

**SOCIO-CULTURAL AND ECONOMIC FACTORS IN PROCUREMENT AND
RATIONAL UTILIZATION OF INSECTICIDE-TREATED BEDNETS IN BUSIA
DISTRICT, KENYA //**

BY

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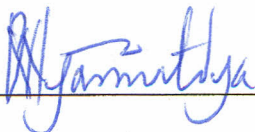
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DECLARATION

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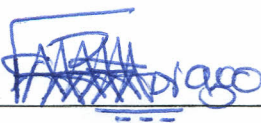
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DEDICATION

I dedicate this work to my late parents, Mr. Patrick Ndieka and Mrs. Lucy Nyaboke Ndieka who taught me the value of hard work.

TABLE OF CONTENTS

DECLARATION.....	i
DEDICATION.....	ii
TABLE OF CONTENTS.....	iii
ACKNOWLEDGEMENTS.....	x
ABSTRACT.....	xi
CHAPTER ONE: INTRODUCTION AND LITERATURE REVIEW.....	1
1.1 INTRODUCTION.....	1
1.2 LITERATURE REVIEW.....	2
1.2.1 DEFINITION AND AETIOLOGY OF HUMAN MALARIA.....	2
1.2.2 VECTORS OF MALARIA.....	2
1.2.3 MALARIA PROGNOSIS.....	4
1.2.4 TREATMENT OF MALARIA.....	6
1.2.5 MALARIA ENDEMICITY.....	8
1.2.6 MALARIA MORBIDITY AND MORTALITY.....	9
1.2.7 SOCIO-ECONOMIC IMPACT OF MALARIA.....	13
1.2.8 PREVENTION AND CONTROL OF MALARIA.....	14
1.2.8.1 MEASURES DIRECTED AT THE PARASITE.....	14
1.2.8.2 MEASURES DIRECTED AT THE VECTOR.....	16
1.2.8.3 MALARIA CONTROL INITIATIVES.....	17
1.2.9 INSECTICIDE TREATED MATERIALS.....	19
1.2.9.1 BEDNETS.....	21

1.2.9.2	INSECTICIDES.....	22
1.2.9.3	BENEFITS OF INSECTICIDE TREATED BED NETS (ITNs).....	23
1.2.9.4	ACCEPTABILITY AND AFFORDABILITY OF ITNs.....	25
1.2.9.5	IMPLEMENTATION MODELS FOR ITNs.....	27
1.2.9.5.1	DELIVERY SYSTEMS.....	27
1.2.9.5.2	TREATMENT OF ITNS.....	28
1.2.9.5.3	SUSTAINABILITY OF ITNs.....	29
1.2.9.6	CURRENT CONCERNS ABOUT ITNs.....	30
1.2.9.7	LIMITATIONS OF ITNs.....	31
1.3	RATIONALE FOR THE STUDY.....	31
1.3.1	STATEMENT OF THE PROBLEM.....	31
1.3.2	RESEARCH QUESTIONS.....	32
1.3.3	JUSTIFICATION.....	32
1.4	HYPOTHESIS.....	33
1.5	OBJECTIVES OF THE STUDY.....	33
1.5.1	GENERAL OBJECTIVE.....	33
1.5.2	SPECIFIC OBJECTIVES.....	34
CHAPTER TWO: MATERIALS AND METHODS.....		35
2.1	STUDY AREA.....	35
2.1.1	LOCATION AND HUMAN POPULATION.....	35
2.1.2	ADMINISTRATIVE UNITS.....	35
2.1.3	TOPOGRAPHY AND CLIMATE.....	37

2.1.4	SOILS AND DRAINAGE.....	39
2.1.5	WATER RESOURCES.....	39
2.1.6	FOREST RESOURCES.....	41
2.1.7	ECONOMIC ACTIVITIES.....	41
2.1.7.1	AGRICULTURAL ACTIVITIES.....	41
2.1.7.2	FISHING.....	42
2.1.7.3	THE MANUFACTURING AND PROCESSING SECTORS.....	42
2.1.8	SOCIAL AMENITIES.....	44
2.1.8.1	COMMUNICATION NETWORK.....	44
2.1.8.2	ELECTRICITY AND OTHER ENERGY RESOURCES.....	44
2.1.8.3	FORMAL EDUCATION.....	44
2.1.8.4	HEALTH AND NUTRITION.....	45
2.1.9	LABOUR FORCE AND INCOME.....	48
2.2	THE STUDY POPULATION.....	48
2.2.1	HISTORY AND MIGRATION.....	48
2.2.2	BALUYIA CULTURE AND PRACTICES.....	49
2.2.3	THE STUDY SUBJECTS.....	51
2.2.3.1	INCLUSION CRITERIA.....	51
2.2.3.2	EXCLUSION CRITERIA.....	51
2.2.3.3	THE SAMPLE SIZE.....	52
2.2.3.4	SAMPLING METHOD.....	52
2.2.3.5	ETHICAL CONSIDERATIONS.....	54

2.3	STUDY DESIGN AND RESEARCH INSTRUMENTS.....	54
2.3.1	STRUCTURED INTERVIEW.....	54
2.3.2	FOCUS GROUP DISCUSSION.....	54
2.3.3	OBSERVATION.....	55
2.4	DATA STORAGE AND ANALYSIS.....	55
CHAPTER THREE: RESULTS.....		57
3.1	SOCIO-ECONOMIC AND DEMOGRAPHIC CHARACTRISTICS OF THE STUDY SUBJECTS.....	57
3.2	HOUSEHOLD SLEEPING PATTERNS AND THEIR POSSIBLE EFFECT ON ACQUISITION AND PROPER UTILIZATION OF MOSQUITO NETS.....	63
3.3	HOUSEHOLD MOSQUITO BITE DETERRENT STRATEGIES.....	73
3.4	THE COST OF MOSQUITO DETERRENT ITEMS PURCHASED BY HOUSEHOLDS AND THEIR POSSIBLE INFLUENCE TO NET ACQUISITION.....	73
3.5	THE COVERAGE OF MOSQUITO NETS, THEIR TREATMENT WITH INSECTICIDE AND PROBLEMS ASSOCIATED WITH BED NET ACQUISITION AND TREATMENT.....	74
3.6	AFFORDABILITY AND WILLINGNESS OF HOUSEHOLDS TO BUY BED NETS.....	80
CHAPTER FOUR: DISCUSSION.....		88
4.1	GENERAL DISCUSSION.....	88

4.2	SOCIO-ECONOMIC AND DEMOGRAPHIC CHARACTERISTICS.....	89
4.3	HOUSEHOLD SLEEPING PATTERNS.....	91
4.4	HOUSEHOLD MOSQUITO DETERRENT STRATEGIES.....	95
4.5	COVERAGE OF MOSQUITO NETS AND THEIR TREATMENT WITH INSECTICIDE.....	96
4.6	AFFORDABILITY AND WILLINGNESS OF HOUSEHOLDS TO BUY BED NETS.....	98
	CHAPTER FIVE: A SUMMARY OF CONCLUSIONS.....	101
	CHAPTER SIX: RECOMMENDATIONS AND SUGGESTIONS FOR FUTURE WORK.....	102
6.1	RECOMMENDATIONS.....	102
6.2	SUGGESTIONS FOR FUTURE RESEARCH WORK.....	102
	REFERENCES.....	104
	APPENDICES.....	118

LIST OF TABLES

Table 1:	Locations, sub-locations, villages and number of households from each village involved in the study.....	53
Table 2:	The level of education of the respondents.....	59
Table 3:	Major occupations of the respondents.....	60
Table 4:	Other jobs done by the respondent other than the main occupation.....	61
Table 5:	Number of children below five years staying in the household....	64
Table 6:	Members of the household sleeping with children below five years.....	64
Table 7:	Number of sleeping rooms per household.....	67
Table 8:	Members of household sleeping on bed.....	69
Table 9:	Household members sleeping on mats/skin.....	70
Table 10:	Members of the household sleeping together.....	70
Table 11:	Determinants of household sleeping arrangements.....	72
Table 12:	Time members of the household go to sleep.....	72
Table 13:	Respondents feelings about mosquito repellants used in the household.....	75
Table 14:	The reasons why households with untreated mosquito nets had not treated them.....	79
Table 15:	What respondents will like to buy or do given money.....	81
Table 16:	Action taken by respondents when money is needed.....	82
Table 17:	Item/services for which households borrow money.....	83
Table 18:	When households are likely to buy a mosquito net.....	85

LIST OF FIGURES

Figure 1:	The global distribution of reported <i>Plasmodium falciparum</i> drug resistance.....	7
Figure 2:	Global malaria status.....	10
Figure 3:	Malaria mortality annual rates since 1900.....	11
Figure 4:	Map of Kenya showing location of Busia District.....	36
Figure 5:	The topography of south Bunyala.....	38
Figure 6:	Flooding caused by river Nzoia during the rain seasons.....	40
Figure 7:	Fishing at one of the beaches in the area.....	43
Figure 8:	Yala swamp, the major permanent breeding site for mosquitoes.....	46
Figure 9:	Water remaining in pools when the floods recede.....	46
Figure 10:	Rain water collected in excavations.....	47
Figure 11:	Flood water from river Nzoia.....	47
Figure 12:	Age at which children sharing sleeping space with parents change their sleeping pattern.....	66
Figure 13:	Frequency of washing treated nets in relation to the duration of using them.....	77
Figure 14:	Number of times the nets had been washed in relation to length of time they had been used.....	78
Figure 15:	Monthly expenditure of the households.....	87

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ABSTRACT

Malaria is a major killer disease that threatens 40% of the world population with over 80% of the global disease burden occurring in Africa south of the Sahara. Insecticide treated bed nets have been an effective prophylactic measure in malaria control and has shown the potential for preventing malaria morbidity and mortality. World Health Organisation (WHO) and its development partners have particularly recognised insecticide treated bed nets (ITNs) in "Roll Back Malaria" initiative as an effective measure in reducing malaria burden. Even though advocated, adoption of ITNs has been slow due to problems in making nets and insecticides available to populations at risk and ensuring that the nets are correctly used, well maintained and routinely treated with insecticides.

This investigation was a cross-sectional household study aimed at establishing socio-economic and cultural factors that may affect acquisition and proper utilization of ITNs in reducing malaria transmission in Busia district, western Kenya. The data were collected from 360 respondents using structured interviews, focus group discussions and observations then analysed using Statistical Package for Social Science (SPSS).

The results of the study indicate that while adults rather than children were more likely to use a bed net in the household, pregnant women were more likely to sleep under a net. Households with more than one bed net presented a slightly higher

opportunity for the child to use it. People sleeping on mats had the lowest chance of using a bed net even when it was to be provided free of charge.

Most households slept and woke up before and after mosquito peak biting hours. Therefore, bed nets are able to reduce mosquito-man contact thereby reducing malaria transmission and consequently malaria burden in the area.

Coverage of mosquito nets was very low and could be attributed to use of mosquito repellants (traditional and modern), perceptions that bed nets are luxuries rather than health maintenance items and lack of available funds to buy bed nets. Most mosquito nets in the community were not treated with insecticide. Inability to treat them had its roots in lack of insecticides for treatment and ignorance.

Residents of Bunyala south might not be willing to buy mosquito nets, as they do not value them highly. Even though most households were able to afford at least one net. They may not buy them especially when mosquito nuisance has reduced. To increase net acquisition and use in the community it may be imperative to develop aggressive bed net marketing strategies, provide credit facilities and start projects that can improve economic status of the residents.

CHAPTER ONE: INTRODUCTION AND LITERATURE REVIEW

1.1 INTRODUCTION

World Vision, Kenya (WVK) through the Anglican Church started Bunyala Area Development Programme (ADP) formerly Bunyala Family Development Project (FDP) in 1986. The programme covers south Bunyala, most of which is covered by Yala swamp and experiences seasonal floods.

The programme covers three locations with an estimated population of 28,400 people of which 5400 are children under five years and 5700 are women of childbearing age. Bunyala ADP activities revolve around promotion of education, health, agriculture and Christianity.

In this area malaria, respiratory diseases and diarrhoea are the leading causes of under-five morbidity and mortality. It is upon this background that implementation of health activities are based. Health activities comprises of Primary Health Care (PHC) and AfriAfya projects.

Malaria is one of the most prevalent diseases constituting about 60% of all annual outpatient and inpatient cases in the area. This appalling malaria situation has its genesis in abundant mosquito breeding sites, ignorance, poverty, inadequate health facilities and shortage of drugs. The PHC project has made malaria control its priority. The project covers 4,960 households and aims at reducing malaria morbidity and mortality by increasing use of

insecticide treated bed nets (ITNs) by pregnant women and children below five years.

This study forms part of the effort to address the community malaria burden. It is designed to address socio-economic and cultural factors that may hinder acquisition of ITNs by the group at risk and also investigate the factors that may hamper the use of ITNs by the same group. Results of this study will go along way in ensuring that the PHC project objectives are achieved.

1.2 LITERATURE REVIEW

1.2.1 Definition and aetiology of human malaria

“Malaria” is an Italian word meaning bad or poisonous air (The Wellcome Tropical Institute, 1987). It is a parasitic disease caused by a protozoan of the genus *Plasmodium*. There are four species that infect humans, namely: *P. ovale*, *P. malariae*, *P. vivax* and *P. falciparum*, all of which have been reported in Kenya (Republic of Kenya, 1998). *Plasmodium falciparum* usually associated with severe and complicated malaria is also the commonest, accounting for 98% of total malaria cases in the country (Republic of Kenya, 1998). *Plasmodium malariae* and *P. ovale* accounts for the remaining 2% of the cases whereas *P. vivax* is very rare.

1.2.2 Vectors of malaria

A female *Anopheles* mosquito principally transmits human malaria. However, malaria can also be acquired transplacentally or through blood transfusion

(White, 1982). More than 350 species of the genus *Anopheles* have been identified but not all are important vectors of malaria (White, 1982; Icon, 1991). Under natural conditions 60 species are vectors of malaria and only 30 of these are of prime importance (Na'jera *et al.*, 1993)

Malaria vectors occur in the tropical and temperate regions of the world where aquatic breeding sites are available. Principal vectors of malaria in East Africa are *An. gambiae s.s.*, *An. arabiensis*, *An. funestus* and *An. merus* (Omumbo *et al.*, 1999). In Kenya *An. gambiae* and *An. funestus* are the main vectors of malaria with *An. pharaoensis* playing a minor role in transmission (Gillies and Coetzee, 1987; WHO, 1989).

Success of a female mosquito in maintaining malaria transmission in a given region is determined by basic case reproductive rate (BCRR). The density of mosquitoes, their man-biting habits and longevity in turn determines BCRR. Vectors responsible for African malaria transmission feed preferentially on people, feed frequently and are long-lived, thereby effectively maintaining malaria transmission in Africa. BCRR in Africa is in excess of 1,000 (Feachem and Jamison, 1991).

The majority of important malaria vectors feed at dusk or during the night and tends to seek blood meals near their breeding sites (Clement, 1996). In Africa south of the Sahara, female *Anopheles* mosquitoes predominantly feed late at night between 10.00 pm – 4.00am (Curtis, 1997). After the blood meal, the

mosquitoes either rest indoors to digest their meal (endophily) or leave at dawn and rest outdoors (exophily) (Gillies and Coetzee, 1987). After the blood meal has been digested the mosquitoes will seek a breeding place to lay eggs, after which they are ready for another blood meal. The length of this cycle depends on temperature and in tropical regions with a mosquito life span of few to several weeks it is as short as two to four days (Na'jera *et al.*, 1993).

1.2.3 Malaria prognosis

Malaria is a term covering four closely related diseases caused by different species of protozoa in the genus *Plasmodium* (Wellcome Tropical Institute, 1987; Na'jera *et al.*, 1993; Cox *et al.*, 1994). The host is usually human who also acts as the sole reservoir of infection. All the forms of malaria are characterized by periods of chills and fever separated by periods of remission. One form of malaria has a four-day cycle (quartan) and the other a three-day cycle (tertian). Tertian malaria can be either benign or malignant depending on the parasite involved (Busvine, 1975). Usually *P. falciparum* is associated with malignant tertian malaria while *P. vivax* is responsible for benign tertian malaria. *P. malariae* is usually suspected in quartan malaria.

The infected individual's level of acquired immunity to the infection determines the outcome of the infection. Immunologically naive individuals have symptoms appearing quickly five to six days following infection. If treatment is not sought, sudden development of severe complications may then follow without warning (Manson-Bahr and Bell, 1987). In such individuals the

resultant malaria morbidity and mortality is very high (Lindsay and Marten, 1998). Adults and older children living in endemic areas acquire immunity as a result of repeated malarial attacks. These groups of people are protected from malaria and rarely suffer severe attacks. In some cases a low level of infection is maintained without clinical malaria.

At the sub-clinical level malaria parasites undergo development in the liver cells before they re-enter the blood stream, a process requiring approximately two weeks. Entry into the blood stream and subsequent invasion of erythrocytes marks the onset of the clinical level of the disease. The time from infection to development of clinical signs and symptoms varies depending on the parasite species responsible and the number of parasites infused if acquired through blood transfusion. This period is approximately 7-14 days, 7-30 days and 8-14 days for *P. falciparum*, *P. malariae*, *P. vivax* and *P. ovale* respectively (Na'jera *et al.*, 1993).

