INFLUENCE OF PREVENTIVE STRATEGIES ON MALARIA PREVALENCE IN MFANGANO ISLAND, MBITA SUB COUNTY, KENYA

BY

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DECLARATION

This research project is my original work and has not been presented for an award of a degree in any other University.

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This work is dedicated to my beloved wife Betty Owuor and my two children Favor Charles and Zawadi Stephanie for their relentless support and prayers during the course of my studies.

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ACRONYMS AND ABBREVIATIONS

ACT	Artemisinin-based Combination Therapy
CCF	Christian Child Fund
CDC	Centre for Disease Control
CHW	Community Health Worker
DHIS	District Health Information System
DOMC	Division of Malaria Control
FY	Financial Year
GOK	Government of Kenya
HH	Household
HBM	Health Belief Model
IEC	Information, Education and Communication
IMM	Integrated malaria management
IPT	Intermittent Preventive Treatment
IRS	Indoor Residual Spraying
ITN	Insecticide Treated Net
KAP	Knowledge Attitude and Practice
KDHS	Kenya Demographic and Health Survey
KII	Key Informant Interviews
KMIS	Kenya Malaria Indicator Survey
LLIN	Long Lasting Insecticidal Nets
MICS	Multiple Indicator Cluster Survey
MOH	Ministry of Health
MOMS	Ministry of Medical Services
MOPHS	Ministry of Public Health and Sanitation

NGO	Non-Governmental Organization
NHSSP II	National Health Sector Strategic Plan II
NMS	National Malaria Strategy
PF	Plasmodium Falciparum
PMI	Presidential Malaria Initiative
RBM	Roll Back Malaria
RDTs	Rapid Diagnostic Tests
UNICEF	United Nations Children Fund
USAID	United States Agency for International Development
WHO	World Health Organization

ABSTRACT

Malaria is preventable and treatable yet it remains the number one killer disease in Africa. In 2010 an estimated 219 million cases of malaria occurred worldwide and 660,000 death cases were reported in Africa alone according to the 7th President's Malaria Initiative (PMI) report of April 2013. Malaria remains the leading cause of morbidity and mortality in Kenya with close to 24 million of the population at risk of infection. Mbita Sub County has a malaria prevalence of 30% compared to 38% Nyanza and western Kenya. Outpatient health facility morbidity data in Mfangano Island shows that there were very high incidences of malaria reported in 2013 as compared to all other diseases reported in selected facilities. The purpose of this study was to investigate the influence of preventive strategies on malaria prevalence in Mfangano Island, Mbita Sub County. This study was guided by the following objectives: To examine how utilization of mosquito nets influence malaria prevalence among households in Mfangano Island, to assess the extent to which environmental hygiene influences malaria prevalence on households in Mfangano Island, to determine how malaria knowledge seeking behaviour influences malaria prevalence among households in Mfangano Island, and lastly to assess the extent to which malaria prophylaxis drug influences malaria prevalence among households in Mfangano Island, Mbita Sub County. The study had a target population of 9,873 and a sample size of 373 households. Data collection instruments used in this study were questionnaires and key informant interviews (KIIs). Questionnaires were administered to 373 household heads in Mfangano Island and 355 questionnaires were returned and analysed representing 95% return rates. Key informant interviews were used to collect qualitative data from 10 respondents chosen by purposive sampling technique. They were District Malaria Control Coordinator, District Disease Surveillance Coordinator, 2 Health facility in-charges, District Health Records Information Officer, 2 Community Health Extension Workers, Area Chief, Area assistant chief and a village elder. The instruments used were organized into sections intended to extract relevant information from the respondents according to the study objectives. The test retest technique was used to ensure reliability of research instruments while validity was ensured through pilot testing and reviews. Data obtained was cleaned, verified and analyzed by Statistical Package for Social Sciences (SPSS) version 20. The study findings indicate that 86.2% own mosquito nets. Among these, 78.9% have nets that are treated by a chemical. The findings on net utilization reveal that 76.6% use the net always as compared to 13.5% who use the nets occasionally and 2.5% do not use at all. Poor attitude at 67.6% was cited as one of the reasons why some people do not use mosquito nets and 14.4% of the respondents cited that the nets are stuffy. The study established that those who clear their compound occasionally had higher cases of malaria at 52% as compared to those who clear their compound 2-3 times a week at 21%. The study also established that health promotion is needed for knowledge dissemination about malaria prevention and behaviour change. The findings showed that only 9% of the responses were sure that malaria is contracted through a bite from a female anopheles mosquito. And on knowledge of malaria prevention, 83.1% cited using a combination of strategies, sleeping under a net, clearing of the compound, using mosquito coil and taking anti-malarial medicine while 17.9% advocated for either of the strategies. The study further established that most people at 58.3% buy antimalarial medicine as a preventive measure against suspected malaria. It was concluded that all the preventive strategies discussed have an influence on malaria prevalence in Mfangano Island. Results from correlations showed significant and positive correlations among variables under study. The researcher then recommended that malaria prevention require a multi-faced approach and that all preventive strategies should be employed together if malaria burden has to be reduced in Mfangano Island.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Malaria is a mosquito-borne disease caused by a parasite. People with malaria often experience fever, chills, and flu-like illness. Left untreated, they may develop severe complications and die. In 2010 an estimated 219 million cases of malaria occurred worldwide and 660,000 people died, most (91%) in the African Region according to the Presidential Malaria Initiative report of April 2013. The WHO has supported various interventions to prevent and treat malaria disease. Approximately 1.1 million lives have been saved, and malaria cases and deaths have sharply decreased—by 25% globally and by 33% in sub-Saharan Africa. However, malaria remains a major public health problem that is preventable and treatable (USAID, 2013).

The President's Malaria Initiative (PMI) is a U.S. Government initiative designed to cut malaria deaths in half in target countries in sub-Saharan Africa. It was announced on June 30, 2005, when President Bush pledged to increase U.S. funding of malaria prevention and treatment in sub-Saharan Africa by more than $1.2 billion over 5 years (FY2006-FY2010). In 2008, the Lantos-Hyde Act authorized an expanded U.S. Government malaria program for FY2009–FY2013. With the launch of the Global Health Initiative and a congressional authorization of extended funding, an expanded USG Malaria Strategy (2009–2014) was developed to achieve Africa-wide impact by halving the burden of malaria in 70 percent of most-at-risk populations in sub-Saharan Africa, or approximately 450 million people. The Global Health Initiative, announced by President Obama in May 2009, includes PMI and other U.S. global health programs in approximately 80 countries worldwide. PMI collaborates with these governments and agencies to conduct country needs assessments,

develop annual Malaria Operational Plans, participate in national malaria partner coordination mechanisms, and complement and expand on monitoring and evaluation strategies. PMI also works with non-governmental organizations (NGOs), including faith-based and community groups, academia, and the private sector.

Malaria is one of the oldest known pathogens. It began having a major impact on human survival about 10,000 years ago with the birth of agriculture. The development of virulence in the parasite has been demonstrated using genomic mapping of samples from this period, confirming the emergence of genes conferring a reduced risk of developing the malaria infection. The first treatment identified is thought to be Quinine, one of four alkaloids from the bark of the Cinchona tree. Originally it was used by the tribes of Ecuador and Peru for treating fevers. Its role in treating malaria was recognized and recorded first by an Augustine monk from Lima, Peru in 1633. Seven years later the drug had reached Europe and was being used widely with the name 'the Jesuit's bark'. From this point onwards the use of Quinine and the public interest in malaria increased, although the compound was not isolated and identified as the active ingredient until 1820.

The development of new anti- malarial drugs spurred the World Health Organization in 1955 to attempt a global malaria eradication program. This was successful in much of Brazil, the US and Egypt but ultimately failed elsewhere. Efforts to control malaria are still continuing, with the development of drug-resistant parasites presenting increasingly difficult problems. Anti-malarial drugs, in combination with mosquito control programs, have historically played a key role in controlling malaria in endemic areas, resulting in significant reduction of the geographic range of malarial disease worldwide. Over the years, however, the emergence and spread of drug-resistant parasites has contributed to a re-emergence of malaria, turning back the clock on control efforts. The need for preventive efforts for malaria campaign has become a critical priority on the global malaria research agenda (WHO, 2011).

In Africa, most of the rural areas do not have access to good health care systems. Usually there are no accessible roads to the health centers, which in turn are poorly equipped and have inadequate drugs for malaria treatment. Drug resistant malaria is common and anti malarial drugs is becoming less effective as the plasmodium parasite develops resistance to affordable drugs. This poses a serious threat to clinical management and treatment of malaria. People cannot afford anti-malarial drugs so they tend to self medicate with local herbs. Children wear little clothing during the day and at night due to heat and humidity, thus leaving their bodies exposed to mosquito bites. Rural dwellers cannot afford to purchase bed nets. Mud houses are poorly constructed and are surrounded by bushes. Water is collected from streams and wells and left standing in open clay pots since there are usually no running taps. This study, with this background in mind, seeks to explore ways through which malaria disease can be prevented as mosquito breeding points are eliminated (WHO, 2011).

Malaria is widespread in Ethiopia, with nearly 55 million out of the 83 million people being at risk of infection. In most areas of the country, malaria transmission is seasonal, from September through November, shortly after the main rainy season, and from April to May, after brief rains in March and April. However, malaria transmission is very low or nonexistent during the long dry season in most parts of the country. The two most important malaria parasite species in Ethiopia are Plasmodium Falciparum and Plasmodium Vivax, which account for 70% and 30% of all laboratory confirmed cases, respectively. The principal vector of malaria is Anopheles arabiensis, and most vector control activities are targeted against this species. The national malaria prevention and control strategy includes indoor residual spraying (IRS), environmental control use of long-lasting insecticide-treated nets (LLINs), and effective case management (WHO, 2011).

A study done in a neighbouring Rusinga Island, Mbita Sub County by Opiyo *et al* (2006) on community factors relevant for participatory malaria control, the authors proposed

that a community-implemented malaria control programme can only be successful and, even more importantly, sustainable if the community considers malaria to be one of their major problems and have the knowledge and skills to participate in its prevention and programme evaluation. This required community participation and change of behaviour, Opiyo *et al* (2006).

A study done in Mwea division, Kenya on the use of integrated malaria management to reduce malaria prevalence by Okech *et al.* (2008) found out the usage of a combination of malaria control tools in an integrated fashion by residents of Mwea division might have influenced the decreased malaria cases in the Kimbimbi sub district hospital and in the school children. A total of 389 households in Mwea division were interviewed in the KAP study while 90 houses were surveyed in the entomological study. Ninety eight percent of the households knew about malaria disease while approximately 70% of households knew its symptoms and methods to manage it. Ninety seven percent of the interviewed households went to a health center for malaria diagnosis and treatment. Similarly a higher proportion (81%) used anti-malarial medicines bought from local pharmacies. Almost 90% of households reported owning and using an insecticide treated bed net and 81% reported buying the nets within the last 5 years. The community also used mosquito reduction measures including, environmental management (35%), mosquito repellent and smoke (31%) insecticide canister sprays (11%), and window and door screens (6%). These methods used by the community comprise an integrated malaria management (IMM) package. Over the last 4 years prior to this study, the malaria cases in the community hospital reduced from about 40% in 2000 to less than 10% by 2004 and by the year 2007 malaria cases decreased to zero. A vigorous campaign emphasizing IMM should be adopted and expanded in other areas with different eco-epidemiological patterns of malaria transmission (Okech, *et al.,* (2008). This study sort to investigate the integrated approach to malaria prevention in Mfangano Island.

According to Kenya Demographic Health Survey (KDHS) report of 2008-9, Malaria is the leading cause of morbidity and mortality in Kenya, with close to 70 percent (24 million) of the population at risk of infection. Although malaria affects people of all age groups, children under five years of age and pregnant women living in malaria endemic regions are most vulnerable. The human toll that malaria exacts and the economic and social influences are devastating: sick children miss school, working days are lost, and tourism suffers. Malaria becomes a self-perpetuating problem, where the disease prevents growth of the human and economic capital necessary to bring the disease under control. Moreover, malaria disproportionately affects the rural poor who can neither afford insecticide-treated bed nets for prevention nor access appropriate treatment when they fall sick (KDHS 2008-9).

According to UNICEF, malaria continues to be the biggest killer of children in Kenya, with 44 per cent in under-five deaths from malaria in Nyanza province. It is a barrier to development, hampers children's schooling, reduces social development and is a major cause of poverty. The cost of malaria control and treatment drains African economies, slowing economic growth by about 1.3 per cent a year, UNICEF, (2013).

The Kenya Vision 2030 goal for the health sector is to provide equitable, affordable, quality health services to all Kenyans. The goal also aims to restructure the health care delivery system to shift the emphasis from curative to preventive health care. The goal of the second National Health Sector Strategic Plan (NHSSP II 2005–2010) is to 'reduce health inequalities and to reverse the downward trend in health-related outcome and influence indicators' (Ministry of Health, 2004). Malaria prevention and control activities in Kenya are guided by the National Malaria Strategy (NMS) and the National Health Sector Strategic Plan 2005-2010. The NMS outlines malaria control activities based on the epidemiology of malaria in Kenya (KDHS 2008-9).

Malaria parasitaemia was measured in both KMIS 2007 and KMIS 2010 to assess the influence of malaria interventions. The results of this survey shows that children aged 5–14 years have the highest prevalence of malaria (13 per cent). The prevalence in children below five years increased from 4 per cent in 2007 to 8 per cent in 2010 which shows that the disease burden increases with age. Malaria prevalence is nearly three times as high in rural areas (12 per cent) as in urban areas (5 per cent). Mbita Sub County is among the Sub Countys in Nyanza with the highest rate of malaria prevalence, at 30% as compared to 38% prevalence in Nyanza and western regions (MOPHS, 2010). This is high compared to other zones with malaria prevalence being less than 5%. Malaria from *P. falciparum* is the leading cause of morbidity for residents in the area, accounting for 50% of all clinically diagnosed illness at the local health centre (Gouagna *et al.*, 2004).

According to the data found in outpatient morbidity forms in the health facilities in Mfangano Island, there are very high incidences of malaria reported in 2013. The data captured in MOH 705A shows the summaries for under fives while data summarized in MOH 705B indicates data for patients above five years . The confirmed cases are 61% for children under 5 years and 53% for those over 5 years when compared to all other diseases reported in the health facilities. Table 1 below illustrates the facilities and malaria outpatient morbidity in Mfangano Island before data collection was done.

Table 1 : The facilities & malaria outpatient morbidity rates

Major Health facilities in Mfangano Island	% malaria incidence rates for under 5 yrs	% malaria incidence rates for over 5 yrs
Soklo Health Centre (Mfangano South)	77%	82%
Sena Health Centre (Mfangano East)	48%	36%
Wakula Dispensary (Mfangano North)	52%	51%
Ugina Health Centre (Mfangano South)	65%	41%
Total %	61%	53%

Source: Kenya Health Information System (DHIS, 2013)

1.2 Statement of the Problem

Malaria is recognized as a health and socio-economic burden by the Government of Kenya. In 2010, clinically diagnosed malaria accounted for 34 per cent of outpatient hospital visits in Kenya (KMIS, 2010) and 50% in Mbita District Hospital (Gouagna *et al*, 2003). According to Multiple Indicator Cluster Survey conducted in Nyanza in 2011 by UNICEF, Malaria remains a leading cause of death in Nyanza province. The region shares the biggest burden of the 21,000 children under five years killed by malaria every year. The PS Ministry of Health quoted in the Star newspaper, remarked that there is a continued high prevalence of malaria in Nyanza province which is worrying and is a great concern to the Ministry of Public Health & Sanitation.

A study done by Mutero, (1998) on Malaria prevalence and use of self-protection measures against mosquitoes in Suba District, Kenya stated that Malaria prevalence and

status among other diseases were assessed using data from past parasitological surveys and hospital records of clinically-diagnosed cases. A short prospective survey was also carried out to determine the methods people used for self protection against mosquito bites. Malaria was the leading cause of morbidity, constituting 42-48% of all illnesses clinically diagnosed at two health centres over a two-year period. Malaria parasite rates in blood samples from people examined at 14 screening centres ranged from 24.4% to 99% over a distance of about 25 kilometres, (Mutero *et al*., 1998; Manda, *et al.*, 2007).

Malaria infection peaks in June, following the long rains and more steadily between September and February. The mean minimum and maximum daily temperatures are 17°C and 34°C, respectively. The mean annual rainfall is 700–1200 mm, primarily occurring during two rainy seasons, March to May and October to November. This climate sustains mosquito breeding resulting in increased intensity of malaria transmission (Gouagna *et al.*, 2003). Communities should employ several strategies to reduce mosquito transmission and breeding within the environment, all households' members need to sleep under treated mosquito nets, wear warm clothing at night among other preventive measures (KMIS, 2010). This study was intended to investigate how these preventive strategies influence malaria prevalence in Mfangano Island.

1.3. Purpose of the study

The purpose of the study was to investigate the influence of preventive strategies on malaria prevalence among households in Mfangano Island, Mbita Sub County.

1.4 Objectives to the study

The study sought to achieve the following objectives:

i. To examine how utilization of mosquito nets influence malaria prevalence among households in Mfangano Island, Mbita Sub County.
ii. To assess the extent to which environmental hygiene influences malaria prevalence among households in Mfangano Island, Mbita Sub County.
iii. To determine how knowledge seeking behaviour influences malaria prevalence among households in Mfangano Island, Mbita Sub County.
iv. To assess the extent to which malaria prophylaxis drug influences disease prevalence among households in Mfangano Island, Mbita Sub County.

1.5 Research Questions

The study sought to answer the following questions:

i. How does utilization of mosquito nets influence malaria prevalence among households in Mfangano Island, Mbita Sub County?
ii. To what extent does environmental hygiene influence malaria prevalence on households in Mfangano Island, Mbita Sub County?
iii. How does knowledge seeking behaviour influence malaria prevalence among households in Mfangano Island, Mbita Sub County?
iv. To what extent does malaria prophylaxis influence disease prevalence among households in Mfangano Island, Mbita Sub County?

1.6 Significance of the Study

It is anticipated that this study has brought out the use of multiple or integrated malaria preventive strategies on malaria prevalence among households in Mfangano Island. It is hoped that the results of this study will help consultants/researchers and policy operators in

the health sector to understand the influence these preventive strategies employed together have on malaria prevalence in Mfangano Island. Although the use of ITNs alone has been shown to reduce morbidity and mortality due to malaria, it is now clear from the findings that other strategies like antimalarial medicines and environmental management need to be factored in as was also found in the studies done by Okech, (Okech, *et al.*, 2008). It is also hoped that the results of this study will be adopted by the ministry of health and partners in formulating implementation strategies to curb malaria in the future in this region.

1.7 Basic Assumptions of the Study

The study assumed that the respondents who took part in the study gave truthful and accurate information when answering the questions. The study also assumed that the respondents who answered the questionnaires have been using multiple malaria preventive strategies.eg. The people using ITNs were the same ones who also kept their environment clean and took antimalarials as preventive measures. Finally, the sample chosen for this study was assumed to be a fair representation of the Island.

1.8 Limitations of the Study

The study had the following limitations: The analysis of the study depended only on the responses of the respondents interviewed. Three hundred and fifty five (355) household heads were interviewed and their results form the basis of this report. These findings are limited only to the area under study and cannot be generalized to the entire country.

1.9 De-limitation of the Study

The study was de-limited to Mfangano Island, Mbita Sub County and for this reason; the findings of this study cannot be used for generalization in all parts of Kenya. Instead, the findings are only relevant to Mfangano Island, Mbita Sub County. The Mbita Sub County is one of the focal points identified as a high vector transmission area in Kenya, and more than

50% of the population is exposed to ≥40% *Pf*$PR_{2–10}$ (*Plasmodium falciparum* parasite rate corrected to a standard age-range of 2 to less than 10 years old, (Noor, *et al.,* 2009).

Mfangano Island is one of the highly malaria endemic areas in western Kenya. Mfangano Island lies in the eastern part of Lake Victoria, at the mouth of the Winam Gulf part of Kenya, it lies west of Rusinga Island. The island is 65 km² in area and rises to 1,694 m at Mount Kwitutu. It had a population of 45,693 as of 2009 census of population. Mfangano Island falls in the following Latitude**:** 0° 28' 36" S and Longitude: 33° 57' 29" E. The mean minimum and maximum daily temperatures are 17°C and 34°C, respectively. The mean annual rainfall is 700–1200 mm, primarily occurring during two rainy seasons, March to May and October to November. This is the climate that is conducive for breeding of mosquitoes. (DOMC & Gouagna, *et al.*, 2003).

1.10 Definition of operational variables

Preventive strategies: These are ways employed to prevent mosquitoes from transmitting malaria disease to the target population.

Malaria: This is a disease caused by a bite from a female anopheles mosquito carrying plasmodium falciparum parasites from one infected partner to another.

Malaria prevalence: These are the reported cases of malaria per household in a given period like one to two weeks.

Environmental hygiene: These are strategies used to make the areas where people live free from mosquito breeding and habitation. It involves clearing of the compound, spraying of the houses and the surrounding bushes and general cleanness.

