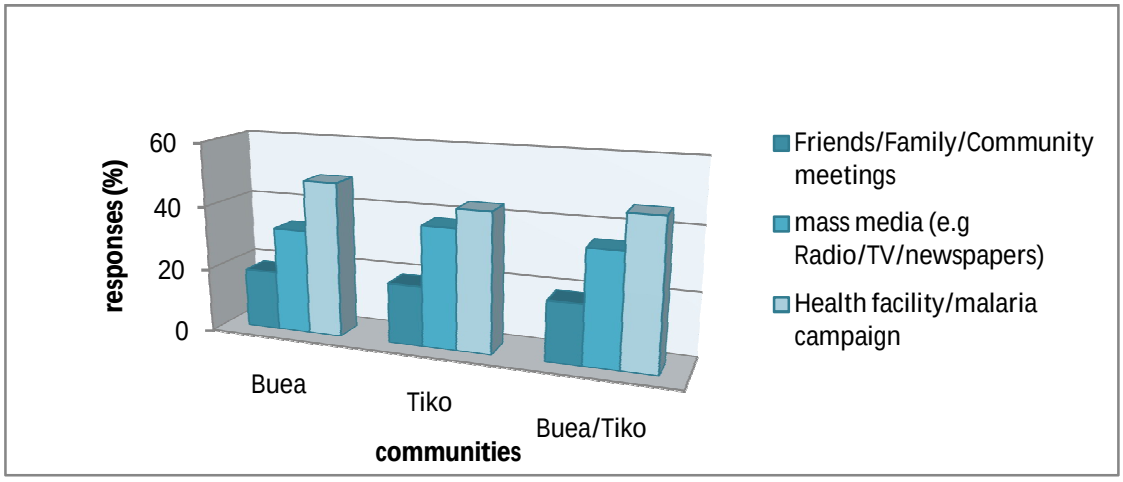
Awareness of the disease was found to be almost universal. Out of the total sample (N=140), 139 respondents claimed to have heard of malaria with one exception from Tiko who was ignorant of the disease.

Table 4.3: Principal Sources of Malaria information

Sources of information	Buea		Tiko		Buea and Tiko	
	(N=70)	%	(N=69)	%	(N=139)	%
Friends/Family/Community meetings	13	18.57	13	18.84	26	18.71
mass media (e.g. Radio/TV/newspapers)	23	32.86	26	37.68	49	35.25
Health facility/malaria campaign	34	48.57	30	43.48	64	46.04

Source: Author

Figure 4.1: Distribution of the principal source of information heard about malaria



Source: Author

For those who had heard of malaria, their most popular source of information was from health facilities or from malaria campaign (46%), followed by the mass media (35%), and finally friends/families/community meetings (18%) as stated in the table above. Examining the principal sources of information on malaria was important in this study, as it was subject to hypothesis testing thereby identifying channels through which effective knowledge could be disseminated for the realization of set objective.

4.2.2 Knowledge on malaria:

Since this was a KAP study, the main components of knowledge on malaria was examined alongside corresponding levels of education of the respondents, to ascertain its role in malaria knowledge comprehension. Responses were classified per "malaria knowledge component" and information collected from 139 of the 140 respondents' who had earlier heard of malaria as a disease.

Table 4.4: Knowledge of the different aspects of malaria in relation to level of education

General knowledge	Responses	Level of Education (Buea and Tiko, N=139)				
		Primary (%)	Secon sch. (%)	High sch. (%)	University (%)	Buea/Tiko (%)
Cause	**Correct**	51.08	20.14	11.51	6.47	89.21
	Incorrect	8.63	2.16	0	0	10.79
Recognition. of signs and symptoms	**diagnostic**	30.94	12.95	8.63	3.6	56.11
	non diagnostic	25.9	7.91	2.16	2.88	38.85
	don't know	2.88	1.44	0.72	0	5.04
Mode of transmission	**Correct**	16.55	6.47	3.6	2.16	28.78
	Incorrect	43.17	15.83	7.91	4.32	71.22
Treatment seeking pattern	**Correct**	25.18	6.47	2.88	3.6	38.13
	Incorrect	34.53	15.83	8.63	2.88	61.87
Prevention and control	**Correct**	45.32	15.11	10.07	6.47	76.98
	Incorrect	14.39	7.19	1.44	0	23.02

Source: Author. *Responses from those who have heard of malaria

To have an overall understanding about respondents' general knowledge of malaria, all the components of malaria knowledge were considered and classified into three major categories: "good", "moderate" and "low knowledge". The criteria for the classification involved an average of the knowledge from each of the aspects of cause of malaria, mode of transmission, recognition of signs and symptoms, curable or not, treated or not, prevention and control measures, treatment seeking patterns and behavior. In the three categories, respondents were included in:

1) Good knowledge: If they could give correct response to approximately 70% of all the different information about malaria.

2) Moderate knowledge: If their responses were rated in the range of 40% to 69% in all the areas of malaria.

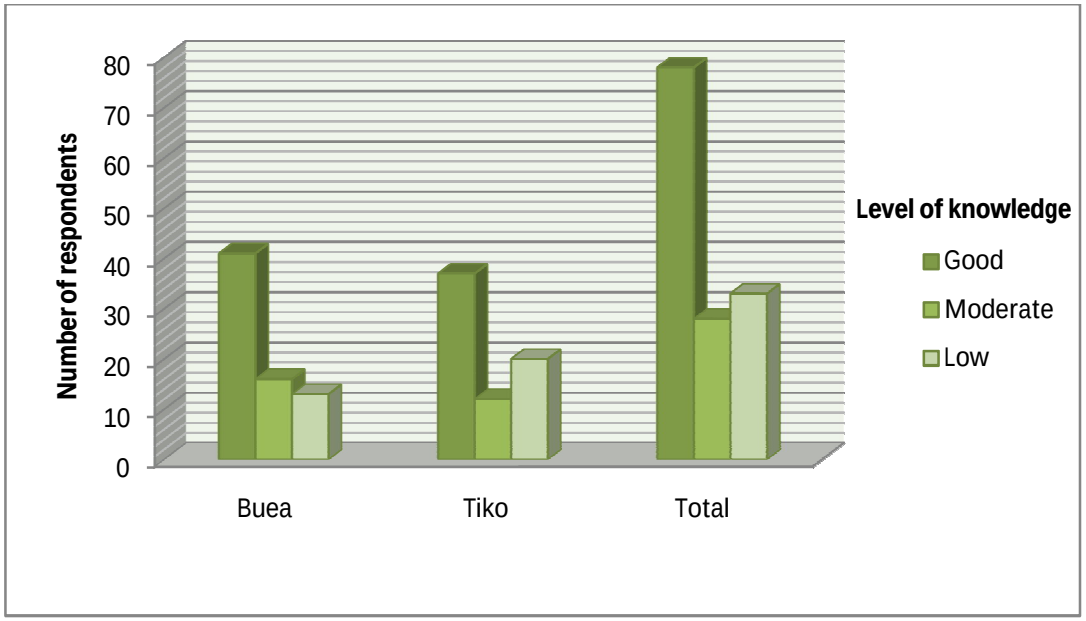
3) Low knowledge: If the responses were below 40% of all the area of malaria information.

However, special emphases were given to diagnostic characteristics which gave an idea on how the respondents actually apprehended the knowledge of malaria.

Table 4.5: Respondents' general knowledge of malaria (Source: Author)

General knowledge	Buea (N=70)	Tiko (N=69)	Total (N=139)
Good	41 (58.57%)	37 (53.62%)	78 (56.12%)
Moderate	16 (22.86%)	12 (17.39%)	28 (20.14%)
Low	13 (18.57%)	20 (28.99%)	33 (23.74%)

Figure 4.2: Respondents distribution of the general knowledge on malaria



Source: Author

The results showed that, 56.12% of the respondents had good knowledge of malaria, 20.14% had moderate knowledge while 23.74% of the respondents had low knowledge.

Respondents' knowledge on malaria was further assessed by considering specific components of malaria knowledge. This was crucial for future planning purposes as gaps were identified in areas where intervention measures could be enforced.

I. Knowledge of the correct association of the cause and mode of transmission and the implication or dangers of malaria

Table 4.6: Respondents' knowledge of the cause and mode of transmission of malaria

Cause	Responses	Buea		Tiko		Buea and Tiko	
		(N=70)	%	(N=69)	%	(N=139)	%
	Correct knowledge	62	88.57	62	89.86	124	89.21
	Some knowledge	6	8.57	4	5.79	10	7.19
	Don't know	2	2.86	3	4.35	5	3.60
Mode of transmission	**Responses**	**Buea**		**Tiko**		**Buea and Tiko**	
		(N=70)	%	(N=69)	%	(N=139)	%
	correct	22	31.43	18	26.09	40	28.78
	incorrect	48	68.57	51	73.91	99	71.22

Source: Author

Though the knowledge of the awareness of malaria was universal (99%), it was found that just 89% of respondents could associate malaria to the vector mosquito or malaria parasite. Respondents who identified mosquito with one or more incorrect responses were considered as having some knowledge (7.19%) while 3.6% thought the cause of the disease was as a result of dirty environment or bites of flies.

In order to fully appreciate the overall level of knowledge on the mode of transmission, a question was designed in a qualitative manner and the average proportion of positive and negative responses identified as either "correct or incorrect", as stated in the table above. Even though the majority of respondents were able to pinpoint mosquitoes as the causative agent of malaria, it was however surprising that only 28.78% of the respondents could explain explicitly the mode of

transmission of the disease. 71.22% of respondents were hardly able to link malaria to the mosquito vector, an infected carrier, and breeding sites as fundamental aspects in the transmission cycle.

II. Signs and symptoms of malaria

Table 4.7 Respondents knowledge of the signs and symptoms of malaria

Signs and symptoms	Buea		Tiko		Buea and Tiko	
	(N=70)	%	(N=69)	%	(N=139)	%
headache	36	51.42	20	28.98	56	40.28
high temperature and fever	62	88.57	49	71.01	111	79.85
chills	45	64.28	14	20.28	59	42.44
body pain	48	68.57	19	27.53	67	48.20
vomiting	20	28.57	13	18.84	33	23.74
loss of energy	40	57.14	8	11.59	48	34.58
delirium	6	8.57	6	8.69	12	8.63
loss of appetite	50	71.42	11	15.94	61	43.88
dizziness	48	68.57	4	5.79	52	37.41
others	1	1.42	2	2.89	3	2.15
don't know	1	1.42	5	7.24	6	4.31
don't care						