Clinical level of malaria is characterized by fever, myalgia, joint pains, chills, splenomegaly, headache, mental confusion, abdominal pain, diarrhoea, nausea, anorexia and vomiting (Republic of Kenya, 1998). If treatment is not sought, death results from complications due to pathological effects of the parasites in organs and systems invaded (Macgrath, 1971; Strickland, 1984). Death usually occurs in two to three weeks and sometimes as soon as two to three days after the onset of symptoms. Un-treated or incompletely treated infections produce recrudescence enabling *P. falciparum* to persist for 1-2 years and *P. malariae*

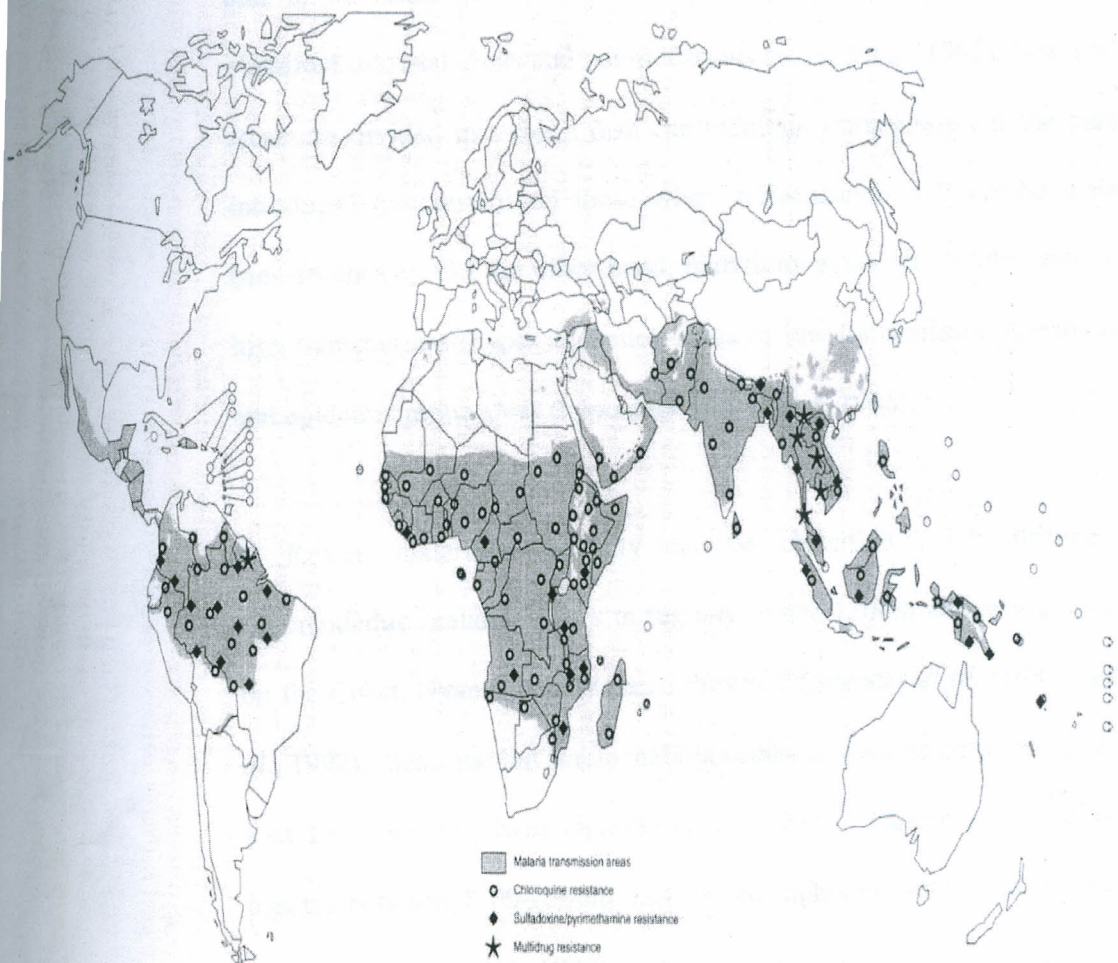
for up to 52 years (Na'jera *et al.*, 1993). Relapses commonly occur in *P. vivax* malaria after about three to four years.

1.2.4 Treatment of malaria

Anti-malarials are the drugs used in the treatment of malaria. Different types of anti-malarial drugs are available and their use depends on whether the patient presents in a health facility with uncomplicated or complicated malaria, the parasite species and its documented resistance to a given group of anti-malarials.

Chloroquine has for a long time been used as the first line drug. However, with the emergence of drug resistant malignant malaria, endemic countries in Southeast Asia, South America and Africa are replacing it with sulfadoxine/pyrimethamine (SP) drugs (WHO, 1999; WHO, 2000). Multidrug resistant *P. falciparum* has been reported in almost all malaria endemic areas (Figure 1). Resistance to chloroquine has even been extended to consistently sensitive *P. vivax* in parts of Southeast Asia and Oceania (WHO, 1999). Of concern at the moment is the rapid development of resistance, with the cost implications of replacement drugs (WHO, 1999; WHO, 2000). To prolong the effective life of successor drugs, multi-drug therapies are advocated. In some areas such as Thailand and Brazil only multi-drug therapies are now effective against drug resistant *P. falciparum* (WHO, 1999).

Figure 1: The global distribution of reported *Plasmodium falciparum* drug resistance



Source: WHO, 2000

1.2.5 Malaria endemicity

Malaria epidemiological picture and transmission pattern in an area are determined by variables such as temperature, humidity, rainfall, topography, parasite and vector species and their bionomics as well as a number of socio-economic factors (Yang, 1986; Lindsay and Marten, 1998). Intensity and pattern of malaria transmission in a specific area is often the result of a complex interaction of all the relevant factors, which vary from place to place, and in the same place at different times. World malaria can be broadly classified into malarious and non-malarious areas (Yang, 1986). Non-malarious areas are divided into those that can maintain transmission if the parasite is introduced (receptive) and those where transmission will not be maintained (non-receptive). On the other hand, malarious areas are divided into areas of high transmission (hyper-endemic), areas of low transmission (meso-endemic) and epidemic prone areas (hypo-endemic) (Yang, 1986).

In Kenya, malaria endemicity can be classified using altitude. Stable hyperendemic malaria occurs in regions below 1300m above sea level (a.s.l.) on the Coast, Nyanza and Western Province (Spencer *et al.*, 1987; Githeko *et al.*, 1992). Seasonal but stable malaria occurs in regions between 1300-1700 m a.s.l for example Mwea (Ijumba *et al.*, 1990). Unstable malaria occurs in regions between 1700-2300m a.s.l on the highlands such as Kisii, Nandi and Kericho (Ngindu *et al.*, 1989).

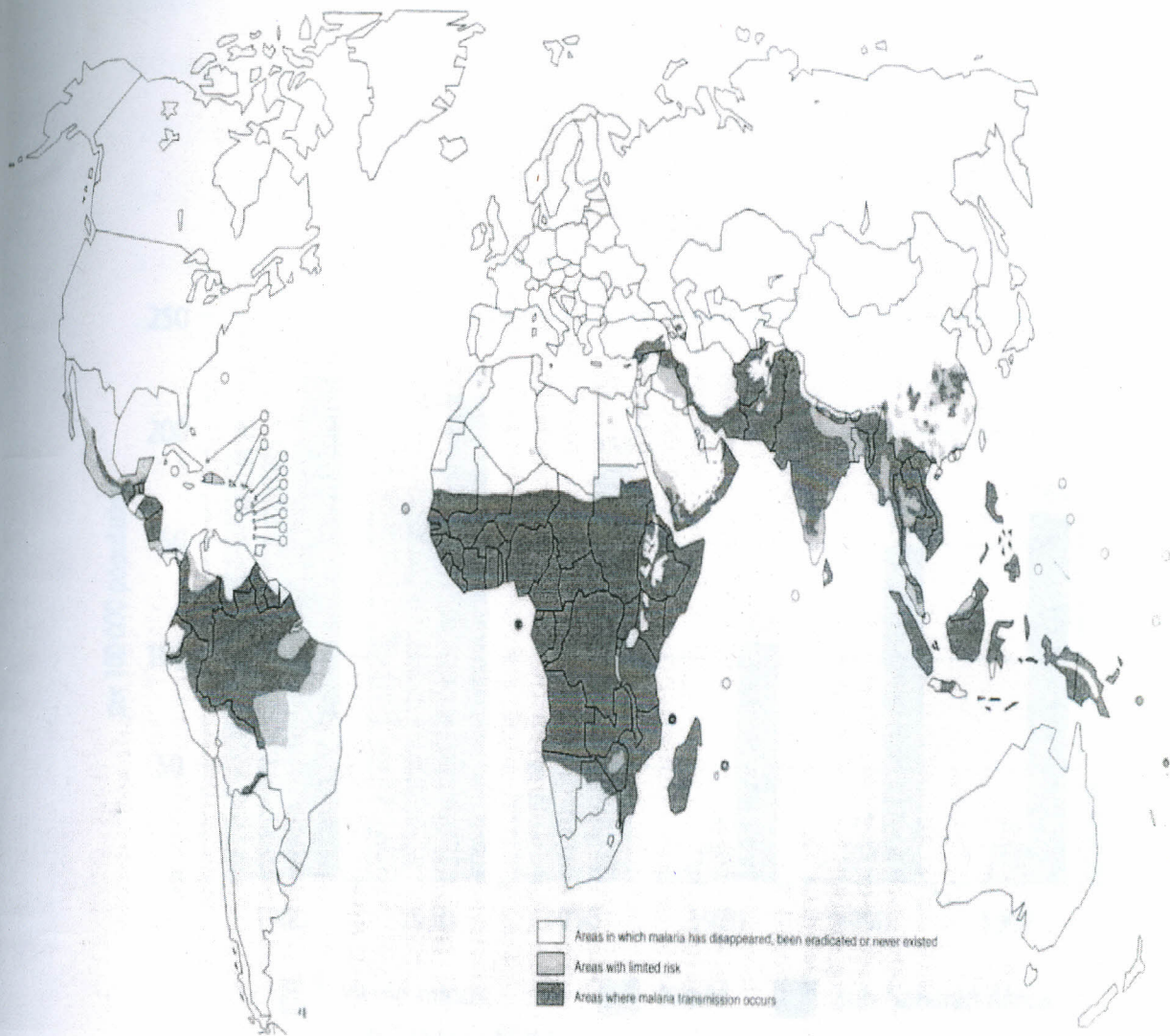
Presently, about 100 countries and territories in the world are considered malarious; half of them in sub-Saharan Africa, compared to 140 countries and territories in the mid 1950s (WHO, 2000) (Figure 2).

1.2.6 Malaria morbidity and mortality

Malaria risk worldwide is estimated at one-fifth of the world population and accounts for an estimated 300-500 million clinical cases annually (Snow *et al.*, 1999; RBM/WHO, 1999; WHO, 2000). It is estimated that about 1.1 to 2.7 million cases die of malaria annually (WHO, 2000).

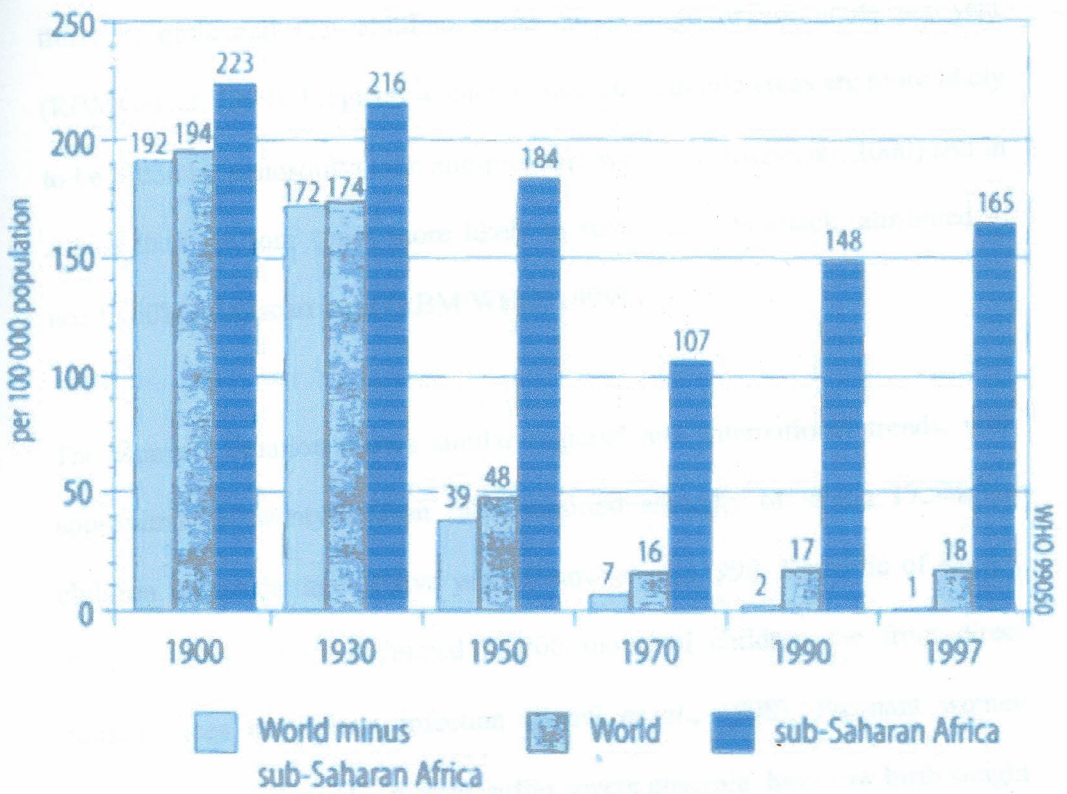
Malaria mortality trends since the turn of the twentieth century showed a decline in mortality up to 1970s, with the zenith of success in the 1960s. Since the late 1980s malaria mortality in Africa has increased (Figure 3) and the situation is expected to worsen due to the spread of chloroquine-resistant *P. falciparum* (WHO, 1999).

Figure 2: Global malaria status



Source: WHO, 2000

Figure 3: Malaria mortality annual rates since 1900



Source: WHO, 1999

In Africa about 74% and 18% of the continent's population live in malaria endemic and epidemic areas respectively, contributing over 80% of the global disease burden (WHO, 1992; Anderson *et al.*, 1996; RBM/WHO, 1999). It is the leading health problem with about 550 million people at risk of infection and 270 million cases per year (WHO, 1999) with an estimated prevalence of 20-40% of out patient visits and 10-15% of hospital admissions. It is estimated that malaria in African in combination with other diseases kills a child every thirty seconds and that children suffer an average of six bouts per year (RBM/WHO, 1999). Pregnant women in malaria endemic areas are more likely to be bitten by a mosquito than non-pregnant women (Moszynski, 2000) and in Africa they are four times more likely to suffer malaria attack, attributed to nearly 60% of miscarriages (RBM/WHO, 1999).

The Kenyan situation shows similar regional and international trends, with approximately twenty million cases reported annually of which 17.5% are children below the age of five years (Snow *et al.*, 1998; Republic of Kenya, 2001). Each year an estimated 26,000 thousand children die from direct consequences of malaria infection (Snow *et al.*, 1998). Pregnant women particularly primigravidae women suffer severe anaemia, have low birth weight babies and run a higher risk of death from the disease. It is estimated that over 6,000 of these group of women develops severe malaria induced anaemia every year (Snow *et al.*, 1998)

1.2.7 Socio-economic impact of malaria

Africa bears the brunt of the disease where the cost of treatment and control of malaria drains its economies. In fact, endemic countries in Sub-Saharan Africa (SSA) are some of the world's most impoverished. Malaria causes nearly 250 times more deaths in the world's poorest countries than in the richest (WHO, 1999). It is one of the major economic burdens African countries have to bear; for instance, in 1997 malaria cost in African countries south of Sahara was more than 2 billion US dollars (RBM/WHO, 1999). An estimate of the impact of malaria on national incomes in Kenya and Nigeria put the overall production loss at 2-6% and 1-5% of gross domestic product (GDP) respectively (Leighton and Foster, 1993).

At the household level malaria devastates an already poor African family that spends an average of over one quarter of its income on malaria treatment, paying preventive costs and loss of income (RBM/WHO, 1999; WHO, 1999). Malaria also results in loss of productivity as workers and families suffering malaria bouts are incapacitated for four to twenty days (Kaburu *et al.*, 1999; RBM/WHO, 1999) with a subsequent reduction in productivity by 40% in agricultural families (RBM/WHO, 1999). In malaria endemic areas, malaria is the major cause of absenteeism in school children with up to 60% of their learning impaired (RBM/WHO, 1999; WHO, 1999).

In Kenya nearly all households are affected by the disease, this has resulted in loss of productivity estimated at 170 million days (Maneno *et al.*, 1998). With

more than eight million out-patient treatments at government of Kenya (GoK) health facilities and hundreds of thousands more either going to private or not reaching formal health system, malaria has exerted a heavy economic burden on the already dwindling Kenyan economy. Due to worldwide fear of drug-resistant malaria, the country is likely to suffer a heavy loss of foreign income from the tourism industry (Maneno *et al.*, 1998).

1.2.8 Prevention and control of malaria

Measures to prevent and control malaria are directed at both the parasite and the vector. A wide range of effective tools for malaria prevention and control is at present available, though not always where most needed.

1.2.8.1 Measures directed at the parasite

Anti-malaria drugs are aimed at destroying parasite developmental stages in the host and suppress relapses (White, 1982). Due to metabolic differences of parasite developmental stages a variety of chemicals are required in order to destroy sporozoites, pre-erythrocytic and erythrocytic schizonts and gametocytes (Busvine, 1975).

High-risk groups such as patients with immuno-suppressive diseases, patients with sickle cell disease, and patients with tropical splenomegaly syndrome, children under five years with recurrent febrile convulsions, pregnant women and non-immune visitors to malarious areas should be given anti-malaria chemoprophylaxis (Republic of Kenya, 1998). Chemoprophylaxis regimen for

patients and children is proguanil and sulfadoxine/pyrimethamine for pregnant mothers. Non-immune visitors to malarious areas can either receive a regimen of proguanil or doxycycline depending on the length of stay in malarious areas (Republic of Kenya, 1998).