Malaria Knowledge seeking behaviour: These are ways that people employ to protect themselves from malaria. It also involves where people get such knowledge and information on Malaria prevention.

Malaria prophylaxis drugs: These are preventive drugs taken before one goes on a malaria prone area and/or drugs taken when one feels s/he has fever.

Mosquito treated nets: These are nets used to protect oneself against mosquito bites at night. They are two types: Insecticide treated nets (ITN) which are nets treated by dipping in a recommended insecticide and Long Lasting Insecticidal Nets (LLINs) which are factory treated.

1.11 Organization of the Study

The study is organized into five chapters; chapter one basically gives the introduction and describes the background of the study, statement of the problem, purpose of the study, objectives to the study, research questions, significance of the study, basic assumptions of the study, limitations of the study, delimitations of the study and definition of operational variables used in the study. Chapter two provides a review of literature related to the study thematically as per the research objectives, the theoretical frame work, the conceptual framework as well as the summary of literature review. Chapter three focuses on the research methodology discussed under the following sub-headings; research design, target population, sample size, sample selection, research instrument, pilot testing of instrument, validity of research instrument, reliability of research instrument, data collection procedures, data analysis techniques and ethical issues in research. Chapter four entails data presentation, analysis, interpretation and discussion where as chapter five consists of summary of findings, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature related to the study based on the following thematic areas; the influence of utilization of mosquito nets as a component of malaria preventive strategy on the prevalence of malaria disease; the influence of environmental hygiene as a component of malaria preventive strategy on the prevalence of malaria disease; the influence of Malaria knowledge seeking behaviour on the prevalence of malaria disease among households; and the extent to which Malaria prophylaxis drug as a malaria preventive strategy influences the prevalence of malaria disease among households.

2.2 Utilization of Insecticide Treated Nets (ITNs) and Malaria Prevalence.

An insecticide-treated net is a mosquito net that repells, disables and/or kills mosquitoes coming into contact with insecticide on the netting material. There are two categories of ITNs: conventionally treated nets (ITNs) and long-lasting insecticidal nets (LLINs): A conventionally treated net is a mosquito net that has been treated by dipping in a WHO-recommended insecticide. To ensure its continued insecticidal effect, the net should be re-treated after three washes, or at least once a year. A long-lasting insecticidal net is a factory-treated mosquito net made with netting material that has insecticide incorporated within or bound around the fibres. The net must retain its effective biological activity without re-treatment for at least 20 -WHO standard washes under laboratory conditions and three years of recommended use under field conditions (WHO/CDS/WHOPES/GCDPP/2005).

All mosquito nets act as a physical barrier, preventing access by vector mosquitoes and thus providing personal protection against malaria to the individual(s) using the nets. Pyrethroid insecticides, which are used to treat nets, have an excito-repellent effect that adds

a chemical barrier to the physical one, further reducing human–vector contact and increasing the protective efficacy of the mosquito nets. Most commonly, the insecticide kills the malaria vectors that come into contact with the ITN. By reducing the vector population in this way, ITNs, when used by a majority of the target population, provide protection for all people in the community, including those who do not themselves sleep under nets (Binka *et al*., 1998 and Hawley *et al*. 2003). A recent study has shown that relatively modest coverage (around 60%) of all adults and children can achieve equitable community-wide benefits (Kellen *et al*., 2001). ITNs thus work in this case as a vector control intervention for reducing malaria transmission. ITNs have been shown to avert around 50% of malaria cases, making protective efficacy significantly higher than that of untreated nets which, under ideal conditions (such as those found in research settings), usually provide about half the protection of nets treated with an effective insecticide (Clarke *et al*. 2001)). In "real life" situations, the protective efficacy of untreated nets is significantly compromised by their poor physical condition. Currently, most mosquito nets are made of polyester and rarely last longer than 2–3 years under field situations. However, new technologies and materials such as polyethylene have been developed to produce nets that are stronger and longer-lasting.

Treated nets and window screening have long been considered useful protection methods against mosquitoes and other insects (Lindsay and Gibson, 1988). Nets reduce the human-vector contact by acting as a physical barrier and thus reducing the number of bites from infective vectors (Bradley et al., 1986). However, nets and screens are not well fitted or are torn, thus allowing mosquitoes to enter or feed on the part of the body adjacent to the netting fabric during the night. The problem of ill-used nets and screens provides one of the motives for impregnating them with a fast-acting insecticide that will repel or kill mosquitoes before or shortly after feeding (Lines *et al.*, 1987).

Over the past three decades, significant advances have been made in the prevention of malaria using ITNs and curtains. The treatment of nets has been made possible by the availability of synthetic pyrethroids which mimic the insecticidal compounds of the natural pyrethrum. They have low mammalian toxicity, are repellent, highly toxic to mosquitoes, and odourless, and have low volatility with consequent long persistence. Their development has led to treatment of nets as a method of vector control. The use of insecticide-treated nets (ITNs) has been shown to be an effective method of reducing severe malaria and when used by all or most members of the household may reduce malaria transmission. Scaling up the use of ITNs and protecting 80 percent of children under five and pregnant women against malaria in Africa by the year 2010 is one of the targets set at the Abuja summit by African Heads of State in 2000. In an effort to scale up the use of ITNs, different mechanisms of delivering ITNs to vulnerable groups have been used in Kenya. Delivery mechanisms used include routine clinic delivery, mass campaigns, retail social marketing, and the commercial sector.

The 2008-09 Kenya Demographic and Health Survey (KDHS) household questionnaire included questions on net ownership and re-treatment practices. The survey showed that 61 percent of Kenyan households own at least one net of any kind, and 36 percent own more than one net. This compares well with data from the 2007 Kenya Malaria Indicator Survey (KMIS) showing that 63 and 34 percent of households own at least one net and more than one net respectively (Island of Malaria Control, Ministry of Public Health and Sanitation, 2009). The country has witnessed an impressive rise in household ownership of ITNs. The 2008-09 KDHS shows that 56 percent of households have at least one ITN, up from 48 percent recorded in the 2007 KMIS and 6 percent recorded in the 2003 KDHS. Similarly, 32 percent of households own more than one ITN compared with 23 percent in 2007 and only 3 percent in 2003. The 2008-09 KDHS indicates that households in urban areas are slightly more likely to own an ITN (58 percent) than those in rural areas (55 percent). There are

greater variations in ownership of ITNs regionally. Whereas 77 percent of households in Nyanza province own at least one ITN, only 33 percent of households in Central province do so.

A study done in Makueni, Kenya on ITNs use among caregivers of under 5s by Malusha *et al* (2009) discovered that Insecticide treated nets is a key strategy in addressing malaria problem among young children and pregnant women. Their utilisation of ITNs among under-fives, however, has been found to be low in some areas. The results indicated that 88.5% of caregivers were aware of ITNs. The proportion of households with children below five years that owned mosquito net were found to be 46.2%, and only 32.0% had at least a treated net. The conclusion was that the Utilisation of ITNs by under fives was low despite high level of awareness among caregivers. Factors such as awareness of ITNs, marital status and occupation significantly affected ITNs utilisation. Although the government with support from other stakeholders has recently embarked on large scale distribution of nets in high risky Sub County's, more interventions from various stakeholders are needed to increase availability and accessibility of subsidised permanently treated nets, including interventions to address non-compliance to proper utilisation of nets. There is also need for intensive education emphasising on their proper and consistent use. Scaling up proper use of ITNs along with other initiatives can contribute significantly in reducing malaria (Malusha *et al.*, 2009). It is because of this that this study seeks to explore the influence of ITNs use on malaria prevalence in an island that is prone to malaria disease; both children and adults die of this disease every year.

A research study done in a neighbouring Rusinga Island in Mbita Sub County by a leading researcher in ICIPE, Dr. Weckenbrock Phillip (2004) on livelihoods, vulnerability and the risk of malaria in Rusinga Island showed that there needs more research especially in malaria preventive strategies as many people own mosquito nets but few people use them for

sleeping under as many others use the nets for other purposes. He proposes further research on fatalism that people seem to have on the preventive strategies. "...about one third of the participants who said they knew about the protection offered by bed-nets stated that they did not use one themselves…" (Weckenbrock, 2004). This begs the question why didn't they use the bed-nets when they had the knowledge? Another study done by Opiyo *et al* (2006) in the same Island had similar results. She reported that the majority of interviewees had a good theoretical knowledge of how to prevent malaria, with bed-nets most frequently mentioned. Notably, clearing vegetation was the second most common method which community members believed to be useful to prevent malaria (Opiyo *et al* (2006)). This study will illucidate whether this is the case in Mfangano Island but Opiyo also found out that knowledge of malaria prevention was high in those respondents with higher level of education.

2.3 Environmental Hygiene and Malaria Prevalence.

Environmental hygiene is a normal cleaning of the environment to remove bushes, clay pots, water points, etc that can enable mosquitoes to breed. It is also spraying of the compound, houses – IRS-indoor residual spraying-done in some part of the country. It is the normal way of preventing the people from being bitten by mosquitoes. The heavy burden of malaria in rural Africa is testimony to the ability of natural breeding sites to sustain vector populations. Natural breeding sites, although less common in rural areas, are nevertheless present. Field studies suggest that anopheline larvae are most likely to be found in permanent, shallow, sunlit pools of water of perimeter greater than 10 meters (Matthys, *et al*., 2010, Nkondjio *et al.,* 2011). Temporary pools are less favoured because they may not provide sufficient time for eggs to develop and emerge as adults. It has also been suggested that they are more likely to be disturbed by human activity.

A study done in Rusinga Island, Mbita Sub County by Opiyo (2007), the results showed that bush clearing was the second most common method that community members practiced (492/1,451) as a malaria preventive strategy; 51% defined bush clearing as cutting down all the vegetation on the compound and burning it, 46% only slashed grass and 3% characterised it as collecting vegetation and empty containers from the surroundings. 56% of respondents said they cleared the bush in the last month. The activity was predominantly implemented by men. Of the 492 respondents that practiced bush clearing, 20% believed that bushes and other vegetation served as larval habitats for mosquitoes and 80% believed that mosquitoes hide in vegetation and can be prevented from entering the compound by removing it (Opiyo *et al.,* (2007).

According to Dongus *et al.,* (2009) a high groundwater table is particularly conducive to breeding sites as the absence of surface runoff allows pools of stagnant water to develop. Coastal Environments Malaria in coastal African cities has been partially attributed to the colonization of shallow salt waters by An. Melas—a less efficient, salt-water-breeding vector species (Akogbeto *et al.,* (1991), Wang *et al.,* (2006)). Clay soils of lagoons have also been noted for collecting stagnant water, providing excellent aquatic conditions for vectors species, with studies in Cote d'Ivoire and Tanzania documenting strong correlations between the presence of clay soil and anopheline mosquitoes (Dongus, *et al*.,2009). Rivers and their floodplains provide great breeding grounds for mosquitoes in riverside urban communities, as demonstrated by the strong association between malaria risk and proximity to a floodplain. Large fields with loamy/clay soils tend to collect stagnant water from rivers and provide optimal conditions for anopheline breeding (Castro *et al,* (2010). In Adama, Ethiopia, for example, households within 250 m of a floodplain have been shown to have a 22 times higher risk of contracting malaria than households further than 950 m away (Peterson *et al.,*2009). In most cases, human activity is associated with a setting that creates fertile conditions for

vector breeding. For example, farms around the confluences of the Blue and White Nile in Khartoum, Sudan, are foci of malaria transmission, as are irrigated rice fields in Dioro, Mali, alongside the Niger River P. (Ceesay, Bojang, Nwakanma, *et al.*,2012).

Altitude also plays an important role in limiting malaria in the tropical highlands by negatively influencing the development of vector species. In a study of malaria prevalence in south-western Uganda, altitudes higher than 1,500 m were shown to be associated with low malaria risk (De Beaudrap, Nabasumba, Grandesso *et al*.2011); however, the presence of vector species at these altitudes cannot be ruled out since a study in the Kenyan highlands revealed high densities *of An. gambiae* mosquitoes in a town at an altitude of 1,650 m above sea level (Omlin *et al*., 2007).

It is widely regarded that artificial rather than natural vector breeding sites provide the most abundant sources of mosquito larvae in African urban centres (Siri, *et al*, 2010). Modern agriculture was the most cited breeding site in the literature search, followed by drains/gutters, ditches, tyre tracks, and water pipes. Also mentioned were water tanks, construction sites, and swimming pools. Some of these sites, such as tyre tracks and swimming pools, were found to contain all life stages of *An. gambiae,* suggesting that they were particularly productive habitats (Impoinvil, *et al*.,2008) and were found mainly in poorly-drained, peri-urban areas (Keating, Macintyre, Mbogo *et al*,2003). Modern agriculture has become commonplace in sub-Saharan Africa, expanding into the peripheral belts and centres of many towns and cities (Fournet, Cussac, Ouari *et al*, 2010). Its benefit is that it increases food security while combating malnutrition and poverty; however, it also provides optimal conditions for vector breeding, leading to a higher risk of malaria transmission in its vicinity (Yadouléton, N'Guessan, Allagbé *et al*.2010). Agricultural trenches create ideal breeding sites due to the formation of shallow water between seed beds and, in one study in Abidjan, Cote d'Ivoire, *anopheline larvae* were present in over half (Matthys *et al*. 2010,

Nkondjio *et al* 2011). In another study in Cote d'Ivoire, rice fields were found to have the highest likelihood of anopheline presence throughout both wet and dry seasons (Matthys, N'Goran, Koné *et al.*2006). Other breeding sites include irrigation wells, non cemented wells, ditches for furrow systems, and human footprints (Machault, Vignolles, Pagès *et al*., 2010).

Larger breeding sites are more productive as they are less likely to be disturbed by irrigation. Higher mosquito densities naturally lead to elevated levels of malaria transmission for people who either work on or live near urban agricultural fields (Machault, *et al*.2003). For example, in a study in Maputo City, Mozambique, malaria *parasitaemia* was found to be higher among those who worked in rural agricultural areas throughout the city, irrespective of other factors such as urban or peri urban location (Macedo de Oliveira, Mutemba, and Morgan, 2003). Modern agriculture is often associated with socioeconomic advantages, such as piped water, refuse collection, a sewage system, and better education. However, data from Accra, Ghana, suggests that the increase in vector breeding sites is sufficient to counteract these beneficial effects in terms of malaria transmission (Stoler, Weeks, Getis, and Hill, 2009) There are currently no known initiatives in place for controlling malaria associated with modern agriculture, and control here should be mindful of socioeconomic considerations.

While agriculture provides the most productive urban vector breeding sites, drains and ditches may provide more habitats that are common. In a study in Dar es Salaam, Tanzania, there were three times more *anopheline-positive* drains and ditches compared to agricultural breeding sites, and *anopheline* presence was much more likely in drains that were blocked (Castro *et. al*, 2010). Blockages are often due to poor sanitation and lead to reduced water flow and accumulation of stagnant water pools that are ideal for mosquito breeding. In Malindi, Kenya, tyre tracks were the second most-cited artificial vector-breeding site. They accounted for as much as 29% of all water bodies that were positive for mosquitoes

(Impoinvil, Keating, Mbogo, Potts, Chowdhury, and Beier, 2008) Tyre tracks are more common in areas of high socioeconomic status, which tend to house more vehicle owners while still having roads of sufficiently poor quality to lead to the formation of potholes, tyre tracks, and other artificial breeding sites. In the same study in Malindi, unused swimming pools were found to provide a particularly productive habitat for Anopheles immature stages. Of the 250 habitats identified in the study, 66 were swimming pools, which were found to have the highest abundance of Anopheles mosquitoes. Hotel workers, tourists, and domestic workers may be at heightened risk of malaria transmission in areas with an abundance of unused pools.

Water pipes can lead to breeding site formation in a variety of ways, most frequently when they are broken and pools of water collect (Donnelly *et al*, 2008). Pipes often break as a result of poor installation or quality, clay soil expansion and contraction, construction work, and as an opportunity to procure free water for sale or consumption (Himeidan and Rayah, 2008). Water sources that are further away from pipes are more likely to be anopheline positive because water flow from nearby pipes may disturb the water surface, reducing the breeding site quality .Artificial water storage containers can also serve as breeding sites, and car washing has been found to provide excellent habitats for larval development (Keating, *et al*., 2003).

A study done in a neighbouring Rusinga Island by Opiyo *et al* (2006) showed that despite that there was a very good knowledge in the community that the removal of water containing borrow pits protects from malaria, a fact recently highlighted with particular strength in nearby areas nobody actually practiced this. Notably, 13% of all respondents did nothing to prevent malaria, Opiyo *et al* (2006).

This study will be on the premise that, vector-borne anthroponoses such as malaria are more strongly affected by environmental factors influencing the abundance and survival of

the vector. The variety and magnitude of environmental influences on this vector-borne disease is enormous (Wilson, 2001). Not only do abiotic elements such as precipitation and temperature affect the abundance of mosquito vectors and the development of parasites within the vectors, but also biotic factors operating through deforestation, agriculture, and housing construction may influence vectorial capacity. The investigation sought to determine the influence of environmental hygiene, behavior and correlated nature of these environmental influences on malaria prevalence in Mfangano Island of Mbita Sub County.

2.4 Knowledge Seeking Behaviour and Malaria Prevalence

Malaria is a leading cause of death in children under the age of five years in sub-Saharan Africa (Rowe *et al*, 2001). The Roll-Back Malaria (RBM) initiative is working to improve prevention efforts in affected countries, through insecticide-treated nets (ITNs), indoor residual spraying (IRS) of pesticides, and intermittent preventive treatment (IPT) for pregnant women (WHO,2005). RBM also focuses on intervention efforts via effective anti-malarial regimens like artemesinin-based combination therapy (ACT), pre-empting epidemics in epidemic-prone areas, and improving home management of the disease. In Sub-Saharan Africa, ACT is currently the most effective treatment option, considering the current state of anti-malarial drug resistance with chloroquine and sulphadoxine-pyrimethamine (Coleman, Morel, Shillcutt, Goodman and Mills, 2004). In addition, artemether-lumefantrine is the now first-line treatment for malaria in Kenya (GoK, 2006) since many individuals in sub-Saharan Africa choose to treat malaria without visiting a medical facility, appropriate home management of malaria is vital to effective treatment of malaria.

A study done in Rusinga Island, Mbita Sub County on malaria and vulnerability indicated that many people had knowledge that malaria kills and that bednets are used to protect against the disease but did not know about other strategies as much (55% of the participants interviewed). Awareness about other ways of protection apart from bednets was

relatively low. The study showed that doctors were the most common sources of malaria information, seconded by family members and neighbours. However the study observed that there are difficulties of access to information on malaria protection from books and IEC materials and the information about malaria prevention is passed from one person to another (Weckenbrock, 2004). In a different study in the same area, Opiyo (2007) added also that most respondents (70%) said they learned that clearing vegetation prevents malaria in school. Another important source of this information was national and international health care organizations like local extension workers of the Ministry of Health and NGOs, including CCF and UNICEF. Only a small number cited that they got information on malaria prevention from radio and newspapers.

A rapid treatment response is essential for effective home management. To this end, an understanding of treatment-seeking behaviour enables communities and the formal health care system to design interventions that cater to a specific population (Lindblad *et al*., 2000). Unlike the inhabitants of areas of high endemicity, populations in highland East Africa are prone to large-scale malaria epidemics and generally lack protective immunity. All age groups are prone to severe malaria and death (Deressa, 2007). Despite the resulting high case fatality rates characteristic of epidemics, malaria treatment-seeking patterns in epidemic-prone areas of Africa are not well studied, particularly among adults. Limited information on treatment-seeking behaviour and anti-malarial use hinders the evaluation and implementation of effective malaria prevention and treatment programmes (Yeung and White, 2005). Some research efforts have pinpointed the need to train drug retailers about appropriate dosages and drug regimens, thus increasing adherence to national recommendations in the community (Marsh *et al*., 2004). Other studies have used survey instruments to assess knowledge, attitudes and practices (KAP) and to characterize actions taken by primary caregivers during malaria infection.

The present study utilizes the latter approach to study treatment-seeking behaviour among both adults and caretakers of children in a highland, epidemic region in Kenya. According to Marsh *et al.,* (2004), one of the key strategic approaches outlined by the Kenya National Malaria Strategy (KNMS) is the improvement of malaria epidemic preparedness and response. With medical facilities, local shops and traditional healers available in Kenya, identifying where and how soon after individuals become symptomatic they seek treatment can help this community to identify current resource use. Financial and educational resources can then be better. Long-lasting insecticide nets (LLINs) are now entrenched as a major anti-malarial intervention. In most malaria-endemic countries > 50% of households own at least one insecticide-treated net (ITNs) (WHO, 2011). Despite this extensive coverage and use of ITNs over the last decade, their effective lifespan, and especially their physical integrity, is not well understood under true operational and varied epidemiological settings. While there is standard method of quantifying the number of holes in a bed net, lack of a standardized method to define a functional bed net in the field is an important limitation of studies evaluating the effectiveness of bed nets (Kilian *et al.*,2011).