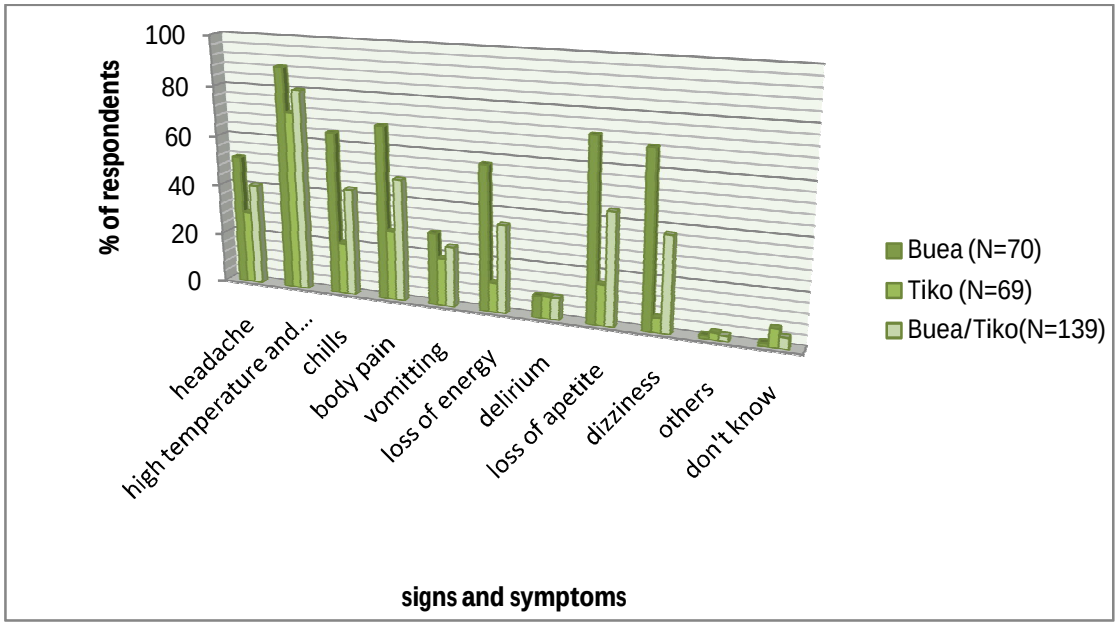
Source: Author. *Multiple responses from those who have heard of malaria

To elicit respondents' knowledge and ability to recognize the signs and symptoms of the disease condition, responses were classified into three categories: Diagnostic (if signs and symptoms solely attributed to and always observed in malaria infection were mentioned e.g. high temperature, fever, chills, headache); Non diagnostic (if others signs and symptoms not always observed were stated) and Don't know (if no response was selected). As such multiple options were required by respondents in

order to examine the extent of their ability to recognize the signs and symptoms. The results showed that 56.11% of the respondents could recognize diagnostic features of the signs and symptoms of malaria; 38.85% stated some signs and symptoms of which could not be solely attributed to malaria infection, while 5.04% of respondents knew nothing about the different possible ways to identify malaria.

However, the most popular and recognizable signs and symptoms were found to be high temperature and fever (79.85%), followed by body pain (48.20%), loss of appetite (43.88%), chills (42.44%), headache (40.28%), dizziness (37.41%), loss of energy (34.58%), vomiting (23.74) and delirium or mental agitation (8.63%). 4.31 % of the respondents did not seem to know any of the signs and symptoms of malaria while 2.15% of respondents stated other ways they could identify the disease.

Figure 4.3: Distribution of respondents' ability to recognize the signs and symptoms of malaria. (Source: Author)



III. Respondents perception of the severity of malaria as a disease and affirmation whether it can be prevented and prevention and control measures

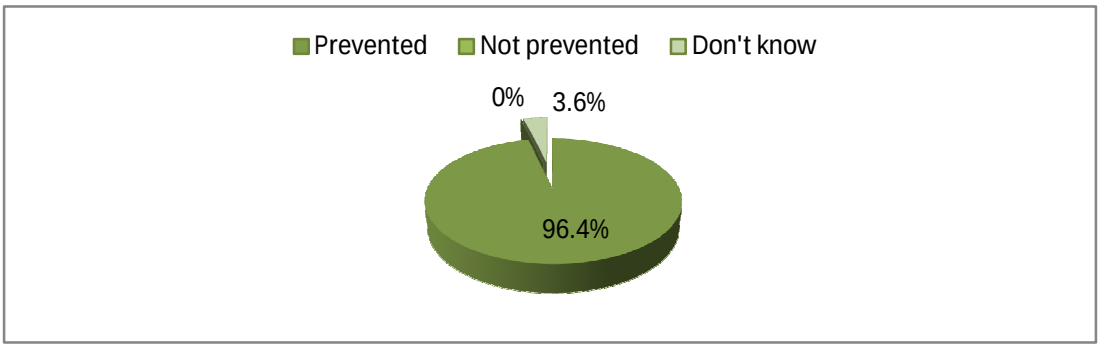
To have an understanding about respondents' perception of the severity of malaria and to further affirm the measures they would undertake on prevention and control, a list of questions was asked about the preventability and curability of the disease.

Table 4.8: Knowledge on the preventability of malaria

PREVENTED OR NOT	Buea(N=70)	%	Tiko (N=69)	%	Buea/Tiko(N=139)	%
Prevented	69	98.57	65	94.20%	134	96.4
Not prevented	0	0	0	0.00%	0	0
Don't know	1	1.43	4	5.80%	5	3.6

Source: Author

Figure 4.4: Respondents' distribution of the knowledge of preventability of malaria



Source: Author

As shown above, 96.4% of respondents indicated that the disease could be prevented and only 3.6% of respondents were not certain about the preventability of malaria. It is worth mentioning that, those who weren't sure the disease could be prevented weren't either sure the disease could not be prevented.

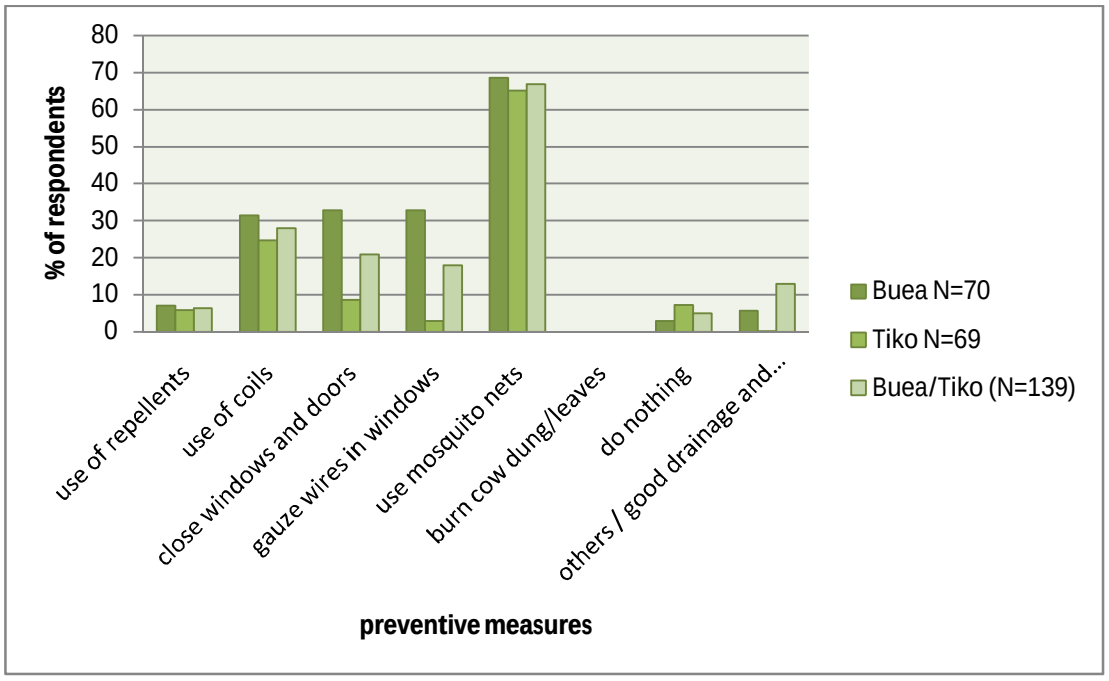
IV. **Knowledge on prevention and control measures:**

Table 4.9: Respondents' knowledge of malaria prevention and control measures

Preventive measures	Buea N=70	%	Tiko N=69	%	Buea/Tiko (N=139)	%
use of repellents	5	7.14	4	5.8	9	6.47
use of coils	22	31.43	17	24.64	39	28.06
close windows and doors	23	32.86	6	8.7	29	20.86
gauze wires in windows	23	32.86	2	2.89	25	17.99
use mosquito nets	48	68.57	45	65.22	93	66.91
burn cow dung/leaves	0		0	0	0	
do nothing	2	2.86	5	7.25	7	5.04
others / good drainage and clear bushes	4	5.71	14	20%	18	12.95

Source: Author. *Multiple responses from those who have heard of malaria.

Figure 4.5: Distribution of the knowledge of preventive measures of malaria



Source: Author

In regards to the method to guard against malaria infection, respondents were asked about their preferred personal protective measures. Multiple responses were allowed in order to determine the degree of protection and to ascertain which protective mechanism was most utilized or preferred by the respondents. As such, lists of nine measures (conventional and unconventional) for malaria protection behavioral options were collected. It was shown that 76.98 % recorded good prevention and control measure against malaria with much emphasis on the use of ITN thought to be effective in endemic regions.

Also characterized was the fact that, almost all of the stated measures were utilized by respondents except for the traditional option of burning cow dung and leaves to repel mosquito. Respondents' most preferable measure was the use of mosquito nets (66.91%), followed by coils (28.06%), closing of windows and doors (20.86%), gauze wires on windows (17.99%), good drainage and clearing of bushes (12.95), and use of repellents (6.47%) respectively. However, 5.04% of respondents personally did nothing to protect themselves against malaria infection.

V. Attitude or behavior towards addressing malaria treatment at the disease onset:

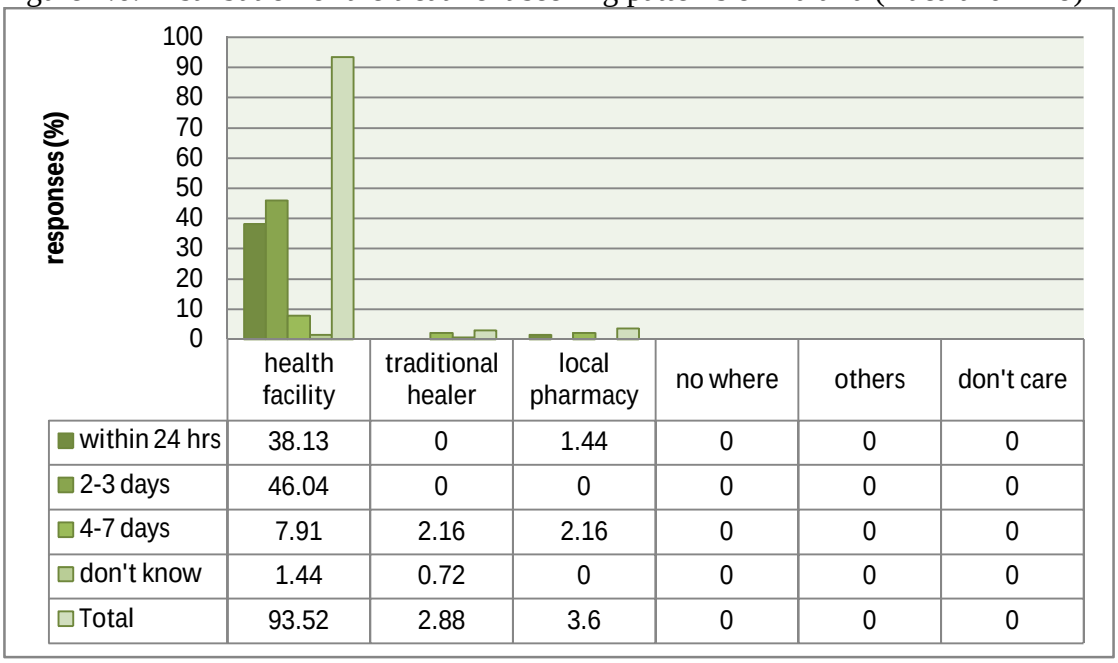
Given the onset of the disease, depending on when the signs and symptoms are recognized, various attitudes of respondents were examined with regards to where and how soon they would seek for help in the form of treatment.