The development of an effective vaccine is a major break through needed in malaria control. A malaria vaccine is likely to be a highly cost effective malaria control strategy. In the past, effective vaccine development has been hindered by multiple stages of parasite development in the host. At present, vaccine development research is promising, though it may take seven to fifteen years before an effective vaccine is ready (WHO, 1999). Malaria vaccines developed using latest advances in technology are undergoing clinical trials in Africa, Asia and United states (US). Some of the vaccines that have been developed include merozoite surface proteins-1 (MSP-1), SPf66, serine repeat antigen (SERA), rhoptry associated protein-1 (RAP-1), erythrocyte binding antigen-175 (EBA-175), apical membrane antigen-1 (AMA-1) and falciparum sporozoite vaccine-1 (FSV-1). SPf66 has been partly effective in field trials; however sophisticated biochemical methods are being employed to improve its potency (WHO, 1999). More promising are vaccines taking advantage of DNA research, for example MuStDO 15.1, a 15-gene malaria DNA vaccine designed to reduce morbidity and mortality in children in sub-Sahara Africa and RTSS, a recombinant protein vaccine designed to prevent the malaria parasite infection stage from entering or developing within the human liver (WHO, 1999). A different approach in which a transmission blocking vaccine is expected to

prevent transmission of malaria parasites from an infected person to another is under development in the US (WHO, 1999).

1.2.8.2 Measures directed at the vector

It is assumed that the solution to malaria problems lies in anti-mosquito measures such as preventing mosquito-man contact, elimination of mosquito breeding sites and destruction of both larvae and adult mosquitoes.

Methods such as use of mosquito repellants, mosquito nets, window and door proofing have been advocated in reducing mosquito-man contact. Repellants (Dimethylphalate, pyrethrin and pyrethroids) can either be applied on the nets, beddings/cloths or skin (Republic of Kenya, 1998; Republic of Kenya, 2001).

Elimination of breeding sites employs environmental management strategies that ensure minimal vector breeding. Drainage of pools, destruction of filled up containers/bottles, leveling of excavations and development of efficient drainage system are the common methods used (Service, 1986).

Mosquito larvae can be controlled biologically, by use of chemicals or both. Biological control entails the use of predators (larvivorous fish) and pathogens (bacteria, viruses, fungi and nematodes) (Republic of Kenya, 2001). Use of chemicals to kill mosquito larvae is only effective in well-defined and limited dwelling sites.

The adult mosquito can also be controlled either biologically or by use of chemicals. Biological control involves changes in the genetic constitution of the mosquito of which transgenic mosquitoes may offer exciting possibilities in malaria control (WHO, 2000). Sterile male technique has also been used in biological control but with minimal success. The most effective control against the adult mosquito is use of insecticides (Republic of Kenya, 2001) such as pyrethrin, synthetic pyrethroids, DDT, Dieldrin and hexachlorocyclohexane. However, all insecticides containing chlorinated hydrocarbons are environmental hazards, hence limiting their use. On the other hand, mosquito vectors have shown the potential of developing resistance to insecticides targeting them.

1.2.8.3 Malaria control initiatives

Efforts to reduce the burden of malaria are as old as human societies but their focus has continually changed from time to time due to growing knowledge and new technologies. For a long time efforts to control malaria have been sporadic, piecemeal and therefore achieved little success in decreasing overall disease burden. In some parts of the world where malaria is endemic, multi-drug resistant strains and economic recession are reversing achievements met earlier. For instance, world illness rates and epidemic outbreaks are showing an upward trend (WHO, 2000; Republic of Kenya, 2001). Although malaria has been a priority of WHO since its inception in 1948, efforts to control it have often suffered from lack of financial resources and uneven implementation. Several national, regional and international malaria control initiatives have

been established in the past but with little success in reducing malaria morbidity and mortality especially in endemic countries.

A recent WHO initiative 'Roll Back Malaria' (RBM) launched in 1998 and a collaborative effort between UNDP, UNICEF and the World Bank aims to focus the world's attention on renewed efforts against the disease. Its main objective is to reduce by half the global malaria burden by the year 2010 (PATH Canada, 2000). To achieve this ambitious goal RBM intends to adapt malaria intervention strategies to local needs and reinforce the health sector of malaria endemic countries.

RBM initiative activities in Africa have been given priority and political commitment by African heads of state and governments. In the recently concluded Abuja declaration, heads of states and governments told the world that they were throwing their political will behind the challenge of ridding the world of malaria. They set out the following targets to be achieved by 2005:

- i. Access to effective and affordable treatment within twenty-four hours to at least 60% of the cases.
- ii. Provision of insecticide treated bed nets to at least 60% of children and pregnant women.
- iii. Access to effective treatment to at least 60% of pregnant women at risk of malaria infection (WHO, 2000)

The Kenyan chapter of RBM recently launched a national multi-million dollar programme to reduce illness and death caused by malaria. The national malaria strategy makes malaria control a policy priority and intends to reduce malaria morbidity and mortality by 30% by the year 2006 (Republic of Kenya, 2001).

1.2.9 Insecticide treated materials

Mosquito nets have been in use since the 16th century. Ross (1910) suggested use of mosquito nets to prevent malaria due to the late night biting habits of most *Anopheles* mosquitoes. Anti-malaria bed nets treated with insecticides such as Dichlorodiphenyltrichloroethane (DDT) were first used during the Second World War by Russian, German and United States of America armies (Blagoveschensky *et al.*, 1945; Nauck *et al.*, 1948; Harper *et al.*, 1947). Field trials of pyrethroid-impregnated nets were recommended by WHO collaborating centers in 1982 (WHO, 1987). Since then, pyrethroids have been used in treatment of bed nets replacing insecticides such as pyrethrins, dieldrin and DDT. Pyrethroids are preferred because they are less toxic to non-target animals and do not accumulate in the food chain.

Treatment of mosquito nets is thought as a more targeted way to use insecticide because it is placed directly in the path of the host-seeking mosquito. Even though treated mosquito nets have been in use for several decades, their use by at risk group is decimal. For example, only 1% of African children are protected by bed nets while they sleep (RBM/WHO, 1999). The current malaria initiative emphasizes the use of insecticide-treated nets as one of the

key strategies for malaria prevention and control in Africa south of the Sahara. However, unless net acquisition especially by at risk group is increased from the current low levels, the strategy will not be beneficial in reducing malaria morbidity and mortality. To increase the number of households using insecticide-treated nets, UNICEF and WHO have set the goal of providing 32 million nets and 320 million net treatments a year for the next decade (Jones, 2000).

In Kenya, village-scale trials using Impregnated bed nets and eave strips begun in late 1980s by Kenya Medical Research Institute (KEMRI) in collaboration with Centers for Disease Control (CDC), Atlanta USA (WHO, 1987; Snow *et al.*, 1998). Recent studies in various parts of Kenya suggest that usage of nets by at risk group (children and pregnant women) is as low as 5-10% and very few of these nets are treated with insecticide (Republic of Kenya, 2001). Covering at risk population in Kenya with this strategy will require at least ten million treated nets. Maintaining this level of coverage will require about two million new nets and at least ten million insecticide treatments per year (Republic of Kenya, 2001).

The Kenyan government targets to provide nets to 60% of the at-risk population and ensure that at least 50% of these nets are regularly treated with insecticides (Republic of Kenya, 2001). The government intends to achieve these goals by creating an enabling environment which will foster participation of private sector in provision of insecticide-treated bed nets (ITNs), create

demand for ITNs through effective communication strategies, reduce duty/tax obstacles to cheaper and more accessible ITBN products, protect economically vulnerable group by developing targeted subsidies to ensure equity and provision of subsidized ITBN services to special groups (Republic of Kenya, 2001).

1.2.9.1 Bed nets

Bed nets are classified using a number of characteristics including:

a) Fabric

Polyester netting is the most common because it is light and does not absorb much water. Cotton netting and synthetic materials such as polyethylene are also used. Nylon nets are preferred but they are often weak and can be destroyed during net treatment (Kroeger *et al.*, 1997).

b) Denier

This is the strength of the fiber used to make the net. Denier of 100 is the strongest whereas anything below 70 is usually too weak and tears easily. In the market denier 40, 75, and 100 are available (WHO, 1997).

c) Mesh size

This can either be in millimeters or in holes per square inch; 1.5mm to 2mm and 156 holes per square inch are considered standards. Some nets have larger holes, which allow better ventilation but will only offer protection as long as they remain treated (WHO, 1997).

d) Shape

Round (conical) and square shapes are the most common. There is less person to net contact under a square net but many people prefer the easy to hang round (conical) net (Mnava *et al.*, 1999).

e) Colour

Nets can be of any color. However, white is the most frequently found. Due to use of insecticides and less frequent washing of nets, dark-colored nets are becoming more popular. Green, blue and pink nets are preferred because they avoid cultural problems often associated with white nets (WHO, 1997).

f) Size

Most nets indicate the size of beds they will cover in millimeters or feet while others state small, medium and large or single or double nets (WHO, 1997).

1.2.9.2 Insecticides

Pyrethroids are the preferred insecticides for net treatment because they are more effective than pyrethrin, are of low toxicity and decompose easily to non-toxic products. Evidence available shows that when used in house spraying, pyrethroids are more effective than DDT in killing malaria vectors (Sharp *et al.*, 1993; Kere *et al.*, 1996) and treated walls and nets have shown excellent persistence of their insecticidal activity up to 8 months (Curtis, 1999).

Different types of pyrethroids are available for net treatment. They include permethrin, deltamethrine, lambdathalothrine, alphacypermethrine, bifenthrin, etofenprox, and cyfluthrin. The insecticides are available in emulsified

concentrate (EC), water emulsion (EW), suspension concentrate (SC), capsule suspension (CS) and wettable powder (WP) formulations (WHO, 1997).

CS, EW and SC formulations are water based, so the preparations contain lower levels of organic solvents making them more user friendly. There are many water-based solutions but none for permethrin. EC formulation has a solvent with a characteristic smell and can be irritating. Deltamethrine and lambdacyalothrin can also cause irritations at high concentrations (WHO, 1997; Kroeger *et al.*, 1997)

1.2.9.3 Benefits of ITNs

ITNs have been shown to reduce child mortality and morbidity in Kenya (Nevill *et al.*, 1996), Burkina Faso (Diallo, 1998), The Gambia (Alonso *et al.*, 1991; D'Alessandro *et al.*, 1995) and Ghana (AHRTAG, 1997). A study in The Gambia showed that overall mortality and morbidity attributed to malaria in children aged 1-4 years were reduced by 63% and 70% respectively in villages where impregnated nets were used (Alonso *et al.*, 1991). A more recent study in rural Gambia has shown that ITNs are one of the most efficient ways of reducing deaths in children less than 10 years (Aikins *et al.*, 1998). In Kilifi on the Kenyan coast, introduction of ITNs led to a reduction of 33% in all cause mortality and incidence of severe malaria attacks fell by 44% among children aged 1-59 months (Nevill *et al.*, 1996). Recently completed field trials in Ghana show that introduction of treated nets is associated with reductions of mortality by 17% (AHRTAG, 1997).

In a recent meta-analysis of African trials, ITNs were found to reduce clinical malaria episodes by 48% and to improve anemia status by an average 0.5g/dL (Lengeler *et al.*, 1998). Most importantly, regular use of ITNs under trial conditions prevents approximately 6 deaths for every 1000 children protected every year across a large range of transmission intensities (Armstrong *et al.*, 1999). Further there is now evidence that these benefits persist for at least 3-4 years after introduction (Diallo, 1998).

Trials in refugee camps in Afghanistan revealed that permethrin treated bed nets could give up to 61% protection against falciparum and 42% protection against vivax malaria (Rowland *et al.*, 1996). Research findings from The Gambia (D'Alessandro *et al.*, 1995) and Kenya (Brown *et al.*, 1996) suggest that use of ITNs during pregnancy provide modest protection against maternal malaria and anemia and from premature birth, low birth weight, and neonatal survival. However, preliminary results of a recent study in Kenya suggest ITNs significantly reduce maternal malaria and anemia during the first three pregnancies (Ter Kuile *et al.*, 1999).

Even though ITNs have shown remarkable epidemiological impact on malaria transmission, studies on the efficacy of insecticide treated material (ITM) in *P. vivax* endemic areas of Latin America have not yielded enough evidence for recommendation for their extensive use in the region (Kroeger *et al.*, 1999).

Field trials using ITNs have shown that they not only kill and deter mosquitoes from biting people sleeping under the nets but they also ward off and kill other blood-sucking insects such as head lice, bed bugs and fleas (MacCormack *et al.*, 1989; Kroeger *et al.*, 1997; Rashed *et al.*, 1997). Other benefits that have been mentioned include privacy (MacCormack *et al.*, 1989; Kroeger *et al.*, 1997; Rashed *et al.*, 1999), preventing dirt dropping from the roof falling on to sleepers and also protecting against cold in the early morning (MacCormack *et al.*, 1989)

1.2.9.4 Acceptability and affordability of ITNs

Treated nets have been considered a cost-effective measure in community-based malaria control activities in many countries, particularly in Sub-Saharan Africa (Aikins, 1998; AHRTAG, 1997). Whereas people with access to treated nets have confessed their benefits, acquisition and use of treated nets is still very low.

Studies on acceptability of the strategy point to a variety of factors. Socio-cultural factors such as sleeping patterns, current usage of nets, cultural attitudes towards nets, sensibility to nuisance insects and expenses incurred in household mosquito control have been shown to effect acceptability (WHO, 1997).

A more recent study found out that the factors that motivated permethrin impregnated bed net (PIB) adoption varied according to the perceptions about

the aetiology of malaria, appropriate treatment and the importance attached to preventive measures. Due to poor understanding of the infection triad, bed nets are used primarily to escape mosquito and other biting insects from undisturbed sleep rather than for malaria prevention (Rashed *et al.*, 1997; Richards *et al.*, 1993; Stephens *et al.*, 1995). For such people a bed net is seen as a luxury rather than a health maintenance item.

In a study in Benin, recourse to non-western medicine especially and in particular, to medicinal teas, which are considered preventive or curative, correlated negatively with PIB use (Rashed *et al.*, 1999). PIB use has also been shown to vary with sex, age, family size and structure. For example, studies indicate that bed nets are most often used by adults and not children, the most vulnerable group (Aikins *et al.*, 1993; Makemba *et al.*, 1995). The level of education is an indirect determinant of PIB use as far as it affects the nature of employment and income (Rashed *et al.*, 1999).

The price of ITNs appears to be the principle obstacle to its use (Aikins *et al.*, 1993; Makemba *et al.*, 1995; Stephens *et al.*, 1995). However, it is not clear whether availability of funds or the price of the bed net constitute the true problem. Where access to cash is seasonal the procurement of commodities aimed at increasing health is not a priority (MacCormack *et al.*, 1989). Therefore, in such communities nets might not be seen as necessary.

On the other hand studies indicate that most communities are able to afford at least one net (Muthami *et al.*, 1999; Onwujekwe, 1999). However, households may still not be willing to buy them, prompting aggressive health campaigns to increase net coverage. Little is known on the role of gender on use of bed nets. However, women are more inclined than men to want to buy PIBs; however, most of them are unable to buy them due to their low income (Rashed *et al.*, 1999).

1.2.9.5 Implementation models for ITNs

1.2.9.5.1 Delivery systems

ITNs implementation models developed on relatively small-scale trials have shown a good deal of success. However, there is a danger that when integrated to larger control programmes rates of regular treatment of the nets with insecticides will drop, greatly limiting their effectiveness as Public Health interventions (Winch *et al.*, 1997).

In Kenya, distribution and re-treatment of bed nets has been achieved using the Bamako Initiative approach (Hill, 1996). Other approaches that have been used in small-scale trials include sale through local health units or the existing primary health care (PHC) system, distribution through community groups and employer-based schemes (Snow *et al.*, 1998).

Appropriate large-scale delivery system for ITNs is the current problem. However, social marketing projects underway in several countries in Africa

and Asia (Fieldon, 1996; Lines, 1996) are expected to yield useful information. Furthermore, information available from an ongoing project in Tanzania suggests that social marketing is a useful approach for delivery of ITNs (Armstrong *et al.*, 1999).

1.2.9.5.2 Treatment of ITNs

Pilot trials conducted in The Gambia showed that conventional bed nets are not very effective at protecting against clinical attacks of malaria in children but that, their protective effect is enhanced substantially when they are impregnated with insecticides (Greenwood & Pickering, 1993; Alonso *et al.*, 1993). In fact untreated nets act more as mosquito traps than as protection against them.

Different options in trials have been considered for insecticide-treatment of nets which include communal (re) treatment services, net (re) treatment and demonstration centers, mobile (re) treatment services, do-it your self and pre-treated nets (WHO, 1997). Each option has its own merits and demerits. For example, supplying pre-treated nets is thought to deny the people the opportunity to learn about the difference between treated and untreated nets and knowledge on how to treat them.

A major problem associated with treated nets is frequent washing. Even though studies have shown that washed nets continue being effective up to 4 months after washing them, there is need to intensify campaigns to reduce net washing

to 1-2 times a year depending on the insecticide used. A study in Nicaragua, Ecuador, Peru and Colombia (Kroeger *et al.*, 1997) identified the following reasons for net washing: soot from kerosene lamps, children's urine, dust, unpleasant side effects of the insecticide and the custom of frequently washing nets.

Treated bed nets are only effective barriers against vectors when people are sleeping under their nets and have no apparent effect on biting out doors though, this depends on the effect of the pyrethroids on the vector (WHO, 1997). Nonetheless, when a good level of ITN coverage is achieved, reduction in the population of mosquito vector, mean age and proportion of sporozoite-bearing mosquitoes can enhance protection to a community.