Bed nets reduce human-vector contact by providing a physical barrier between the human sleeping under the bed net and the malaria vector mosquito. This protection is enhanced when the bed net is treated with an insecticide that deters, repels, or kills vectors that attempt to bite the sleeper. A bed net that has its mesh (the number of holes per square inch) intact will rarely allow mosquitoes to reach the person sleeping under the bed net However, with use bed nets accrue holes that are big enough to allow mosquitoes to pass through. Thus, a functional or useful net is one that is physically intact and has insecticidal protection. In addition to evaluating the physical presence (retention) of nets, it is paramount for malaria control programmes to also investigate the 'usefulness' of surviving nets (nets under routine use) (Kilian, 2010 and Noor, 2010). Following the free mass distribution of

bed nets in 2006, bed net ownership in Kenya has been sustained at very high levels. The distribution of free nets at maternal and child clinics to pregnant women and children under five years of age has been the primary approach through which most nets continuously get into the community. Secondary approaches include social marketing, where partial subsidy is offered, and *ad hoc* distribution by NGOs. Bed nets are also available through retail outlets at full cost for those who can afford them. Although the ownership situation continues to improve, the physical condition and maintenance behaviour of the nets in use is rarely evaluated and may undermine efforts to scale up ITNs. This study will identify the extent to which the use and availability of ITNs influence the prevalence of malaria in Mbita Sub County, Kenya.

Another study done by Opiyo *et al* (2007) in Rusinga Island on community factors relevant for malaria control concluded that

> *"...Community-based organizations and schools need to be equipped with knowledge through partnerships with national and international research and tertiary education institutions so that evidence-based research can be applied at the grassroots level."*

Opiyo et al (2007) quoting Chuma (2006) in a *malaria journal* 2006 **5**:76, stated that scientific knowledge was mixed with traditional knowledge in regard to malaria prevention in Rusinga Island, Mbita Sub County. The economic burden of malaria for households can be extremely high. Treatment costs for small-scale farmers in rural Kenya have been estimated to be as high as 7% of the monthly household expenditure, not considering any costs for prevention measures. Opiyo et al (2007). Rural areas have always been a major challenge for disease control worldwide, but the involvement and active participation of communities has been identified as a key factor for success in these environments Mutuku *et al* (2006). Alaai *et al* (2003) cited in Opiyo (2006) reports that while knowledge of prevention measures might be confounded by demographic variables like the age and education level of the respondent,

the actual usage of various methods might be decided by the household head and depend on the socio-economic status of the household (Alaai *et al* (2003).

2.5 Prophylaxis drugs and Malaria Prevalence.

The flow of international travellers to and from malaria-endemic areas, especially Africa, has increased in recent years. Apart from the very high morbidity and mortality burden imposed on malaria-endemic areas, imported malaria is the main cause of fever possibly causing severe disease and death in travellers coming from tropical and subtropical areas, particularly Sub-Saharan Africa. The importance of behavioural preventive measures (bed nets, repellents, *etc.*), adequate chemoprophylaxis and, in selected circumstances, stand-by emergency treatment may not be overemphasized.

Malaria prophylaxis is often discussed among travellers. Different recommendations are confusing. This is partially due to the availability of drugs in different countries and to the fact that few evidence-based data exist. Many factors influence the malaria risk. Travel style, duration and season of travel, the transmitting anopheline mosquitoes, the causative Plasmodia and resistance of the parasites against antimalarial drugs influence the recommendations. Malaria protection consists of various components. Exposure prophylaxis substantially reduces the risk of infection. Drugs for chemoprophylaxis and standby emergency medications are available in different countries.

The infected female Anopheles mosquito that inoculates Plasmodium sporozoites during blood feeding transmits malaria. They only feed during night (from dusk to dawn) when mosquitoes bite prevention is imperative (WHO, 1999). All travellers to high malarial risk areas should be adequately educated on personal preventive measures, including behavioural prevention (long sleeved clothes, covering trousers and shoes, sleeping in air-conditioned rooms), chemical prevention (repellents and insecticides), mechanic prevention (bed nets, window screens). Night hours are the target hours for protection against mosquito

bites. Covering clothes (long sleeved clothes and covering trousers, preferably white) or light colours are a barrier for mosquito bites (WHO, 1999). Kilan, (2010) adds that Insect repellents applied on clothing are effective for longer than they are on skin and extra protection is provided by treating clothing with permethrin or etofenprox. Feet should be protected by appropriate footwear and by tucking long trousers into the socks. It is also important to screen windows, to use air conditioners and to avoid staying close to freshwater pools and lakes.

Drug chemoprophylaxis has proved to be an effective preventive strategy in travellers to malaria endemic areas (Bodker *et al.*, 2003) both for *Plasmodium falciparum* and *non-falciparum* malaria, despite it does not usually prevent the later relapses that can occur with *P. vivax* and *P. ovale*. Drugs can act on different stages of the *Plasmodium* biological cycle, on the pre-erythrocytic liver forms (*causal* prophylaxis) and on the erythrocytic blood forms (*suppressive* prophylaxis) (Skovmand, 2010). Suppressive prophylaxis is mainly indicated for prevalent *P. falciparum* malaria areas, such as sub-saharan Africa. It is important to emphasize that no chemoprophylactic regimen confers complete protection and it must always be associated with primary prophylaxis aimed at avoiding mosquito bites. When drugs with exclusive suppressive activity are used, chemoprophylaxis must be continued for four weeks after the last possible exposure to account for pre-erythrocytic phase of the plasmodial cycle (Ndenga, 2006).

Studies have previously observed that anti-malarial drugs are bought from commercial pharmacists, street vendors, retail shops (e.g. grocery) or from licensed and unlicensed drug sellers. Additional studies also observed that most patients reporting at the health facilities would have at least gone through home-based treatment or local drug shops initially (Buabeng *et al.*, 2007) Hence, there is concern that household and communities' patterns of use of anti-malarial drugs are often inadequate and inappropriate depending on the

knowledge and behaviour adopted for use of other medicines, not only for malaria. It is upon this background that the current study on behaviours and knowledge determining the patterns of anti-malarial drug use among the residents of Mfangano in Mbita Sub County need to be carried out. This study sought to elucidate that malaria prophylaxis is a preventive strategy that has an influence in the prevalence of malaria disease among households in Mfangano Island, Mbita Sub County.

2.6 Theoretical Framework

The theory upon which this study is anchored is called The Health Belief Model. The Health Belief Model (HBM) was developed initially by Rosenstock (1966) and further by Becker and colleagues throughout the 1970s and 1980s in order to predict preventive health behaviour. Because of several criticisms, the theory has undergone various revisions and contributions to overcome the criticisms. Revisions by Becker and Rosenstock (1987), Rosenstock, Strecher, & Becker (1988) have played a major role in propounding this theory. Norman and Fitter (1989) are among those who have contributed to the development of this theory by supporting individual components of the model like screening.

This theory states that health-related action depends on the simultaneous occurrence of three factors: the existence of sufficient motivation (or health concern) to make health issues salient; secondly, the belief that one is susceptible to a serious health problem, that is a sense of a perceived threat; and third, the belief that following a particular health recommendation would be beneficial in reducing the perceived threat at an acceptable cost, that is the perceived barriers that must be overcome in order to follow the health recommendation.

Norman and Fitter (1989) examined health behaviour screening (for example breast cervical cancer) and found that perceived barriers (the costs of attending) were the greatest predictors of whether a person attended the clinic. Several studies have examined breast self-

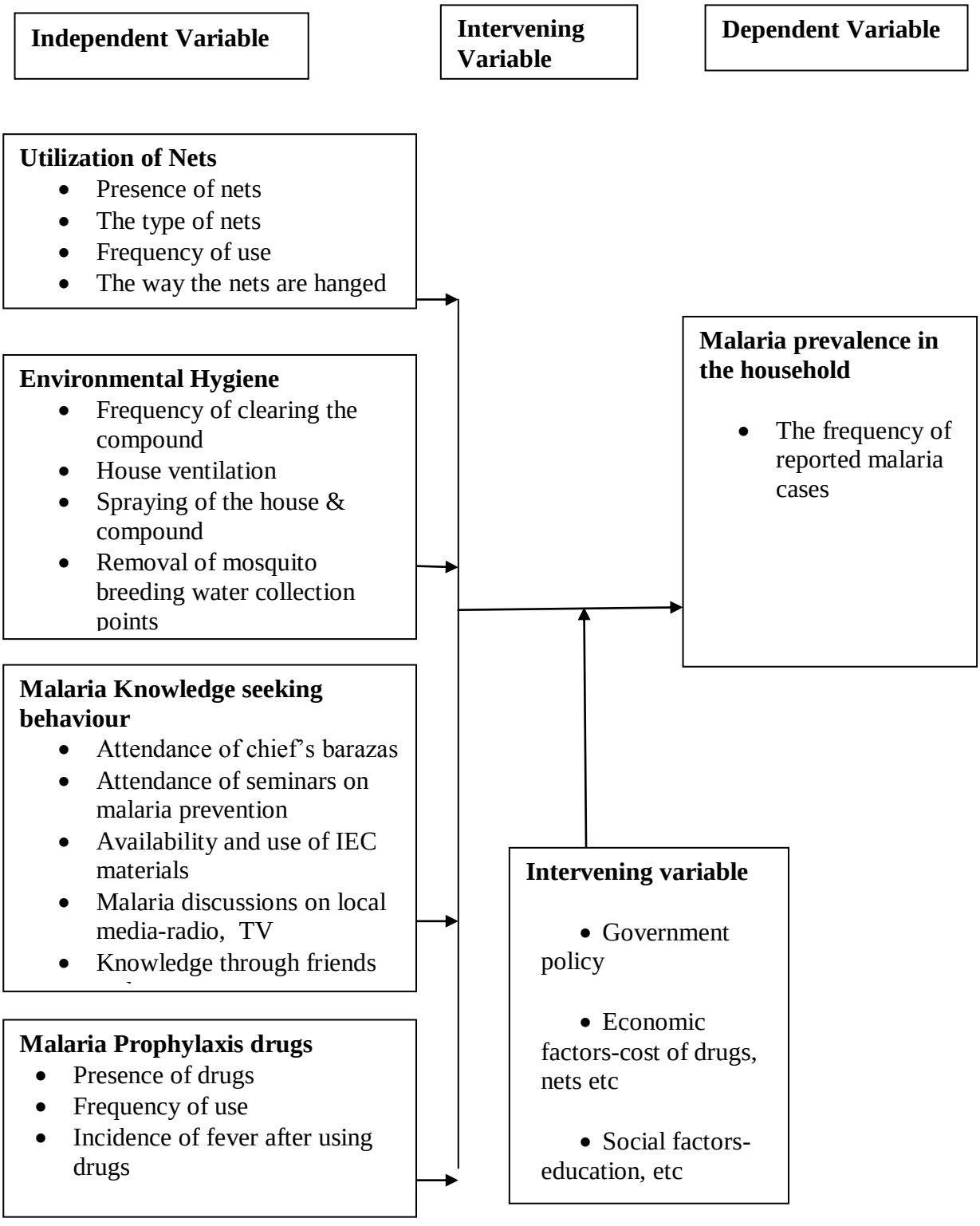
examination (BSE) behaviour and report that barriers (Lashley 1987; Wyper 1990) and perceived susceptibility (the likelihood of having the illness) (Wyper 1990) are the best predictors of healthy behavior.

This theory is relevant in this study in that information about the effects of not sleeping under ITNs has consequences and it helps people desire to have ITNs and sleep under them. Several studies report a significant relationship between people knowing about an illness and their taking precautions (Sutton 1982; Flay 1985). Rimer *et al.* (1991) reports that knowledge about breast cancer is related to having regular mammograms. Several studies have also indicated a positive correlation between knowledge about BSE (Breast Self-examination) and breast cancer and performing BSE (Alagna and Reddy 1984; Lashley 1987; Champion 1990). When people are informed about clearing of their compound to protect themselves against mosquitoes or to take malaria prophylaxis as a way to prevent Malaria, they will always give in for fear of the disease. Leventhal *et al.* (1985) have argued that health-related behaviour is related more to the way in which people interpret their symptoms (e.g. if you feel unwell and you feel it is not going to cure itself then you would probably do something about it).

2.7 Conceptual Framework

This is a schematic representation of variables showing how they relate and interact with one another.

Figure 1: Conceptual framework:



2.8 Summary of Literature

The literature summarized above has the potential of covering to a great extend the study. The literature has come from various research studies conducted under similar conditions, they are from journals, books, and published academic articles on health issues. The chapter was divided into different sub sections namely: the influence utilization of ITNs has on prevalence of malaria disease, the influence environmental hygiene has on prevalence of malaria disease, the influence knowledge seeking behavior has on prevalence of malaria disease, the influence of malaria prophylaxis drug on prevalence of malaria disease, theoretical framework and lastly the conceptual framework.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

The methodology elements are outlined in this section include the study design, the target population, the sample size and sampling procedure, data collection instruments, validity and reliability of the instruments, data collection methods, data processing and analysis techniques as well as ethical issues in research.

3.2 Research Design

The study used descriptive survey research design with both qualitative and quantitative approaches. Descriptive survey design is a method of collecting information by interviewing or administering questionnaires to a sample of individuals and is hence suitable for extensive research. It maintains a high level of confidentiality; it is convenient and enables data to be collected faster, enables questions to be asked personally in an interview or impersonally through a questionnaire about things which cannot be easily observed. It also gives the study an opportunity to get an accurate view of response to issues as well as test theories on social relationship at both the individual and group level (Kothari, 2004). Descriptive survey design is appropriate for this study because it enables the researcher to collect and analyze data using both qualitative and quantitative approaches.

3.3 Target Population

This study investigated the influence of preventive strategies on malaria prevalence among households in Mfangano Island, Mbita Sub County. Mfangano Island has a total of 9,873 households. The population breakdown per location, sub location and household is illustrated in Table 3.

Table 3 Population distribution by number of households and administrative units

LOCATION	SUB LOCATION	HOUSEHOLD
Mfangano North	Waware & Soklo	5573
Mfangano West	Wakula North & Soklo South	1872
Mfangano East	Wakinga	1086
Mfangano South	Wakula South	1342
TOTAL		**9873**

*Source***:** Kenya National Bureau of Statistics (2009)

3.4 Sample Size and Sampling Procedure

This section describes the sample size and sampling procedures employed in the study.

3.4.1 Sample Size

A sample is a sub group carefully selected so as to act as a representative of the whole population with relevant characteristics (Mugenda & Mugenda, 2008). Krejcie & Morgan, 1970 have developed a table of samples to determine the sample size in a given a population. Table 3, in appendix 3 below illustrates that the sample size for this study is 373 households, Krejcie & Morgan (1970).

3.4.2 Sampling Procedure

Sampling is a process of selecting subjects or cases in order to draw conclusions about an entire population. The cases selected form the units of observation in a study, Mugenda & Mugenda, (1999). In this study, both probability and non probability sampling were used. Probability sampling was used in the study because it provided an efficient system of capturing the variations that exist in the target population. A representative sample was

selected without bias from the target population to ensure that each member of the target population gets an equal and independent chance of being included in the sample.

The researcher used multi-stage cluster sampling and principles of systematic sampling methods. According to Mugenda & Mugenda (2003), Cluster sampling is used when it is not possible to obtain a sampling frame because the population is either very large or scattered over a large geographical area. The 4 locations in Mfangano Island fall in a very large geographical area with very bad terrain and other areas inaccessible. Multi-stage cluster sampling technique was used to select sub locations and villages in which questionnaires and KIIs were administered. In multi-stage cluster sampling, after locations were selected, sub locations and villages were also selected. This saved time and money, Oso & Onen, (2005).

In the first stage of sampling, Mfangano Island has 4 locations. The 4 locations were marked by a unique code and using ruffle method, 2 locations were picked to be included in the study. Mfangano South and Mfangano East locations were chosen. The number 2 was chosen based on the judgement of the researcher, (Oso & Onen, (2005).

In the second stage of sampling, the chosen 2 locations each had 1 sub location. Mfangano South had Wakula South sub location while Mfangano East had Wakinga sub location. And because there were no other sub locations to choose from, these sub locations were automatically chosen to form the sample.

In the third stage of sampling, the 2 sub locations picked have a list of villages each. All the villages under Wakinga sub location were listed 8 villages in all, using purposive sampling technique, 4 villages were randomly selected; the same was done to the villages under Wakula South sub location which had 16 villages, 8 villages were randomly selected to form the sample. The researcher purposively and randomly chose 12 villages which was 50% of the total villages in the 2 sub locations. (Oso & Onen, (2005). Table 5.2 in the appendix section shows the list of names of villages in Mfangano Island.

The principle of systematic sampling technique was employed after multi-stage sampling shall have been completed. According to Sekaran (2006), the systematic sampling design involves drawing every *n*th element in the population starting with a randomly chosen element between 1 and *n*. For this study a sample of 373 household heads were be sampled for the study. And dividing $^{373}/_{12}$, a sample of 31 household heads was interviewed from each village. The researcher chose the number 3 at random and so research assistants moved to every 3rd household for data collection in the following sequence 3rd, 6th, 9th, 12th and 15th and so on until all the 31sampled households were completed in one village. To choose the first household with which to start the survey, the researcher went to the centre of the first randomly selected village after which he spun a bottle on the ground to determine the first household. The household at which the bottle stopped spinning while facing was the first one to be sampled. The same was repeated in other villages until all the villages were sampled.

Non probability sampling was used to capture qualitative data provided during key informant interviews. Purposive sampling technique was used for the Key Informant Interviews (KIIs). 10 key informants were selected, people who were able to provide the desired information. They included the District Malaria Control Coordinator, The District Disease Surveillance Coordinator, and The District Health Records Information Officer, 2 hospital facility in-charges drawn from the 2 sub locations sampled, 2 Community health extension workers drawn from the 2 sub locations; one area Chief and one area Assistant chief. Their perceptions and knowledge of preventive strategies was sort after to verify and confirm the data from the household questionnaires.

3.5 Research Instruments

The research instruments used were questionnaires and Key Informant Interviews (KIIs) schedules. A questionnaire is a research instrument that is used to gather data over a large sample and diverse regions. It upholds confidentiality, saves time, and has no

interviewer bias (Kombo and Tromp, 2006). Primary data were sourced through administration of questionnaires to household members in Mfangano Island. The sets of questionnaires and KIIs were designed on the basis of the study objectives and research questions. The KIIs were used to collect qualitative data from the key public health officers, health workers, and provincial administration officials cited above. The Key Informant Interview (KII) involved talking to the District Malaria Control Coordinator, the District Disease Surveillance Coordinator, the District Health Records Information Officer, hospital facility in-charges, Community health extension workers and the provincial administration for their knowledge on the topic of research. KII was used because it enabled the researcher to get information from individuals who were considered particularly knowledgeable on the topic of the study. It also allowed a face to face interaction which permitted the researcher to seek new insights, ask questions, and assess phenomena in different perspectives.

The questionnaire comprised closed-ended questions and a few open ended questions. Closed ended questions were included because they are easier to administer and analyze. Open ended questions were included because they allowed the subjects to respond to questions in their own words and provide more detail. The questionnaires were organized into sections intended to extract specific information from the respondents. The first section sort to obtain information related to demographic characteristics of respondents, second section sort to address questions related to influence of mosquito nets on the prevalence of malaria disease, section three addressed questions related to influence of environmental hygiene on malaria prevalence, section four captured information pertaining to the influence of malaria knowledge seeking behaviour on the prevalence of malaria and finally section five contained questions addressing the influence of malaria prophylaxis drug on the malaria prevalence.

3.5.1 Pilot testing of the Research Instruments

Pilot testing involves conducting a preliminary test of data collection tools and procedures to identify and eliminate problems to allow corrective changes or adjustments before actual data collection. Pilot testing for this study was conducted in Mfangano North location using convenience sampling technique and simple random sampling method. Convenience sampling is a sampling technique in which the researcher selects a sample from units that happen to be available at the time of data collection, usually on a first come first served basis until the desired sample size is attained. The researcher collected data at the spur of the moment by taking advantage of the households whose members were available at the time, Oso & Onen (2009). A pre test sample of a 10^{th} of the sample respondents with homogenous characteristics was appropriate for the study according to Mugenda & Mugenda (1999). Using a simple random sampling technique, 22 people were selected from Mfangano North to take part in the pilot study. This was a 10^{th} of the sample of 218 participants from Mfangano North location. It was done in one day and corrected a few discrepancies and ambiguities found in the instruments and corrective measures were made and final questionnaires generated for the study which were believed to be reliable.

3.5.2 Validity of the Research Instruments

According to Mugenda (2008), reliability and validity refers to the quality and trustworthiness of data. Dooley (1996) further defines validity as the extent to which the study instruments captured what they purport to measure. The validity of the instruments was ascertained by the pilot test. This ensured that the instructions are clear and all possible responses to a question are captured. Content validity of a measuring instrument is the extent to which it provides adequate coverage of the investigative questions guiding the study (Mugenda, 2008). In this study, content validity was determined by consulting the judgment

of research supervisors within the university. The Researcher reviewed the instruments and sought opinions of the University supervisors to recommend for improvements and verify whether the instruments adequately addressed the objectives of the study and answer the research questions.