Table 4.10: Respondents' treatment seeking pattern

Indicators	within 24 hrs	2-3 days	4-7 days	don't know	Buea/Tiko
health facility	38.13	46.04	7.91	1.44	93.52
traditional healer	0	0	2.16	0.72	2.88
local pharmacy	1.44	0	2.16	0	3.6
no where	0	0	0	0	0
others	0	0	0	0	0
don't care					

Source: Author

Figure 4.6: Distribution of the treatment seeking patterns of malaria (Buea and Tiko)



Source: Author

The distribution showed that almost all of the respondents (93.52) would seek for medical treatment at a health facility if signs and symptoms of the disease were recognized. 3.6% of the respondents preferred to seek for help at a local pharmacy

while 2.88% of respondents would go for treatment to a traditional healer. It was however noted that all of the respondents would seek treatment despite the disparity of where treatment would be sought.

As concerns “how soon” after recognizing the signs and symptoms the respondents would seek for treatment in each of the stated treatment preference, they gave a clearer understanding of their knowledge on the severity of the disease.

Out of the 93.52% of the total respondents who would seek for treatment at a health facility, 38.13% of respondents had correct knowledge on treatment of the disease within 24 hours of disease onset as stated by the WHO. 46.04% of the respondents would seek treatment within 2 to 3 days; 7.91% within 4 to 7 days and 1.44% of respondents were not certain on when they would seek treatment at a health facility respectively.

For those respondents who preferred to seek treatment at a local pharmacy, 1.44% in a total of 3.6% would do so within 24 hours while 2.16% would wait till after 4 days for treatment to be sought.

Respondents’, who would seek treatment at a traditional healer though small in proportion, also presented a behavioral pattern. Here, 2.16% of respondents would seek treatment within 4 to 7 days at the onset of disease, while 0.72% was not sure on when they would commence treatment.

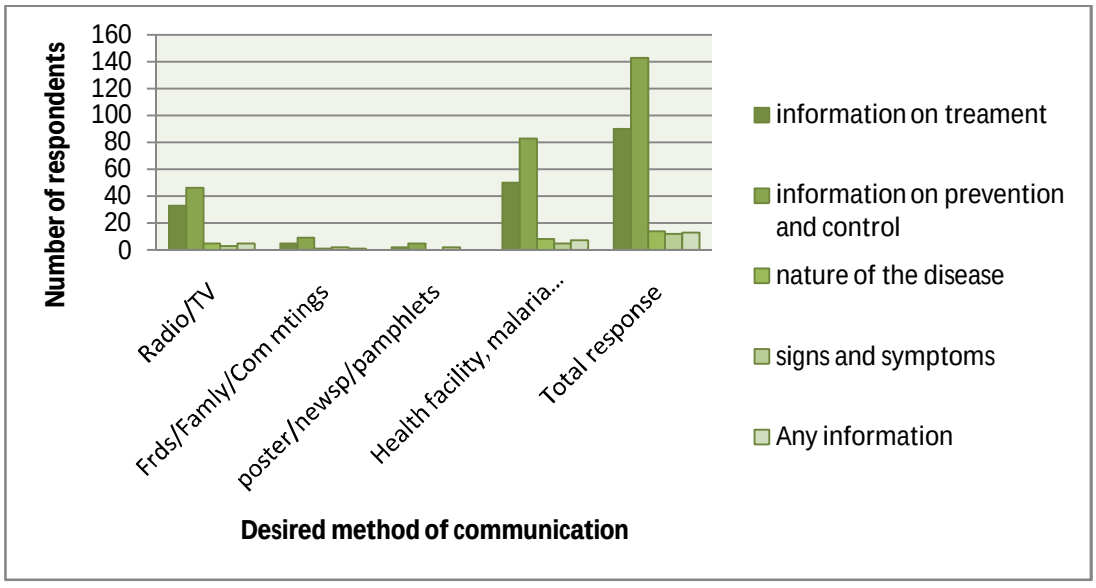
4.2.3 Information and Communication of malaria:

Table 4.11: Respondents' desired information on malaria and method of communication

Desired information on malaria	Radio or TV	Friends/Family/ Community meetings	poster/news papers/pam phlets	Health facility, malaria campaign/heal th worker	Total response
Information on treatment	33	5	2	50	90
Information on prevention and control	46	9	5	83	143
Nature of the disease	5	1	0	8	14
Signs and symptoms	3	2	2	5	12
Any information	5	1	0	7	13

Source: Author. *Multiple responses for both desired information on malaria and method of communication.

Figure 4.7: Distribution of desired knowledge of malaria in relation to desired method of communication. (Source: Author)



Given the importance in divulging detailed information on malaria, it was necessary to design questionnaires that would underscore the needs of the community as well as identify the most acceptable and understandable means of communication.

The result derived above indicates the frequencies in which respondents' desired particular information on malaria and how they preferred this information communicated to them. It was found that information on prevention and control (143) was the most desired information about malaria, in which case 83 respondents prefer such knowledge delivered to them through workers in health facilities or through malaria campaign officials, followed by radio and television (46), friends, families, community meetings (9), and lastly through posters, newspapers and pamphlets (5) respectively.

The second most desired information was that of treatment (frequency of 90), in which the number of respondents' preferences of knowledge acquisition was through health facility (50), radio/television (33), friends (5) and posters and newspapers in that order.

It was however noted that the information on nature of the disease, signs and symptoms, and any information on malaria was not highly desired given the frequencies of 14, 12 and 13 respectively. Yet such information was still preferred to be communicated through health facility, radio/television, friends/families and posters/newspapers in descending order.

4.2.4 Possession and Utilization practices of ITN

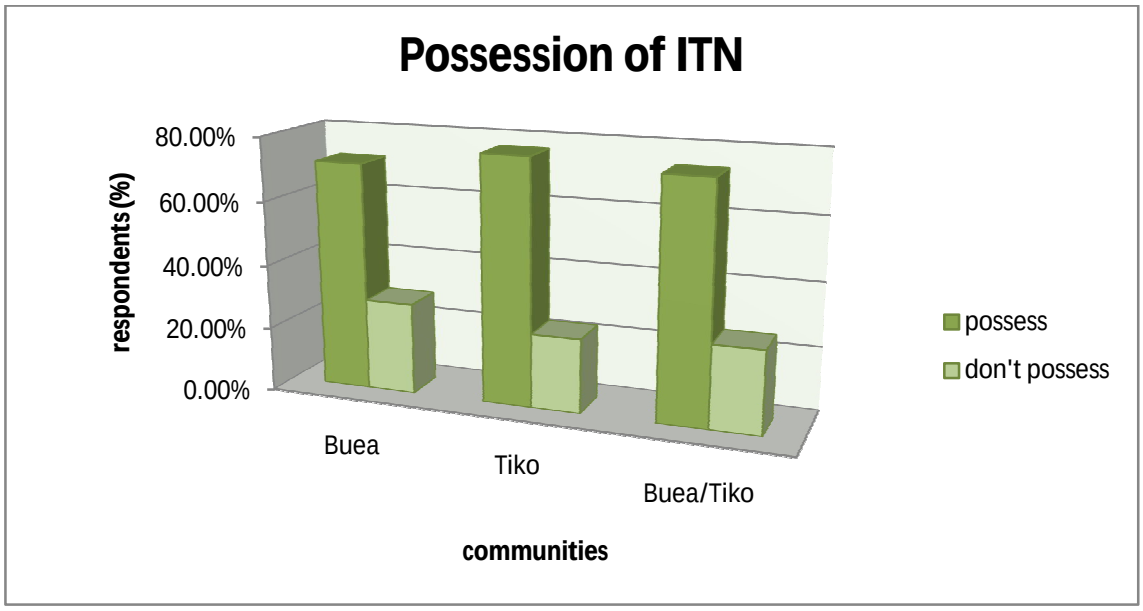
I. Possession of ITN

Table 4.12: Respondents attitude towards ITN possession

possession 0f ITN	Buea (N=70)	%	Tiko (N=69)	%	Buea/Tiko (N=139)	%
possess	50	71.43%	53	76.81%	103	74.10%
don't possess	20	28.57%	16	23.19%	36	25.90%

Source: Author

Figure 4.8: Distribution of the possession of ITNs



Source: Author

In a total of 139 respondents who were aware of malaria through various sources, 74% possesses ITN as opposed to approximately 26% who doesn't. The figures are very much similar at the two different localities in terms of possession.

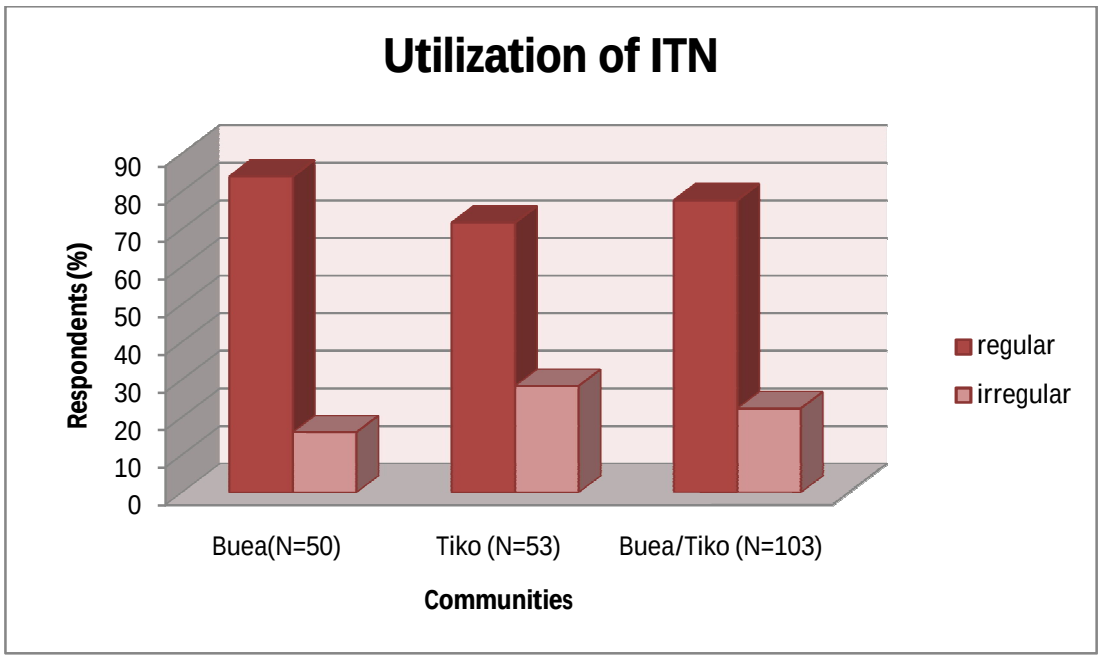
II. Utilization practices of ITN

Table 4.13: Respondents practices towards ITN utilization

Pattern of ITN utilization	Buea(N=50)	%	Tiko(N=53)	%	Buea/Tiko (N=103)	%
regular	42	84	38	71.7	80	77.67
irregular	8	16	15	28.3	23	22.33

Source: Author. *Response among those who possess ITN.