1.2.9.5.3 Sustainability of ITNs

Studies in this field have identified a number of issues; of importance is regular net acquisition and re-treatment. It has been suggested that the rate of acquisition of new nets and net re-treatment after the trials are over is very low (Kachur *et al.*, 1999). To sustain net acquisition and re-treatment revolving fund projects managed by the community have been suggested. However, in Tanzania rates of re-treatments dropped significantly when payments for the insecticides were introduced (Winch *et al.*, 1997). Of concern is the evidence that nets brought for re-treatment more often are of adults rather than of small children and that an adult is more likely to sleep under a treated net than a young child (Kroeger *et al.*, 1997; Winch *et al.*, 1997).

Studies done in Latin America (Kroeger *et al.*, 1997), Kenya (Kachur *et al.*, 1999) and Tanzania (Winch *et al.*, 1997; Armstrong *et al.*, 1999) have identified reasons for non re-treatment of nets as: fee charged for re-treatment, inconvenience of the re-treatment, concerns about toxicity of the insecticide, poor state of nets and lack of the insecticides.

1.2.9.6 Current concerns about ITNs

While results of ITNs are undoubtedly encouraging, there are a number of concerns about ITNs. First is the applicability of results to higher transmission setting: Information available shows a decrease in percentage mortality with increasing intensity of transmission (Curtis, 1996). However, recent studies suggest that the protective efficacy of treated nets may be similar at high and low level transmissions (Rowland, 1999; Armstrong *et al.*, 1999).

Second is the long-term impact of ITNs on small children in high malaria transmission areas. The potential consequences of delaying acquisition of immunity are worrying in that in such areas it has been suggested that overall survival could be better without ITNs (Snow *et al.*, 1997). However, Armstrong *et al.*, (1999) argued that good data on the issue are scanty and that the discussion has been based on indirect evidence. More evidence exists against the potential consequences; for example, following the discontinuation of malaria control trials in the past no evidence in delay or rebound in mortality was found (Greenwood, 1997).

Third, pyrethroids are the only class of insecticides used for treatment of nets. Due to intense use of pyrethroids in agriculture mosquito vectors have developed resistance to them. Pyrethroid resistance has already been reported in important malaria vectors in West Africa, Central America, Turkey, India and Pakistan (WHO, 2000). Owing to pyrethroid resistance, researchers are faced with the challenge of prolonging the useful life of available insecticides, searching for non-pyrethroid insecticides and developing alternative preventive measures.

1.2.9.7 Limitations of ITNs

Even if ITNs have been advocated world wide for use to reduce malaria transmission, there are situations where they are not suitable. For example, in South East Asia where malaria transmission occurs in transient people moving in and out of forests, in areas where *Anopheles* vectors are active early in the evening before people go to bed and in cases where houses are too small for bed nets (PATH Canada, 2000). In such circumstances materials such as hammock nets, curtains, eaves-strips and raffia fordable shields can be treated with insecticides and be used to prevent mosquito bites (WHO, 2000).

1.3 Rationale for the study

1.3.1 Statement of the problem

Even though impregnated bed nets have been shown to be an effective prophylactic measure in malaria control, its adoption has been slow and uneven. There are problems in making nets and insecticides available to

populations living in malaria endemic areas and in ensuring that the nets are correctly used, well maintained and routinely treated with insecticides.

1.3.2 Research questions

To achieve its goals the study is guided by the following research questions:

- i. What socio-cultural factors may affect acceptability of ITNs in Bunyala, Busia district?
- ii. Are the residents of Bunyala able and willing to buy treated bed nets and pay for treatment of existing nets?

1.3.3 Justification

Programmes designed to increase ITN coverage require that the role of social, cultural and economic factors is understood and incorporated into the project design. It should be recognized that individuals are already making decisions for themselves and their families regarding malaria prevention and control. Therefore, such actions need to be understood and utilized in project implementation to ensure community participation and ownership of the project.

Perceptions and practices that may affect acquisition and use of ITN are not uniform across communities and even in the same community differences may occur. Therefore, extrapolation of results of other studies may not be possible and if done it may lead to wrong assumptions about the community, resulting

into irrelevant programmes. Such programmes may not tackle the community's health problems, encourage community participation or ensure sustainability.

Most bed net programmes in Kenya are concentrated in areas of low malaria risk with low population density as opposed to the densely populated high and moderate transmission areas (Omumbo, 1999). Bunyala is a malaria endemic area, which suffers seasonal floods, the worst being during the 1997/98 El Nino rains.

This study is intended to elicit information on socio-economic and cultural factors affecting acquisition and rational use of mosquito nets. Results from this study will be used in successful implementation of Bunyala ITN project. Being a scientific study, it will contribute to the body of knowledge about ITNs particularly that necessary in order to increase and sustain coverage.

1.4 Hypothesis

Socio-economic and cultural factors do not affect acquisition and utilization of insecticide treated bed nets in Bunyala.

1.5 Objectives of the study

1.5.1 General objective

To assess the effect of socio-economic and cultural factors in procurement and utilization of insecticide treated bed nets for the control of malaria in Budalangi division, Busia district.

1.5.2 Specific objectives

- a) To establish household sleeping patterns and identify their possible effects on acquisition and utilization of mosquito nets.
- b) To identify household mosquito bite deterrent strategies used in the household
- c) To determine the cost of household mosquito bite deterrent strategies and identify their possible influence on net acquisition.
- d) To identify problems associated with acquisition and treatment of mosquito nets with insecticides.
- e) To assess the economic status and willingness of the households to buy treated mosquito nets and pay for treatment of existing ones.

CHAPTER TWO: MATERIALS AND METHODS

2.1 Study area

2.1.1 Location and human population

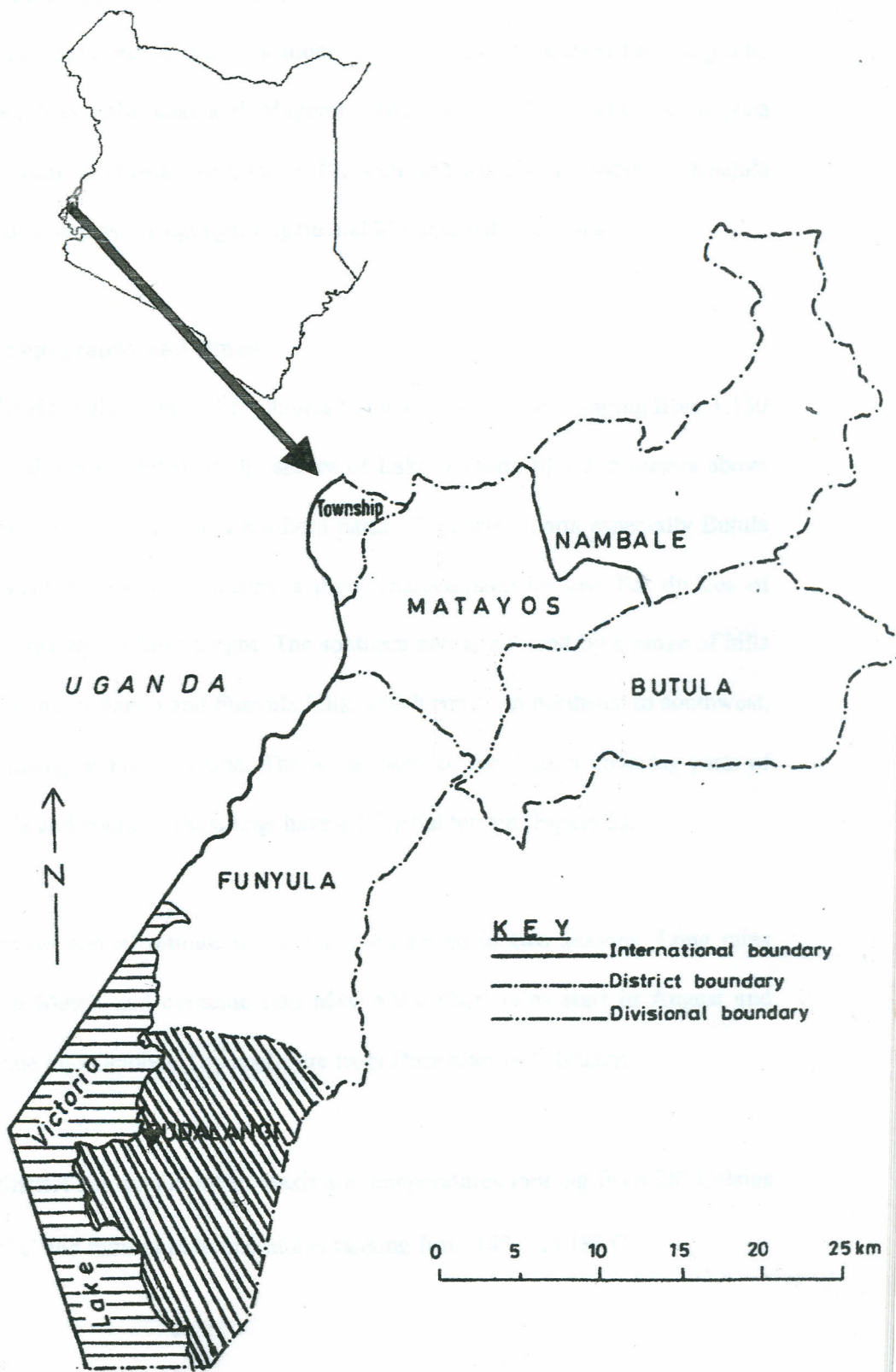
The study was carried out in Budalangi division, Busia district of Western province, Kenya. Busia district lies between latitudes $0^{\circ} 250'$ South and longitudes $33^{\circ} 54'$ East and is bordered by Kakamega district to the east, Teso district to the north, Siaya district to the south east and the republic of Uganda to the west (Figure 4). It covers a total area of 1,262 square kilometers of which 137 square kilometers is under permanent water surface. Budalangi division is among the largest divisions covering an area of 312 square kilometers, with a water surface area of 120 square kilometers.

The total population of the district is projected to have reached 391,913 people by the year 2000 (Republic of Kenya, 1997). The area that was covered by this study had a total population of 19,239 people and 4,960 households with an average population density of 212 people per square kilometer (Republic of Kenya, 1999).

2.1.2 Administrative units

Busia district is divided into six administrative divisions, namely: Nambale, Butula, Funyula, Budalangi, Matayos and Township (Figure 4). Budalangi division is divided into north and south Bunyala, both of which have three locations. North Bunyala comprises of Bunyala west, Bunyala east and Bunyala north.

Figure 4: Map of Kenya showing location of Busia District.



This study was conducted in south Bunyala that comprises of Bunyala central, Bunyala south and Khajula locations. Bunyala central location has Magombe central, Magombe east and Magombe west sub-locations whereas Bunyala south location consists of Osieko, Bulwani and Rukala sub-location. Khajula location comprises Rugunga, Lugare and Mabinju sub-locations.

2.1.3 Topography and climate

The district falls in the Lake Victoria basin with an altitude ranging from 1,130 meters above sea level on the shores of Lake Victoria to 1,375 meters above sea level in the central and northern parts. The central parts especially Butula and Nambale divisions occupy a plain characterized by low flat divides of approximately uniform height. The southern part is covered by a range of hills comprising of Samia and Funyula hills, which run from northeast to southwest, culminating at Port Victoria. The lower parts of the district covering parts of Funyula and south of Budalangi have a fairly flat terrain (Figure 5).

The mean annual rainfall is 1,500mm occurring in two seasons. Long rains start in March and continue into May while short rains start in August and continue into October. Dry spells are from December to February.

The district has annual mean maximum temperatures ranging from 26° Celsius to 30° C and minimum temperatures ranging from 14° C to 18° C.

Figure 5: The topography of south Bunyala



Atmospheric humidity of the area is relatively high due to evaporation of water mass from Lake Victoria.

2.1.4 Soils and drainage

Soils in Bunyala are derived from recent alluvial deposits and colluvium. The soils are poorly drained and are mainly deep, firm and clay type. Some parts of Bunyala have soils that are regularly waterlogged and difficult to cultivate but if properly drained can be put into agricultural use.

The district has been divided into four agro-ecological zones, namely: Lower midland zone 1 (LM1), LM2, LM3 and LM4. LM1 and LM2 are the high agricultural production zones whereas LM3 and LM4 are the medium agricultural production zones. Budalangi division is a medium agricultural potential area of the district having approximately 7,680 hectares of LM3 and 1,150 hectares of LM4.

2.1.5 Water resources

Main water sources in the district are Lake Victoria, permanent and seasonal rivers, streams, springs, natural dams, swamps and boreholes. There are two main permanent rivers in the district (Nzoia and Sio) and a number of seasonal rivers. River Nzoia is the main cause of annual floods in south Bunyala that have greatly contributed to poverty and outbreaks of vector and water-borne diseases (Fig 6).

Bunyala has fairly distributed surface water resources from Lake Victoria and

the Nile. However, the water is not always available in the form of

springs or streams. Shallow wells if properly sited and protected provide good

quality water.



Bunyala is a low agricultural potential area due to poor soils and drainage. For instance maize one of the staple crops does not do well. The division does not produce any of the major cash crops.

Bunyala has fairly distributed surface water resources from Lake Victoria and river Nzoia. However, the division lacks clean surface water in the form of springs or streams. Shallow wells if properly sited and protected provide good quality water.

However, the water is generally saline and sometimes has a high content of iron, reducing its use for home consumption. The area has also a high potential for irrigation using Lake Victoria and river Nzoia but this potential remains largely untapped.

2.1.6 Forest resources

The district has gazetted forest areas covering approximately 579 hectares, situated to the south of the district in Budalangi division. Most hilltops in the district are free of human habitation hence suitable for afforestation.

2.1.7 Economic activities

2.1.7.1 Agricultural activities

Most farmers in the district practice small-scale farming, growing maize, sugarcane, coffee, cotton, cassava, sorghum, beans, groundnuts, rice and tobacco. Major cash crops in the area include sugarcane, cotton and tobacco. Bunyala is a low agricultural potential area due to poor soils and drainage; for instance maize one of the staple crops does not do well. The division does not produce any of the major cash crops.

Livestock activities in the district include cattle, pig, sheep and goat rearing, bee and poultry keeping. Almost all divisions practice dairy farming, poultry keeping, goat and sheep rearing. However, infections transmitted by tsetse flies have greatly hampered dairy farming especially in the study division. Most farmers in Bunyala rear Zebu cattle, sheep, goats, pigs and keep bees.

Agriculture is the major source of income for households. However, people are not fully engaged throughout the year. Agricultural activities account for almost 70% of total income per household.

2.1.7.2 Fishing

Fishing is the second most important economic activity after land. Fishing is done in Lake Victoria, Yala swamp, marsh areas and rivers. Major fish caught include Nile perch, Tilapia and Omena. Budalangi is the leading division in the district in terms of fish production. Most people living to the southern part of the district and bordering the lake engage in fishing where child labour is also rampant (Figure 7).

2.1.7.3 The manufacturing and processing sectors

This sector of the economy is not well developed in the district even though there is unexploited potential for developing fish processing plants, sugar factory and milling plants. Few processing industries are situated in urban areas, majority of which are bakeries.

Figure 7: Fishing at one of the beaches in the area



2.1.8 Social amenities

2.1.8.1 Communication network

The road network extends for 532.7 kilometers of which only 27 kilometers is tarmacked. Approximately 377.5 kilometers of the road network are classified roads and 147 kilometers are unclassified roads. Budalangi is one of the divisions least served by classified roads.

2.1.8.2 Electricity and other energy sources

Most of the high potential areas are served with electric power supply. However, most rural areas have not been adequately served. Wood fuel is the major source of energy for home consumption with-on farm firewood contributing about 26.32% of firewood fuel consumed. Other sources of energy include diesel, kerosene and petrol.

2.1.8.3 Formal education

The district has twenty-seven secondary schools, 225 primary schools, 241 pre-primary schools, eight polytechnics, one farmer-training center and three family training centers. Budalangi division has the least number of primary and pre-primary facilities and Funyula division has the highest. Most of the education facilities are under utilized, due to low enrolment and high drop out rates especially in regions surrounding the lake.

2.1.8.4 Health and nutrition

The district has 28 health facilities out of which two are government hospitals, five private nursing homes, seventeen health centers and dispensaries manned by the government and four either private or mission. Budalangi has one government hospital, one government health center and two government dispensaries. Doctor: population ratio is low (1:47,000) and most of them are in Busia town.

The district has one of the highest child mortality rates (86 per 1000 live births), which has been attributed to improper weaning of infants, poor child feeding practices and high prices of major foodstuffs (Republic of Kenya, 1997).

In respect to disease prevalence, malaria, acute respiratory infections (ARI), anaemia and intestinal worms are the common diseases. Malaria and ARI are the most prevalent diseases in outpatients visiting health facilities with malaria alone accounting for 50% of total morbidity. Malaria, respiratory infections and diarrhoeal disorders largely affect people in the low social class and have their genesis in poverty, lack of safe drinking water, poor sewerage, food contamination, low standards of personal hygiene and poor environmental sanitation practices. Mosquito breeding sites in the area are widespread and range from the Yala swamp (Figure 8), water remaining in pools after the floods recede (Figure 9), rain water collected in excavations (Figure 10) and flood water (Figure 11).

Figure 8: Yala swamp, the major permanent breeding site for mosquitoes



Figure 9: Water remaining in pools when the floods recede



Figure 10: Rainwater collected in excavations



Figure 11: Flooding water from river Nzoia



2.1.9 Labour force and income

The total labour force according to 1989 census stood at 122,929 with agriculture being the major employer. Other employers constitute fishing, commerce and trade. Most people living in areas bordering the lake are engaged in fishing while those in urban centers are engaged in small and large-scale businesses.

Wage employment comprises people in civil service, teaching, non-teaching staff in schools and employees in various parastatals and non-governmental organizations (NGOs) operating in the area. Child labour is common in the district along the shores of Lake Victoria, border points and urban centers.

Income distribution in the district is not even. In general, people along sugar cane, tobacco and cotton growing areas have high income compared to those living in divisions where foodstuffs such as cassava, finger millet, sorghum and potatoes are grown. Pockets of poverty are in some parts of Funyula and Budalangi divisions where people have resources but lack the know-how to adapt new farming methods.