3.5.3 Reliability of the Research Instrument

Reliability refers to how consistent a research procedure or instrument is (Kasomo, 2006). It therefore means the degree of consistency demonstrated in a study. Polit & Hungler (1993:445) refer to reliability as the degree of consistency with which an instrument measures the attribute it is designed to measure. It therefore means the measure of degree to which research instruments yields consistent results or data after repeated trials. The test re-test method was used to assess the reliability of the instruments. This involved administering the same questionnaires twice to household respondents in Mfangano North Location at a period interval of two weeks and correlating their responses independently. After administering the questionnaires, a correlation co-efficient was calculated using appropriate formula to establish the relationship between the two set of scores.

Spearman's Brown Prophecy formula was applied as shown below:

$$\text{Reliability of the entire test} = \frac{(\text{Reliability of 0.5 test})\,(r)}{1 + (\text{Reliability of 0.5 test})\,(r)}$$

Where r, is Coefficient of correlation

A correlation test was run on responses to the four major study variables questions and an average coefficient of correlation of r = 0.81 was obtained. This indicated that there was a strong and positive correlation on the two sets of data from Mfangano North location and a confirmation of the reliability of the research instruments.

3.6 Methods of data collection

The data was collected by research assistants who directly administered questionnaires to respondents in there households. The research assistants were trained on the procedures for administering the questionnaires and on the necessary ethical issues involved in research. Field supervisors checked, clarified and verified the data collected for completeness and accuracy. The KII were done personally through in-depth face to face questioning sessions by the researcher. All filled up questionnaires were reviewed on a daily basis to ensure accuracy and completeness by the researcher.

Primary data was generated from scrutiny of house hold members attributes relating to the influence of preventive strategies on malaria prevalence in Mfangano Island, Mbita Sub County. Secondary data was obtained from the intensive literature search generated from the academic papers, journals and the internet. The District Health Records Information Officer provided data on the malaria prevalence for the facilities in the last quarter.

3.7. Methods of data analysis

Data analysis is a process of modelling or manipulating and transforming data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making. According to Bryman and Cramer (2008), data analysis seeks to fulfil research objectives and answer research questions. For the purposes of this study, data analysis involved field editing before bringing the instruments together in order to reduce on errors and ensure that all instruments have all the required information.

For analysis of closed-ended questions, Statistical Package for Social Sciences (SPSS) version 20 was used. Data was analyzed by descriptive statistics. Frequency tables and percentages were generated. Qualitative information obtained through open ended sections of the questionnaire was summarized into study briefs. For inferential statistics, Pearson's correlation coefficient was used. This was followed by content analysis and description of the

responses to produce finding reports. Data from Key Informant Interviews (KIIs) were analysed to triangulate and confirm the findings from the household questionnaires.

3.8 Ethical Issues in Research

Attention was paid to the principle of voluntary participation and the requirement of informed consent was upheld throughout the study period. Essentially therefore, prospective respondents were fully informed about the purpose of the study and their consent to participate sought through verbal consent before administering the questionnaires and KIIs. Issues of confidentiality of the information generated were dealt with through assurance to the respondents. Research Assistants were trained on ethical issues in data collection. Issues of confidentiality were highly upheld.

Permission to proceed to the field and collect data was sought from the national council of science and technology after presentation and approval of the research proposal before panellists in the School of Continuing and Distance Education- University of Nairobi, Kisumu Campus. The necessary letters and permits were obtained from the University of Nairobi. Permission was sought and granted by the Mbita Sub County Medical Officer of Health and the Provincial Administration in Mfangano Island.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSIONS

4.1 Introduction

This chapter presents the data, analyzes the data and interprets the findings of the study. The presentation, analyses interpretation and discussions of the findings are in accordance with the four major objectives of the study, to examine how utilization of mosquito nets influence malaria prevalence among households in Mfangano Island, Mbita Sub County, to assess the extent to which environmental hygiene influences malaria prevalence among households in Mfangano Island, Mbita Sub County, to determine how malaria knowledge seeking behaviour influences malaria prevalence among households in Mfangano Island, Mbita Sub County and to assess the extent to which malaria prophylaxis drug influences malaria prevalence among households in Mfangano Island, Mbita Sub County.

4.2 Questionnaire response rate

The response rate for the questionnaire was worked out and results were as shown:

Table 4.1 Questionnaire response rate

Sample size	**Respondents reached**	**Percentage**
373	355	95

The response rate shows that out of the 373 respondents in the main sample, 355 were reached and their questionnaires completed for analysis. This represented a response rate of 95%. A response rate of 50% is considered adequate for analysis and reporting, 60% is good and that of 70% and above is very good, (Mugenda and Mugenda, 2003). This response rate

confirms the MICS survey response rate that was done by UNICEF in Homabay County that stated over 95% response rate in rural areas, (MICS, 2011). This shows that many people in rural areas like Mfangano respond positively to the surveys when researchers come to their doorstep.

4.3 Reported cases of malaria in the household

To determine the malaria prevalence rate of the respondents in Mfangano Island, the respondents were asked whether they have been diagnosed and tested for malaria in the past 2 weeks. The reported cases of malaria were correlated with other independent variables to determine the relationship that exists among the variables under study. The responses of the reported cases are illustrated in table 4.2:

Table 4.2 Reported cases of malaria in the household in the past 2 weeks

	Frequency	**Percent**
Yes	102	28.7
No	253	71.3
Total	**355**	**100.0**

The findings show that 102 (28.7%) of the respondents have been diagnosed and treated for malaria in the past 2 weeks while 253 (71.3%) did not experience malaria incidences. Similar results were reported by Zama, (2013) in a study done in Nigeria on the prevalence of parasitaemia levels in adults which showed the positivity rates at 32.5% and 67.5% negative cases, (Zama, *et al.,* 2013). The results also were similar to a study conducted in Ethiopia by Ferede, (2013), where a total of 55,833 patients were examined for malaria; of these, 9486 (17%) study subjects were positive for malaria while 83% were negative, (Ferede, *et al.,* 2013). These findings can be attributed to the malaria knowledge that most respondents possess on prevention and always discuss with their family members

(60.3%), and with friends and relatives (24.5%). The results can also be attributed to the fact that the government rolled out mass net distribution in most villages in Nyanza and Western and so most people (76.2%) sleep under mosquito treated bed nets. The results are lower than the recorded Nyanza Province's average malaria prevalence rate of 38%, which can also be interpreted that the various interventions rolled out by the government as outlined in the National Malaria Strategy (2009-2017) has some positive effects in the community, (KMIS 2010).

4.4 Demographic characteristics of the respondents

The demographic characteristics considered during the study were age, sex, level of education, occupation and household members. Decision making on the use of any preventive measure is determined by these demographic factors.

4.4.1 Age of the respondent in completed years

The study sought to establish the age distribution of the respondents who were interviewed in order to determine variations in their ages so as to inform future studies and interventions of the most vulnerable age group to be considered with different preventive strategies in the Island. The respondents were required to indicate their age and the results were as shown in table 4.3:

Table 4.3 Distribution of respondents by age

Age of the respondent	Reported cases of malaria in the past 2 weeks		Total
	Yes	**No**	
18-25	48 (13.5%)	31 (8.7%)	79 (22.3%)
26-35	68 (19.2%)	86 (24.2%)	154 (43.4%)
36-50	33 (9.3%	46 (13.0%)	79 (22.3%)
over 50 years	13 (3.7%)	30 (8.5%)	43 (12.1%)
Total	**162 (45.6%)**	**193 (54.4%)**	**355 (100.0%)**

Of the respondents, majority (154) 43.4% were between age brackets of ages 26 and 35, (79) 22.3% were between age brackets of 18 and 25 while (79) 22.3% were of age bracket of 36 and 50 years. (43) 12.1% were over 50 years of age. On the malaria prevalence determined by the reported cases, the results showed that the age bracket of 26 and 35 had the highest malaria cases at 68 (19.2%), followed by age between 18 and 25 with 48 (13.5%). The ages between 36 and 50 years had 33 cases (9.3%) and lastly those over 50 years at 3.7%. The findings show that most of the respondents are below 35 years coinciding with the UNICEF's MICS survey of 2011, (MICS, 2011) and the findings by a study done by Ferede, (2013) which showed that ages between 15 and 29 years had a malaria positivity rate of 18.5%, (Ferede, 2013).

4.4.2 The sex of the respondents.

The study sought to establish the sex of the respondents in the Island to determine which gender plays an active role in terms of utilizing preventive strategy information available and curbing malaria prevalence. The respondents were asked to state their sex as either male or female. The results are shown in table 4.4.

Table 4.4 Distribution of respondents by sex

Sex of the respondent	Reported cases of malaria in the past 2 weeks		Total
	Yes	**No**	
Male	60 (16.9%)	73 (20.6%)	133 (37.5%)
Female	102 (28.7%)	120 (33.8%)	222 (62.5%)
Total	**162 (45.6%)**	**193 (54.4%)**	**355 (100.0%)**

The results showed that of the 355 respondents, 133 (37.5%) were male and 222 (62.5%) were female. This showed that most household heads in the Island are female as compared to male. Female-headed households are more common in rural areas (37 per cent) than in urban areas (31 per cent) according to KMIS (2010).

As per the malaria prevalence between the sexes, females were found to have the highest positivity rate at 28.7% as compared to males at 16.9%. This shows that females are almost two times more likely to be infected than males and so most strategies of malaria prevention should target them. However, findings by Ferede had opposite results; they showed that males were more likely to be infected than females, (Ferede, *et al.*, 2013). These findings may be due the fact that many females are engaged in activities that expose them to mosquito bites like farming in an open but bushy terrain in the day.

4.4.3 The level of education of the respondents

The researcher thought it important to study the education levels of the respondents. This was considered important because the education levels of the respondents can make one utilize one or more of the preventive strategies which has an impact on malaria prevalence in the household. The respondents were required to give their education attainment and the results were as shown in table 4.5:

Table 4.5 Level of education

Education level	Frequency	Percent
None	36	10.1
Primary	214	60.3
Secondary	85	23.9
Post Secondary	20	5.6
Total	**355**	**100.0**

Majority of the respondents 214 (60.3%) had obtained primary school level of education. They had some knowledge of malaria preventive strategies and stated what they always do to prevent malaria in their households. Out of the respondents, 85 (23.9%) of the respondents had obtained secondary school education. Twenty, 20 (5.6%) of the respondents had post secondary education; they were very cooperative and gave invaluable and detailed responses towards addressing the research questions. The results showed that 36 (10.1%) of the respondents had never attended school. These results compare well with those found by the MICS survey done by UNICEF which showed that those respondents who attained Primary level of education accounted for 63.5%, while those who attained Secondary level and above were 29.2% and those who never went to School were 7.3%, (MICS, 2011).

4.4.4 The number of household members

The people were asked about their household membership, how many people stay in their household. A household was defined as any persons or group of people staying together and eating from the same pot. The results were as shown in table 4.6:

Table 4.6 Number of household member

No. of Household	Frequency	Percent
1-5	235	66.2
6 and above	120	33.8
Total	**355**	**100.0**

From the respondents, 66.2% had household members of between 1 and 5 members while 33.8% of the members had household members above 6 people. This is in line with the general household membership of a household having averagely 4.2 members according to KDHS, (2008-9). The mean size of a Kenyan household is 4.2 persons (KDHS, 2008-9), as compared with 4.4 in the 2007 KMIS. Households which have many household members are more likely to suffer from sickness since they may not have a mosquito net for every member as nets are shared. But fewer household members can access nets and anti-malaria medicines.

The number of members of a household determines to a large extent the demand for goods and services the household purchases. The larger the household, the more strain is put on the resources available for the household's disposal. This in turn affects the general welfare of household members in terms of nutrition, as well as access to health care, bed nets, malaria medication, etc, (KMIS, 2010).

4.4.5 Place of stay of the respondents

The respondents were asked where they reside in the Island, whether they stay in their rural homes or they do business and stay at the market centres away from home (semi-urban). This was to determine which people mostly are affected by malaria to determine which strategies to be employed to assist them in future. The results are shown in table 4.7.

Table 4.7 Place of stay of the residents

	Frequency	Percent
At home (rural)	314	88.5
At the market centre far away from home (semi-urban)	41	11.5
Total	**355**	**100.0**

The results showed that the majority 88.5% stated that they stayed in at home in the rural while 11.5% stated that they stayed in the market centres or beaches (semi-urban). This data compares well with household characteristics data in Kenya Demographic Health Survey which showed that 74.6% of the women stay in rural areas as compared to 25.4% of the male counterparts, (KDHS, 2008-9). Similar results were discovered during the Malaria Indicator Survey; 76% of the residents stayed in rural areas whereas 24% stayed in urban areas, (KMIS, 2010). The government and stakeholders should consider having more malaria interventions targeting the rural areas especially on environmental hygiene, health promotion messages on malaria prevention and control.

4.4.6 Length of stay of the respondents

The respondents were asked for how long they have stayed where they are. This was important because in the study area, residents tend to travel a lot when doing business especially from beach to beach. This movement may have effects on the spread of malaria from one region to another. The results were shown in table 4.8.

Table 4.8 Duration of habitat

	Frequency	Percent
Less than six months	4	1.1
6-12 months	26	7.3
Over 12 months	325	91.5
Total	**355**	**100.0**

The findings showed that most of the respondents 325 (91.5%) reported that they have stayed in their place for over 12 months while 26 (7.3%) of the respondents mentioned that they have stayed there for between 6 months to 12 months and only 4 (1.1%) mentioned that they have stayed there for less than 6 months. The data confirms that most people, who reside in the Island, are natural residents. Only a few are mobile which may be because of small businesses in the Island.

4.4.7 Main Occupation of the respondent

The place of residence is also depended on the occupation that one does in Mfangano Island. The respondents were required to indicate their main occupation and the results were as shown in table 4.9.

Table 4.9 Main occupation of the respondents

Occupation	Frequency	Percent
Housewife	42	11.8
Farming	104	29
Business	96	27
Fishing	84	24
Formal Employment	29	8.2
Total	**355**	**100.0**

Majority of the respondents at 29% engaged in farming; Mfangano being an Island, many people engage in farming for subsistence. But fishing is also an activity that most people like. Fishing accounts for 24% of the respondents while 27% reported to be engaged in other businesses. It is noteworthy to state that many regard fishing as a business and engage in farming for day to day subsistence. The findings showed that 8.2% of the respondents engaged in formal employment and 11.8% are housewives. A study done in Rusinga Island by Weckenbrock on livelihoods and risk of malaria in Rusinga Island gave slightly different results. The findings showed that 20% engaged in farming, 40% in fishing, 20% in business and 20% in other engagements, (Weckenbrock, 2004). The results should inform policy makers on the proper interventions especially that addresses the farming and fishing communities.

4.5 Utilization of mosquito nets

This section examines the utilization of mosquito nets and how it influences malaria prevalence in the households. The section is presented under several sub headings like net ownership, net usage, number of nets in a household, net hanging and why some people do not use mosquito nets for mosquito bite prevention.

4.5.1 Net ownership

Studies have discovered that Insecticide treated nets (ITNs) is a key strategy in addressing malaria problem. The study sought to determine malaria prevalence in the households who own the mosquito nets and those who did not own mosquito nets. The respondents were asked whether they have a mosquito net and their responses are shown in table 4.10.

Table 4.10 Net ownership and malaria prevalence

Net ownership	**Reported cases of malaria in the past 2 weeks**		**Total**
	Yes	No	
Yes	76(21.4%)	230(64.8%)	306(86.2%)
No	26(7.3%)	23(6.5%)	49(13.8)
Total	**102 (28.7%)**	**253 (71.3%)**	**355(100%)**

The study showed that 306 (86.2%) of the respondents owned a mosquito net while 49 (13.8%) did not have the nets. This showed that most people own nets used to prevent mosquitoes. This confirms the data from the KDHS (2008-9) which indicates that 77% households in Nyanza province own mosquito nets as compared to households in Central province with only 33%. Malusha, (2009) did a similar study in Makueni which showed that 46.2% of the respondents owned nets, (Malusha *et al*., 2009).

The study results indicated that of those who had bed nets, 306 (86.2%), 230 (64.8%) cases did not have malaria in the household while only 76 cases (21.4%) reported to have malaria. The data also showed that those who did not have bed nets had higher cases reported for malaria at 26 cases (7.3%) as compared to 23 cases (6.5%) that were not diagnosed.

The researcher then concluded that one not using a treated mosquito net is more likely to contract malaria than one using a mosquito net, (MICS, 2011; KMIS, 2010; KDHS, 2008-9).

4.5.2 The number of nets in a household

The researcher wanted to determine whether the number of nets owned in a household can also influence malaria prevalence. The respondents were asked how many nets they have in their household. The findings are shown in table 4.11:

Table 4.11 The number of mosquito nets per household and malaria prevalence

	Frequency	Percent
None	53	14.9
1	102	28.7
2-3	186	52.4
Over 4	14	3.9
Total	**355**	**100.0**

The findings were as follows: Of the respondents, 53 (14.9%) reported that they have no mosquito nets. 102 (28.7 %) of the respondents reported to own 1 net per household, 186 (52.4%) of the respondents own between 2 to 3 nets, and 14 (3.9%) of the respondents own more than 4 nets per household. The findings confirm that of the KDHS which showed that in Nyanza, most households own 2 nets on average, (KDHS, 2008-9).

Possession of mosquito nets in a household is very important for the study because it shows that the community members are aware that nets prevent malaria and that having more than 1 net means that most of the household members have opportunity to sleep under a mosquito net at night since many households have about 4.2 people on average, (KMIS, 2010).

4.5.3 Type of net

There are so many nets in the market today with some treated while others untreated. The study sought to find out which types of nets are owned by the respondents. The responses are documented in table 4.12.

Table 4.12 Type bed of nets

	Frequency	Percent
Treated nets(ITN/LLIN)	280	78.9
Not treated	30	8.5
N/A	45	12.7
Total	**355**	**100.0**

The findings showed that of the respondents who reported to own mosquito nets, 280 (78.9%) have treated mosquito nets while only 30 (8.5%) reported to have untreated mosquito nets. Data compares well with that of KDHS showed that in Nyanza 76.5% of the residents have treated mosquito nets (KDHS, 2008-9). The findings reveal that many people in Mfangano are not only aware of the use of mosquito nets but possess knowledge that the nets need to be treated with a chemical so as to increase its efficacy.

4.5.4 Where the nets were got from

Since it has been established that the respondents are aware of the usage of treated mosquito nets, the researcher went further to establish where these treated nets were got from. The respondents who had nets were asked where they got the nets from. The table 4.13 gives the responses.

Table 4.13 Places where the nets were got from

	Frequency	Percent
Clinic/dispensary	194	54.6
Community Health Worker	22	6.2
Shop	14	3.9
Mass distribution nets	65	18.3
Total	**355**	**100.0**

The findings show that 54.6% of the respondents mentioned that they got the nets from the clinic/dispensary. This may mean that they are referring to the LLINs nets given freely by the government to pregnant mothers or mothers with children under 1 year when they visit the dispensary. 6.2% of the respondents mentioned that they received the nets from the community health workers, 3.9% of the respondents bought the nets from the shops. 18.3 % got them during mass net distribution. In 2012 the government distributed mosquito nets to households in Nyanza and western Kenya, and so some people still had them in Mfangano Island.

4.5.5. Net sharing in the household

The study sought to know whether there are people sharing nets in the Island. Net sharing is a common practice among people who own nets but it may be counter-productive especially if a household has many members and nets are few. The researcher asked the respondents about net sharing and the findings were tabulated in table 4.14:

Table 4.14 Net sharing per household

	Frequency	**Percent**
1 net for one person	25	7.0
2 people share	174	49.0
3 people share	83	23.4
4 people and above	24	6.8
No net to share	49	13.8
Total	**355**	**100.0**

The findings show that 49% of the respondents mentioned that they share 2 people per net, 23.4% said they share1 net three people. 7% of the respondents said they do not share with any one while and 6.8% said they share four people in a household. This showed that net sharing is rampant in the households as many people share the nets. A high percentage of the

respondents (49%) share one net for 2 people which is in line with the division of malaria control guidelines where a net should be shared between 2 people only (KMIS 2008-9). Net sharing between 2 people is a recommended practice since the nets are not readily available for each to use alone. It is cost-effective to share 1 net 2 people and this is what is being advocated elsewhere by organizations like PSI which does mass production and promotion of mosquito nets. The use of mosquito nets has played a leading role in ensuring that malaria prevalence is contained in Mfangano at about 28.7%.