Figure 4.9: Distribution of utilization pattern of ITN



Source: Author

Among those who possessed an ITN, further evaluation was conducted to identify their utilization pattern. This was important to identify respondents' practices with regards to utilization of ITN and the impact it has to the disease burden. Out of 103

respondents who owned one or more ITN, it was found that 80 (77.67%) utilized them on a regular basis as opposed to 23 (22.33%) who utilized them irregularly.

However among those who were aware of malaria (N=139), the utilization distribution pattern was categorized into: regular", "irregular" and "don't use", with values recorded as 57.55%, 16.55% and 25.9% respectively. It was however noted that other than those who did not utilize ITN, neither possess one. Those who possessed ITN utilized them at least at some point in time. Thus, in the entire study, "don't use" have been referred to respondents who did not possess ITN.

4.2.5 Perception of the value of ITN:

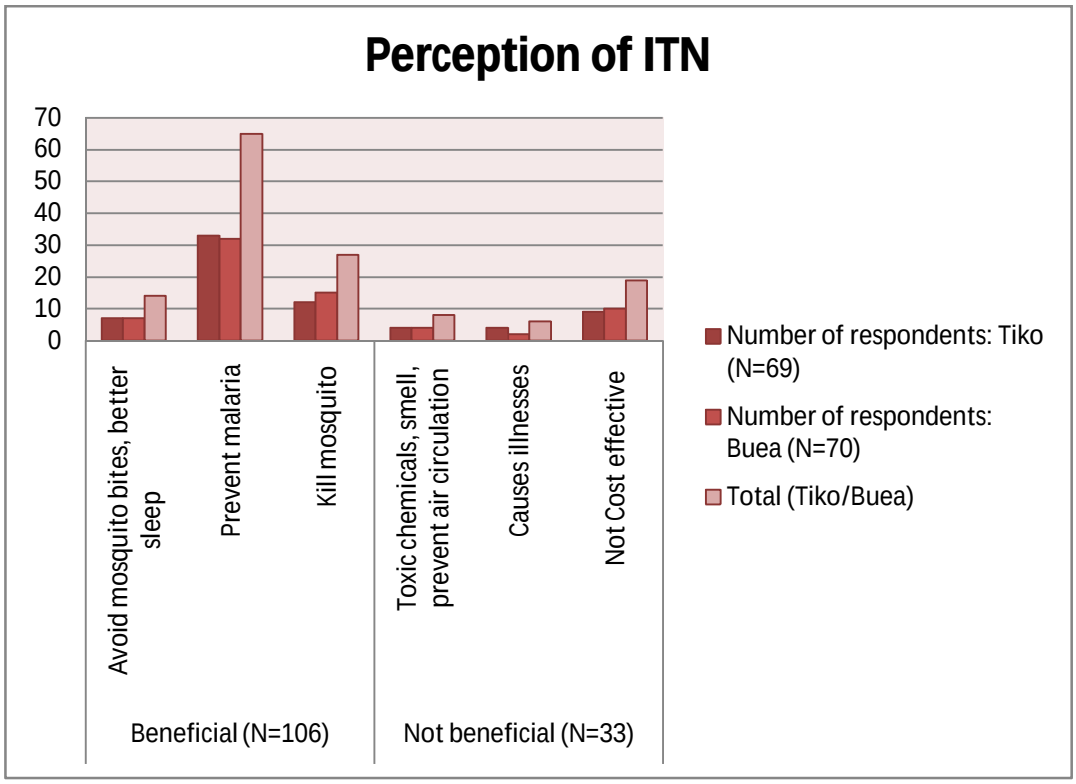
This study assessed how caregivers valued ITN as a preventive tool, and perceived malaria risk severity.

Table: 4.14: Perception of respondents about the value of ITN

Perceived Value to ITN use	**Beneficial (N=106)**			**Not beneficial (N=33)**		
Reasons	Avoid mosquito bites, better sleep	Prevent malaria	Kill mosquito	Toxic chemicals, smell, prevent air circulation	Causes illnesses	Not Cost effective
Number of respondents: Tiko (N=69)	7	33	12	4	4	9
Number of respondents: Buea (N=70)	7	32	15	4	2	10
Total (Tiko/Buea)	**14**	**65**	**27**	**8**	**6**	**19**

Source: Author

Figure: 4.10: Distribution of the respondents' perception and value about ITN



Source: Author

From the study findings, it was shown that 103 (76.26%) individuals perceived some advantages for utilizing ITNs. The most commonly mentioned were: to "prevent malaria" (65)," kill mosquito" (27) and "avoid nuisance by mosquito bites and a better sleep" (14). Among those who perceived ITNs as disadvantageous (33), their reasons included the fact that these nets were not "cost effective" (19) in comparison to other preventive methods. Other reasons were the perceived toxicological effects of the chemicals impregnated in the nets (8) and the illnesses such as cough and irritations (6) associated to these nets.

4.2.6 Factors that influence possession and regular use of ITN:

Factors associated with ITN use were explored in the questionnaire to examine respondents' possible reasons for their attitude and practices, thus identifying constraints towards ITN possession and use.

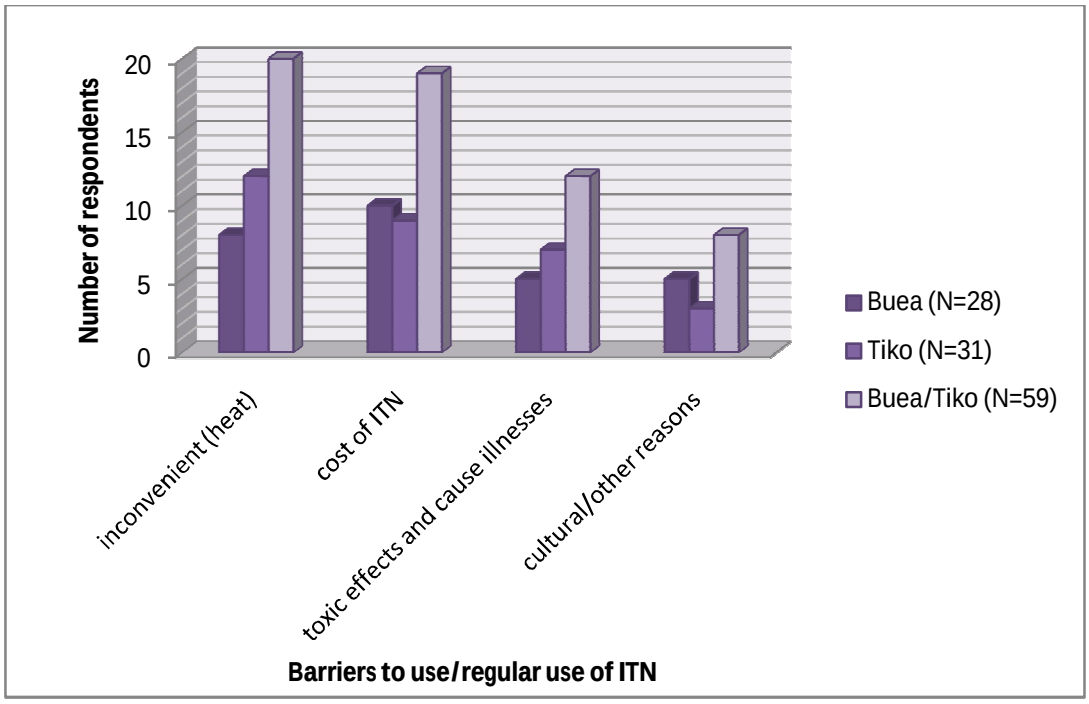
In this regard, a total of 59 out of 139 respondents were identified as either using ITN "irregularly" or "not all at". The possible reasons for their behavior as stated in the table below are as follows;

Table: 4.15: Barriers to the use or regular use of ITN

Barriers	Buea (N=28)	%	Tiko (N=31)	%	Buea/Tiko (N=59)	%
inconvenient (heat)	8	28.57	12	38.71	20	33.9
cost of ITN	10	35.71	9	29.03	19	32.2
Toxic effects and cause illnesses	5	17.86	7	22.58	12	20.34
cultural/other reasons	5	17.86	3	9.67	8	13.56

Source: Author

Figure 4.11: Barriers to the use or regular use of ITN



Source: Author

It was emphasized that the most significant hindrances of respondents to ITN possession and regular use was the cost of purchasing these nets (32.2%), and inconveniences due to hot weather as responded by (33.9%) of the respondents respectively. Other stated reasons included barriers due to perceived toxicological concerns by parents and cause of illnesses associated to ITNs (20.34%). However, (13.56%) of respondents identified barriers to cultural beliefs and other reasons of which they deemed unnecessary to explain.

4.3 Results of Analytical Statistics:

The results of analytical statistics involved: Hypothesis testing which constituted decision and interpretation in a Chi Square test computation. These tests were conducted to prove with certainty, significant relationships in a cause-effect association between the independent variables and the dependent variable (ITN utilization). In other words, the chi-square test of independence tested the influence or impact that a subject's value on one variable has on the same subject's value for a second variable.

4.3.1 Hypothesis Testing

The study tested five hypotheses to ascertain the associations or determinants of ITN utilization practices. Probabilities for the test statistics were obtained from the chi-square probability distribution so that decisions could be reached for testing the hypotheses.

Results that showed significant relationship were further interpreted by checking individual cells in a post hoc analysis in order to determine significant contributors to the chi square relationship.

I. Possession of ITN in relation to Utilization pattern of ITN

- The first hypothesis states: "*There is an association between the possession of ITN and the utilization pattern of ITN*".

Given this hypothesis, the null and alternate hypotheses were defined and the results further processed using SPSS.

- **Null hypothesis Ho** = Possession of ITN is independent (not associated) to the utilization pattern of ITN.
- **Alternative hypothesis H1** = Possession of ITN is not independent to the utilization pattern of ITN.

Table 4.16: Chi Square computation between Use of ITN and Possession of ITN

Crosstab

			Possession of ITN		
			no	yes	Total
Utilization of ITN	don't use	Count	36	0	36
		Expected Count	9.3	26.7	36.0
		Std. Residual	8.7	-5.2	
	irregular	Count	0	23	23
		Expected Count	6.0	17.0	23.0
		Std. Residual	-2.4	1.4	
	regular	Count	0	80	80
		Expected Count	20.7	59.3	80.0
		Std. Residual	-4.6	2.7	
Total		Count	36	103	139
		Expected Count	36.0	103.0	139.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	139.000[a]	2	.000
Likelihood Ratio	159.016	2	.000
Linear-by-Linear Association	113.848	1	.000
N of Valid Cases	139		

Source: Author. *0 cells (.0%) have expected count less than 5. The minimum expected count is 5.96.

II. Knowledge of malaria in relation to ITN utilization

- The second hypothesis states: "*There is an association between respondents' level of knowledge of malaria and the utilization pattern of ITN"*.

-**Null hypothesis Ho** = Respondents knowledge of malaria is independent (not associated) to their utilization of ITN.

-**Alternative hypothesis H1** = Respondents knowledge of malaria is not independent to their utilization of ITN.