2.2 The study population

2.2.1 History and migration

The word Abaluyia meaning 'fellow tribes men' is derived from the verb 'Okhuyia' which means 'burn'. Baluyia consist of seventeen major sub-tribes in Kenya and four sub-tribes in Uganda. All the seventeen sub-tribes claim to

have originated from either Egypt (Misri) or West Africa but they all agree to have passed through Bunyoro in Uganda during migration. The Banyala are among the seventeen sub-tribes and comprise of Abanyala be Buongo, Abanyala be Magero/Ndombi and Kabras. The original Abanyala are Abanyala be Buongo who presently occupy Budalangi division and the other two came from them and migrated to other parts of the province.

2.2.2 Baluyia culture and practices

The Baluyia people like other Bantus were basically agriculturalists, keeping cattle, sheep and goats. They also made metal tools, baskets, fishing nets and dairy equipments although blacksmith was despised. Circumcision is practiced as form of initiation except the Banyala and Samia, who through close links with the Luo people for a long time have acquired the nilotic practice of removing four to six lower front teeth.

Polygamy is allowed and where consent has been given pride price is paid. There is no limit on the number of wives to marry so long as the person is able to pay dowry and provide for the needs of the family. The most important responsibility of the women is cooking, taking care of children and farm work. They believed in God called Were, whom they pray to for life and wealth. They stay in round huts with a stick projecting from the top of their thatched roof to keep evil spirits away.

The Abaluyia have witch doctors that are consulted when family members are sick and who instructs them on what should be done to appease the hungry spirits responsible for the disease. Medicine men/women also treat sickness by use of herbal concoctions and magic. They also have sorcerers who are believed to be the source of man-made diseases. Rainmakers are believed to possess powers to either cause rain or withhold it.

Health protection and awareness were adequately observed and this was the responsibility of the elder of that home or village. Families or clans known to have a history of chronic diseases had difficulties marrying and any body with infectious disease was forbidden to eat and mix with others. People feared meeting those suffering from diseases that were thought to be infectious. For example, they feared people suffering from gonorrhoea since the disease was thought to be infectious. Therefore to avoid accidental meeting they were isolated from the village and continued to live in isolation until they were cured.

Baluyia people were fond of beer made by fermenting millet or sorghum and that was usually drunk during funerals that lasted between three to four days depending on the sex of the person. They had elders called 'umwami' who convened special meetings on special occasions and if any body committed murder, adultery or theft, such meetings deliberated on the appropriate action to be undertaken.

The Baluyia people prohibit the sharing of latrines with in-laws and the grand mother of the girl takes care of an illegitimate child. Also a child born out of wedlock is not allowed to stay with the parents.

2.2.3 The study subjects

The population of interest included male and female heads of households or their representatives who were residing in south Bunyala; an area also covered by Bunyala area development programme (ADP), Primary Health Care (PHC) project (World Vision).

2.2.3.1 Inclusion criteria

Those who were included in the study were all household heads or their representatives residing in areas covered by the Bunyala area development programme (ADP), PHC project.

2.2.3.2 Exclusion criteria

Those who were excluded from the study were all household heads or their representatives not residing in areas covered by the Bunyala ADP, PHC project.

2.2.3.3 The sample size

The number of individuals / subjects who participated in the study was determined using a formula from Fisher et al., (1998) as follows:

$$N = \frac{Z^2 p q D}{d^2}$$

Where:

N = Sample size.

Z = 95% Confidence interval.

p = Proportion of households with bed nets (0.326)

q = 1.0 - p; (1.0 - 0.326).

D = Design effect equaling to 1.

d = Level of precision equaling to 0.05.

Therefore sample size (N) from calculation was =338 \cong 350. However, in total the study collected information from 360 households.

2.2.3.4 Sampling method

Multistage sampling was used to identify households that were involved in the study. Since the project had already identified one administrative division, three locations and nine sub-locations for the study, multistage sampling was used at village and household levels. The study area was first mapped to identify village boundaries, households, roads and paths, schools, churches, health facilities and shopping centers. Using simple random sampling two villages were sampled from each sub-location. Further, in each village 20 households were sampled using random numbers (Table1).

Table 1: Locations, sub-locations, villages and number of households from each village involved in the study

Location	Sub-location	Village	No of households
Bunyala Central	Magombe East	Magombe	20
		Busagwa	20
	Magombe Central	Buongo	20
		Mundika	20
	Magombe West	Bwalanga	20
		Mukhobola	20
Bunyala South	Rukala	Lukala	20
		Idokho	20
	Bulwani	Bubuni	20
		Mkhowa	20
	Osieko	Osieko	20
		Maduwa	20
Khajula	Lugare	Makhoma	20
		Sigomere	20
	Rugunga	Rugunga	20
		Bukhwanga	20
	Mabinju	Mabinju	20
		Mwalo	20

2.2.3.5 Ethical considerations

Content of the study was explained to all stakeholders and informal consent obtained. All information that was collected was kept confidential. Names of the respondent were not indicated in the interview guide to protect the identity of the participants. Only respondents willing to participate in the study were interviewed.

2.3 Study design and research instruments

This study was a cross-sectional household survey, which made use of the following research tools to collect required data.

2.3.1 Structured interview

In total 360 structured interviews were conducted. The structured interviews sought to collect information on demographic and socio-economic characteristics of the study population, its sleeping patterns, household mosquito control activities, mosquito net coverage and costing, reasons for using or not using nets, reasons for treating or not treating nets, expenses incurred in non-bed net household mosquito control activities, willingness of households to acquire nets and pay for treatment of existing ones and affordability of insecticide treated mosquito nets (Appendix 1).

2.3.2 Focus group discussion (FGD)

Four focus group discussions were conducted with different groups of people in the community. The focus groups had between four and six participants, a

moderator and a note taker. The entire discussion was recorded with the aid of a tape recorder. In addition, a note taker wrote down as much information as was practically possible. The first focus group comprised of men aged 30 years and above, followed by that of women aged 30 years and above, then that of people in formal employment and lastly that of women with a child or children below five years.

The focus groups collected information on people's opinions about mosquito nuisance and malaria, when the mosquito nuisance is thought to be highest, malaria prevention practices, mosquito net usage, sleeping places and use of nets and decision-making regarding household expenditure especially mosquito net acquisition (Appendix 3).

2.3.3 Observation

This research tool involved the use of a checklist (Appendix 2). Information was collected from 360 households, which included information about condition of bed nets and presence or absence of screens on doors and windows.

2.4 Data storage and analysis

Information from interviews and checklists was first verified for its completeness, after which it was coded and entered into a computer using Microsoft Excel computer package and then stored in diskettes.

Microsoft Excel data was later transferred to Statistical Package for Social Science (SPSS). The data was then summarized using descriptive statistics

such as frequencies, mean and standard error. Data was further analysed by use of Chi square and relative risk (RR) for relationships between different variables and mosquito net acquisition and use. T-test was used to compare the means of household income and expenditure.

For the case of FGDs, all the notes made were expanded to the fullest possible record and the recorded tape was transcribed at the end of each discussion. The information was organised and a discussion of the findings held (de-brief).

CHAPTER THREE: RESULTS

3.1 Socio-economic and demographic characteristics of the study subjects

A total of 360 structured interviews were conducted of which 60.8% of the respondents were female and 39.2% were male. Of the respondents interviewed 56.9% were household heads whereas 43.1% were their representatives. The study showed that 79.2% of household heads were males, while 20.8% were female. Sex of the household head was not related with the presence or absence of a bed net in the household ($\chi^2 = 3.44$, $df = 1$; $P > 0.05$). However, households headed by females were less likely to use bed nets (relative risk [RR] = 1.79; 95% confidence interval [95%CI] = 0.96, 3.32).

The mean age of the respondents was 36.04 ± 0.71 S.E years while that of the household heads was 39.75 ± 0.71 S.E years. The possibility of having a net in the household was independent of the age of the household head ($\chi^2 = 2.425$, $df = 5$; $P > 0.05$).

Most of the respondents (95.5%) belonged to the Luyia ethnic group with the remaining percentage shared between Luo (4.2%) and Kikuyu (0.3%). Majority of the respondents were either Protestants (50.3%) or Catholics (48.1%). Other religions represented were Traditional (1.1%), Muslim (0.3%) and those with no religion (0.3%). Mosquito net possession was highly independent of the religion of the respondent ($\chi^2 = 3.97$, $df = 4$; $P > 0.05$).

The study showed that 79.2% of the respondents had at least attended a formal education institution; a majority had either not completed primary education (38.3%) or completed primary school (22.2%). Some of the respondents (20.8%) had never gone to school (Table 2). The possibility of a household having a bed net was related to the level of education of the respondent ($\chi^2 = 31.07$, $df = 6$; $P < 0.05$). Respondents with low level of education had a lower chance of reporting net possession than those that had high education levels (RR = 2.26; 95%CI = 1.30, 3.92)

Major occupations of respondents ranged from housekeeping (29.4%) to guarding (0.3%) (Table 3). Some of the respondents (61.9%) had other jobs apart from the main occupation others (38.1%) had only one job. For those that had more than one job, farming was the most important part time occupation (67%) whereas plaiting (0.3%) and brick making (0.3%) were the least important (Table 4). Whether or not a household had a mosquito net highly depended on the major occupation of the respondent ($\chi^2 = 33.72$, $df = 11$; $P < 0.05$). Respondents whose income were seasonal were less likely to report net use in the households than those with monthly income (RR = 7.28; 95%CI = 2.52, 20.99)

Table 2: The level of education of the respondents

Level of education	Frequency	Proportion of respondents (%)	Proportion with bed nets (%)
Never attended school	75	20.8	16.0
Not completed primary	138	38.3	25.4
Completed primary	80	22.2	33.8
Not completed secondary	30	8.3	33.3
Completed secondary	25	6.9	36.0
Not completed college/ university	3	0.8	33.3
Completed college/ university	9	2.5	100.0

Table 3: Major occupations of the respondents

Occupation of respondent	Frequency	Proportion of respondents (%)	Proportion with bed net (%)
Unemployed	42	11.7	14.3
House wife	106	29.4	27.4
Casual labourer	24	6.7	25.0
Skilled artisan	21	5.9	20.0
Business	60	16.7	26.7
Office	2	0.6	50.0
Fisherman	55	15.3	23.6
Teacher	13	3.6	84.6
Community health worker	2	0.6	50.0
Farmer	34	9.4	44.1
Watchman	1	0.3	0.0

Table 4: Other jobs done by the respondents other than the main occupation

Occupation of respondents	Frequency	Proportion of Responses (%)
Farming	191	67.0
Business	17	6.0
Hunting	5	1.8
Weaving	42	14.7
Fishing	5	1.8
Brewing	3	1.1
Collect and sell firewood	10	3.5
Bicycle taxi	4	1.4
Brick making	1	0.4
Evangelism	3	1.1
Casual labour	3	1.1
Plaiting	1	0.4

Nearly half the households (48.3%) had an income of between Kshs.2000 to 7999, 41.9% had less than Kshs.1999, 4.4% had no income, 2.8% had more than Kshs.8000 and 2.5% did not know their income. 60.6% of the respondents had their income supplemented, whereas 39.4% were the sole income earners for the households. The mean household income was KS. 4,577.9 \pm 163.18 per month.

Households that had a single source of income were significantly different from those that had multiple sources of income ($t = 1.99$, $df = 353$; $P < 0.05$). The major occupation of the respondent determined the income he or she earned ($\chi^2 = 109.85$, $df = 44$; $P < 0.05$). The sex of the respondent was a determinant of the amount of money earned ($\chi^2 = 19.98$, $df = 4$; $P < 0.05$), with males earning more than females ($RR = 2.59$; $95\%CI = 1.67, 4.02$). The household ability to possess a bed net was related to the income of the household ($\chi^2 = 9.86$, $df = 3$; $P < 0.05$). With households with higher income being more likely to use a net compared to those with low income ($RR = 1.70$; $95\%CI = 1.05, 2.75$).

Majority of the respondents were either married or cohabiting (81.7%). The remaining proportion was widowed (14.7%), separated or divorced (2.2%) and single (1.4%). Having a bed net in the household was independent of the marital status of the respondent ($\chi^2 = 4.45$, $df = 3$; $P > 0.05$).

The study showed that 72.4% of the households stayed in mud grass-thatched houses, 19.2% in mud mabati-roofed houses and 4.2% in semi-permanent and permanent houses. The mean number of rooms per house was 1.83 ± 0.06 S.E whereby, 78.1% of the houses had one to two rooms, 19.5% three to four rooms and 1.4% more than five rooms. Possession of a bed net in the household was dependent on the number of rooms in the house ($\chi^2 = 22.67$, $df = 6$; $P < 0.05$).

3.2 Household sleeping patterns and their possible effects on acquisition and proper utilization of mosquito nets

The mean number of people per household was 5.1 ± 0.24 S.E. Out of 360 households, 46.1% had five to eight people, 45.8% one to four people, 6.9% nine to twelve people and 1.1% thirteen to sixteen people. The number of people in the household was not related to the possibility of possessing a mosquito net ($\chi^2 = 0.17$, $df = 3$; $P > 0.05$).

The majority of the households (72.4%) had at least a child below five years. The mean number of children below five years was two children per household. Most households had one to two children whereas very few households had more than four children below five years (Table 5). A high percentage (90%) of the children below five years shared sleeping space with someone while 10% slept alone. Of those that shared sleeping space, a good number (86.8%) shared sleeping space with parents and siblings (Table 6).

Table 5: Number of children below five years staying in the households

Number of children	Frequency	Proportion of households (%)
One	117	45
Two	100	38.5
Three	37	14.2
Four	5	1.9
Five	1	0.4

Table 6: Members of the household sleeping with children below five years

Member of the household	Frequency	Proportion of households (%)
Parents	146	49.7
Aunt/uncle	3	1.0
Grandmother/father	34	11.6
Sibling	109	37.1
Other relatives	1	0.3
House-help	1	0.3

The mean age at which children sharing sleeping space changed their sleeping arrangement was 6.05 ± 0.27 years. The age at which the children's sleeping pattern changed was dependent on the person the child was sharing sleeping space with ($\chi^2 = 85.11$, $df = 12$; $P < 0.05$), with most of those sharing sleeping space with parents changing their sleeping pattern before they attained five years (Figure 12). Whether a household had a child below five years or not was not related with possession of mosquito nets by the households ($\chi^2 = 1.8$, $df = 1$; $P > 0.05$). However, households with children below five years were slightly more likely to possess a bed net than those without them ($RR = 1.38$; $95\%CI = 0.81, 2.35$). The possibility of the households having a mosquito net was related to the number of children below the age of five years in the household ($\chi^2 = 10.22$, $df = 4$; $P < 0.05$) with households with more children being less likely to possess a bed net compared to those with one child ($RR = 2.33$; $95\%CI = 1.36, 4.00$).

Most of the households (77.8%) had one sleeping room and very few (0.3%) had four sleeping rooms (Table 7). Possession of a bed net in the household was independent of the number of sleeping rooms in the household ($\chi^2 = 5.16$, $df = 3$; $P > 0.05$).

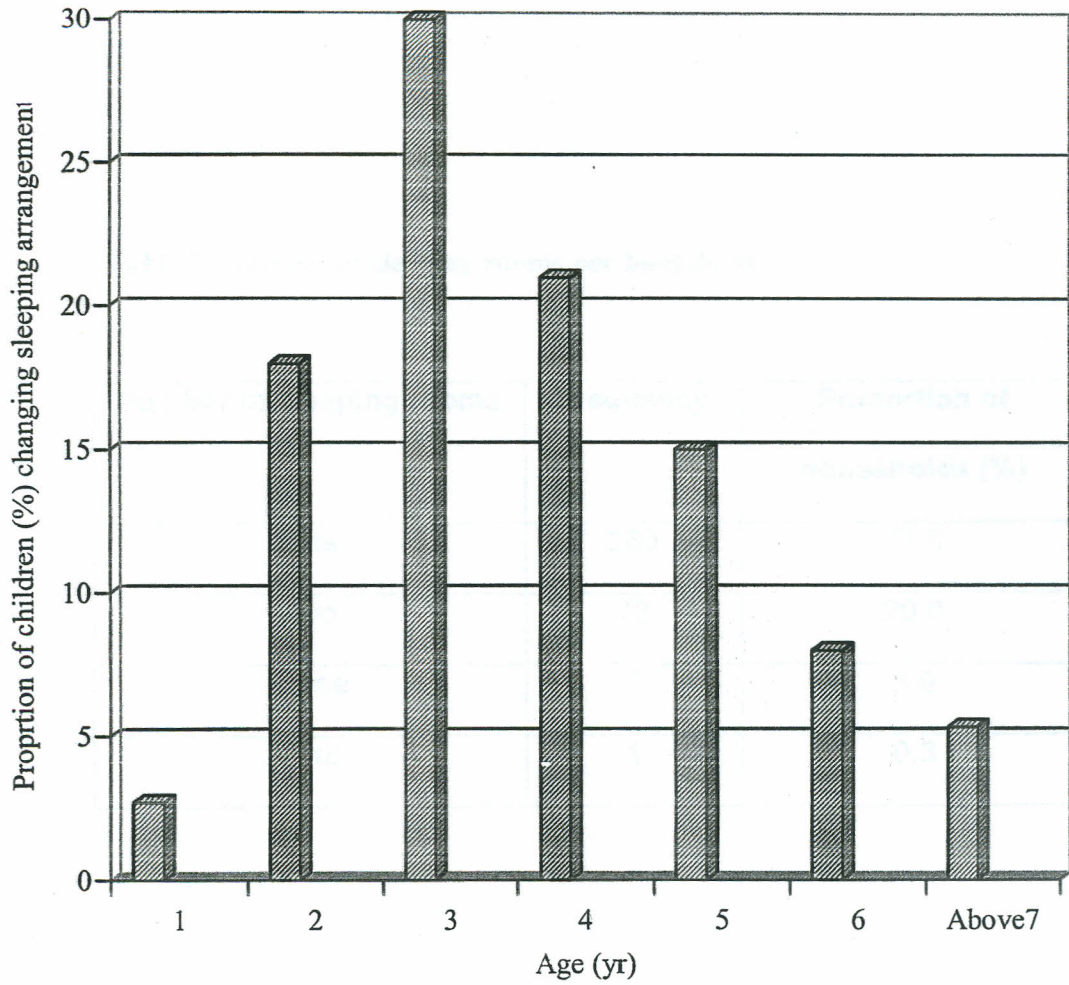


Fig. 12: Age at which children sharing sleeping space with parents change their sleeping arrangement

Table 7: Number of sleeping rooms per household

Number of sleeping rooms	Frequency	Proportion of households (%)
One	280	77.8
Two	72	20.0
Three	7	1.9
Four	1	0.3

Most of the households (54.2%) had their members sleeping on beds and mats, 34.7% had all its members sleeping on beds while 11.1% had all its members sleeping on mats. What members of a household slept on was independent of the income of the household ($\chi^2 = 6.68$, $df = 6$; $P > 0.05$) and occupation of the respondent ($\chi^2 = 23.11$, $df = 22$; $P > 0.05$) but was related to education level of the respondent ($\chi^2 = 22.52$, $df = 12$; $P < 0.05$). The possibility of having a bed net in a household was related to whether the members of the household were sleeping on beds, mats or both ($\chi^2 = 14.95$, $df = 2$; $P < 0.05$). Households that had all its members sleeping on mats had the lowest chance of having a bed net (RR = 7.69; 95%CI = 2.25, 26.32) compared to those using beds and (RR = 4.48; 95%CI = 1.33, 15.17) when compared to those using both mats and beds. Members sleeping on beds varied from all members of a household (29.1%) to grand parents and children (0.3%) (Table 8). On the other hand, majority of households (68.3%) had children sleeping on mats while in very few households (0.4%) were visitors offered mats to sleep on. (Table 9).