4.5.6. Net usage in the household

On net usage, it has been argued by other researchers that it is one thing to own a net but another thing to sleep under it always. The researcher planned to investigate whether the respondents use the nets one time or always as is recommended. The findings are found in Table 4.15:

Table 4.15 Frequency of net use

	Frequency	**Percent**
Always	272	76.6
Occasionally	48	13.5
Never	9	2.5
Other(specify)	2	0.6
N/A	24	6.8
Total	**355**	**100.0**

The findings show that of those who own mosquito nets, 76.6% slept under the nets always while only 13.5% slept under it occasionally. 2.5% never slept under mosquito net while the rest did not have the net. This data compares well with the MICS survey data which showed that 74.2% use mosquito nets to prevent malaria, (MICS, 2011). Net usage is very important to malaria prevention and control. Many studies have been conducted that show

discrepancy between net ownership and usage. A study done by (Malusha, *et al*., 2009) advocate for intensive education emphasizing on proper and consistent use of mosquito nets. A research conducted in a Rusinga Island, also reiterated that more emphasis should be employed on net usage since "many people own nets but few people use them," (Weckenbrock, *et al.,* 2004). The researcher can then conclude that the current study reveals that more and more people should be sensitized to utilize mosquito nets always and not when convenient as this might reverse the gains already made in net utilization in Mfangano.

4.5.7. Net use the previous night

The respondents were asked whether they slept under the mosquito net, the previous evening. The responses are tabulated in table 4.16:

Table 4.16 Those who slept inside the nets last night

	Frequency	**Percent**
Yes	273	76.9
No	82	23.1
Total	**355**	**100.0**

Of the respondents, 76.9% of the people responded in that they slept on mosquito nets last night while only 23.1% confessed that they did not sleep under the net last night. These findings can be related to the MICS survey report by UNICEF which showed that 83.9% of the respondents slept under the nets the previous night, (MICS, 2011) and slightly lower at 58.4% findings by KDHS report, (KDHS, 2008-9). A study done in Tanzania showed almost similar results in 2011. "During this period, there was a consistent improvement in net use across all the regions, with rates of up to 75% in 2011" (Ikenna, 2014). The data showed that many people who own mosquito nets (86.2%), almost 90% slept under the nets last night.

This may be attributed to knowledge of net use that the respondents have. The researcher recommends net usage on daily basis for the sustenance of malaria prevention in the Island.

4.5.8 Net hanging

Nets are often not well fitted or are torn, thus allowing mosquitoes to enter or feed on the part of the body adjacent to the netting fabric during the night. This is according to (Lines *et al*., 1987). The study sought to establish whether respondents have knowledge of net hanging in the community. Net hanging has an influence in malaria prevalence in the household. The respondents were asked whether they hang their nets alone. Table 4.17 illustrates the various responses as found in the study.

Table 4.17 Do you hang their nets alone?

	Frequency	**Percent**
Yes	277	78.0
No	35	9.9
N/A	43	12.1
Total	**355**	**100.0**

The findings showed that 78% of the respondents hang their nets alone while only 9.9% do not hang their nets alone whereas 12.1% do not have nets to hang. A Malaria Indicator Survey done in Kenya had similar results. The findings showed that 80.8% of the residents in Lake endemic regions hang their nets alone and 90.3% in highland epidemic areas hand their nets alone, (KMIS, 2010). These results are against what the District Disease Surveillance Coordinator recorded during the KIIs interviews. He commented:

> *"Many households do not know how to hang the nets and even use the nets for decoration, fishing and covering of vegetable farms or poultry".*

The problem of ill-used nets or not able to hang nets correctly provides one of the motives for impregnating them with a fast-acting insecticide that will repel or kill mosquitoes before or shortly after feeding (Lines *et al*., 1987; Hossan and Curtis, 1989).

4.5.9 Have you attended any forum on net hanging?

Net hanging is always an issue in many places. Most people say they hang nets but have not had any forum where they are taught and sensitized on net hanging. The respondents were asked whether they have attended any forum on net hanging. This is because many people (86.2%) own nets as has been illustrated above and also net usage is high (76.6%) but in the same area, there is still high malaria burden. One of the reasons why this may be so may be attributable to the fact that many people do not know how to hang the nets. This is what informed the question on net hanging and forum for the same in the community. Table 4.18 shows the responses:

Table 4.18 ***Seminar on net hanging***

	Frequency	**Percent**
Yes	154	43.4
No	201	56.6
Total	**355**	**100.0**

The findings are of great interest in that 43.4% have attended net hanging sessions organized by health workers while the majority 56.6% have not attended the sessions. It therefore means that even though the 78% of the respondents hang nets themselves, they may not exactly know the details of net hanging and so may purport to be hanging nets when they do not know how to and this may also be the reason why many sleep under nets and yet many still contract malaria in the same environment.

4.5.10 The reason why some people do not use mosquito nets

The uptake of preventive strategies depends on effective advocacy, social communication and behaviour change communication. Although many studies including the current one show that many people use mosquito nets to prevent malaria, there are still some people who are not convinced. The researcher sought to establish from the respondents why some people still do not use mosquito nets for malaria prevention. The findings are stated on table 4.19:

Table 4.19 Reasons for non use of mosquito nets

	Frequency	**Percent**
Attitude	240	67.6
Culture and Tradition	22	6.2
Ignorance	28	7.9
It is stuffy	51	14.4
Laziness	14	3.9
Total	**355**	**100.0**

The findings reveal that attitude of people was one of the leading reasons why some people do not use mosquito nets. Among the respondents, 67.6% said that attitude prevents people from using mosquito nets. 14.4% of the respondents mentioned that the nets are stuffy due to the high concentration of chemicals that are used to repel mosquitoes. The others mentioned include ignorance, laziness and culture which are 7.9%, 3.9% and 6.2% respectively as the reasons why residents in Mfangano Island don't use the mosquito nets.

The District Disease Surveillance Coordinator, when interviewed by the researcher, remarked:

"People's beliefs hinder usage of nets in the community. That some people believe that nets are supposed to be used to cover coffins and dead people to prevent flies and not people that are alive."(DDSC)

A similar study, Kenya Malaria Indicator Survey, conducted in Kenya showed that attitude plays a role in net usage at the household level. The survey showed that over 20% confirmed that they use nets for other purposes besides sleeping, (KMIS, 2010). Other studies that had poor attitude of the respondents were those done by (Opiyo *et al*., 2007; Weckenbrock, *et al*., 2004 and Marsh, *et al*., 2004). The researcher concluded that poor attitude plays a leading role in preventing usage of mosquito nets. The government and all stakeholders should embark on a sensitization programme that targets Knowledge, Attitudes and Practices of people (KAP) so that they view mosquito nets positively and use them always for malaria prevention. Myths about nets, stuffiness and laziness should be addressed by health workers in community dialogue sessions so that good and correct knowledge about preventive strategies passed to people so that they can own their own health.

4.6 Environmental hygiene

This section investigates the extent to which environmental hygiene influences malaria prevalence on households. It involved clearing of the compound, draining of water collection points, spraying of the house and compound and house ventilation. Study done by Opiyo (2007) revealed that clearing vegetation was the second most common method which community members believed to be useful to prevent malaria (Opiyo *et al.*,2006). Several people have different opinions on whether these strategies work or not. For example, community health extension officer in Nyamaua community unit mentioned:

"Draining of water and clearing the compound reduces mosquito breeding points and if this activity is maintained, it is effective".

The District Disease Surveillance Coordinator adds:

"Indoor Residual Spraying (IRS) was done until 2012. It was a program of division of malaria control but has since stalled because of lack of resources. Currently household heads just use local sprays like dooms spray from the shops to spray houses."

4.6.1 Frequency of clearing the compound

The respondents were asked the frequency of clearing of the compound, the researcher sought to establish whether the frequency of compound clearance has any bearing on malaria prevalence in the households. The table 4.20 illustrates the responses:

Table 4.20 Frequency of clearing the compound and malaria prevalence

Frequency of compound clearing	**Reported cases of malaria in the past 2 weeks**		**Total**
	Yes	No	
Occasionally	53(14.95)	77 (21.7%)	130 (36.6%)
1 time a week	27 (7.6%)	156 (43.9%)	183 (51.5%)
2-3 times a week	22 (6.2%)	20 (5.6%)	42 (11.8%)
Total	**102 (28.7%)**	**253 (71.3%)**	**355 (100.0%)**

The findings establish that 36.6% of the respondents mentioned that they clear the compound occasionally, 51.1% said they do it once a week and only 11.8% of the respondents mentioned that they do it 2-3 times a week. The findings establish that for those respondents who cleared their compound occasionally, 53% contracted malaria in the past 2 weeks. For those who cleared only 1 time a week, 27% reported to have contracted malaria while those who cleared 2-3 times a week, 22% reported to have malaria in the past 2 weeks.

These results compare well with the findings of the study done in Rusinga Island by Opiyo (2007) which showed that 56% cleared the bush the previous month, (Opiyo *et al*.,

2007). His findings further elaborated that of the 56% who practised bush clearing, 20% believed that bushes and other vegetation served as larval habitats for mosquitoes and 80% believed that mosquitoes hide in vegetation and should be prevented through removing all the surrounding vegetation, (Opiyo *et al*., 2007). The researcher concluded that compound clearing have an influence in malaria prevalence in the households especially when all community members are sensitized on its benefits and all practice it.

The finding was further enhanced by the statement from the area chief:

"Clearing of the compound, draining of water collection points and general environmental sanitation will only succeed in mosquito prevention if all the community members are mobilized to do this routinely. But if it is being done in one homestead and the neighbour is not doing anything, then it will fail..."

It means that environmental sanitation involves the work of all community members. If some people do it while others do not, then at the end of the day, no impact shall be created and the work of the few would be futile since the gains would be reversed. Mosquitoes will still kill people as they will be breeding in other bushes and water collection points in the neighbourhood and coming to infect those who have been clearing the bushes around the homestead.

4.6.2 Do you have a litter bin or compost pit in your compound?

The researcher sought to find out whether the respondents had compost pit or litter bin in their compound. These litters when left unattended are breeding sites for mosquitoes. The table 4.21 illustrates the findings:

Table 4.21 Presence of compost pit or litter bin in compound

	Frequency	**Percent**
Yes	164	46.2
No	191	53.8
Total	**355**	**100.0**

The study revealed that 46.2% of the respondents had litter bin or compost pit in the compound as compared to 53.8% who did not have. Collection of wastes generated in the compound is important in environmental management. Active involvement and participation of community members play a leading role in people's their environmental hygiene, Mutuku, *et al.,* (2006). Mosquitoes breed in wastes that are left unattended and so when the communities do not take care of the environment, they promote mosquito breeding areas. One of the KIIs respondents remarked:

> *"The community members collect dirt on a small scale because there are so many used containers and mosquitoes breed on them"* **(PHO)**

4.6.3 The reasons for not having a litter bin or compost pit in the compound

The respondents were asked the reasons for not having compost pit or litter bins, they had various answers as shown in the table 4.22:

Table 4.22 Reason for not having a litter bin in the compound

	Frequency	Percent
No reason	39	11.0
N/A	164	46.2
Pour in the shamba	15	4.2
Burn rubbish immediately	45	12.6
Incapable of digging one	12	3.4
Doesn't know its importance	72	20.3
Collected by town council	8	2.3
Total	**355**	**100.0**

The respondents had various reasons why they did not have litter bins or compost pits in their compounds and the following were the responses: 11% said they had no reason why they did not have. 46.2% of course cited that they already had and so the question was not relevant to them. 4.6% said they do not have because they could pour the litter into the gardens, 12.6% stated that they burned the litters immediately and so they did not see the need of having one; 3.4% of the residents were too old to dig or have one, 20.3% said they did not know its importance and 2.3% of the residents who stayed in the market centres mentioned that the town council people collected them. Community mobilization and sensitization is key to environmental hygiene and control of mosquitoes.

4.6.4 Time for closing windows and doors in the evening

Time of closing the windows is a factor in environmental hygiene. Mosquitoes have changed their style of biting. The researcher sought to establish whether there was any relation existing between time for closing doors and windows and malaria prevalence. The data are indicated in table 4.23:

Table 4.23 Time of closing windows and doors in the evening

	Frequency	Percent
at 6	210	59.2
at 7-8pm	135	38.0
No specific time	10	2.8
Total	**355**	**100.0**

Findings revealed that 59.2% responded that they close the doors and windows by 6pm while 38% responded that they do by 7-8pm. 2.8% of the respondents did not have specific time for closing doors and windows. This means that the people quite know that mosquitoes should be kept away by closing all doors and windows in the evenings.

4.6.5 Presence of water collection points in the compound

The respondents were asked whether they have water collection points in the compound or not. Mosquito larvae always breed on uncovered pits larine or water collection tins or points. The researcher sought to investigate the presence of these in the compound of the respondents. The findings were as illustrated in the table 4.24:

Table 4.24 Presence of water collection points

	Frequency	Percent
Yes	46	13.0
No	309	87.0
Total	**355**	**100.0**

The findings showed that 87% of the respondents did not have any water collection points in the compound compared to 13% who answered in the affirmative. It shows that the respondents do not entertain water collection points in their compound as they are aware that they are mosquito breeding points. This data compares well with the findings in Rusinga by Opiyo, *et al*., (2006). Her findings showed that despite a good knowledge of removal of water

containing borrow pits, a close examination in the neighbourhood showed that nobody actually practised this. The recent data showed that 13% of the respondents did nothing to prevent malaria, (Opiyo, *et al.*, 2006).

4.6.6 Spraying of the house

As part of keeping mosquitoes at bay, many people resort to spraying of the houses to kill the mosquitoes. Indoor residual spraying (IRS) was a programme that was rolled by the government in early 2011 as a way of killing mosquitoes in the households and inside the house. But it did not continue as it was not sustainable. The researcher wanted to find out whether the respondents practice spraying of their house and using what kind of chemical. The findings were illustrated in table 4.25:

Table 4.25 Spraying of the compound

	Frequency	**Percent**
Yes	133	37.5
No	222	62.5
Total	**355**	**100.0**

The findings showed that 37.5% percent of the respondents said they do spray their houses while 62.5% of the respondents said they do not spray. Out of the 37.5% who spray were asked what chemical they use and where they got the chemicals from. 36.6% mentioned they use doom spray which they said they bought from the nearby agrovet or grocery store. This data compares well with the findings by Okech, *et al*., (2008) which revealed that among all the strategies, the sprays with canisters was only 11% of the respondents while the other strategies went to other mosquito reduction measures including, in order of preference, environmental management (35%), mosquito repellent and smoke (31%) insecticide canister sprays (11%), and window and door screens (6%), (Okech, *et al*., 2008). Okech mentioned that mosquito management should employ all the strategies which he termed an integrated

malaria management (IMM) package. The researcher can then conclude that sprays is not a popular way of mosquito prevention but play a small part (37.5%) in the control effort and those who are able to buy the spray and use it are encouraged.

4.7 Malaria knowledge seeking behavior

This section discusses how malaria knowledge seeking behaviour influences malaria prevalence among households in Mfangano Island. The researcher sought to investigate the knowledge that the respondents have on malaria acquisition and prevention. This also required knowledge and availability of IEC materials and attendance of chief's barazas and seminar on malaria prevention if any, in the community.

4.7.1 How malaria is contracted

Knowledge about acquisition of malaria parasites in humans is relevant to prevention and to malaria prevalence in the household level. Household heads with some knowledge of how malaria is acquired can develop control and preventive measures as compared to those without knowledge. The responded were asked to state whether they have any knowledge of how malaria is contracted. Table 4.26 shows the responses:

Table 4.26 How malaria is contracted

	Frequency	**Percent**
Bite from a mosquito	32	9.0
Playing in polluted water	5	1.4
By walking in cold weather	2	.6
All 3 above	274	77.2
1 and 2	33	9.3
Bite from mosquito and By walking in the cold weather	9	2.5

Total	**355**	**100.0**

From the responses, 9% said they contract malaria through a mosquito bite, 1.4% cited playing in polluted water, 0.6% cited walking in cold weather, most of the respondents 77.2% cited a combination of mosquito bite, playing in polluted water and walking in cold weather as the reasons for contracting malaria. 9.3% of the respondents cited mosquito bite as well as playing in polluted water while 2.5% of the responses were for mosquito bite as well as walking in cold weather. This shows how varied knowledge of malaria is in the people of mfangano.

One of the key informants interviewed stated:

"…mosquito bite from a female anopheles mosquito from one infected person to another is the main cause of malaria in Mfangano and other regions. However, the knowledge that people have are varied depending on who gives them the information."

(Community Health Extension Worker)

There is need for more community sensitization on how malaria is contracted so that the myths and misconceptions can be cleared and relevant and correct knowledge is shared with the respondents. This is what Okech *et al*., (2006) advocates for in his conclusion of a study in Rusinga Island.

4.7.2 How malaria is prevented

Knowledge about malaria acquisition and prevention go hand in hand. The more knowledge one has will be proportional to the actions taken by that individual in prevention of the disease. The researcher sought to investigate the knowledge of prevention from the respondents. The findings were tabulated in table 4.27:

Table 4.27 How malaria is prevented

	Frequency	**Percent**
Sleeping under treated mosquito net	7	2.0
Clearing the compound and bushes	3	.8
Taking malaria medicine	30	8.4
Using mosquito coil	1	.3
All the four	295	83.1
1 &3	6	1.7
1, 2 & 4	13	3.7
Total	**355**	**100.0**

The findings reveal that 2.0% of the respondents cited that malaria can be prevented through sleeping under treated mosquito net, 0.8% said clearing the compound and bushes, 8.4% said taking malaria medicine.0.3% said using mosquito coil can prevent mosquitoes. 83.1% of the responded cited all the four above. 1.7% cited sleeping under net and taking malaria medicine while 3.7% stated that malaria can be prevented by sleeping under a net, clearing the compound and using mosquito coil. The findings confirm a study done in Tanzania by Randall Heather on the Environmental management for malaria control, most respondents gave multiple answers as follows: 87% advocated for nets usage, 50% for clearing of the residential areas, 32% clearing of the bushes around the homestead, 18% drain stagnant water, 11% spraying of the houses, 10% use of antimalarial drugs and 7% usage of mosquito coils, (Heather, 2008).

These findings clearly show that most people advocate for a combination of strategies to prevent malaria cases. But a study done in Rusinga Island showed that though there was good knowledge of malaria prevention, 13% of the respondents interviewed did nothing to prevent malaria, (Opiyo, *et al*., 2006). The researcher can then conclude that many people

possess knowledge on malaria prevention and advocate for a combination of these strategies, (Okech, *et al*., 2008).

4.7.3 Where information on malaria prevention can be found

The researcher sought to establish where the respondents got information on malaria prevention from, they gave the following answers contained in table 4.28:

Table 4.28 Where to get information on malaria prevention

	Frequency	**Percent**
Chief baraza	18	5.1
Health workers	205	57.7
Radios and TV	102	28.7
Chief Baraza, Health-workers, Radios and TV	10	2.8
Others	4	1.1
Never had any info	6	1.7
Health workers, Radios and TV	10	2.8
Total	**355**	**100.0**

The findings show that most of them 62.8% stated that they got the information from health workers, while 1.7% stated that they had no information, 28.7% of the responses stated that they got malaria preventive information from radios and TV, 2.8% cited a combination of the chief baraza, health worker, radios and TV, 5.1% cited chief's baraza only. The data shows that health workers are popular in giving health information and in this case malaria prevention messages. A study in Rusinga Island showed similar results. It showed that doctors were the most common sources of information on malaria prevention at 70%, seconded by family members and neighbours at 25%; the other 5% were taken by teachers, among others, (Weckenbrock, (2004). The researcher concluded that policy makers, line

ministries and relevant authorities should concentrate more on the health workers, radios and TV when passing health care messages to the population as these avenues reach many people.

4.7.4 IEC materials

Availability of IEC materials play a key role in malaria prevention and control. On IEC materials, the respondents were asked whether they have any IEC material in the house. The findings are shown in table 4.29:

Table 4.29 Availability of IEC materials in the household

	Frequency	**Percent**
Yes	143	40.3
No	212	59.7
Total	355	100.0

Of the respondents, 40.3% stated they have IEC materials while 59.7% stated they do not have any IEC materials. This shows that there is need for constant reminders now that there are few IEC materials for people to read. Similar results were found by the study by Weckenbrock, *et al*., (2004) that showed that many people had little or no knowledge of IEC materials with malaria preventive messages. A concerted effort by the government and partners should address the issue of availability and use of IEC materials. Health promotion exercises can be very effective if accompanied by IEC materials with relevant messages on malaria prevention and control.

4.7.5 Seminar on malaria prevention.

The researcher sought to investigate where people always get knowledge of malaria prevention so that measures can be taken to improve them. The respondents were asked whether they have attended any seminar on malaria prevention. Seminar attendance also plays a leading role in ensuring proper knowledge of malaria prevention. Table 4.30 below shows the responses:

Table 4.30 Seminar attendance on malaria prevention

	Frequency	Percent
Yes	174	49.0
No	179	50.4
Not sure	2	.6
Total	**355**	**100.0**

The findings revealed that 49% of the respondents stated they have attended a seminar on malaria prevention while 50.4% of the respondents reported that they have not and 0.6% respondents were not sure. The findings reveal that almost 50% of the respondents have attended seminars and so have knowledge on malaria prevention.