Table 4.17: Chi Square computation between knowledge of malaria and ITN utilization

Crosstab

			Knowledge of malaria			Total
			low	moderate	good	
Utilization of ITN	don't use	Count	20	4	12	36
		Expected Count	8.5	7.3	20.2	36.0
		Std. Residual	3.9	-1.2	-1.8	
	irregular	Count	7	5	11	23
		Expected Count	5.5	4.6	12.9	23.0
		Std. Residual	.7	.2	-.5	
	regular	Count	6	19	55	80
		Expected Count	19.0	16.1	44.9	80.0
		Std. Residual	-3.0	.7	1.5	
Total		Count	33	28	78	139
		Expected Count	33.0	28.0	78.0	139.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.561[a]	4	.000
Likelihood Ratio	32.239	4	.000
Linear-by-Linear Association	25.629	1	.000
N of Valid Cases	139		

Source: Author. *1 cell (11.1%) has expected count less than 5. The minimum expected count is 4.63.

III. Sources of knowledge on malaria versus utilization of ITN

- The third hypothesis states, "*There is a significant relationship between the principal sources of malaria knowledge acquired by mothers and the utilization pattern of ITN*".

The null and alternate hypotheses were also defined and the results further processed using SPSS.

-**Null hypothesis Ho** = Respondents utilization pattern of ITN is independent (not associated) to the principal sources of information acquired on malaria.

-**Alternative hypothesis H1** = Respondents utilization pattern of ITN is not independent to the principal sources of information acquired on malaria.

Table 4.18: Chi Square computation between the principal sources of information on malaria and Utilization of ITN

Crosstab

			Principal source of information heard about malaria			
			family or friends or community meeting	mass media	health facility or health workers or malaria campaign	Total
Utilization of ITN	don't use	Count	12	15	9	36
		Expected Count	6.7	12.4	16.8	36.0
		Std. Residual	2.0	.7	-1.9	
	irregular	Count	8	9	6	23
		Expected Count	4.3	7.9	10.8	23.0
		Std. Residual	1.8	.4	-1.5	
	regular	Count	6	24	50	80
		Expected Count	15.0	27.6	37.4	80.0
		Std. Residual	-2.3	-.7	2.1	
Total		Count	26	48	65	139
		Expected Count	26.0	48.0	65.0	139.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.800[a]	4	.000
Likelihood Ratio	24.688	4	.000
Linear-by-Linear Association	20.281	1	.000
N of Valid Cases	139		

Source: Author. *1 cell (11.1%) has expected count less than 5. The minimum expected count is 4.30.

IV. **Perception of ITN in relation to utilization of ITN**

- The fourth hypothesis states, "*There is an association between respondent's perception about ITN and the utilization pattern of ITN*".

-**Null hypothesis Ho** = Respondents perception about ITN is independent (not associated) to the Utilization pattern of ITN.

-**Alternative hypothesis H1** =Respondents perception about ITN is not independent to the Utilization pattern of ITN.

Table 4.19: Chi Square computation between Perception and value of ITN, and Utilization of ITN

Crosstab

			Perception and value of ITN		
			not beneficial	beneficial	Total
Utilization of ITN	don't use	Count	23	13	36
		Expected Count	8.5	27.5	36.0
		Std. Residual	4.9	-2.8	
	irregular	Count	10	13	23
		Expected Count	5.5	17.5	23.0
		Std. Residual	1.9	-1.1	
	regular	Count	0	80	80
		Expected Count	19.0	61.0	80.0
		Std. Residual	-4.4	2.4	
Total		Count	33	106	139
		Expected Count	33.0	106.0	139.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	61.905[a]	2	.000
Likelihood Ratio	73.781	2	.000
Linear-by-Linear Association	60.098	1	.000
N of Valid Cases	139		

Source: Author. * 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.46.

V. Knowledge of the use of ITN in relation to the educational level

- The fifth hypothesis states: "*There is no association between the level of education of respondents (mothers) and the utilization pattern of ITN"*.

Given this hypothesis, the null and alternate hypotheses were defined and the results further processed using Microsoft excel.

-**Null hypothesis Ho** = Respondents practices of ITN utilization is independent (not associated) to their level of education.

-**Alternative hypothesis H1** = Respondents practices of ITN utilization is not independent to their level of education.

Table 4.20: Chi Square computation between educational levels and ITN Utilization

(Observed Counts)

use of ITN	Primary school	Secondary School	High school	university	RowTotal	
Regular	46	20	10	4	80	
irregular	15	4	2	2	23	
Don't use	22	7	4	3	36	
ColumnTotal	83	31	16	9	139	GrdTotal

(Expected Counts)

use of ITN	Primary school	Secondary School	High school	university	RowTotal
Regular	47.76978417	17.84172662	9.20863309	5.17985612	80
irregular	13.73381295	5.129496403	2.64748201	1.48920863	23
Don't use	21.49640288	8.028776978	4.14388489	2.33093525	36
ColumnTotal	83	31	16	9	139

use of ITN	Primary school	Secondary School	High school	university	RowTotal	
Regular	0.065567305	0.261081457	0.06800809	0.268745		
irregular	0.116735946	0.248710989	0.15835158	0.17519897		
Don't use	0.011797791	0.131823573	0.004996	0.19204636		
ColumnTotal					1.703063	ChiSquare

df	6
Alpha	0.05
Critical Value	12.59158724
Conclusion	Accept Ho
p-Vlaue	0.944884548

Source: Author

VI. Association between the use of ITN in relation to the socio-demographic variables of marital status, family size, occupation, income and housing type

Tables 4.21: Chi Square tests between utilization of ITN and marital status, family size, occupation, income and housing type of respondents.

a) Marital status in relation to ITN utilization

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.215[a]	2	.200
Likelihood Ratio	3.613	2	.164
Linear-by-Linear Association	.006	1	.940
N of Valid Cases	139		

Source: Author

b) Family size in relation to ITN utilization

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.536[a]	4	.472
Likelihood Ratio	3.513	4	.476
Linear-by-Linear Association	.022	1	.883
N of Valid Cases	139		

Source: Author

c) Occupation in relation to ITN utilization

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.386[a]	6	.625
Likelihood Ratio	4.554	6	.602
Linear-by-Linear Association	.392	1	.531
N of Valid Cases	139		

Source: Author

d) Income in relation to ITN utilization

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.661[a]	8	1.000
Likelihood Ratio	.651	8	1.000
Linear-by-Linear Association	.012	1	.912
N of Valid Cases	139		

Source: Author

e) Housing type in relation to ITN utilization

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.418[a]	4	.115
Likelihood Ratio	8.138	4	.087
Linear-by-Linear Association	1.633	1	.201
N of Valid Cases	139		

Source: Author

4.3.2 Decision and Interpretation of Chi Square test results:

- The alternative hypotheses stated that the two variables (independent and dependent) are associated or related to each other. These would be true if the observed counts for the categories of the variables in the sample are different from the expected counts.

- The null hypotheses are that the two variables are independent or not associated to each other. These would be true if the observed counts in the sample are equal to the expected counts.

- The decision rule for the chi-square test of independence is, to reject the null hypothesis and conclude that the data supports the alternative hypothesis if the probability of the test statistics is less than or equal to the alpha error rate, otherwise we accept the null hypothesis and conclude that the data does not support the alternative hypothesis if the probability of the test statistics is greater than the alpha error rate.

After the results of the chi square test showed statistical significance, a post hoc analysis of the cells that contributed to the observed relationships was done by examining the results of the standardized residuals alongside the chosen critical value of -/+ 2.58. The residuals, or the differences, between the observed and the expected frequencies (counts) gave a reliable indication of the cell or cells that caused the significant difference in the chi square tests, especially as the residuals were

converted to z-scores (standardized residuals) and compared to a critical value equivalent to the alpha level.

- Standardized residuals with positive values implied that the cells were over-represented in the actual sample, compared to the expected frequency, i.e. there were more subjects in the category than was expected.
- Standardized residuals with negative values meant that the cells were under-represented in the actual sample, compared to the expected frequency, i.e. there were fewer subjects in the category than was expected.

Table 4.22: Summary of Chi Square tests

Association between variables	**Chi square value (X^2)**	**df**	**P value**
Possession vs. ITN use	139	2	< 0.001
Knowledge vs. ITN use	32.56	4	< 0.001
Sources of information vs. ITN use	23.80	4	< 0.001
Perception vs. ITN Utilization	61.91	2	< 0.001
Marital status vs. ITN Utilization	3.215	2	0.20
Family size vs. ITN Utilization	3.536	4	0.47
Level of education vs. ITN use	1.703	6	0.94
Occupation vs. ITN utilization	4.386	6	0.63
Income vs. ITN utilization	0.661	8	1.00
Housing type vs. ITN utilization	7.418	4	0.11

I. Utilization of ITN in relation to Possession of ITN, knowledge of malaria, sources of malaria information and perception of ITN respectively:

The probability of the chi-square test statistics (chi-square = 139, 32.56, 23.80 and 61.91) were all less than 0.001 ($p < 0.001$), less than an alpha level of significance of 0.01. Therefore, the null hypotheses that **"**Possession of ITN, knowledge of malaria, sources of information of malaria, and perception and value of ITN were independent (not associated) to the utilization pattern of ITN", is rejected with 99% confidence that the result was correct.

Conclusion: As shown in table 4.22, the decision is to reject the null hypothesis, so that at 1% significance level, the utilization pattern of ITN is not independent of respondents' attitude of ITN ownership, perception, knowledge of malaria and sources of information for this knowledge.

Using a level of significance of 0.01, the critical value for a standardized residual would be -2.58 and +2.58. Analyzing from the standardized residuals it was found that, only the cells in the "don't use" and "regular use" rows were the significant contributors to the chi-square relationship between "possession and utilization pattern of ITN", cells in the "low" knowledge of malaria column corresponding to "don't use" and "regular use" rows were significant contributors to the chi-square relationship

between “knowledge and utilization pattern of ITN”, cells in the “regular” row corresponding to “family/friends/community meeting” and “health facility” columns were the significant contributors to the chi-square relationship between “sources of malaria information and utilization pattern of ITN”, and, cells on the “don’t use” and “regular use” rows corresponding to “not beneficial” and “beneficial” columns were the significant contributors to the chi-square relationship between “respondents’ perception of ITN and utilization pattern of ITN”.

This could be interpreted as there were larger residuals or differences between the observed and expected counts of these cells relatively to other cells, in comparison to the critical value of -/+ 2.58.

II. Level of education versus utilization of ITN:

The probability of the chi-square test statistic (chi-square=1.703) was p= 0.94, greater than an alpha level of significance of 0.01. Therefore, the null hypothesis that “Respondents practices of ITN utilization is independent (not associated) to their level of education” is accepted.

Conclusion: The decision is to accept the null hypothesis, so that at 0.01% significance level, the respondents’ educational levels are independent of the utilization practices of ITN.

III. Interpretation of the demographic variables of marital status, family size, occupation, income and housing type in relation to ITN utilization:

Result of the chi square test according to this study showed that the demographic variables of marital status (X^2=3.215, p=0.20), family size (X^2=3.536, p=0.47), occupation (X^2=4.386, p=0.63), income (X^2=0.661, p=1.00) and housing type (X^2 = 7.418, p=0.11) of respondents were not associated with the utilization pattern of ITN at 1% level of significance.

4.4 DISCUSSION OF RESEARCH FINDINGS:

The overall purpose and contribution of this KAP research was to examine and understand the human and environmental factors that propagate the failure of ITN adherence and use in spite of the initiatives of NMCP in Cameroon. As we approach the MDG, it was necessary to understand the various aspects of malaria knowledge of the community and discrepancy that exists between factors that impaired the use of ITN.