Most of the households (82.7%) had their members sleeping together while 17.3% households had all its members sleeping alone. Children had the highest chance of sleeping together (37.2%) among those households where members slept together whereas child and house help had the lowest (0.2%) (Table 10).

Table 8: Members of households sleeping on bed

Members sleeping on bed	Frequency	Proportion of households (%)
Household head	59	16.7
Husband and wife	93	26.3
All members	103	29.1
Parents and young child	48	13.6
Wife and children	24	6.8
Older children	20	5.6
Young children	4	1.1
Husband and children	2	0.6
Grandparent and children	1	0.3

Table 9: Household members sleeping on mat/skin

Members sleeping on mat	Frequency	Proportion of households (%)
Wife and children	17	7.1
Children alone	164	68.3
Head of household	2	0.8
Children and grandparents	9	3.8
All members	41	17.1
Wife alone	3	1.3
Husband and wife	2	0.8
Husband and children	1	0.4
Visitor	1	0.4

Table 10: Members of the household sleeping together

Members sleeping together	Frequency	Proportion of households (%)
Wife and children	78	16.4
Husband and wife	141	29.7
Husband and children	9	1.9
Children	177	37.2
Children and grandparents	10	2.1
Parents and young child	60	12.6
Children and house-help	1	0.2

Several reasons were given for sleeping together; 35.6% of the households had their members sleeping together because they lacked sleeping space and materials and only 0.2% of the households members slept together as a result of pregnancy (Table 11). Possession of a bed net in the household had no influence on sharing of sleeping space ($\chi^2 = 0.6$, $df = 1$; $P > 0.05$).

Majority of the households (53.5%) had their members sleeping between eight and nine o'clock and very few households (0.6%) had their members sleeping after eleven o'clock (Table 12). The mean sleeping time was 9.16 ± 2 pm. The time members of the household slept were not related with possession of a mosquito net ($\chi^2 = 8.36$, $df = 4$; $P > 0.05$). In most households (95.6%), adults were the first to wake up, followed by both young (2.2%) and old children (2.2%). In 42.7% of the households, members woke up between 5-6 am, 38% between 6-7 am, 8.1% between 4-5 am, 5.6% between 7-8 am, 3.1% between 2-3 am and 2.5% between 3-4 am. Mosquito net possession was independent of the time members of the households woke up ($\chi^2 = 3.567$, $df = 5$; $P > 0.05$).

Those who woke up before five in the morning took the following measures to protect themselves from mosquito bites; 27.9% used heavy clothing, 6% killed the mosquitoes mechanically, 2.5% used mosquito coils, and 0.5% used smoke. A high proportion (63.2%) did nothing to protect themselves from mosquito bites. Protection or non-protection from mosquito bites was not related with the presence or absence of a net in the household ($\chi^2 = 5.67$, $df = 5$; $P > 0.05$).

Table 11: Determinants of household sleeping arrangements

Determining factor	Frequency	Proportion of households (%)
Pregnancy	1	0.2
Maternal care	92	16.8
Age	103	18.8
Sex	13	2.4
Culture	59	10.8
Lack of sleeping material/space	195	35.6
Security	51	9.3
Poor sleeping habits	20	3.6
Prevent mosquito bites	5	0.9
Family planning	9	1.6

Table 12: Time members of the household go to sleep

Sleeping time	Frequency	Proportion of households (%)
7-8pm	29	8.1
8-9pm	199	53.5
9-10pm	119	33.3
10-11pm	16	4.5
11-12pm	2	0.6

Most of the households (74.4%) had all their members sleeping indoors at night with the remaining households (25.6%) having at least a member sleeping outdoors. Of those who slept outdoors, 52% did nothing to protect themselves from mosquito bites, 27% used heavy clothing, 11% used smoke, 4% killed the mosquitoes mechanically, 3% protection taken was not known, 2% used repellent cream and 1% used mosquito spray. Possession of a mosquito net by a household was independent of whether or not its members slept outdoors ($\chi^2 = 0.789$, $df = 1$; $P > 0.05$).

3.3 Household mosquito bite deterrent strategies

Mosquito bite deterrent strategies included the use of mosquito repellents in 29.1% of households, mosquito nets (24.8%), smoke (18.8%), heavy clothing (2.8%), and mechanical killing of mosquitoes (0.7%). In 24% of households nothing was done to protect against mosquito bites. Mosquito repellents used included mosquito coils, in 72.6% of the households, burning special herbs (23.7%), mosquito sprays (2.2%) and mosquito repellent creams (1.5%).

3.4 The cost of mosquito bite deterrent items purchased by households and their possible influence to net acquisition

The mean cost of mosquito nets in the community was $KS.408.20 \pm 9.70$. The mean cost of mosquito coils, mosquito repellent creams and mosquito sprays used per month was $KS.146.80 \pm 9.20$, $KS.140 \pm 60$ and $KS.181.30 \pm 62.40$ respectively. Most respondents (53.7%) felt that buying repellents was expensive whereas a small number of respondents (0.8%) were satisfied with

the protection afforded by the repellants; they felt it was money wisely spent (Table 13). Use of mosquito repellants in the households was dependent on possession of a mosquito net ($\chi^2 = 7.387$, $df = 1$; $P < 0.05$). Households that used repellants were less likely to use a bed net compared to those that did not (RR = 2.01; 95%CI = 1.21, 3.35).

3.5 The coverage of mosquito nets, their treatment with insecticide and problems associated with bed net acquisition and treatment

Of the households that possessed mosquito nets 55.3% had one mosquito net, 29.1% had two while 15.6% had more than three mosquito nets. The mean number of mosquito nets per household was 1.62 ± 0.08 . Most of the nets in the households (61.1%) were bought from local shops, 14.2% local vendors, 11.5% from World Vision, 10.6% from hawkers and 2.9% from Bamako sites. Most of the respondents (65.2%) used mosquito nets to avoid mosquito bites, 27.7% did so in order to prevent malaria, 3.5% to prevent other hazards, 2.1% for privacy while 1.4% used them for comfort.

Of all the mosquito nets in the households, 70.9% were not treated with insecticides while only 29.1% were treated with insecticide. Sources of treated nets included local shops (37.9%), World Vision (34.5%), local vendors (10.3%), Bamako sites (10.3%) and hawkers (6.9%). 77.1% of the respondents bought insecticide treated bed nets because they were effective in repelling mosquitoes, 8.6% because the price was fair, 5.5% because it was the one available, 5.5% had no idea and 2.9% because it did not get dirty easily.

Table 13: Respondent's feelings about mosquito repellents used in the household

Response	Frequency	Proportion of respondents (%)
Expensive but mandatory	17	14
Expensive	65	53.7
Satisfied with protection offered	1	0.8
Unsatisfied with protection offered	25	20.6
Not expensive	10	8.3
Irritates them	3	2.5

Duration of using a treated net showed that 53.4% of the respondents had used the net for more than six months whereas 46.6% had used it for less than six months. In general 68.8% of the nets had been washed whereas 31.2% had not. However, frequency of net washing varied depending on duration of bed net use (Figure 13). Most insecticide treated bed nets that had been used for less than six months (76%) had been washed less than two times while majority of those that had been used for more than six months (75%) had been washed more than three times (Figure 14). Majority of the respondents (85.7%) washed their mosquito nets because they were dirty and 14.3% because they had an irritating smell.

A good number of households (89.9%) with mosquito nets had not treated them. Only 10.1% had treated their nets, out of which 41.7% did so in order to keep mosquitoes away, 33.33% were instructed to do so, 16.7% treated them to prevent malaria and 8.3% treated their nets because money was available. The group that had not treated bed nets cited reasons ranging from ignorance (44.2%) to nets not being in use (1%) (Table 14).

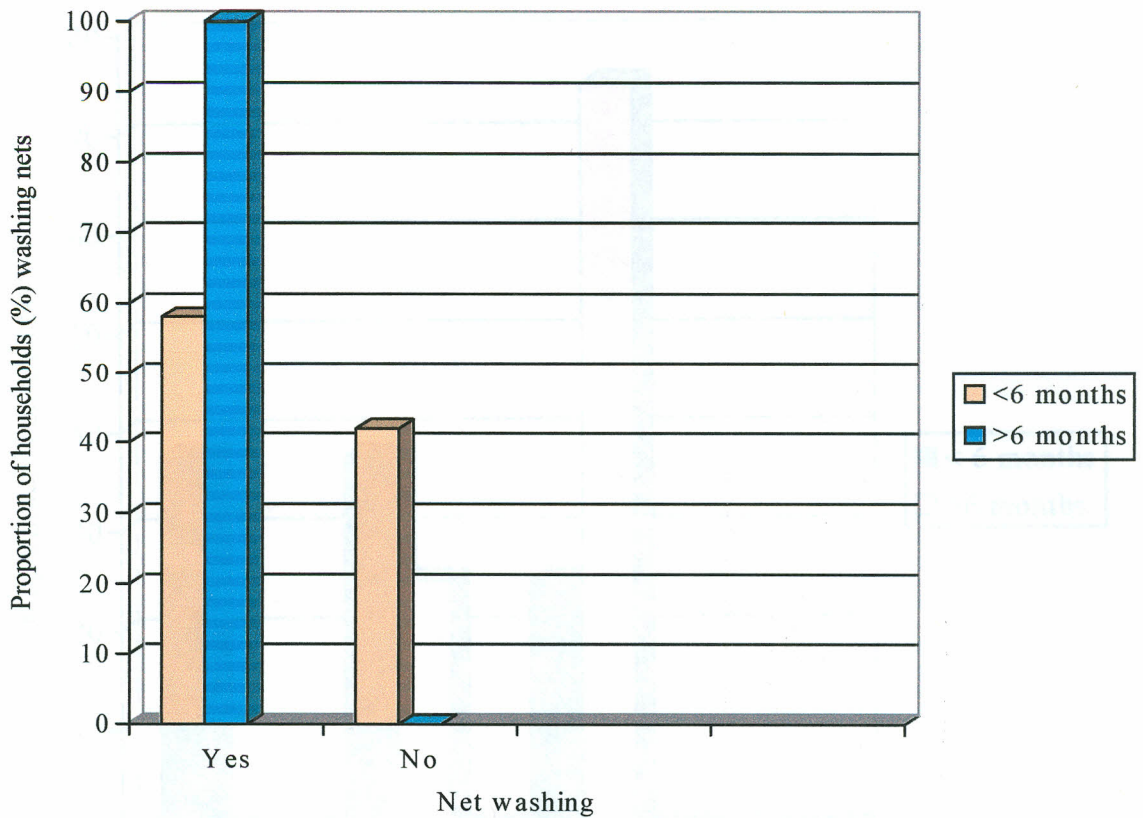


Figure 13: Frequency of washing treated nets in relation to the duration of using them

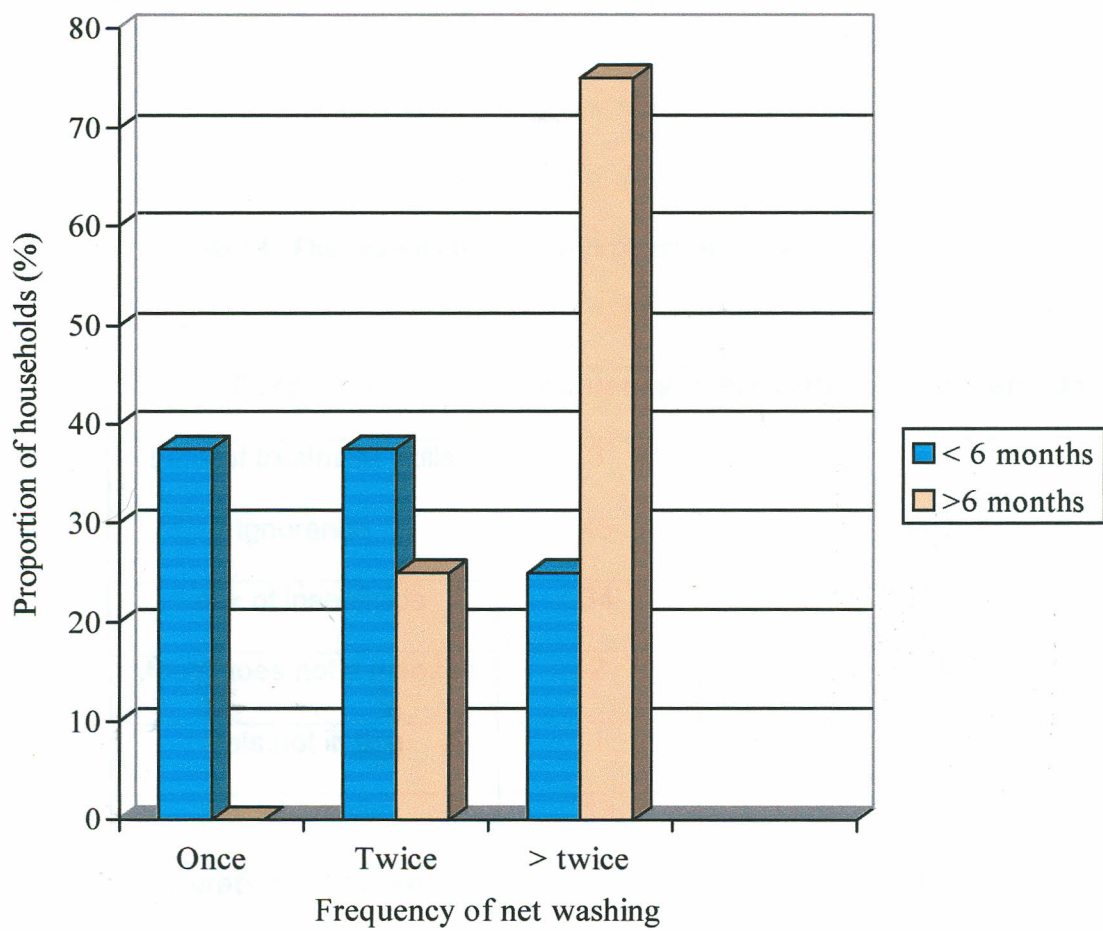


Figure 14: Frequency of washing nets in relation to length of time they had been used

Table 14: The reasons for non-treatment of mosquito nets

Response	Frequency	Proportion of households (%)
Lack of treatment skills	3	2.9
Ignorance	46	44.2
Lack of insecticide	34	32.7
Mosquitoes not a menace	2	1.9
Nets not in use	1	1.0
Lack of money	13	12.5
Duration not expired	5	4.8

Household's inability to possess a mosquito net was attributed to various reasons. Lack of money was cited by 55.2% of the households, low priority of bed net by 6.2%, cost of bed by 7.7%, some households viewed bed nets as a luxury (4.5%), others found them uncomfortable (3.7%), while others feared them (3.7%), some respondents felt that nets easily catch fire burning houses (1.9%), While others found it shameful to hang a bed net over a mat (1.9%). The study, also revealed that some people do not view mosquitoes as a menace (1.6%), others lacked mounting space (1.3%), still some responses indicated that only young children needed to be protected from mosquito bites, so absence of children did not warrant possession of bed nets (1.3%). A small proportion (1.1%) had no access to the nets.

3.6 Affordability and willingness of households to buy bed nets

When asked what they would like to buy or do given money, 22.9% of the respondents (highest percentage) said they would furnish their house while 1.2% (lowest percentage) mentioned seeking medical attention (Table 15). Majority of households (89.6 %) took action aimed at getting money required in the household while 10.4% did nothing. Most of those that took action either borrowed money from different sources or sold household property (Table 16). Majority of households (77.2%) borrowed money or sold household items when some one was sick/died and when they lacked food (Table 17).