4.7.6. Venue for seminar attendance

Of the number of people, 49% of the respondents who stated they have attended the seminars, they were asked to state where they have had the meetings. The findings are shown in table 4.31:

Table 4.31 Venue for the seminar

	Frequency	Percent
At the chiefs baraza	37	10.4
At the health centre/dispensary	59	16.6
When some NGOs came to the area	35	9.9
When some health workers did health promotion in the area	21	5.9
Not applicable	178	50.1
2,3,4	25	7.0
Total	**355**	**100.0**

The findings revealed that 10.4% of the respondents got the training at the chiefs baraza, 16.6% stated they got it from the health facility, 9.9% stated they got the information when some NGOs came to the area, 5.9% stated that received the training during a health promotion exercise in the area, 7% combined health facility, NGOs and health promotion. The data confirms that dispensaries and health workers play a great role in dissemination of knowledge in malaria prevention. Similar results were discovered in a study conducted by Opiyo, *et al*., (2007). The researcher concluded that the venue for health promotion can be multiple, including the chief's baraza, dispensaries and from community health workers.

4.7.7 Discussion of malaria prevention with others

Receiving knowledge in isolation without sharing it with others may not be of any help to an individual. The researcher sought to find out who the respondents discuss with knowledge of malaria prevention and control. Table 4.32 show the findings.

Table 4.32 Discussion with others

	Frequency	**Percent**
Family members	214	60.3
Relatives and friends	87	24.5
All the above	23	6.5
Others	6	1.7
None	25	7.0
Total	**355**	**100.0**

The findings established that discussion and sharing of disease prevention knowledge was high with family members taking 60.3%, 24.5% is discussion with relatives and friends, 6.5% combined family members sharing together with relatives and friends and only 7% did not share information with anyone. Studies done by Kilan, (2010) revealed that knowledge of

the malaria prevention was done with friends and close family members. He however, cited sharing of behavioural knowledge, like putting on warm clothes at night to prevent mosquitoes bites, sleeping in air-conditioned rooms, insect repellent sprayed on clothes protect one for longer hours, (Kilan, 2010). The researcher concluded that sharing with family members, and close relatives and friends is leading in preventive strategies. This should be encouraged by all parties.

4.8 Malaria prophylaxis

The section discusses the extent to which taking malaria drugs influences malaria prevalence among households in Mfangano Island. Roll Back Malaria initiative supported by WHO focuses on among other strategies of prevention, the use of malaria medicines – prophylaxis – like artemisin-based combination therapies (ACTm), (Coleman, Morel, Shillcut, Goodman and Mills, 2004).

4.8.1 Taking anti-malarials as a preventive measure against malaria

A rapid treatment response is essential for effective home management. Because of this, the researcher sought to ask the respondents to state whether they have taken over the counter antimalarial drugs to prevent malaria. Table 4.33 illustrates the findings:

Table 4.33 ***Number of respondents taking antimalarials***

	Frequency	**Percent**
Yes	207	58.3
No	148	41.7
Total	**355**	**100.0**

Most of the people take drugs as a preventive measure in this community. 58.3% of the respondents confirmed talking malaria drugs to prevent malaria while 41.7% responded that they did not take the drugs. These findings are slightly higher than those found by KDHS which showed those who took antimalarial drugs to be 44.1% but the results of KDHS only

examined pregnant women, (KDHS, 2008-9). 58.3% is a higher number, but it confirms the data by Coleman, (2004) whose results revealed that "...many individuals in Sub Saharan Africa chose to treat malaria without visiting a medical facility...", (Coleman, et al., 2004).

4.8.2 The use of mosquito repellent jelly

The respondents were asked whether they have used a mosquito repellent jelly as a preventive measure against malaria in the Island. The following table 4.34 shows the findings:

Table 4.34 Have you used mosquito repellent Jelly

	Frequency	**Percent**
Yes	111	31.3
No	244	68.7
Total	**355**	**100.0**

The findings show that 31.3% of the respondents use mosquito repellent jelly against 68.7% who do not use the jelly to prevent mosquito bites. A study by Deressa, (2014) had similar study findings. It revealed that the use of mosquito repellent jelly against malaria prevalence was 34% effective but only when combined with ITNs, (Deressa, *et al*., 2014). It can be concluded that mosquito repellent jelly should be used in combination with other measures for the prevention of malaria in the household.

4.8.3 Frequency of use of mosquito repellent jelly

For those who use the jelly, they were asked how frequently they use it. The following table 4.35 illustrates the varied answers.

Table 4.35 ***How frequent do you use mosquito repellent jelly?***

	Frequency	**Percent**
Daily	101	28.5
Once a week	2	.6
Only when travelling	7	2.0
Cannot say how often	6	1.7
Never used mosquito repellent	239	67.3
Total	**355**	**100.0**

According to the responses, 28.5% said they use the jelly daily, 0.6% said they use it once a week, 2.0% said while travelling while 1.7% cannot tell when they used it. Data from a CDC article written by Roger, (2013) reveal that travellers are advised to use the mosquito repellent sparingly and should be used with precautions, (Roger, *et al.*, 2013). This is one of the reasons why the repellent jelly is not popular in preventing mosquitoes and used in isolation may not do much but should be combined by other strategies like bed nets.

4.8.4 Utilization of antimalarial drugs

The respondents were asked whether they had left Mbita Sub County in the past 1 month and whether when they returned, they used any antimalarial drugs and why they used the drugs. The researcher wanted to investigate whether the residents actually used the antimalarial drugs in the past 1 month and for what purpose. The results of the survey are shown in table 4.36:

Table 4.36 ***Did you or any of your HH members leave Mbita Sub County?***

	Frequency	Percent
Yes	76	21.4
No	279	78.6
Total	**355**	**100.0**

It was discovered that 21.4% of the respondents left Mbita while 78.6% did not leave the Sub County. The results confirm the fact that most residents are not business people who travel a lot in and out of the Sub County but are native residents in the Island.

4.8.5 Reason for taking antimalarial drugs

For those who left Mbita, 21.4% upon return, the respondents were asked whether they took any antimalarials and reasons for taking the drug. Table 4.37 show the results:

Table 4.37 Reasons for taking anti-malarial drug

	Frequency	Percent
No Reason	30.2	8.5
To prevent malaria	45.8	12.9
Total	**76**	**21.4**

The findings reveal that 45.8 (12.9%) of the respondents who took the antimalarial drugs attributed it to malaria prevention. The others, 30.2 (8.5%) of the respondents who took the drug had no reason why they took the drugs. For seasoned travellers especially to a malaria prone area, visitors are recommended to take antimalarials a day or before they travel to prevent acquisition of plasmodium falciparum which causes malaria, (CDC, 2012). A qualitative study done in Ghana, Kenya and Malawi on the prevention and management of malaria by Pell, (2013) revealed that the antimalarial drugs are easily accessible in the drug stores for all populations but in health facilities, mostly pregnant women are given antimalarials intermittently (IPTp) while others are tested first before being given the drugs,

(Pell, *et al.*, 2013). The researcher can then conclude that the study revealed malaria prevention as the main reason for taking the drugs.

4.9 Pearson's correlation coefficient of variables

As a way of revealing the relationships among the study variables, the researcher conducted a Pearson's correlation coefficient of key variables. Pearson's correlation coefficient is used when the researcher wants to find out whether there is a linear and significant relationship between 2 variables. The relationship can either be positive or negative correlation. This study sought to determine the significant level between the independent variables (the preventive strategies) and the dependent variable (malaria prevalence in terms of reported cases of malaria). The findings were as shown on table 4.38:

Table 4.38 Correlations among variables under study

Variables	Reported cases of malaria in the past 2 weeks	Significance Level
Utilization of a mosquito net	r = 0.578**	0.01(1-tailed)
Environmental hygiene (Frequency of clearing the compound)	r = 0.113*	0.05 (2-tailed)
Knowledge of malaria prevention (Knowledge of malaria prevention)	r= 0.038	0.01 (2-tailed)
Malaria prophylaxis (taking OTC antimalarials)	r= -.182**	0.01 (2-tailed)

The findings reveal that between the variable of utilization of mosquito net and malaria prevalence, the correlation is highly significant at 0.01 (1 –tailed). The relationship is a strong positive one at 0.578 which means that as utilization of mosquito nets fluctuates up or down, malaria prevalence will also fluctuate up or down.

The second findings reveal a relationship between environmental hygiene and malaria prevalence. The correlation is significant at 0.05 levels (2-tailed). The relationship is a

moderate positive one at 0.113. The findings reveal that the uptake of clearing the bushes and other environmental human activity towards mosquito reduction will influence malaria prevalence in the Island. This should be encouraged by all stakeholders.

The third relationship is between malaria knowledge seeking behaviour and malaria prevalence. The correlation is significant at 0.01 (2 tailed). The relationship is a positive correlation at .038. This also means that information and sensitization of people on preventive strategies influences positively the rate of prevalence of malaria in the households.

The fourth relationship is between the malaria prophylaxis drug and malaria prevalence. The correlation is significant at 0.01 levels (2-tailed). The relationship is a negative correlation at -.182. This means that as one variable increases in value, the other decreases and for this study, as many people take the antimalarial drugs (malaria prophylaxis), the malaria prevalence will decreases in value.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the findings of the main study, conclusions recommendations arrived at and contribution to knowledge base. It also gives suggestions for further studies.

5.2 Summary of Findings

The main sample comprised of 373 respondents, 355 respondents were reached and their questionnaires completed for analysis. This gave a response rate of 95%. Among the 10 respondents targeted for the Key Informant Interviews (KIIs), 10 were reached and data sourced from them for analysis. This represented a response rate of 100%.

In terms of gender, out of the respondents interviewed, 222 (62.5%) were women while 133 (37.5%) were men. It establishes that women-headed households are on the increase in the Island. It also can be concluded that, at the point of data collection, more men had gone out for business-oriented tasks and other engagements.

According to the findings, majority of the respondents, 154 (43.4%) were ages 26-35 years of age, 79 (23.1%) were 18 - 25 years, another 79 (23.1%) were 36-50 years and 43 (12.1%) were above 50 years of age. Most of the respondents are below 35 years and are active in fishing, farming and business in the Island. The government and policy makers should factor the preventive strategies and messages targeting this age bracket.

The findings showed that according to the respondent's level of education, majority at 60.3% had obtained primary school level of education, 23.9% of the respondents had obtained secondary school education, 5.6% had post secondary education and 10.1% of the

respondents had never attended school. This means that the majority are able to read and write and so are able to grasp information and be sensitized to understand the various preventive efforts towards malaria prevention and control.

The findings establish that, in terms of occupation of the respondents, the majority at 29% engaged in farming; Mfangano being an Island, many people engage in farming for subsistence. But fishing is also an activity that most people like. Fishing accounts for 24% of the respondents while business 27%. It is worthy to not that many regard fishing as a business and engage in farming for day to day subsistence. 8.2% engaged in formal employment.

According to the findings, 66.2% of the respondents had household membership range of 1 - 5 while 33.8% of the respondents had household members above 6 people. This means that if the households are given mosquito nets for example, they are able to utilize the nets very well to protect themselves from mosquitoes. The members should also capitalize on the mass net distribution exercise that the government plans to roll out in 2014.

The study established that majority of the people 86.2% own mosquito nets while 13.8% did not have the nets. It was also established that majority owned more than 2 nets at the time of the data collection. From the findings, 52.4% respondents said that they have between 2 to 3 nets in their household while 28.7% said that they own 1 net per household and 3.9% of the respondents own more than 4 nets.

The findings established that out of the 86.2% who had mosquito nets, 78.9 % of the respondents have mosquito nets that were treated with a chemical while only 8.5% reported to have untreated nets. This data reveals that the majority, 91.5% of the respondents own mosquito treated nets in the Island.

The study findings established that treated mosquito nets are able to prevent malaria hence reduce malaria prevalence in a households. 75.2% confessed that they have not been

diagnosed with malaria in the past 2 weeks while only 24.8 had been diagnosed with malaria in the past 2 weeks.

The study established that 54.6% of the respondents got the nets from the clinic/dispensary, 6.2% of the respondents mentioned that they received the nets from the community health workers, 3.9% of the respondents bought the nets from the shops while 18.3 % got them during mass net distribution of 2011. These can either be LLINs that are given to pregnant and lactating mothers free from the health facilities, or ITNs that are bought from the shops already treated or nets that are dipped in a chemical for treatment.

On net sharing, 49% of the respondents mentioned that they share 2 people per net, 23.4% said they share 1 net three people. 7% of the respondents said they do not share with any one while and 6.8% said they share four people in a household. The government recommends net sharing of 2 people per net, (KMIS, 2010).

The study established that 76.9% of the respondents slept inside mosquito treated nets the previous evening while only 23.1% confessed that they did not sleep under the net last night. This showed a high percentage of net usage in the Island. This is supported by a similar study in Tanzania where 75% of the respondents slept in the nets the previous evening, Ikenna, (2005). The few respondents that did not sleep inside the treated nets either have no nets or were away in the lake fishing at night or maybe they had different reasons like attitude towards the nets as was established.

The study findings showed the reasons why people do not use nets at night are mainly because of poor attitude. Among the respondents, 67.6% said that attitude prevents people from using mosquito nets. 14.4% of the respondents mentioned that the nets are stuffy due to the high concentration of chemicals that are used to repel mosquitoes. Ignorance was 7.9%, laziness 3.9% and 6.2% of the respondents mentioned culture as a deterrent to using mosquito nets.

The findings also showed that many respondents keep their environmental clean so that mosquitoes do not find breeding points. 36.6% of the respondents clear the compound occasionally, 51.1% do it once a week and only 11.8% mentioned that they do it 2-3 times a week. The study established that those clear their compound occasionally had higher cases on malaria at 52% as compared to those who clear 2-3 times a week (21%). The findings confirm those of Opiyo, *et al.*, (2000) who found that bush clearing and burning of the litter was the leading environmental hygiene exercise done in the neighbouring Rusinga Island.

The findings also showed that for those households which close their windows and doors at 6pm have less cases of malaria at 40.9% as compared to those who close their doors and windows at 8pm at 53.9%. Mosquitoes bite household members early but blocking them by closing doors and windows early is a recommended practice.

The study established that upon comparing those who had water collection points in their compound vis a vis malaria incidences in the households in the past 2 weeks. The results show that 21.7% of the respondents had been diagnosed with malaria while 78.3% had not. And those who did not have pit or water collection points in their compound, 90.2% of the respondents reported they have not been diagnosed and treated of malaria in the past 2 weeks. This establishes the fact that environmental hygiene plays a role in malaria prevalence at the household level.

The study established that people had little knowledge of how malaria is contracted. From the responses, 9% said they contract malaria through a mosquito bite, 1.4% cited playing in polluted water, 0.6% cited walking in cold weather, most of the respondents 77.2% cited a combination of mosquito bite, playing in polluted water and walking in cold weather as the reasons for contracting malaria. 9.3% of the respondents cited mosquito bite as well as playing in polluted water while 2.5% of the responses were for mosquito bite as well as walking in cold weather. It means that many still lack correct knowledge which calls for

health promotion on the right kind of messages which should be passed to the community members.

However, the opposite is true on the knowledge of malaria prevention. 83.1% of the respondents cited multiple strategies in preventing malaria, from treated mosquito nets, to environment hygiene to taking antimalarial drugs. These findings clearly establish that most people advocate for a combination of strategies to prevent mosquito bites and hence prevent malaria. This finding is in line with that of Okech, *et al*., (2008) that advocated for integrated malaria management.

The findings showed that health workers remain the leading avenues where health messages are received from. The findings show that 62.8% of the respondents stated that they got the information from health workers, while 1.7% stated that they had no information. 28.7% of the respondents stated that they got malaria preventive information from radios and TV, 2.8% cited a combination of the chief baraza, health worker, radios and TV, 5.1% cited chiefs baraza only. The data shows that health workers are popular in giving health information and in this case malaria prevention messages. The findings are comparable to what Weckenbrook, (2004) found in his research. He found out that health workers pass information from one person to another in the community and that there are no books, IEC materials available for people to read.

Seminars on malaria prevention have not been popular in the community with 49% stated they have attended while 50.4 stated they have not attended and 0.6% are not sure of attending any seminar. Of those who said they have attended the seminars/training, 10.4% stated they got the training at the chiefs baraza, 16.6% stated they got it from the health facility, 9.9% stated they got the information when some NGOs came to the area, 5.9% stated that received the training during a health promotion exercise in the area, 7% combined health

facility, NGOs and health promotion. The data confirms that dispensaries and health workers play a great role in dissemination of knowledge in malaria prevention.

The study also established that most people buy medicine as a preventive measure towards malaria. Majority of the respondents, 58.3% stated they have taken antimalarial drugs to prevent suspected malaria. And findings from crosstabs showed that majority of those who did not take the drugs had higher percentage of malaria positivity rates.

The study established that Mfangano Island had a malaria prevalence of 28.7%. Findings from the respondents who reported to have been diagnosed with malaria in the past 2 weeks were at 28.7% against 71.3% respondents who did not experience malaria incidences. These findings can be attributed to the malaria knowledge that most respondents possess on prevention and always discuss with their family members (60.3%), and with friends and relatives (24.5%). The results can also be attributed to the fact that the government rolled out mass net distribution in most villages in Nyanza and Western and so most people (76.2%) sleep under mosquito treated bed nets. The results are lower than the recorded Nyanza Province's average malaria prevalence rate of 38%, which can also be interpreted that the various interventions rolled out by the government as outlined in the National Malaria Strategy (2009-2017) have some positive effects in the community, (KMIS 2010).

The findings based on the correlations (Pearson's correlation coefficient) reveal that most preventive strategies had a positive correlation and were significant among the variables under study.

5.3 Conclusion

Based on the findings of the study as summarized above, it can be concluded that the preventive strategies employed to fight and prevent malaria have positive effects on malaria prevalence in the Island. However, the researcher concluded that no one method is sufficient to prevent the disease. The use of multi-faced approach is recommended. As malaria prevention and control officer reiterated:

> "*All the preventive strategies should be employed to curb the malaria prevalence in Mbita Sub County. The strategies to be employed include IRS, Net utilization, compound clearing, and case management"* (SCMCC).

The first objective was to examine how utilization of mosquito nets influences malaria prevalence among households in Mfangano Island, Mbita Sub County. From the findings, it was noted that households that utilized mosquito nets had few cases of malaria diagnosed and reported as compared to those who did not utilize the nets. And there was a strong positive correlation between net utilization and malaria prevalence in the Island.

The second objective was to assess the extent to which environmental hygiene influences malaria prevalence among households in Mfangano Island, Mbita Sub County. From the findings, it was noted that those households who ensured environmental cleanliness 2 to 3 times a week had less cases of malaria reported from their households as compared to those who occasionally made their compounds free from mosquito breeding points. The correlation was also positive though not as strong. This was attributed to the fact that it requires the whole community to be sensitized and work as a team to ensure environmental hygiene. And when a few households engage in the exercise while others do not, then the positive results may be reversed as mosquitoes travel and breed about 1km away, (Okech, *et al*., 2009).

The third objective was to determine how malaria knowledge seeking behaviour influences malaria prevalence among households in Mfangano Island, Mbita Sub County. It was also noted from the findings that attitude affects the way nets are utilised in this community. So there is need for behaviour change communication to address the attitudes, myths and beliefs that people have about malaria prevention. The findings established that the information passed should be filtered to ensure the right information on malaria prevention is disseminated. Health workers are the most popular avenue of disseminating information to the community and this should be encouraged. It was also observed that routine health promotion activities are needed in the Island.

The forth objective was to assess the extent to which malaria prophylaxis drug influences malaria prevalence among households in Mfangano Island, Mbita Sub County. From the study findings, antimalarial drugs remain the leading way by which most people prevent symptoms attributable to malaria. 12.9% of the respondents reported to have taken the antimalarial drug to prevent suspected malaria while 8.5% of the respondents who also took the drug did not have a reason for taking the drug. The correlation between this variable against malaria prevalence established that there was a negative but significant correlation. The findings meant that the increase in uptake of the antimalaria drugs enables the malaria prevalence in the households to go down.

5.4 Recommendations

Based on the finding of the study, the researcher wishes to make the following recommendations;

There is need for a multi-faced approach to preventive strategies. All the strategies should be employed together to prevent mortality and morbidity attributable to malaria in Mfangano Island. Health promotion should be encouraged to ensure continued utilization of all the preventive strategies. The ministry of health under the department of health promotion

can liaise with other stakeholders to provide regular advocacy and continued health education and sensitization to the people of Mfangano Island.

The provincial administration always plays a key role in community engagement. They can lead in community mobilization and sensitization towards environmental hygiene as a way of preventing opportune illnesses. All the community members need to be mobilized and sensitized if environmental cleanliness is to succeed. As the area chief singled out:

> *"Clearing of the compound, draining of water collection points and general environmental sanitation will only succeed in mosquito prevention if all the community members are mobilized to do this routinely..."*

The ministry of health should work on provision of mosquito nets to those who do not have and ensure education on net hanging and use to avoid net misuse in the community. Health promotion and advocacy will go a long way in correcting any attitudes, myths and misconceptions in the community towards net utilization, environmental hygiene, promoting good knowledge seeking behaviors and ensuring proper utilization of malaria medicines.