4.4.1 Demography:

Respondents were recruited from rural communities as approximately 43% of the Cameroonian population live within this areas (WHO, 2009b, pg. 84.), and people who face the greatest threat and malaria burden. A representative demographic characteristic (based on marital status, number of dependents, educational level, occupation, income and housing type) of the country was described from the sample population.

The results on demography showed that most of the caregivers were married (72%). This could be attributed to the cultural and religious values within the Cameroonian society which discourages pre-marital relationships. The chi square test between marital status and utilization pattern of ITN was not statistically significant at 1% significance levels. The result showed significant association at 80% confidence interval. However studies that were conducted in rural Kenyan communities

illustrated a strong association between marital status and the use of ITN among children under-5 (Malusha, 2009).

The average number of dependents in most households ranged from 1 to 9, a reflection of a typical African family (Uche, 1972). The large size of African households, the majority of which has weak economic status, could be problematic in preventing malaria using ITN. As illustrated by Macintyre (2006), possible behavioral patterns between ITN possession and use among large household may include rationing of fewer nets than members or beds in the households in order to avoid mosquito bites, given a lack of understanding on the mode of transmission of the disease.

With regards to the educational level, it was shown that the majority of the population living in rural communities has just primary education (60%). Secondary, High and University levels had 22%, 11% and 6% respectively. Considering the importance of education in the growth of any nation, it is worth mentioning that more emphasis needs to be put in place to encourage and promote education in Cameroon.

It was also found that the occupations within the rural communities were limited to farming (13%), petty businesses (35%), and housewives (38%). In the Cameroonian context, most of the above mentioned occupations are considered “unskilled, mean, or hand to mouth”, with less opportunity to have enough savings. As such, most of these individuals find themselves in a cycle of poverty with less capability to afford

ITNs. More so, the income range for most of the respondents (52%) was $59 and below, supportive of the fact that about 48% of the entire country's population live below the poverty line (< $1.25 per day) the majority of whom live in rural communities and largely dependent on subsistence farming as their main source of living (CIA World fact book, 2011).

The two major dwelling types recorded were those built with wood (51%) and those with cement block (46%). Residence in Tiko recorded the highest proportion of wood buildings as opposed to their counterpart in Buea who also had greater proportion for cement houses. At the household level, the greatest burden of malaria could be felt among the poor. As stated by the WHO and UNICEF (2003) report, *"Poor families live in dwellings that offer little protection against mosquitoes and are less able to afford insecticide-treated nets"* (WHO & UNICEF, 2003). Results of the chi square test between the dwelling type and ITN utilization was not statistically significant at 1% significance level. However, there was a significant association at $p \leq 0.20$ significance level. The results could however be attributed to the fact that the majority of the population of Tiko would prefer wood houses due to the harsh and hot climatic conditions as opposed to Buea where majority of the population lives in cement houses because it's at a very high altitude with a characteristic cold climate.

Although the objectives of this study didn't address the impact of the demographic variables to the dependent variable of ITN utilization, yet it was important to understand such indicators within rural communities and their role with regards to

this KAP study. According to the study, there wasn't any significant association at 1% alpha rate between the dependent variable (use of ITN) and the demographic variables. However, other KAP studies, like a typical cross-sectional survey of 7,200 households in Nigeria has demonstrated that demographic characteristics such as education, wealth index, the presence of children under-five in the household, size of the family, area and type of residence, in addition to the accessibility of health centers, gender of the head of the family, and health index considering caregivers' education were important determinants of ITN ownership, whereas determinants of the utilization among pregnant women and children under-5 included religion, availability of health facilities, and caregivers' education (Olusola et al. 2008).

4.4.2 Knowledge of malaria:

Assessing the respondents' knowledge on malaria was one of the main objectives of the study, in order to identify gaps and loopholes, to assist in future planning and design. Results were analyzed based on general and specific components of malaria knowledge perspective. This approach was necessary as findings of Syed (2010) in the investigation of the possession and usage of LLINs in Uganda noted that, it was impossible to take adequate preventive actions if there was a lack of a comprehensive knowledge on the different aspects of malaria (Syed, 2010).

I. Awareness, Cause and mode of transmission:

Results showed that although malaria awareness was almost universal (99%), only 89% could associate the disease to malaria parasite or mosquito vector while just 28.78% of the respondents could explain explicitly the mode of transmission of the disease. 71.22% of respondents were hardly able to link malaria to a mosquito vector, an infected carrier, and breeding sites. This shows a weakness in the understanding of how prevention and control measures could be carried out within communities, evident as their personal and community hygiene was observed to be very poor. Characteristic features among all of the communities were stagnant water, bushes, garbage and sewage disposals, and pit toilets within the vicinity of the houses; thus suitable habitat for mosquito breeding.

II. Signs and symptoms:

Recognition of the signs and symptoms of any disease is very important if prompt and appropriate treatment would be sought. Given that home management of malaria is very common among African households (Chirdan et al., 2008), the ability to recognize signs and symptom becomes important in order to avoid the confusion that often occurs in childhood illnesses by the usual overlap of diagnostic features (Rooth and Bjorkman, 1992). Results from the study show that 56% of respondents had a good knowledge of the diagnostic features of the disease. 38% mentioned signs and symptoms that were not solely attributed to malaria while 5% had no knowledge of

the disease features. The most popular signs and symptoms recorded were high temperature and fever (79%), followed by body pain (48%), loss of appetite (43%), chills (42%), headache (40%), etc. This result is suggestive of the fact that many people have some knowledge of the signs and symptoms of malaria. However, in order to illicit the confusion that usually arises as a result of disease overlap, as characterized with children illnesses, it is necessary to enhance respondents' knowledge with regards to the signs and symptoms of malaria.

III. Preventive measures:

Observations regarding the preventability and curability of the disease showed that most respondents (96%) believed malaria could be prevented. However given the list of preventive measures, the results showed that the most popular was the use of ITN (66%), followed by coils (28%), closure of windows and doors (21%), use of gauze wires on windows (17%), and surprisingly just 13% was recorded for the option of good drainage system and clearing of nearby bushes around households. Despite these positive responses from the respondents, 5% did not take any personal protective measures to guard against the disease. The lack of adherence to neither method to guard against malaria, as also supported by Khumbulani et al. (2009), may be due to peoples' total dependence on interventions by the National Malaria programs.

The use of Insecticide treated nets is one of the main strategies recommended by the Roll Back Malaria (RBM) partnership to halve the disease burden in the endemic and vulnerable populations of the world (WHO, 2002a). Even though several studies have shown the protective efficacy, effectiveness and cost effectiveness of ITNs, the relatively underestimated uptake of ITN according to this study could be associated with several factors which are either behavioral, environmental or the national control programs. This is in accordance as Macintyre (2006) illustrated challenges such as access and availability of the ITNs, cost of ITNs on the open market in poor communities, timely retreatment and the issues of adherence, deployment and utilization; that remain for both the national implementation program and the population at large.

IV. Treatment:

Proper management of malaria demands that the benefactors and the care-givers seek, receive, and use drugs suitably. This involves the timely decision to treat, access, and correctly use the drugs and follow-up to detect failure and referrals after prescription (WHO, 2004). Malaria in children under five requires that mothers who usually represent caregivers at home, recognize early signs and symptoms of the disease, thus, playing a prime role to any intervention. In this regard, Management of the disease at home has become an important strategy to achieve the target of eliminating the disease.

Examining malaria treatment at the disease onset was important to underscore respondents' behavior of their treatment seeking pattern and also to understand their knowledge on how they perceive the severity and consequences of malaria if treatment was delayed. The results exhibited several treatment patterns as expressed by the respondents. 38% respondents would seek treatment at a health facility within 24 hours of disease onset, 46% and7% would do so within 2-3 days and 4-7 days respectively. A small amount of respondents mentioned traditional healers (2.88%) and local pharmacy (3.6%) as options for treatment in the event of the disease condition.

Malaria treatment in Cameroon has been a problem for decades because people have sought treatment in various ways. Usually, most people seek for hospitalization after embarking on self or home management. Others will afford to seek medical treatment only after the disease has been chronic or when traditional malaria treatment measures have not proved reliable. Such practices have resulted in drug resistance of the parasite, which makes it even worse when trying to treat the disease.

Greenwood et al. (2005) demonstrated the importance of timeliness in treatment intervention especially with *P. falciparum* malaria infections in which case, 1 in 250 individuals will progress to severe disease within a few hours to a few days (Greenwood et al., 2005). It is generally accepted that the diagnosis and effective treatment should be provided within 24 hours of the onset of symptoms and signs. The result of treatment pattern as shown in the data is suggestive that, though subjects

have positive attitude towards where to seek for treatment (heath facilities), many respondents have not yet understood the importance of prompt treatment.

4.4.3 Utilization of ITN:

I. Possession vs. Utilization (Attitude and Practices towards ITN utilization)

The data from a total of 139 respondents showed that 103 (74%) individuals possessed an ITN. Among them 80 (77.67%) utilized regularly, while 23 (22.33%) utilized irregularly. It was observed that 36 (26%) of the total number of respondents (N=139) did not possess a net.

Possessing ITN is one thing and using it or better still regular utilization is another aspect that has to be considered in order to appreciate the impact in preventing malaria. Even though few studies have really elaborated and differentiated between possession of ITN and its use, which is fundamental if effective management would be achieved, however possessing these nets is considered a positive response with high enough probability to be used.

Some of the stated reasons among those who either did not possess or utilize ITN regularly were due to the cost of these nets or inconveniences due to heat. This finding is supportive to wide gaps on net possession and use in a meta-analysis of household surveys in Africa (Korenromp et al., 2003). They showed that possession of ITN varied in the range of 0.01 and 28.5% in 14 surveyed regions and 3.6% to

79.7% in 69 regions, while its use among children under-5 years ranged between 0% and 16%. It was also found that net usage ranges from 50 % to 70 % in intervention trials where free nets were distributed.

This finding also goes to elucidate the fact that scaling through free distribution within the entire country is sub-optimal.

This study like the one also carried out in western Kenya showed an irregular ITN utilization pattern. Alaii et al. (2003) observed the deployment and adherence of permethrin-treated bed net (ITN) utilization in 2,178 individuals (784 households) participating in a large-scale trial of ITNs on child mortality. To ensure high coverage, the ITNs were given free of charge with a ratio of 1.46 per ITN. The results showed that, approximately 30% of ITNs present were unused having an overall percentage adherence of 72.3%. It was also shown that the *"probability of adherence by individuals depended strongly on age in which children less than five years of age were less likely to use ITNs than older individuals, and temperature, in which ITNs were more likely to be used in periods of cooler weather"*. In his studies, excessive heat was frequently perceived as a reason for non-usage of ITN to the children (Alaii et al., 2003).

The fact that adherence varies as a function of season is extremely important as the use of ITNs only when mosquitoes are a nuisance, or only when the weather is cool

(i.e. during the rains) may place many individuals at risk of malaria infection outside the immediate rainy season.

II. The role of Education in ITN Utilization.

In as much as education is important in the easy comprehension of knowledge, it was however fundamental to differentiate their immediate role and impact on the utilization pattern of ITNs. In this study, the role of education in relation to the utilization of ITN was subject to hypothesis testing. The results showed a Chi Square of 1.703, Critical Value of 12.59 with a Power of 0.94. With a degree of freedom of 6 and alpha of 0.01 ($p \leq 0.01$), the conclusion was to accept the null hypothesis, so that at 1% significance level, the respondents' educational levels are independent of the utilization practices of ITN.