Table 15: What respondents would like to buy or do given money

What will like to (do)/buy	Frequency	Proportion of respondents (%)
Mosquito net	98	11.1
Food stuff	82	9.3
House wares	202	22.9
Fishing net	18	2.0
Cloths	92	10.4
Medical attention	11	1.2
Start business	113	12.8
Livestock	64	7.3
Built house	86	9.8
Bicycle	32	3.6
Land	32	3.6
School fee	23	2.6
Farm equipment	14	1.6
Boat	15	1.7

Table 16: Action taken by respondents when money is needed

Action taken	Frequency	Proportion of respondents (%)
Do nothing	47	10.4
Borrow	268	59.4
Sell household items	67	14.9
Pray	25	5.5
Casual labour	39	8.6
Withdraw from bank	5	1.1

Table 17: Items/services for which households borrow money

Item/service	Frequency	Proportion of households (%)
Food stuff	181	24.9
Sickness/funeral	381	52.3
Imprisonment	11	1.5
Cloths	7	1.0
Mosquito net	7	1.0
Fishing net	7	1.0
Boat	3	0.4
Bicycle	2	0.3
Visit/Visitors	24	3.3
School fees	66	9.1
Start business	16	2.2
Toiletries	4	0.5
Pay debt	8	1.1
Build house	11	1.5

Almost all the households (99%) that had a bed net were willing to treat their nets. Out of this proportion 48.5% preferred to treat nets themselves, 38.4% preferred a trained member of the community while 13.1% preferred a health worker.

Most of the households (86.9%) were able to buy insecticide treated bed net at the World Vision price of KSh. 350 and only 13.1% could not. Those who were unable to buy cited various reasons ranging from financial constraints (70.5%), sufficient nets (25%), discomfort of net use (2.3%) and nets not necessary items (2.3%).

For the households that could not be able to buy a net, 94.3% gave suggestions on what could be done to enable them buy mosquito nets. Majority of the households (71.4%) suggested to payment by instalments, 14.3% suggested economic empowerment economically, 5.7% suggested free handouts and 2.9% suggested that nets be sold at half price.

For those households that could afford to buy a net, 41% could buy two insecticide-treated bed nets, 26.3% three, 19.8% one, 7.1% four and 5.9% more than five. The mean number of bed nets per household was 2.4 ± 0.07 . A reasonable number of households (54%) would buy them whenever money would be available while a small number (1.2%) did not know when they could be able to buy them (Table 18).

Table 18: When households are likely to buy a mosquito net

Period/season/condition	Frequency	Proportion of households (%)
Mosquitoes are menace	118	27.3
Money is available	233	54.0
Harvesting time	34	7.9
Net is availed	35	8.1
Possess a bed	7	1.6
No idea	5	1.2

Most households (50%) spent below KSh. 2,500 while few (2%) spent more than KSh. 10,000 per month (Figure 15). The mean expenditure per household per month was KSh. 3292.50 \pm 156. Expenditure per household per month was significantly different from the income of the households ($t = 7.27$, $df = 354$; $P < 0.05$). Income of households with bed nets was significantly higher than those without bed nets ($t = 3.82$, $df = 358$; $P < 0.05$).

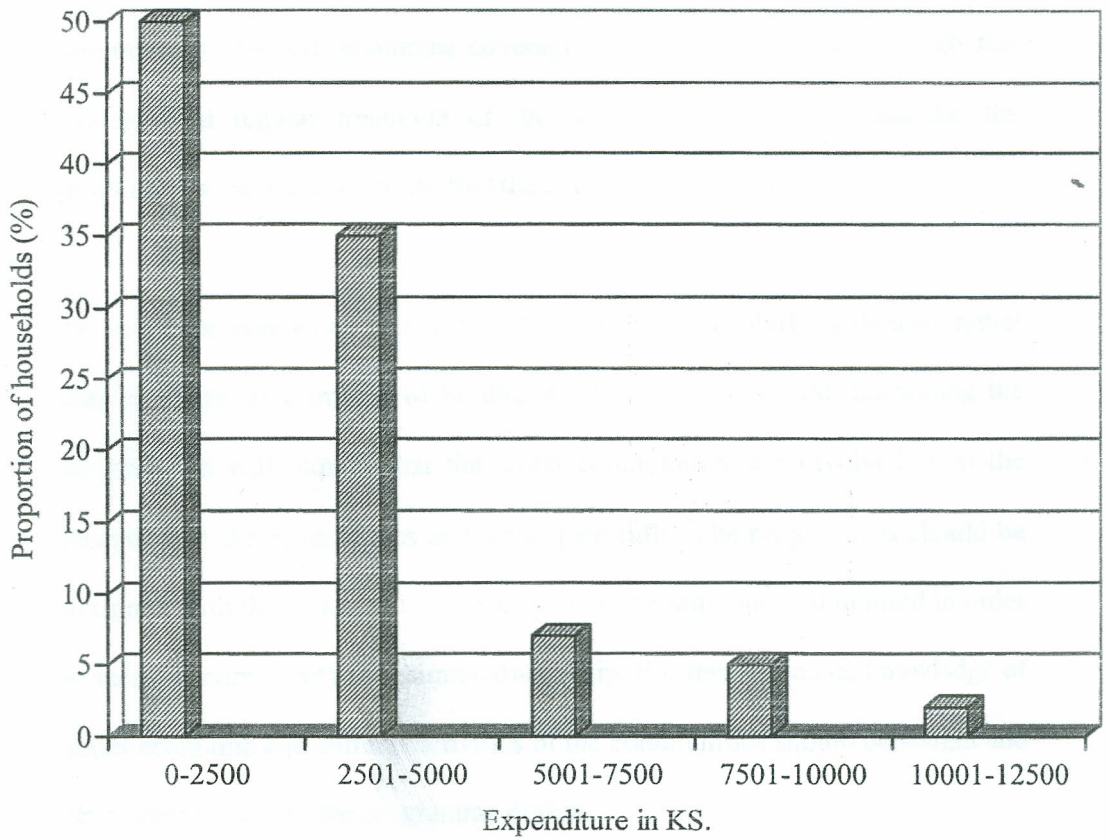


Figure 15: Monthly expenditure of the households

CHAPTER FOUR: DISCUSSION

4.1 General discussion

From literature it is clear that insecticide treated bed nets are effective in reducing malaria burden especially in Africa south of the Sahara. Success of ITNs in the region lies on sustainable community, national and regional programmes that will guarantee coverage of the population at risk with this strategy and regular treatment of the nets with insecticides. Besides the programmes should also ensure that the nets are used appropriately.

To cover the population at risk and treat their nets regularly is rhetoric rather than a reality, as a myriad of hurdles must be overcome first. Sustaining the programmes will require that the target communities are involved from the inception of the programmes and participate fully. The programmes should be designed with the community were they are to be implemented in mind in order to increase community programme ownership. For this to reason, knowledge of socio-economic and cultural activities of the communities should be sought and be incorporated into the programme design.

It is against this background that this study sought to investigate socio-cultural and economic profiles of the Bunyala people to enhance implementation of the bed net project.

4.2 Socio-economic and demographic characteristics

Owing to their role in the family, women have been reported to be more inclined than men to buy health-maintaining items such as bed nets (Rashed *et al.*, 1999). Women are responsible for the health of their family members, take care of children and are as a result usually more aware of children vulnerability to malaria. Findings from this study showed a low likelihood of households headed by women using a bed net compared to those headed by men. However, in general women were more informed about malaria in children and the need to use nets to protect them. Even if they recognize the need to use mosquito nets especially for children below five years, women may be unable to buy them due to their low economic status. This calls for involvement of women in activities that will empower them economically in order for them to improve the health of their children.

The community literacy level was low as evidenced by the number that had completed elementary education. Community misconception regarding malaria prevention may also be indicative of a low literacy level. For example, in a focus group discussion, a member said,

“Malaria can be prevented by covering food and improving hygiene, for example ensuring that children do not defecate near the house, do not drink dirty water and eat after washing hands”.

The above statement might not only show lack of knowledge on malaria etiology but may also suggest lack of specificity of the term malaria. In the community malaria may be a term used to cover a number of different diseases.

Lack of specificity of local terms used to refer to malaria has been reported (Kengcya-kayondo *et al.*, 1994; Ahorlu *et al.*, 1997). When the community has other supposed causes of malaria other than mosquitoes, malaria control measures will be considered to be only effective against the type caused by mosquitoes. As a result, perceived efficacy of malarial control measures may probably be low leading to low community adoption rates. In such situation aggressive health information, education and communication campaigns should be considered to clear the misconceptions and create demand for the advocated strategy.

Education level, occupation and income were important determinants of bed net use, findings that were consistent with those of Rashed *et al.*, (1999). Education level was a determinant of the occupation of the participant, which in turn determined the income. Participants in occupations with seasonal variation in income had a lower chance of possessing a bed net compared to those in occupations with constant income. The same findings have been documented by MacCormack *et al.*, (1989), who reported that households with seasonal access to cash will not consider procurement of health maintaining items a main concern.

Households with a higher income were more likely to use a mosquito net compared to those that had a low income. The amount of money flowing to the household will determine disposable income available after meeting basic needs of the family. The amount of disposable income together with the

significance attached to malaria and its control methods will determine the ability and willingness of the household to acquire a bed net.

Most respondents (67%) considered farming a part time activity. It is therefore possible that food production in the area is low, thus most families might be using a considerable amount of their income on food provision. This might leave little or no money for other household needs making purchase of health maintaining items practically impossible. For such households items such as bed nets will not be seen as necessary. It is therefore imperative for stakeholders to devise innovative technologies to utilize available land and water resources in order to enhance farming and food production in the area. For example, revamping the defunct Bunyala irrigation scheme will go along way in increasing food production and income of households. However, it may also present a challenge to malaria control activities due to creation of new mosquito breeding sites.

4.3 Household sleeping patterns

The chance that a household was using a bed net was slightly higher in households with children below five years than those without children. On the other hand, households that had only one child below five years had a higher chance of possessing a bed net compared to those that had more children. This finding differed from those of Tanner and Vlassof (1998) and Yeneneh *et al.*, (1993), who reported a higher chance of women with more children participating in programmes aimed at malaria prevention than those with only

one child. Families with poor educational and economic backgrounds might not utilize family planning services. For that reason they may have more children below five years who will exert more pressure in their already meager resources. In such families acquisition of bed nets may not be possible. Therefore there is need to popularize and make accessible family planning methods in the community in order to increase their uptake.

In most households (86.8%), children below five years shared sleeping space with either their parents or siblings. This finding is consistent with that of a study carried out in Kilifi, Kenya (Muthami *et al.*, 1999). Unpublished data from the same area indicate that most (44.4%) of the nets in the household are used by parents. Findings from the present study suggest that children below five years are not likely to benefit from a bed net present in the household. Children in household's having more than one net may have a chance of using a net (Chavasse *et al.*, 1999). However this may not be possible since not in all such households will the children be perceived more deserving, especially if nets are used basically to give a good night's sleep. Similar studies by Aikins *et al.*, (1993) and Kuchar *et al.*, (1999) have also reported use of bed nets by adults rather than children. A study by Muthami *et al.*, (1999) reported a higher chance of a net found in the household being used by children than by adults. Covering the group at risk with ITNs remain the cornerstone of the strategy in reducing malaria associated morbidity and mortality. It therefore remains a challenge given that studies continue to document low net usage by the group at risk. In the study community, the need for children to use bed net rather than

other members of the family was quite clear. However, the community might not be willing to change the pattern of use as illustrated by the explanation below:

“In this community people believe that they are poor, stay in grass thatched houses and use lanterns (korobois). Children like playing with the lanterns, moving with them from one part of the house to the other. The children sometimes forget and put the lantern near the net, causing a fire outbreak that burns the house. It is for this reason that we prefer the nets to be used by adults”

The other community view explaining net use by adults (parents) was linked to the role of the parents in provision of family basic needs. Parents are the breadwinners of the family and so protecting them from malaria ensure that the family continues meeting its basic needs. Increasing mosquito nets coverage for the group at risk may present a challenge to the community. It is necessary to determine the extent of the practices in the community first before tangible solutions can be reached. However, in the mean time targeted subsidies may help to improve coverage.

Households whose members slept on mats had the lowest chance of possessing a net compared to those whose members either slept on both mats and beds or beds alone. Promoting bed net use for people who do not sleep on beds may be problematic. In all the four focus groups, participants mentioned that it was shameful to use a bed net on a mat and that such people will only own a net after buying a bed. There existed conflicting views on whether those sleeping

on mats will use a net if available. Some participants felt that such people will devise innovative ways of ensuring use of the net, a finding reported elsewhere (Jones, 2000). The other group felt that they would keep it until they buy a bed. Since, no participant was using a mat it may be difficult to state which options that may be taken if bed nets were to be offered free of charge. Participants felt that sleeping on a mat was a sign of abject poverty. Thus, those sleeping on mats may not be able to afford a bed net.

On the other hand net acquisition may be hindered by the misconception that a bed net is meant for a bed. As a result, those without a bed might not see the need to acquire a mosquito net. The present study did not investigate the magnitude of the misconception; the strength of the factor in hindering net acquisition and use in the community is unknown.

In most households (94.9% and 94.4% respectively) members slept before 10.00 pm and woke up after 4.00 am. Studies on mosquito-man biting habits have shown the peak biting periods for female *Anopheles* mosquitoes in Africa south of the Sahara to be late at night (Clement, 1996; Ahorlu *et al.*, 1997; Curtis, 1997). If implemented effectively the ITN project has the potential of reducing mosquito-man contact thereby reducing the community's disease burden, especially of the vulnerable group. Sleeping out door even if not so common (25.6%) may present a challenge to use of bed nets if overall malaria morbidity has to be reduced. It may be particularly difficult to use a net while outdoors at night and fishermen may present the greatest challenge as they

usually go to fish at night and stay at the shores of the lake away from their families. However other innovative strategies of protecting them such as treating their cloths with insecticides should be explored.

4.4 Household mosquito deterrent strategies

The community responded to mosquito nuisance with both traditional and modern methods of vector control. The findings are consistent with those of Kachur *et al.*, (1999) but differ on the frequency of use of the methods. The response might be an indication of the importance attached to mosquito nuisance especially during the rainy season when mosquito densities are high. By extension this might be an indication of the willingness of the community to be involved in more effective mosquito bite deterrent strategies such as use of ITNs. Gyapong *et al.*, (1992) have suggested possible negative influence of traditional means of repelling nuisance insects on modern ones such bed nets. Findings from this study support this idea, as households that used mosquito repellants were two times more unlikely to use a net as compared to those that did not use repellants.

The majority of households either burned special herbs and cow dung or used mosquito coils to repel mosquitoes. Special herbs and cow dung are cheaply available resources that are free of charge. Households that use them and are satisfied with the protection they offer may not see the need to use other methods especially when such methods require money. On the other hand those who use mosquito coils may not be willing to acquire a bed net, which may

only benefit a few members of the family and costs more. There is a possibility of households comparing the amount of money needed to buy a coil to that needed to buy a net. In such comparisons mosquito coils may present cheap alternatives making it difficult for such households to buy bed nets.

Money used to buy mosquito repellants in the household per month is nearly half the cost of an insecticide treated bed net in the area. Since households are not required to avail the entire amount spend per month in order to use the repellants, they may prefer them even though they know they are less effective than mosquito nets and more expensive in the long run.

4.5 Coverage of mosquito nets and their treatment with insecticide

Coverage of mosquito nets in the community was very low, a phenomenon that has been documented elsewhere (Ahorlu *et al.*, 1997). Low bed net coverage was explained either to be a result of the inability of the household to save enough money to buy them or the household did not consider them among priority items (71.4%).

A considerable number of households (65.2%) used mosquito nets primarily to avoid mosquito bites. Use of the nets to escape mosquito and other biting insects from undisturbed sleep rather than to prevent malaria has been documented (Rashed, *et al.*, 1997; Richards *et al.*, 1993; Alaii *et al.*, 1999; Brieger *et al.*, 1997; Binka and Adongo, 1997). Communities that use bed nets to avoid mosquito bites are likely to see a net as a luxury rather than a health maintenance item. Coupled with the reported convenience afforded by bed nets

such as privacy and protection from snakes and lizards (Kroeger *et al.*, 1997; Aikins *et al.*, 1994), insecticide treated bed nets might be seen as comfort items that will come after food and other needs of the households have been met. To increase net coverage health campaigns promoting treated bed nets as health-maintaining items should be undertaken.

Majority (70.9%) of nets in the community was not treated with insecticide and few households (10.1%) with treated nets had re-treated them. These findings are consistent with those of Muthami *et al.*, (1999) and Kachur *et al.*, (1999). Most households (76.9%) had not treated their nets either because they had no idea nets are treated and the need to do so or lacked insecticide to treat their nets. Similar findings have been reported (Kroeger *et al.*, 1997; Winch *et al.*, 1997; Kachur *et al.*, 1999; Armstrong *et al.*, 1999) but with differing magnitudes. However, none of the studies had cited ignorance as one of the reasons for not treating nets. All the studies involved populations that were at one time part of an ITN project. Therefore, they were more likely to know nets needed to be treated with insecticides. The findings that insecticides for net treatment were not available in the community is of great concern since untreated bed nets have been shown not to be very effective at protecting malaria especially in the group at risk (Greenwood and Pickering, 1993). Since bed nets are often damaged or hang incorrectly and mosquitoes can penetrate them, un-treated mosquito nets may act as mosquito traps rather than protection against them, thus resulting in increased malaria transmission. There is need to

find through research appropriate ways of sustaining supply and use of insecticides for net treatment if ITNs have to achieve the desired results.

Frequent net washing which has also been reported by Kroeger *et al.*, (1997) was rampant among those who were using treated bed nets (Figure 14 and 15). Kroeger *et al.*, (1997) reported dirt, side effects of the insecticide and custom of washing nets regularly as reasons for net washing. In the present study, most households either washed a net because it was dirty or had an irritating smell. Even though studies have shown that washed nets may continue being effective up to four months after washing, there is need to intensify campaigns to reduce frequent net washing in the community. Alternatively, the bed nets can be treated with a wash resistant insecticide.