Lastly, it is recommended that before one takes over the counter drug to prevent malaria, one should be diagnosed and tested for malaria to be sure that one is treating the correct disease as symptoms of malaria are also similar to those of other disease like Typhoid. Malaria case management at the community level is recommended and the government is currently advocating for testing first before treatment.

5.5 Contribution to Knowledge base

Table 5.1 Contribution to the body of knowledge

	Objective of the study	Contribution to the body of Knowledge
1.	To examine how utilization of mosquito nets influences malaria prevalence among households in Mfangano Island, Mbita Sub County.	It was established that treated mosquito nets play a key role in the prevention of malaria thereby reducing malaria prevalence at the household level. It was also established that the nets should be treated, properly hanged and used by 1 person or shared with 2-3 people to ensure maximum protection against mosquito bites.
2.	To assess the extent to which environmental hygiene influences malaria prevalence among households in Mfangano Island, Mbita Sub County.	It was established that clearing of the bushes around the homestead, draining of stagnant water from water collection points, spraying are among the activities that should be routinely practiced by all to ensure reduced malaria incidences in the households. The community members should take this seriously as the positive gains may be reversed by a few who neglect their responsibilities.
3.	To determine how malaria knowledge seeking behaviour influences malaria prevalence among households in Mfangano Island, Mbita Sub County	It was determined that prevention of malaria require multi-faceted approach; that is all interventions should be employed to prevent malaria; from using treated mosquito nets, to ensuring proper hygiene of the environment around the household, to using malaria prevention medicines and ensuring routine health promotion campaigns geared towards disease prevention.
4.	To assess the extent to which malaria prophylaxis drug influences malaria prevalence among households in Mfangano Island, Mbita Sub County.	From the study findings, taking medicines as a preventive strategy was employed by most people when they realized they had fever. However, malaria case management at the community should be encouraged for people to get diagnosed and tested before they are given drugs.

5.6 Suggestions for further research

The researcher suggests that;

1. A study should be conducted on the disposal of used mosquito nets to prevent misuse by the fishing and farming community in Mfangano Island, Mbita Sub County.

2. A study should be conducted on the utilization of malaria prophylaxis drugs by pregnant women to control malaria disease in Mfangano Island, Mbita Sub County.

REFERENCES

Alaai, J.A., Borne, H.W, Kachur, S.P., Mwenesi, H., Vulule, J.M., Hawley, W.A..., Howard P.A., (2003). Perceptions of bed nets and malaria prevention before and after a randomized controlled trial of permethrin-treated bed nets in western Kenya. *American Journal of Tropical Medicine & Hygiene*, **68** (4 Suppl)**:**142-14

Allan, R., O'Reilly, L., Kilian, A., (2012). An observational study of material durability of three World Health Organization–recommended long long-lasting insecticidal nets in Eastern Chad. *American Journal of Tropical Medicine & Hygiene* 2012, 87:407-411.

Alvarado, B.E., Gomez, E., Serra, M., Carvajal, R., Carrasquilla, G., (2006). Evaluation of an educational strategy on malaria in rural areas of the Colombian Pacific Coast. *Biomedica* 2006, 26:342-352.

Asidi, A., N'Guessan, R., Hutchinson, R.A, Traore-Lamizana, M, Carnevale. P., Curtis, C.F. (2004). Experimental hut comparisons of nets treated with carbamate or pyrethroid insecticides, washed or unwashed, against pyrethroid-resistant mosquitoes. *Med Vet Entomology* 2004, 18:134-140.

Atkinson, J. A., Bobogare, A., Fitzgerald, L., Boaz, L, Appleyard, B., Toaliu, H and Vallely, A. (2009). A qualitative study on the acceptability and preference of three types of long-lasting insecticide-treated bed nets in Solomon Islands: implications for malaria elimination. *Malaria Journal* 2009, 8:119.

Batisso, E., Habte, T., Tesfaye, G, Getachew, D., Tekalegne, A., Kilian,...,Lynch C., (2012). A stitch in time: a cross-sectional survey looking at long lasting insecticide-treated bed net ownership, utilization and attrition in SNNPR. *Ethiopia. Malaria Journal* 2012, 11:183.

Baume, C.A, Reithinger, R, Woldehanna, S (2009). Factors associated with use and non-use of mosquito nets owned in Oromia and Amhara regional states. *Ethiopia Malaria Journal* 2009, 8:264.

Beier, J.C, Oster, C.N, Onyango, F.K, Bales, J.D, Sherwood, J.A, Perkins,…Roberts C.R (1994). *Plasmodium falciparum* incidence relative to entomologic inoculation rates at a site proposed for testing malaria vaccines in western Kenya. *American Journal of Tropical Medicine & Hygiene* 1994, 50:529-536.

Binka, F., Indome, F., Smith, T. (1998). Impact of spatial distribution of permethrin impregnated bednets on child mortality in rural northern Ghana. *American Journal of Tropical Medicine and Hygiene,* 1998, 59:80–85

Bødker, R., Akida, J., Shayo, D., Kisinza, W., Msangeni, H.A, Pedersen, E.M & Lindsay S.W., (2003). Relationship between altitude and intensity of malaria transmission in the Usambara Mountains, Tanzania. *Journal of Medicine Entomology* 2003, 40:706-717.

Buabeng, K.O, Duwiejua, M, Dodoo, A.N, Matowe, L.K, Enlund, H (2007). Self-reported use of anti-malarial drugs and health facility management of malaria in Ghana. *Malaria Journal* 2007, 6:85.

Burnham, K.P, & Anderson, D.R. (2002). *Model Selection and Multi model Inference: A Practical Information-Theoretic Approach*. 2nd edition. New York: Springer

Carnevale, P., Bitsindou, P, Diomandé, L, Robert, V (1992). Insecticide impregnation can restore the efficacy of torn bed nets and reduce man-vector contact in malaria endemic areas. *Transaction of the Royal Society of Tropical Medicine & Hygiene* 1992, 86:362-364.

Centre for Disease Control, (2012). Article "*Choosing a drug for malaria prophylaxis*." http://www.cdc.gov/malaria/travelers/drugs.html

Central Bureau of Statistics (CBS) [Kenya] MoHMK, and ORC Macro., (2004). *Kenya Demographic and Health Survey*. Calverton, Maryland: CBS, MOH and ORC Macro.

Chuma, C., Okungu, V., Ntwiga, J., Molyneux, C. (2010). Towards achieving Abuja targets: Identifying and addressing barriers to access and use of insecticides treated nets among the poorest populations in Kenya. *BMC Public Health* 2010, 10:137.

Chuma, J.M, Thiede, M, Molyneux, C.S (2006). Rethinking the economic costs of malaria At the household level: evidence from applying a new analytical framework in rural Kenya. *Malaria Journal* 2006, **5:**76.

Clarke, S.E., Bogh, C., Brown, R.C., Pinder, M., Walraven, G.E.L., & Lindsay, S.W. (2001). Do untreated bednets protect against malaria? *Transaction of the Royal Society of Tropical Medicine & Hygiene* 2001, 95:457-462.

Cochran, W.G., (1977). Sampling Techniques. *New York: Wiley* 3rd edition.

Coleman, P.G., Morel, C., Shillcutt, S., Goodman, C., Mills, A.J. (2004). A threshold analysis of the cost-effectiveness of artemisinin-based combination therapies in sub-saharan Africa. *American Journal of Tropical Medicine & Hygiene* 2004, 71(2 Suppl):196-204.

Dapeng, L. *et al*. (1994). The effect of DDT spraying and bed nets impregnated with pyrethroid insecticide on the incidence of Japanese encephalitis virus infection. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1994, 88:629–631.

Deressa, W., (2007). Treatment-seeking behaviour for febrile illness in an area of seasonal malaria transmission in rural Ethiopia. *Malaria Journal* 2007, 6:49.

Dhawan, G., Joseph, N., Pekow, P.S., Rogers, C.A., Poudel, K.C., Bulzacchelli, M.T.,

(2014). Malaria-related knowledge and prevention practices in four neighbourhoods in and around Mumbai, India: a cross-sectional study. *Malaria Journal* 2014, 13:303 doi:10.1186/1475-2875-13-303

Distribution of insecticide-treated bednets during a polio immunization campaign, Niger. *Morbidity and mortality weekly report,* 2006, 55(33):913–916.

Distribution of insecticide-treated bednets during an integrated nationwide immunization campaign, Togo, West Africa. *Morbidity and mortality weekly report,* 2005, 54(39):994–996.

Donnelly, M.J., McCall, P.J., & Lengeler C., (2005). "Malaria and urbanization in sub-Saharan Africa," *Malaria Journal*, vol. 4, article e12, 2005.

Eisele, T.P., Thwing, J., Keating, J. (2011). Claims about the misuse of insecticide-treated mosquito nets: are these evidence-based? *PLoS Med* 2011, 8:4. e1001019

Erlanger, T.E., Enayati, A.A., Hemingway, J., Mshinda, H., Tami, A., & Lengeler, C. (2004). Field issues related to effectiveness of insecticide-treated nets in Tanzania. *Med Vet Entomol* 2004, 18:153-160.

Ettling, M.B., (2002). *The control of malaria in Viet Nam from 1980 to 2000: What went right?* Manila, World Health Organization Regional Office for the Western Pacific,

Etuk, S.J., & Ekanem, E.I., (2005). Impact of mass media campaigns on the knowledge and attitudes of pregnant Nigerian women towards HIV/AIDS. *Tropical Doctor* 2005, 35:101-102.

Ferede, G.,Worku, A., Getaneh, A., Ahmed, A., Haile,T.,Abdu, Y.,…Alemu, A., (2013). *Prevalence of Malaria from Blood Smears Examination: A Seven-Year Retrospective Study from Metema Hospital, Northwest Ethiopia.* http://dx.doi.org/10.1155/2013/704730

Fumiya, S. *et. al*., (2001). The feasibility of a bed net impregnation program to enhance control of Malayan filariasis along a swamp forest in southern. *A manual for malaria programme managers* 80 Thailand. *Southeast Asian Journal of Tropical Medicine and Public Health,* 2001, 32:235–239.

Gamble, C., Ekwaru, J.P., Kuile, F.O., (2006). Insecticide-treated nets for preventing malaria in pregnancy. *Cochrane Database of Systematic Reviews, 2006,* 19 Apr. (2):CD003755.

Geneva, 11–14 December 2006. Geneva, World Health Organization, 2006 (WHO/CDS/NTD/WHOPES/2007).

Gimnig, J.E., Lindblade, K.A., Mount, D.L., Atieli, F.K., Crawford S, Wolkon A.,...Doston, E.M., (2005). Laboratory wash resistance of long-lasting insecticidal nets. *Tropical Medicine & International Health* 2005, 10:1022-1029.

Githinji, S., Herbst, S., Kistemann, T., Noor, A.M. (2010). Mosquito nets in a rural area of Western Kenya: ownership, use and quality. *Malaria Journal* 2010, 9:250.

Gitonga, C.W, Karanja, P.N., Kihara, J., Mwanje, M., Juma, E., Snow, R.W., Noor, A.M., & Brooker, S. (2010). Implementing school malaria surveys in Kenya: towards a national surveillance system. *Malaria Journal* 2010, 9:306.

Gouagna, L.C, Okech, B.A, Kabiru, E.W, Killeen, G.F, Obare, P. (2003). Infectivity pf *Plasmodium falciparum* gametocytes in patients attending rural health centers in western Kenya. *East African medical Journal* 80: 627–634.

Grabowsky, M., Nobiya, T., Ahun, M.,Donna, R.,Lengor. M., Zimmerman, D.,…Amofar, G., (2005). Distributing insecticide-treated bednets during measles vaccination: a low-cost means of achieving high and equitable coverage. *Bulletin of the World Health Organization,* 2005, 83:195–201.

Graves, P.M., Ngondi, J.M., Hwang, J., Getachew, A., Gebre, T., Mosher, A.W.,...&

Richards, F.O. Jr. (2011). Factors associated with mosquito net use by individuals in households owning nets in Ethiopia. *Malaria Journal* 2011, 10:354.

Guyatt, H., Ochola, S. (2003). Use of bednets given free to pregnant women in Kenya. *Lancet*, 2003, 362:1549–1550.

Guyatt, H.L., Gotink, M.H., Ochola, S.A., Snow, R.W., (2002). Free bednets to pregnant women through antenatal clinics in Kenya: a cheap, simple and equitable approach to delivery. *Tropical Medicine and International Health*, 2002, 7:409–420. DOI: 10.1046/j.1365-3156.2002.00879.x

Guyatt, H.L., & Snow, R.W. (2004). The management of fevers in Kenyan children and Adults in an area of seasonal malaria transmission. *Transaction of the Royal Society of Tropical Medicine & Hygiene* 2004, 98:111-115.

Hamel, M, J., Odhacha, A., Roberts, J.M., Deming, M.S.(2001). Malaria control in Bungoma Sub County, Kenya: a survey of home treatment of children with fever, bednet use and attendance at antenatal clinics. *Bull World Health Organ* , 79:1014-1023.

Hawley, W.A, Phillips-Howard P.A., ter Kuile, F.O., Terlouw, D.J., Vulule, J.M., Ombok, M.,...Hightower, A.W., (2003). Community-wide effects of permethrin-treated bed nets on child mortality and malaria morbidity in western Kenya. *American Journal of Tropical Medicine and Hygiene*, 68:121–127

Heather, R., (2008). *Environmental Management for Malaria Control: Knowledge & Practices in Mvomero District, Tanzania*. M.A Thesis of Duke University.

Hill, J., Lines, J., & Rowland, M. (2006). Insecticide-treated nets. *Advances in Parasitology*, 61, 71–128

http://www.the-star.co.ke/news/article-21562/fears-new-malaria-breakout-nyanza#sthash.0Ys72MZm.dpuf

John, C.C., McHugh, M.M., Moormann, A.M., Sumba, P.O., Ofulla, A.V. (2005). Low prevalence of Plasmodium falciparum infection among asymptomatic individuals in a highland area of Kenya. *Transaction of the Royal Society of Tropical Medicine & Hygiene* , 99:780-786.

Kachur, S.P., Phillips-Howard, P.A., Odhacha, A.M., Ruesbush, T.K., Oloo, A.J., & Nahlen, B.L. (1999). Maintenance and sustained use of insecticide-treated bednets and curtains three years after a controlled trial in Western Kenya. *Tropical Medicine & International Health* , 4:728-735.

Kenya National Bureau of Statistics, 2010**.** *Kenya Demographic and Health Survey* 2008-9, Nairobi, Kenya

Kenya National Bureau of Statistics, UNICEF 2012. *Nyanza Province Multiple Indicator Survey*, 2011.

Kenya National Bureau of Statistics, (2010). Island of Malaria Control, Ministry of Public Health and Sanitation, ICF Macro, 2010 *Kenya Malaria Indicator Survey (KMIS)*, Nairobi, Kenya.

Kenya National Bureau of Statistics, (2007). Island of Malaria Control (DOMC) Ministry of Public Health and Sanitation. *Kenya malaria indicator survey (KMIS)*. Nairobi, Kenya.

Kenya Health Information Systems (DHIS), (2014). Ministry of Health 705A & 705B outpatient morbidity summary retrieved from https://hiskenya.org/dhis-web-reporting/showDataSetReportForm.action on Feb 25th 2014 at 1800 hours.

Khambira, M., (2013). *Insecticide treated bednets ownership, use and maintenance Behaviour in Kwale, Msambweni and Kinango Districts in Kenya*. An MPH Master's thesis of Kenyatta University.

Kilian, A., Byamukama, W., Pigeon, O., Gimnig, J.E., Atieli, F., Koekemoer, L.,

Protopopoff, N., (2011). Evidence for a useful life of more than three years for a polyester-based long-lasting insecticidal mosquito net in Western Uganda. *Malaria Journal* 2011, 10:299.

Kilian, A., (2010). How long does a long-lasting insecticidal net last in the field? *Public Health Journal* 2010, 21:43-47.

Killeen, G.F., Smith, T.A., Ferguson, H.M., Mshinda, H.,Abdulla, H., Lengeler, C., Kachur, S.P., (2007). Preventing childhood malaria in Africa by protecting adults from mosquitoes with insecticide-treated nets. *PLoS Medicine* 2007, 4(7): e229. DOI: 10.1371/journal.pmed.0040229

Kothari, C.R., (2004). *Research Methods: methods and techniques*, New Delhi, New Age International Publishers Ltd.

Kenya National Bureau of Statistics, (2009). *Population and housing census, population distribution by administrative areas and urban centers*. Nairobi, Kenya.

Kroeger, A. *et al*. (2003) Preventing the transmission of Chagas disease with pyrethroid impregnated materials. *American Journal of Tropical Medicine and Hygiene*, 68(3):307–311.

Lines, J.D., Curtis, C.F., Myamba, J., Njau, R., (1985). *Tests of repellent or insecticide impregnated curtains, bednets and anklets against malaria vectors in Tanzania*. WHO/VBC/SS; 1985:920. Unpublished document

Malik, E.M., Hanafi, K., Ali, S.H., Ahmed, E.S., & Mohamed, K.A. (2006). Treatment-seeking behaviour for malaria in children under five years of age: implication for home management in rural areas with high seasonal transmission in Sudan. *Malaria Journal*, 5:60.

Malima, R.C., Magesa, S.M., Tungu, P.K., Mwingira, V., Magogo, F.S., Sudi, W., …,

Rowland, M. (2008). An experimental hut evaluation of Olyset nets against anopheline mosquitoes after seven years in use in Tanzanian villages. *Malaria Journal* 2008, 7:38.

Malusha, J.M., Mwanzo, I., Yitambe, A., & Mbugi, J.P. (2010). Use of insecticide treated nets among caregivers of children under five years in Makueni Sub County, Kenya. *East African medical journal*, 86 (7), 308-13

Manda, H.,Gouagna, L.C., Nyandat, E, Kabiru, E.W., Jackson,R.R., Foster, W.A., Githure,J.I.,...Hassanali J., (2007). Discriminative feeding behaviour of *Anopheles gambiae s.s.* on endemic plants in western Kenya. *Med Vet Entomol; 21(1)*: 103–111. doi: 10.1111/j.1365-2915.2007.00672.x

Marsh, V.M, Mutemi, W.M, Muturi, J., Haaland, A., Watkins, W.M., Otieno, G. & Marsh K (1999). Changing home treatment of childhood fevers by training shop keepers in rural Kenya. *Tropical Medicine & International Health* 1999, 4:383-389.

Matthys, E. K., N'Goran, M., Koné, *et al*.,(2006). "Urban agricultural land use and characterization of mosquito larval habitats in a medium-sized town of Côte d'Ivoire," *Journal of Vector Ecology*, vol. 31, no. 2, pp. 319–333.

Maxwell, C.A., Msuya, E., Sudi, M., Njunwa, K.J., Carneiro, I.A., Curtis, C.F. (2002). Effect of community-wide use of insecticide-treated nets for 3–4 years on malaria morbidity in Tanzania. *Tropical Medicine & International Health* 2002, 7:1003-1008.

Mboera, L.E.G., Kamugisha, M.L., Rumisha, S., Kisinza, W., Senkoro, K.P., Kitua, A.Y., (2008). Malaria and mosquito net utilisation among schoolchildren in villages with or without healthcare facilities at different altitudes in Iringa Sub County, Tanzania. *African Health Sciences* 8:114-119.

Mbogo,C.M., Mwangangi, J.M., Nzovu, J., Gu, W., Yan, G., Gunter J, Beier, J.C. (2003).

Spatial and temporal heterogeneity of *Anopheles* mosquitoes and *Plasmodium falciparum* transmission along the Kenyan coast. *American Journal of Tropical Medicine & Hygiene* 2003, 68:734-742.

Ministry of Health K, (2010). *National Guidelines for the Diagnosis, Treatment and Prevention of Malaria in Kenya*. Ministry of Public Health & Sanitation 3rd edition.

Ministry of Health K, (2001): *National Malaria Strategy 2001–2010.* Island of Malaria Control MoH, Nairobi, Republic of Kenya.

Ministry of Health K, (2006). *National Malaria Treatment Guidelines.* Nairobi, Kenya: Ministry of Health, Kenya.

Mugenda, M.M., & Mugenda, A.G., (2003). *Research Methods: Quantitative and Qualitative Approaches***.** Nairobi. ACTS Press

Mutero, C.M, Ouma, J.H, Agak, B.K., Wanderi, J.A., Copeland, R.S., (1998). Malaria prevalence and use of self-protection measures against mosquitoes in Suba district. *East African Medical Journal* 1998, 75(1):11-16.

Mutuku, F.M., Alaii, J.A., Bayoh, M.N., Gimnig, J.E., Vulule, J.M., Walker, E.D.,...Hawley W.A. (2006). Distribution, description, and local knowledge of larval habitats of Anopheles gambiae s.l. in a village in western Kenya**.** *American Journal of Tropical Medicine & Hygiene* 2006, **74**(1)**:**44-53.