This test however did not show statistical significance as there was a 94% probability or chance of error. This could be as a result of the causal effects associated with mechanisms of knowledge through which education operates (Caldgwell, 1979, pg. 410).

That notwithstanding, this result was supportive of the fact illustrated by Agyepong & Manderson (1999) that Knowledge of the existence of an association between mosquitoes and malaria, the most common cause of illness, was not related to literacy or formal education, in which case this knowledge did not predict bed net use but rather how people perceived the cost and the various circumstances of and reasons to prevent mosquitoes.

As also shown by Aikins (1993) in the Gambia, the use of ITN had correlation with some demographic indicators such as ethnic groups, age, and polygamy, but not with education.

III. The role of Malaria knowledge in ITN Utilization

To be able to measure the impact of respondents' acquired knowledge on malaria, the output consequences of prevention and control practices of ITN use was examined in relation to three categorized levels of knowledge. Frequencies of the three levels of ITN utilization practices were determined for each of the corresponding categorized levels of knowledge as indicated in the Chi square contingency table 4.17.

It was interesting to note that in each of the categories of knowledge, there was a trend in utilization practices by the respondents.

The result showed that the majority of the respondents had good knowledge on malaria (78) and also utilized ITN regularly (80). Among those having good knowledge (78), 55 of them utilized the nets regularly while for those with low knowledge of the disease (33), majority did not use ITNs. This result is suggestive of the fact that, there were higher chances of utilizing ITNs if the knowledge on malaria increased.

It was however noted that for those respondents who didn't use ITN, the reason was because they neither possessed them. Though some of them were identified to have

good (12) and moderate (4) knowledge of malaria, reasons for their non-adherence was attributed to cost of the nets and inconveniences due to hot weather.

The three categorized knowledge levels of malaria knowledge (Good, Moderate and Poor) were further examined in a Chi Square test in order to prove statistically if it was independent of the Utilization pattern of ITN. This was also important to differentiate the effects between knowledge and levels of education as determinants of the use of ITN. The results showed a Chi Square of 32.56, with a Power ($p < 0.001$). With a degree of freedom of 4 and alpha of 0.01 ($p \leq 0.01$), the conclusion was to reject the null hypothesis, such that at 1% significance level, the respondents knowledge on malaria was not independent of the utilization practices of ITN. The results could also be interpreted as that, there was a 99% chance that the utilization practices of ITN were significantly related to respondents' knowledge on malaria.

Thus, in order to maximize the utilization of ITN among households, it was important to have a general understanding on the various aspects of malaria. This association also was illustrated by Nganda (2004) who showed that individual knowledge of malaria was an important factor for ITN uptake among pregnant women in Tanzania.

IV. Sources of information in relation to ITN Utilization

With regards to the sources of information on malaria, results showed a Chi Square of 23.80 and Power ($p<0.001$). With a degree of freedom of 4 and alpha of 0.01 ($p \leq 0.01$), the conclusion was to reject the null hypothesis, such that at 1% significance

level the principal sources of malaria information of respondents was not independent to the utilization pattern of ITN. The result also meant that there was 1% chance that the result would have occurred by chance.

This finding is suggestive of the fact that, areas where information on malaria is acquired play a vital role if adherence and positive potential impact of ITNs on malaria-related incidence, morbidity and mortality are achieved. The finding was also supportive to the predictions by Olusola et al. (2008) that probable utilization of ITN depended on the presence of a health facility within communities.

4.4.4 Perception and barriers associated to ITN use

Most of the respondents' perception and value towards ITN was positive as they stated attributes of the efficacy of ITN, as has already been demonstrated in many studies (Lengeler, 2004), (Schellenberg, 2001). However due to the perception that these nets were not cost effective, the belief that ITN had caused many adverse toxic effects and in addition to this, the fear of illnesses such as cough and irritation, greatly limited its value.

Among those who either did not own ITNs or owned but utilized them irregularly, though knowledgeable about malaria, many factors influenced their attitude and practices; most of which were associated with the environment and their socio-

economic status. Commonly cited barriers included: cost of the nets, inconveniences due to heat, fear of intoxication by chemicals and other cultural beliefs.

Perception and value of ITN alongside barriers could be conceived based on Becker(1974) Health Belief Model (HBM) which stipulates that, any recommended health related or preventive action by individuals depends on their: health concern, belief of vulnerability of a disease having serious consequences, and that adhering to any health recommendation of prevention would be cost effective and guarantee beneficial outcome which surpasses the perceived barriers to preventive actions (Becker, 1974).

This therefore means that any possible action by individuals is a sum total of their perceived susceptibility, severity, benefits and barriers to the malaria as a disease, as they live in endemic areas.

The results of this study were consistent with other findings that documented perception along with barriers, regarding the use of ITNs in preventing malaria.

Studies like the one in Uganda found that, though mosquito vectors were perceived as the sole cause of malaria, a relatively low utilization rate (26%) was registered as the subjects principally cited inconveniences due to heat, and the high cost of the nets as reasons for their non-adherence (Nuwaha, 2002). Similarly in Kenya, Alaii et al. (2002) assessed the communities' reaction to the implementation of ITNs to prevent malaria. They showed that despite the concerns about the disease, little benefits were

associated with the introduced ITNs because of the perception that its impregnation with toxic chemicals could interfere with their reproductive health (Alaii et al., 2002).

Therefore, if the MDG objective of increased uptake and utilization of ITNs to at least 80% must be reached, this perception would have to be demystified through proper knowledge dissemination about ITN. In regard to complains of inconveniences due to hot weather, more knowledge on the disease risk severity outweighing the barriers will have to be re-emphasized. However, considering that the majority of the population in rural communities especially in developing countries are basically farmers who live on subsistence agriculture practices, possessing a net would hardly be a priority if the tariffs were huge as already proven by Simon, (2002) and Schellenberg (2001). This is therefore suggestive that a lot has to be done to encourage social marketing and free distribution of the nets, otherwise alternative preventive measures have to be emphasized based on specific localities.

CHAPTER V:

CONCLUSION AND RECOMMENDATIONS

5.1 Summary of findings

The study revealed that malaria awareness was almost universal (99%), but only 89% of subjects could associate the disease to malaria parasite or mosquito vector. The majority of the subjects has a good knowledge of malaria (78) and also utilizes ITN regularly (80). Among those having good knowledge (78), 55 of them utilizes the nets regularly while for those with low knowledge of the disease (33), the majority does not use ITNs.

Health care centers (64) were the most cited sources of knowledge. 56% of respondent had a good knowledge of the diagnostic features of malaria while 5% had no knowledge of the disease features. 96% of subjects believed malaria could be prevented and the most popular preventive measure included the use of ITN (66%). However, 5% did not take any personal protective measures to guard against the disease. Generally, personal and community hygiene was observed to be very poor with characteristic features such as stagnant water, bushes, garbage and sewage disposals, and pit toilets within the vicinity of the houses.

Regarding the mode of transmission, there was still a deficiency in specific knowledge, as 71.22% of the subjects were hardly able to link malaria to a mosquito vector, an infected carrier, and breeding sites. Subjects exhibited several patterns as options for treatment in the event of a disease condition. Misperceptions regarding

the treatment seeking patterns included: health facilities (53%) within 2 to 7 days; and local pharmacy (3.6%) and traditional healers (2.8%) within 1 to 7 days.

With respect to the Attitude and Practices, the data revealed 74% possession of ITN among which 77.67% of respondents utilized them regularly while 22.33% utilized ITN irregularly. Reasons for not possessing or irregular utilization included the high cost of nets and inconveniences due to hot weather.

106 subjects perceived that the use of ITN was beneficial .However, misperception regarding the value and use of ITN such as, not cost effective, the belief that ITN had multiple consequences of adverse toxic effect, and the fear of illnesses such as cough and irritation, seemed to be common among subjects. Other factors or barriers that reduced the widespread adherence to ITNs include: high cost of nets, inconveniences due to hot weather and some cultural beliefs.

In this study, there was no significant association between the dependent variable (Use of ITN) and the demographic variables of marital status, household size, education level, occupation, income and housing type. However, the subjects' attitude to possess ITN, level of knowledge of malaria, sources of this knowledge (health facilities versus media and community) and perception and value of ITN showed significant association with the levels of the use of ITNs.

5.2 Overall conclusion:

This study was an effort towards divulging the knowledge, attitude and practices of the use of ITN among households in two rural communities within the Mount Fako region of Cameroon with characteristic features typical of which cut across most of the country.

The study sought to assess the respondents' knowledge on malaria, possession and utilization practices of Insecticide Treated Bed nets as the prevention and control method implemented by the "Roll Back" malaria campaign in sub-Sahara African countries and more especially the NMCP in Cameroon.

Given the countries Millennium Development Goal (MDG) target to reduce the burden of malaria to about 50% in 2015 and to attain a distribution of ITN rate of 80%, if was necessary to ascertain the knowledge of the population with regards to the utilization pattern of ITN if this objective has to be achieved. This would aid local malaria control programs to improve both their ITN distribution programs and re-define their strategy based on information, education, and communication (IEC) activities such that the desired impact of ITNs utilization may be met.

It was found that the challenges of Malaria endemicity and the possession and use of ITN are enormous. The root cause of the endemicity is deeply embedded and cuts across climatic conditions, species variability, to the populations' knowledge on Malaria as a disease and the perceived need of ITN as a preventive tool. Likewise the

utilization of ITN which represents one of the most effective mechanisms to prevent malaria is highly affected by the perceptive knowledge, social, climatic, cultural and economic fabrics of a society which ultimately drives individuals to behave in ways that are likely to contribute to the spread of the disease.

Therefore, until the behavior and practices of individuals or a group is understood and enough information and knowledge especially with regards to the mode of transmission, the severity and effects of the disease is disseminated within families and communities through the desired methods of communication, meeting the set goals is not possible.

5.3 Recommendations:

Haven assessed the gaps (on the basis of the study findings) in malaria knowledge and the eventual use of ITN among the community, the following recommendations are suggested:

- Educating the subjects on personal and community hygiene are recommended as there is a lack of understanding on the mode of transmission of the disease with features of stagnant water, bushes etc. around the vicinity of houses.
- Various patterns of treatment were shown by respondents. Knowledge of the disease severity and importance of prompt treatment at health facilities seemed to be yet another area of malaria specific knowledge that needs to be understood.

- Massive free ITN distribution and social marketing campaign especially at the rural communities would have to be strengthened, as the relatively high cost of nets would prompt risky behaviors rather than investing in the purchase of what is perceived as an expensive solution.
- The study revealed climatic conditions as one of the major barriers to the regular use of ITNs. Because of the differences in weather conditions within different communities, it is recommended that future programs embark on alternative protective measures based on specific localities.
- Though most respondents are aware of some malaria related issues, misperceptions regarding the value of ITN are still common among the people. Recommendation for future programs involves demystifying some of these perceptions.
- It is necessary that any future intervention based on IEC be channeled through the health care facilities, health workers or health campaign for effective malaria knowledge comprehension. This route of communication is reliable as it was preferred by most respondents coupled with the fact that it was shown to trigger most respondents to uptake and use ITNs regularly.

The findings from this studies would not only be useful for planning purposes by the NMCP, but will also be useful as an advocacy material to draw attention of others who are involved in policy marking, bureaucrats and the private sectors for better policy development and resource mobilization.