4.6 Affordability and willingness of households to buy bed nets

Majority of respondents (89.9%) would not buy a bed net if they were presented with the opportunity to decide what to buy. This finding may serve to reinforce the perception that bed nets may not be among the priority items in the community and therefore they may be grouped as luxuries. It has been reported that households that use nets come to value them so much compared to those that have no experience with nets (Kachur *et al.*, 1999). Since most people in the community have not used bed nets they may not value them highly. However, bed nets are particularly recognised as necessary household items during the rainy seasons when mosquito nuisance is highest. There is a

likelihood that if campaigns to increase net coverage are intensified during the rainy season net acquisition may be increased substantially.

Bed nets were least mentioned as items that respondents and participants could borrow money to buy. Borrowing to buy a net was strongly disapproved as was clarified by a focus group discussion participant:

“In this community you can borrow money to take a sick person to hospital or you can borrow drugs such as chloroquine from the shop if your child is sick but you can not go to the shopkeeper to give a bed net on credit because mosquitoes have become a menace”

This expression may suggest that bed nets are not a priority and are perceived as items only the richer members of the community who do not need credit can buy. Changing this perception requires aggressive information, education and communication campaigns that would make people appreciate nets as health maintaining items, which need to be acquired by every body. It may also require change of policy at the project level such that bed nets can be available on hire purchase.

The study shows that most households (86.9%) had the ability to buy a treated bed net at the price of K.S. 350. Affordability was further supported by findings that household expenditure was significantly less than income. Other investigators (Muthami *et al.*, 1999; Onwujekwe, 1999) had also reported that

most communities were able to afford at least one net. The households lack motivation to buy them since; they are not highly valued items in the community.

CHAPTER FIVE: A SUMMARY OF CONCLUSIONS

- i. Most young children were not likely to sleep under a bed net for all the first five years of their lives.
- ii. There was low bed net coverage, which probably may be attributed to existence of alternative mosquito bite deterrent strategies and the perception that nets are luxuries rather than health maintenance items.
- iii. *Lack of money to buy bed nets and not their price seemed to explain the low coverage.* However, lack of money tended to suggest that a net was not a priority item in the community.
- iv. Low bed net treatment levels had their roots in ignorance and unavailability of insecticides.
- v. Most respondents whose incomes were seasonal were less likely to report net use in the household.
- vi. Most households were able to save money to buy a mosquito net though very few would do so as bed nets were not among the priority items.
- vii. Mosquito nets were able to reduce mosquito-man contact thereby reducing malaria transmission in the area.
- viii. All people who used mats were less likely to use a bed net with children having a much higher risk than adults were.

CHAPTER SIX: RECOMMENDATIONS AND SUGGESTIONS FOR FUTURE RESEARCH WORK

6.1 RECOMMENDATIONS

- i. There is need for health education campaigns to sensitize the community on the group at risk of malaria and hence the need to use bed nets on children below five years.
- ii. There is need for aggressive Information, Education and Communication (IEC) campaigns to create and increase demand for bed nets and insecticides.
- iii. There is need for development of targeted subsidies to increase usage of insecticide treated bed nets (ITNs) by the group at risk.
- iv. There is need for the government and its development partners to start projects that would empower households economically in order to increase disposable income, thereby increasing demand for bed nets.
- v. There is need for the project to establish local outlets to supply insecticides for net treatment and train communities on net treatment.
- vi. There is need for the project to be restructured in order to provide nets on hire purchase to increase net acquisition.

6.2 SUGGESTION FOR FUTURE RESEARCH WORK

- i. Misconceptions about causes of malaria and consequently its prevention should be investigated in order to determine specificity of the term and focus control measures to reduce malaria transmission in the area.

- ii. Use of mosquito nets by adults rather than children should be investigated to identify other factors and determine the extent to which reasons advanced in this study contribute to the community situation.

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APPENDICES

APPENDIX 1: BED NET ACCEPTABILITY AND AFFORDABILITY

INTERVIEW GUIDE (HOUSEHOLD HEADS/REPRESENTATIVES)

SECTION 1

101. INSTRUCTIONS FOR INTERVIEWER.

- a) Interview all household heads or their representatives in the selected households.
- b) Circle or write the number as appropriate of all answers given.
- c) Do not read out answers to respondents.
- d) Write in answers if response is not covered by checklist.

102. IDENTIFICATION

- a) Location's name. -----
- b) Sub location's name. -----
- c) Name of the village. -----
- d) Household number. -----
- e) Interviewer's name. -----
- f) Date of interview. -----
- g) Time interview started. -----
- h) Time interview concluded. -----

103. INTRODUCTION

I am Mr. Robert Ndieka from the department of zoology at Kenyatta University. I am trying to learn more about health problems here and I would like to ask you a few questions. I would very much like you to participate in the study. However, you are free to decide if you want to or not. So do you want to participate in the study?

Yes 1
No 2

SECTION 2

BACKGROUND CHARACTERISTICS

No.	Questions and filters	Coding categories	Skip to
Q201	RECORD SEX OF RESPONDENT	Male 1 Female 2	
Q202	How old are you? (Probe for best estimate)	AGE _ _ _	
Q203	To which ethnic group do you belong? (If "other" specify) -----	Kikuyu 1 Luhya 2 Luo 3 Kisii 4 Kamba 5 Kipsigis 6 Nandi 7 Marakwet 8 Meru 9 Somali 10 Teso 11 Other 12	
Q204	What is your religion? (If "other" specify) -----	Protestant 1 Catholic 2 Muslim 3 Traditional 4 No religion 5 Other 6	
Q205	Have you ever-attended school? IF YES, What was the highest level that you completed?	None 1 Primary not completed 2 Primary completed 3 Secondary not completed 4 Secondary completed 5 Not completed college/University 6 Completed College/University 7	
Q206	What is your main occupation? (Probe the kind of work done most of the time. If "other"specify)	Unemployed 1 Housewife 2 Casual(day to day basis) 3 Skilled artisan 4 Commercial sex worker 5 Business 6 Office 7 Fisherman 8	

	-----	Teacher 9 Community health worker 10 Student 11 Doctor/nurse 12 Other 13	
Q207	Do you do other jobs apart from being a -----? (Say rank given to Q206)	Yes 1 No 2	Q209
Q208	What other job(s) do you do? (More than one answer possible rank them in order mentioned)	1----- 2----- 3----- 4-----	
Q209	What is your income per month? (If people refuse to tell you, ask them what they spent last month) <i>The given answer refers to:</i>	None 1 Less than 1,999/= 2 2,000/= - 7,999/= 3 Over 8,000/= 4 Don't know (DK) 5 Income per month 1 Spending per month 2	
Q210	Do other people contribute in terms of income or food to the household?	Yes 1 No 2	Q212
Q211	How much do they contribute to the household? (Estimate food in Kshs)	Income. Kshs----- 1 Food. Kshs----- 2	
Q212	In this household do you have? (Read aloud) 1. Bicycle 2. Electricity 3. Radio 4. Television 5. Cattle 6. Boat 7. Sofa set 8. Vehicle(s)	Yes 1 No 2 Yes 1 No 2 Yes 1 No 2 Yes 1 No 2 Yes 1 No 2 Yes 1 No 2 Yes 1 No 2 Yes 1 No 2	
Q213	Are you married/cohabiting or living as single, separated/divorced, or widowed?	Single 1 Married/cohabiting 2 Separated/divorced 3 Widowed 4	

SECTION 3

HOUSEHOLD SLEEPING PATTERNS AND COST OF BEDNETS,
INSECTICIDE AND OTHER MOSQUITO CONTROL ACTIVITIES

No.	Questions and filters	Coding categories	Skip to
Q301	Are you the head of the household?	Yes 1 No 2	Q304
Q302	How old is the head of the household? <i>(Probe for best estimate)</i>	AGE ____	
Q303	What is the sex of the head of the household?	Male 1 Female 2	
Q304	How many people stay in this household?	No. -----	
Q305	Do you have children below five years in this household?	Yes 1 No 2	Q310
Q306	How many children are they?	No. -----	
Q307	Do/Does it/ they sleep with someone?	Yes 1 No 2	Q310
Q308	Who do/does they/it sleep with? <i>(More than one answer possible. Rank them in order mentioned)</i> If "other" specify -----	Parents ____ Aunt/uncle ____ Grandmother/father ____ Siblings ____ Other relatives ____ House-helps ____ Other ____	
Q309	Those who sleep with _____ <i>(Say rank one of Q308) at what age do they start sleeping alone?</i>	Age ____	
Q310	This house has how many rooms?	No ____	
Q311	How many of these are sleeping rooms?	No ____	
Q312	Which of these rooms do people sleep in? <i>(Probe to establish which rooms people sleep in)</i> If "other" specify -----	Kitchen ____ Store ____ Bed room 1 ____ Bed room 2 ____ Bed room 3 ____ Other ____	

Q313	What do you and other members of the household sleep on?	Beds _____ Hides/skins/mats _____	
Q314	Who sleeps on the bed (s) Write verbatim in the space below		
Q315	Who sleeps on the mats/skins/ hides? <i>Write verbatim in the space below</i>		
Q316	Do persons sleep together in this household?	No 2	Yes 1
Q317	Who shares sleeping space with whom? <i>Write verbatim in the space below</i>		Q319
Q318	What determines this pattern? <i>Write verbatim in the space below</i>		
Q319	What time do most people go to		

	sleep in this household?	Time. -----	
Q320	Who is the first member of the household to wake up? If "other" specify -----	Young children 1 Older children 2 Adults 3 Other 4	
Q321	When does he or she wake up?	2 - 3 am 1 3 - 4 am 2 4 - 5 am 3 5 - 6 am 4 6 - 7 am 5 7 - 8 am 6	Q323 Q323
Q322	What type of protection against mosquito bites does he/she take? <i>Write verbatim in the space below</i>		
Q323	Do some members of the household sometimes sleep outdoors?	Yes 1 No 2	Q325
Q324	What type of protection against mosquito bites do they take while outdoors? <i>Write verbatim in the space below</i>		
Q325	How do you and other members of the household protect yourselves from mosquito bites? (<i>More than one answer possible. Rank them in the order given</i>) If "other" specify -----	Do nothing ___ Use mosquito repellants ___ Use bed nets ___ Use cloths ___ Others ___	Q352 Q347 Q352 Q352
Q326	How many bed nets do you have in this household?	One 1 Two 2 Three 3	

		Four 4 More than five 5	
Q327	What do you think are the reasons why you use a bed net? (<i>More than one answer possible. Rank them in the order mentioned</i>) If "other" specify. -----	Prevent malaria ___ Avoid mosquito bites ___ Privacy ___ Cold ___ Other ___	
Q328	Where was/were the bed net(s) bought? (<i>More than one answer possible. Rank them in the order mentioned</i>) If "other" specify -----	Local shop ___ Local vendors ___ Bamako sites ___ Others ___	
Q329	How much did it cost? (<i>Say rank 1 of Q327</i>)	Kshs. _____	
Q330	How much did it cost? (<i>Say rank 2 of Q327</i>)	Kshs. _____	

Q331	How much did it cost? (<i>Say rank 3 of Q327</i>)	Kshs. _____	
Q332	Was/were the net(s) bought treated with an insecticide?	Yes 1 No 2	Q339
Q333	Where was/were the treated net(s) bought? (<i>More than one answer possible. Rank them in the order mentioned</i>) If "other" specify -----	Local shop ___ Local vendors ___ Bamako sites ___ Others ___	
Q334	What do you think are the reasons why you bought insecticide treated bed net(s)? <i>Write verbatim in the space below</i>		

Q335	How long have you been using the insecticide treated net(s)?	Less than 6 months 1 More than 6 months 2	Q339
Q336	Have you ever washed the net(s)?	Yes 1 No 2	
Q337	How many times have you washed the net(s)?	One 1 Two 2 More than three 3	
Q338	What do you think are the reasons why you washed the net(s)? <i>Write verbatim in the space below</i>		
Q339	Have you ever treated the mosquito net(s) with insecticide since you bought it/them?	Yes 1 No 2	Q343
Q340	How much did the insecticide cost? <i>(Probe the cost of insecticide in the area).</i>	Kshs. _____	
Q341	How many nets were treated with the insecticide?	No _____	
Q342	Why did you treat the mosquito net(s)? <i>Write verbatim in the space below</i>		Q344
Q343	Why haven't you treated the net(s)? <i>Write verbatim in the space below</i>		
Q344	Are you willing to treat your net(s)	Yes 1	Q346

	with insecticide?	No 2	
Q345	What arrangements do you think can be put to place to enable you treat your net/s? <i>Write verbatim in the space below</i>		
Q346	Who would you prefer to treat the net(s)? If "other" specify -----	Trained members of the community 1 Health worker 2 Self 3 Other 4	
Q347	What type of mosquito repellants do you use in the household? (<i>More than one answer possible. Rank them in the order mentioned</i>) If "other" specify -----	Mosquito coils ___ Mosquito repellent creams ___ Burning herbs ___ Mosquito sprays ___ Other ___	Q349 Q352 Q350 Q352
Q348	How much money do you use on mosquito coils per month? (<i>Probe to establish average number of coils used per night and cost per coil</i>)	Kshs. ___	
Q349	How much money do you use on mosquito repellent creams per month? (<i>Probe to establish average number of repellent cream packs used per month and cost per pack</i>)	Kshs. ___	
Q350	How much money do you use on mosquito sprays per month? (<i>Probe to establish average number of mosquito spray cans used per month and cost per can</i>)	Kshs. ___	

Q351	<p>What do you think of the expenses incurred in buying mosquito coils, repellent creams or sprays? <i>Write verbatim in the space below</i></p>		
------	---	--	--

Q352	<p>What do you think are the reasons why you don't use mosquito net(s)? <i>(Only households where nets are not in use). Write verbatim in the space below</i></p>		
------	--	--	--

SECTION 4

AFFORDABILITY AND WILLINGNESS TO BUY BED NETS

No	Questions and filters	Coding categories	Skip to
Q401	<p>What do you usually spend cash on in this household? <i>(More than one answer possible. Rank them in the order mentioned)</i> If "other" specify -----</p>	<p>Food ___ Fuel ___ Medicines ___ Clothes ___ Other ___</p>	

Q402	How much cash do you use weekly on -----? (Say ranks mentioned to Q401). (Probe for estimate of weekly expenses).	Kshs. _____	
Q403	If you had the money what are some of the things you would like to buy? Write verbatim in the space below (Rank in order mentioned)		
Q404	What do you do when you need money and you have none? (More than one answer possible. Rank them in order mentioned) If "other" specify -----	Do nothing ___ Borrow from relatives ___ Borrow from friends ___ Sell household assets ___ Other ___	
Q405	For what kind of item(s) or purpose(s) would you borrow or sell household assets? Write verbatim below		
Q406	What about bed nets? (Only if bed nets are not mentioned in Q403&405). Write verbatim below		
Q407	Do you think you can be able to buy a bed net at the current World	Yes 1 No 2	Q410

	Vision project cost?		
Q408	Why do you think you can not buy it? <i>Write verbatim in the space below</i>		
Q409	What arrangements do you think can enable you to acquire bed net/s at the current cost? <i>Write verbatim in the space below</i>		
Q410	When do you think you can afford to buy a bed net? <i>Write verbatim below.</i>		
Q411	How many do you think you can afford considering sleeping patterns?	No ___	

APPENDIX 3: FOCUS GROUP DISCUSSION GUIDE QUESTIONS

1. Do you think mosquitoes and malaria are problems in this community?
2. In this community, are mosquitoes a nuisance throughout the year or in some particular months of the year?
3. What do you think can be done in order to prevent malaria?
4. Assuming there is a bed net in the household, which members do you think are more likely to use it?
5. What is your and the community's view on sleeping on a mat/skin and the use of a mosquito net?
6. Let us say there is a certain problem in the household may be you want to buy a given item. How do you go about deciding whether the item should be bought or not?

APPENDIX 4: ABSTRACTS FOR CONFERENCES / SEMINARS/**WORKSHOPS****Socio-economic and cultural factors in procurement and rational utilization of insecticide-treated bednets in Busia District, Kenya**

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Malaria is a major killer disease that threatens 40% of the world population with over 80% of the global disease burden occurring in Africa south of the Sahara. Insecticide treated bed nets have been an effective prophylactic measure in malaria control and has shown the potential for preventing malaria morbidity and mortality.

This investigation was a cross-sectional household study aimed at establishing socio-economic and cultural factors that may affect acquisition and proper utilization of ITNs in reducing malaria transmission in Busia district, western Kenya. The data were collected from 360 respondents using structured interviews, focus group discussions and observations then analysed using Statistical Package for Social Science (SPSS).

The results of the study indicate that while adults rather than children were more likely to use a bed net in the household, pregnant women were more likely to sleep under a net. Households with more than one bed net presented a

slightly higher opportunity for the child to use it. People sleeping on mats had the lowest chance of using a bed net even when it was to be provided free of charge.

Most households slept and woke up before and after mosquito peak biting hours. Therefore, bed nets are able to reduce mosquito-man contact thereby reducing malaria transmission and consequently malaria burden in the area.

Coverage of mosquito nets was very low and could be attributed to use of mosquito repellants (traditional and modern), perceptions that bed nets are luxuries rather than health maintenance items and lack of available funds to buy bed nets. Most mosquito nets in the community were not treated with insecticide. Inability to treat them had its roots in lack of insecticides for treatment and ignorance.

Residents of Bunyala south might not be willing to buy mosquito nets, as they do not value them highly. Even though most households were able to afford at least one net. They may not buy them especially when mosquito nuisance has reduced. To increase net acquisition and use in the community it may be imperative to develop aggressive bed net marketing strategies, provide credit facilities and start projects that can improve economic status of the residents.

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