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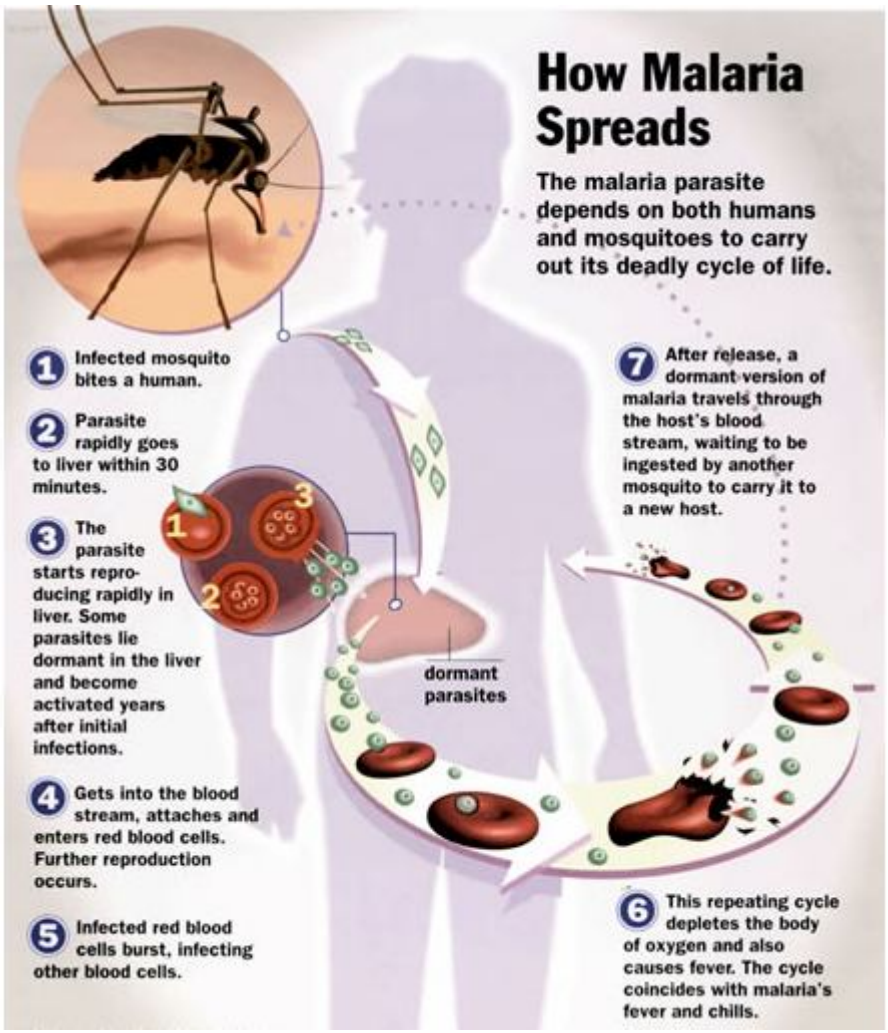
APPENDICES

Appendix 1.1: Life cycle of malaria:

Complete life cycle involves a female anopheles mosquito and a host (in these case; humans). Infection begins when the malaria vector (female anopheles mosquito) go for a blood meal and inoculates plasmodial sporozoites from its salivary gland into the blood stream of humans. The sporozoites migrate to the liver where they become mature and are later released into the bloodstream as merozoites. These merozoites invade and destroy the red blood cells causing malaria fevers. Other forms of the parasites develop as gametocytes and are ingested by the mosquitoes when it goes for its next meal. Gametocytes later develops to sporocytes and are stored in the salivary gland of the mosquito completing the cycle (Jamison et al. 2006, Pg 413.).

Diagrammatic representation of the life cycle of malaria:



Source: Mowry Graphic GlaxoSmithKline. 21/11/06

Appendix 1.2: Malaria-Related Mortality and Morbidity, Africa (in 2000):

Estimates of cases of hearing impairment, visual impairment, epilepsy, etc. caused by malaria.

		Percentage affected by age in years			
Condition	**Number range**	**0-4**	**4-5**	**5 to 14**	**15 and above**
Morbidity and Mortality					
Malaria specific mortality	1,144,572A (702,957–1,605,448)	65		19	16
Maternal mortality (anemia)	5,300	NA		NA	100
Infant mortality (pregnancy related)	71,000–190,000	100		NA	NA
Fatal adverse events from malaria drugs	2,300	100		Unknown	Unknown
HIV from blood transfusion necessitated by malaria	5,300–8,500		100		-
Epilepsy-related mortality after cerebral malaria	Unknown	Unknown		Unknown	Unknown
Malaria-related anemia, under nutrition, and HIV mortality	Unknown	Unknown		Unknown	Unknown

Episodes of malaria (thousands)	213,549 (134,322–324,617)	51		35	14
Illness days from malaria (thousands)	803,699 (494,416–1,298,872)	69		21	10
Neuro-cognitive sequelae after CM					
Hemi paresis	360–400		100		Unknown
Quadri-paresis	770–860		100		Unknown
Hearing impairment	650–730		100		Unknown
Visual impairment	300–330		100		Unknown
Behavioral difficulties	1,540–1,720		100		Unknown
Language deficits	7,000–7,800		100		Unknown
Epilepsy	2,700–3,000		100		Unknown
Effects on cognition	Unknown	Unknown		Unknown	Unknown

Source: Breman, Alilio, and Mills. (2004), Snow et al. (2003).
NA = Not Applicable.
NB: Figures in parentheses = Inter-quartile ranges.
A. WHO (2002b) Reports 1,124,000 deaths from malaria.

I. Appendix 2.1: Total number and densities of the health workforce in Cameroon (2002)

Specialty	Total number in Cameroon	Density/1000 Cameroon	Density /1000 Afro
Physicians	3124	0.192	0.217
Nurses and midwives	26042	1.598	1.172
Dentists and technicians	147	0.009	0.035
Pharmacists and technicians	700	0.043	0.063
Environmental and public health workers	28	0.002	0.049
Laboratory technicians	1793	0.110	0.057
Other health workers	16	0.001	0.173
Community health workers	n.a	n.a	0.449
Health management and support	5902	0.362	o.411
Sum total	37752		2.626

Source: WHO; country health system fact sheet 2006, Cameroon; Human resources for health. http://www.who.int/whosis/en/

Appendix 3.1: Research Questionnaire:

A letter of consent

Dear respondent,

I am a Cameroonian student studying International Cooperation Policy, specializing in the field of Public Health Management at **Ritsumeikan Asia Pacific University in Japan**. As part of the program prerequisite for completion and award of a master's degree, a comprehensive research thesis is mandatory.

I have chosen to research on Malaria, which represents one of the biggest disease burdens in Cameroon. Below are set of questions which would help in the analysis of my research topic. I will appreciate your kind participation in answering these questions and the information provided shall **only** be used for the sake of the academic research work.

Individual Questionnaire

(Please check response(s) which apply to you)

Part I: SOCIO DEMOGRAPHIC AND SOCIO ECONOMIC CHARACTERISTICS

- **Family and personal data:**

1) Marital status: Divorce Single

2) Total number of dependents 1-4 5-8 9 and above

3) Age range of your children 0-5 years 6-10 years 11-20 years above 21 years

- **Educational level, occupation and housing type:**

4) Highest qualification obtained: First School Leaving Certificate GCE Ordinary Level GCE Advance Level University Degree

5) Respondents occupational status: Housewife Farmer Trader Others

6) Husbands' occupation: Farmer Trader Petty officer Retired Others

7) Approximate monthly income in Francs CFA (combined)
Below 30,000 31,000-60,000 61,000-100,000 100,000-150,000

150,000 and above

8) What type of dwellings/ structures is there in your households?

Type of walls			Type of roof		
1	Fire bricks		1	Grass	
2	Stones and cement		2	Asbestos	
3	Cement blocks		3	Zinc	
4	Wood or plank		4	Tiles	
5	Others (specify)		5	Others (specify0	

Part II

Section A: MALARIA INFORMATION EDUCATION AND COMMUNICATION (IEC):

9) Have you heard about malaria? Yes No

10) If (Yes) to question (9), **where** or **how** did you hear about malaria (**principally**)?

1	Friends /Family members /Community meetings
2	Radio/ Television/ Posters/ pamphlets/ Newspapers
3	Health facility/ Community Health workers/ Personnel from malaria campaign
4	Others (specify)

11) What transmits malaria? .....

12) Do you think malaria can kill, if it is untreated?

Yes No don't know don't care

13) What do you think are the most common signs and symptoms in malaria infection? (You may choose more than one response)

1	Headache	4	Chills	7	Delirium (or mental agitation)	10	Others (specify)
2	High temperature/fever	5	Vomiting	8	Loss of appetite	11	Don't know
3	Body pain	6	Loss of energy	9	Dizziness	12	Don't care

14) In brief could you explain how malaria is transmitted? .....

.....

.....

15) Do you think you have enough information on malaria? Yes No Don't know

16) If (no) to question (15), what information would you like to get about malaria?

1	Information on treatment	4	Nature of the disease	7	Others (specify)
2	Information on control and control	5	Any information	8	Don't know
3	Mode of transmission	6	Signs and symptoms	9	Not applicable

17) Where or how would you like this information communicated to you? (Through what means of communication)

1	Family members	6	Posters/ pamphlets	11	Community Health workers
2	Friend	7	Newspapers	12	Personnel from malaria campaign
3	Church	8	Health facility	13	Others (specify)
4	Radio	9	Traditional healer	14	Don't care
5	Television	10	Community meetings	15	

Section B: TREATMENT AND TREATMENT-SEEKING BEHAVIOUR

18) If you or your child under-5 were to present with the signs and symptoms of malaria where would you seek treatment?

1	Health facility	4	No where
2	Traditional healer	5	Other (specify)
3	Local Pharmacy	6	Don't know

19) How soon after suspecting that you or your child under 5 is infected with malaria, would you seek treatment?

1	One day (within 24 hours)	3	4-6 days	5	Don't know
2	2-3 days	4	7 days or more	6	Don't care

20) If you would seek treatment immediately (within 24 hours), what would you do?

1	**.....**	**2**	**Don't care**

Section C: PERSONAL PROTECTION

21) Do you think malaria can be prevented? Yes No don't know

22) If yes to question 21, how? ..... don't know

23) What personal protective measures do you use to guard against malaria infection?

1	Use repellents	5	Close windows and doors	9	Do nothing
2	Use mosquito coils	6	Gauze wires in windows	10	Not applicable
3	Use doom	7	Use mosquito nets		
4	Burn cow dung/ leaves	8	Others (specify)		

24) Does the household have bed nets? Yes No

24 - (A). If (yes) to question (24), who owns the available bed nets in this household?

Father Children under 5 others
(specify).....

24 – (B). Are all these bed-nets being used regularly?

Yes No don't know

24 – (C). State reasons for any chosen answer to question (24-
B): .....
.....

don't know don't care

25). If (No) to question (24), what stops you from owning a bed
net: ....
.....

26) What in your opinion are the possible barriers to own or regularly use
ITNs: .....
.....

27) If you were to realize that the neighborhood that you live is highly risky to malaria, can you spend your income in the purchase of a bed-net?

willing to purchase Ability to purchase Can't purchase

OBSERVATIONAL CONSIDERATIONS

1. Contribution of geography factors to the malaria incidence rate at highland and low land regions.

2. General healthcare behavior with respect to personal and environmental hygiene.

3. Rural community initiatives on environmental healthcare.