Mutuku, F.M., King, C.H., Mungai, P., Mbogo, C.M., Mwangangi, J.M., Muchiri, E.M.,... Kitron, U. (2011). Impact of insecticide treated bednets on malaria transmission indices on the south coast of Kenya. *Malaria Journal* 2011, 10:356.

Mwangi, T.W., Ross, A., Marsh, K., Snow, R.W. (2003). The effects of untreated bednets on malaria infection and morbidity on the Kenyan coast. *Transaction of the Royal Society of Tropical Medicine & Hygiene* 2003, 97:369-372.

Ndenga, B., Githeko, A., Omukunda, E., Munyekenye, G., Atieli, H., Wamai, P. ... Yan, G. (2006). Population dynamics of malaria vectors in western Kenya highlands. *Journal of Medical Entomology* 2006, 42:200-206.

Ng'ang'a,P.N., Shililu, J.I.,, Jayasinghe, G., Kimani, V., Kabutha, C., Kabuage, L., ... Mutero C., (2008). Malaria vector control practices in an irrigated rice agro-ecosystem in central Kenya and implications for malaria control. *Malaria Journal* 2008, 7:146.

Ngechu, M**.** *Understanding the Research Process and Methods: An Introduction***.** University of Nairobi. First edition

Ngondi, J.M., Graves, P.M., Gebre, T., Mosher, A.W., Shargie, E.B., Emerson, P.M., Richards, F.O Jr, (2011). Which nets are being used: factors associated with mosquito net use in Amhara, Oromia and Southern Nations, Nationalities and Peoples' Regions of Ethiopia. *Malaria Journal* 2011, 10:92.

Ngufor, C., N'Guessan, R, Boko, P, Odjo, A, Vigninou E, Asidi A, Rowland M, (2011). Combining indoor residual spraying with chlorfenapyr and long-lasting insecticidal bed nets for improved control of pyrethroid-resistant Anopheles gambiae: an experimental hut trial in Benin. *Malaria Journal* 2011, 10:343.

Njama, D., Dorsey, G., Guwatudde, D., Kigonya, K., Greenhouse, B., Musisi, S.,(2003). Urban malaria: primary caregivers' knowledge, attitudes, practices and predictors of malaria incidence in a cohort of Ugandan children. *Tropical Medicine & International Health* 2003, 8:685-692.

.Noor, A.M., Amin, A.A., Akhwale, W.S., & Snow, R.W. (2007). Increasing coverage and decreasing inequity in insecticide-treated bed net use among rural Kenyan children. *PLoS Med* 2007, 4:e255.

Noor, A.M., Kirui, V.C., Brooke, S.J., & Snow, R.W. (2009). The use of insecticide treated

nets by age: implications for universal coverage in Africa. *BMC Public Health* 2009, 9:369.

Noor, A.M, Gething, P.W, Alegana1, V.A, Patil, A.P, Hay, S.I. (2009). The risks of malaria infection in Kenya in 2009. *BMC Infectious Diseases* 9: 180.

Nsabagasani, X. & Meinert, L. (2005). *Findings from a study on malaria and medicine in nine primary schools in rural and urban areas in Uganda.* Child Health and Development Center and Makerere Institute of Social Research, Makerere University

Okech, B.A., Mwobobia, I.k., Kamau, A., Muiruri, S., Mutiso, N., Nyambura, J.,...Mwandawiro, C.S. (2008). Use of Integrated Malaria Management Reduces Malaria in Kenya. *PLoS ONE.* 2008; 3(12): e4050. doi: 10.1371/journal.pone.0004050

Opiyo, P., Mukabana, W.R., Kiche, I., Mathenge, E.,Killeen, G.F., Fillinger, U., (2007). An exploratory study of community factors relevant for participatory malaria control on Rusinga Island, western Kenya. *Malaria Journal* 2007, 6:48 doi:10.1186/1475-2875-6-48

Onen, D., & Osoo, Y. W., 2005. *A General Guide to Writing Research Proposal and Report: A Handbook for Beginning Researchers.* Options Press and Publishers

Panter-Brick, C., Clarke, S., Lomas, H., Pinder, M., Lindsay, S.W. (2006). Culturally compelling strategies for behaviour change: a social ecology model and case study in malaria prevention. *Social Science & Medicine* 2006, 62:2810-2825.

Pell, C., Meñaca, A., Afrah, N. A., Manda-Taylor, L., Chatio, S., Were, F.,...Pool, R., (2013). Prevention and management of malaria during pregnancy; findings from a Comparative qualitative study in Ghana, Kenya and Malawi. *Malaria Journal* 2013, **12**:427 doi:10.1186/1475-2875-12-427

Peters, W. (1986). *Chemotherapy and drug resistance in malaria.* London: Academic Press.

Port, G.R., Boreham, P.F.L. (1982): The effect of bednets on feeding by Anopheles gambiae Giles (Diptera: Culicidae). *Bull Entomological & Research* 1982, 72:483-488.

Public Health Journal (2010), **21:**43-47. WHO: *Guidelines for monitoring the durability of long-lasting insecticidal mosquito nets under operational conditions*. Geneva: WHO/HTM/NTD/WHOPES; 2011.

Pulford, .J, Hetzel, M.W., Bryant, M., Siba, P.M., Mueller, I., (2011). Reported reasons for not using a mosquito net when one is available: a review of the published literature. *Malaria Journal* 2011, 10:83.

Ranson, H., N'Guessan, R., Lines, J., Moiroux, N., Nkuni, Z., Corbel, V., (2011). Pyrethroid resistance in African anopheline mosquitoes: what are the implications for malaria control? *Trends in Parasitology* 2011, 27:91-97.

Rehman, A.M., Coleman, M., Schwabe, C., Baltazar, G., Matias, A., Gomes, I.R.,…, Kleinschmidt, I., (2011). How much does malaria vector control quality matter: the epidemiological impact of holed nets and inadequate indoor residual spraying. *PLoS One* 2011, 6:e19205.

Report of the tenth WHOPES Working Group meeting. Review of spinosad 0.5% GR & 12% SC, lambda-cyhalothrin 10% CS, K-O Tab 1-2-3, Interceptor.

Reyburn, H., Ashford, R., Mohsen, M., Hewitt, S., Rowland, M., (2000). A randomized controlled trial of insecticide-treated bednets and *chaddars* or top sheets, and residual spraying of interior rooms for the prevention of cutaneous leishmaniasis in Kabul, Afghanistan. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 94:361–366.

Roll Back Malaria, Key Malaria Facts, 2012, http://www.rbm.who.int/keyfacts.html.

Roll Back Malaria, MEASURE Evaluation Project, World Health Organization, UNICEF.

Guidelines for core population coverage indicators for Roll Back Malaria: to be obtained from household surveys. Chapel Hill, NC, MEASURE Evaluation Project, 2004

Rowe, A.K., Hamel, M.J., Flanders, W.D., Doutizanga, R., Ndoyo, J., Deming, M.S. (2000). Predictors of correct treatment of children with fever seen at outpatient health facilities in the Central African Republic. *American Journal of Epidemiology* 2000, 151:1029-1035.

Saugeon, T., Baldet, M., Akogbeto, & Henry, M. C., (2009). "Will climate and demography have a major impact on malaria in sub-Saharan Africa in the next 20 years?" Médecine Tropicale, vol. 69, no. 2, pp. 203–207.

Sekaran, U., (1992) *Research Methods for Business.* Second edition, John Wiley and Sons. Singapore

Siri, J.G., Lindblade, K.A., Rosen, D.H., Onyango, B., Vulule, J., Slutsker, L., Wilson, M.L. (2008). Quantitative urban classification for malaria epidemiology in sub-Saharan Africa. *Malaria Journal* 2008, 7:34.

Skovmand, O., & Bosselmann, R., (2011). Strength of bed nets as function of denier, knitting pattern, texturizing and polymer. *Malaria Journal* 2011, 10:87.

Skovmand, O., (2010). Insecticidal bednets for the fight against malaria – present time and near future. *The Open Biology Journal* 2010, 3:92-96.

Snow, R.W., Peshu, N., Forster, D., Mwenesi, H., Marsh, K., (1992). The role of shops in the treatment and prevention of childhood malaria on the coast of Kenya. *Transaction of the Royal Society of Tropical Medicine & Hygiene* 1992, 86:237-239.

Spencer, S., Grant, A.D., Piola, P., Tukpo, K., Okia, M., Garcia, M.,…, Guthman, J.P.,

(2004). Malaria in camps for internally-displaced persons in Uganda: evaluation of an insecticide-treated bednet distribution programme. *Transaction of the Royal Society of Tropical Medicine & Hygiene* 2004, 98:719-727.

Tavrow, P., Shabahang, J., Makama, S., (2003). Vendor-to-vendor education to improve malaria treatment by private drug outlets in Bungoma Sub County, Kenya. *Malaria Journal* 2003, 2:10

Tsuang, A., Lines, J., Hanson, K., (2010). Which family members use the best nets? An analysis of the condition of mosquito nets and their distribution within households in Tanzania. *Malaria Journal* 2010, 9:211.

UNICEF, (2009-2013) retrieved from http://www.unicef.org/kenya/overview_4616.html

UNICEF, (2009-2013) retrieved from http://www.unicef.org/health/files/health_africamalaria.pdf on 20th February 2014 at 2030 hours

United States Agency for International Development, (2013). "Presidential Malaria Initiative, *7th Annual Report to congress*".

Watsierah, C.A, Jura, W.G.Z.O., Oyugi, H, Abong'o, B., & Ouma, C. (2010). Factors determining anti-malarial drug use in a peri-urban population from malaria holoendemic region of western Kenya. *Malaria Journal* 2010, 9:295.

Weckenbrock, P. (2004) *Livelihoods, vulnerability and the risk of malaria on Rusinga Island/Kenya.* [S.l. : s.n.], 2004.eBook dissertation. German

World Health Organization, (2005). *Guidelines for laboratory and field testing of long lasting insecticidal mosquito nets.* Geneva, (WHO/CDS/WHOPES/GCDPP/2005.11).

World Health Organization, (1987): Conference of Experts on rational use of drugs. Nairobi,

World Health Organization, (1999). Report on the progress in Essential Drugs and Management Policy, 1998-1999. Geneva.

World Health Organization, (2000). The use of antimalarials. Report of WHO informal consultations 13-17, November, 2000.

WHO/GMP, (2007). *Insecticide-treated mosquito nets: a WHO position statement*. Geneva: World Health Organization, Global Malaria Programme; 2007.

World Health Organization, (2001), *Report of the fifth WHOPES Working Group meeting. Review of Olyset Net, bifenthrin 10% WP*. Geneva, 30–31 October 2001. Geneva (WHO/CDS/WHOPES/2001.4).

World Health Organization, (2004). *Report of the seventh WHOPES Working Group meeting. Review of Vecto Bac WG, PermaNet, Gokilaht S-5EC.* Geneva, 2–4 Dec. 2003. Geneva, (WHO/CDS/WHOPES/2004.8).

World Health Organization. *World malaria report 2011*. Geneva:

World Health Organization, (2005): *World Malaria Report.* Roll Back Malaria.

World malaria report 2005. Geneva, World Health Organization, (WHO/HTM/MAL/2005.1102).

World Health Organization: *Guidelines for monitoring the durability of long-lasting insecticidal mosquito nets under operational conditions*. Geneva: WHO/HTM/NTD/WHOPES; 2011.

Worrall, E., Hill, J., Webster, J., Mortimer, J., (2005). Experience of targeting subsidies on insecticide-treated nets: what do we know and what are the knowledge gaps? *Tropical Medicine and International Health*, 2005, 10:19–31. DOI: 10.1111/j.1365-3156.2004.01355.x

Yeung S, White, N. J., (2005): How do patients use antimalarial drugs? A review of the evidence: *Tropical Medicine & International Health* 10:121-138.

Zama, I.,Yakubu, A., Okwesili, A.N.,Ishaku, E., Erhabor, O.,Mainasara, A.S.,Uko, K.E.,

(2013). Prevalence of malaria parasitaemia and methaemoglobin levels among blood donors in Sokoto, Nigeria. *Herbert Open access journals.* DOI : http://dx.doi.org/10.7243/2052-6954-1-4

APPENDICES

APPENDIX I: LETTER OF TRANSMITTAL

UNIVERSITY OF NAIROBI
COLLEGE OF EDUCATION AND EXTERNAL STUDIES
SCHOOL OF CONTINUING AND DISTANCE EDUCATION
KISUMU CAMPUS

Our Ref: UON/CEES/KSM/4/13

Your Ref:

Telephone: 057-2021534 Ext. 28626

University of Nairobi Plaza
Oginga Odinga Street,
P.O. Box 825,
KISUMU, Kenya.

30th June, 2014

TO WHOM IT MAY CONCERN

RE: OUMA FRANCIS OWUOR- REG NO: L50/69460/2011

This is to confirm to you that the above named **Ouma Francis Owuor** is a student of the University of Nairobi, College of Education and External Studies, School of Continuing and Distance Education undertaking Masters in Project Planning and Management in Kisumu Campus and he has successfully completed his course work and examinations as required.

In partial fulfilment of the requirements for the Masters in Project Planning and Management, **Francis** is undertaking research for his Masters Project. We therefore request you to allow him access the data/information he may need for the purpose of his study. Any assistance, information or data collected is needed for academic purposes only and will therefore be treated in strict confidence.

We would appreciate any assistance that may be given to him to enable his carry out the study.

Thank you.

Dr. Raphael O. Nyonje, PhD
RESIDENT LECTURER
KISUMU CAMPUS

ISO 9001: 2008 CERTIFIED
The Fountain of Knowledge Providing Leadership in Academic Excellence

APPENDIX II: QUESTIONNAIRE FOR THE HOUSEHOLDS

INSTRUCTIONS TO ENUMERATORS

Greetings

My name is _____ I am involved in the study to investigate the influence of preventive strategies on malaria prevalence in Mfangano Island, Kenya. The findings of this research work are significant for several reasons. Most importantly, this research work will throw more light on the issue of integrated malaria preventive strategies in Mfangano Island. The result of this study will help consultants/researchers and policy operators in the health sector to understand the influence utilization of mosquito nets on malaria prevalence among households in Mfangano Island. This study will also help in understanding the extent to which environmental hygiene affects malaria prevalence. The result of this study can help in understanding how Knowledge seeking behaviour affects malaria prevalence among households and finally this study will result in the formulation of special policy decision with an aim of improving strategies and focus energies for efficient programme implementation to enable eliminate illness and death attributable to malaria.

Please inform the respondent of the following and request the respondent to provide verbal consent.

1. Please note that confidentiality will be maintained and the information will be used strictly for the purposes of this study.

2. The interview will take approximately 45 minutes to 1 hour of your time.

Part A: Personal Information

Please tick or write where applicable

1. Gender

1) Male 2) Female

2. Nationality

1) Kenyan 2) Foreigner

3. Age

1) 18-25 years 2) 26-35 years 3) 36-50 years 4) Over 50 years

4. What is your level of education?

1) None 2) Primary 3) Secondary 4) Post secondary

5. How many members stay in your household?

1) 1-5 2) 6 and above

6. Where do you stay?

1) At home 2) At the market centre far from home 3) Others (specify)

7. How long have you stayed there?

1) Less than six months 2) 6-12 months 3) Over 12 months

8. What do you do for a living?

_____

Part B: The following set of statements relate to your feelings, perceptions and understanding based on Malaria preventive strategies in your community. For each statement, please tick (√) the answer you feel is appropriate in each of the statements.

Utilization of Mosquito nets

9. Do you have a mosquito net?

1) Yes 2) No

10. If yes, which type?

1) Treated nets (ITN/LLIN) 2) not treated

11. How many mosquito nets do you have?

1) None 2)1 3) 2-3 4) 4 & above

12. Where did you get the mosquito nets from?

1) Clinic/dispensary 2) Community health worker 3) Shop 4) mass distribution of nets 5) Other (specify)

13. Was the net ever dipped in a liquid to kill or repel mosquitoes?

1) Yes 2) No 3) Don't know

14. How many people share a net in your household?

1) 1 net for one person 2) 2 people share 3) 3 people share 4) 4 people and above

15. For how long have you and your household slept under the treated mosquito net

1) Always 2) Occasionally 3) Never 4) Others (specify)

16. Did you and your household sleep under a treated mosquito net last night?

1) Yes 2) No

17. Do you hang your net alone?

1) Yes 2) No

18. Do you also hang the net for your other household members?

1) Yes 2) No

19. If no to the question above, who actually does net hanging for them?

1) Themselves 2) Others (specify)

20. Have you attended any forum on net hanging?

1) Yes 2) No

21. If yes to the question above, who organized the net hanging session?

1) Health workers 2) NGO/CBO 3) Others (specify)

22. In your opinion, what prevents people from using treated mosquito nets?

1) Attitude 2) Culture & tradition 3) Other (specify)

Environmental hygiene

23. How many times do you clear your compound?

1) Occasionally 2) 1 time a week 3) 2-3 times a week 4) others (specify)

24. Do you have a litter bin or compost pit in the compound?

1) yes 2) no

25. If yes to the above question, where in the compound is it situated (*seek to see it*)

26. If no to question above, what are the reasons for not having.....

.....

27. Observe whether the house has windows and chicken wire on the windows or above the windows and doors.

1) Has 2) Does not have

28. And at what time do you close the windows and doors in the evening?

1) at 6pm 2) at 7-8pm, 3) others (specify)

29. Do you have any pit or water collection point in your compound?

1) yes 2) no

30. Do you ever spray your house?

1) yes 2 No

31. If yes, with what chemical?

1) doom spray, 2) others (specify)

32. Where do you get the chemicals for spraying from?

1) Agro vet shop 2) Health workers 3) Others (specify)

Malaria knowledge seeking behaviour

33. In your opinion, how is malaria contracted?

Tick as many that apply:

1) By a bite from a mosquito
2) By playing in polluted water
3) By walking in cold weather
4) Don't know
5) Other (specify).....

34. In your opinion, how is malaria prevented?

Tick as many that apply:

1) Sleeping under treated mosquito net
2) Clearing the compound and bushes
3) Taking malaria medicine
4) Using mosquito coil
5) Don't know
6) Others (specify).....

35. Where do you get information on malaria prevention?

1) chief's barazas 2) health workers 3) Radios and TV 4) others (specify)

36. Have you attended any village baraza in the past 3 months?

1) yes 2) no

37. Do you have any IEC materials in your house with information on malaria?

1) yes 2) no

38. If yes to the above question where did you get the material from? (*Seek to see the material*),

1) Health worker 2) children brought from school 3) clinic/dispensary 4) others (specify)

39. Have you attended any seminar on malaria prevention?

1) yes 2) no

40. If yes to the above question, where?

1) At the chiefs baraza

2) At the health centre/dispensary

3) When some NGOs came to your area

4) When some health workers did health promotion in your area

5) Others (specify).....

41. Have you discussed malaria prevention issues with other people?

1) Family members 2) relatives & friends 3) others (specify)

42. Do you or a member of your household, put on warm clothing at night to prevent mosquitoes?

1) Yes 2) no

43. If no to the above question, why?

1) Because you don't have warm clothing

2) Because you don't know if warm clothing can prevent mosquito bites

3) Others (specify).....

Malaria prophylaxis drugs

44. Have you or any member of your household taken over the counter antimalarial drugs as a preventive mechanism because you suspect malaria?

1) yes 2) no

45. Have you ever used a mosquito repellant jelly or equivalent to prevent malaria?

1) yes 2) no

46. If yes, how frequent 1) daily 2) once a week 3) only when travelling 4) others (specify)

47. Have you or any household member ever been diagnosed and treated on malaria in the past 2 weeks?

1) Yes 2) No.

48. Have you or any member of your household had any incidences of fever attributable to malaria in the past 1 week?

1) Yes 2) No

49. In the past 2 weeks, did you or any household member been outside Mbita Sub County?

1) Yes 2) No

50. If yes to the above question, on your way back, did you or any household member taken any anti-malaria drug?

1) Yes 2) No

51. If yes, to the above question, state the reason for taking the drug.....

.....

52. Have you or any household member been tested of malaria in the past 2 weeks?

1) Yes 2) No

We have come to the end of our interview and I would like to thank you so much for your time.

APPENDIX III: KEY INFORMANT INTERVIEWS (KIIs) SCHEDULE

With Health workers and Provincial administration (Chiefs & Assistant Chiefs)

INSTRUCTIONS TO INTERVIEWERS

Greetings

My name is **Francis Ouma**, I am involved in the study to investigate the influence of preventive strategies on malaria prevalence in Mfangano Island, Kenya. The findings of this research work are significant for several reasons. Most importantly, this research work will throw more light on the issue of integrated malaria preventive strategies in Mfangano Island. The result of this study will help consultants/researchers and policy operators in the health sector to understand the influence utilization of mosquito nets on malaria prevalence among households in Mfangano Island. This study will also help in understanding the extent to which environmental hygiene affects malaria prevalence. The result of this study can help in understanding how Knowledge seeking behaviour affects malaria prevalence among households and finally this study will result in the formulation of special policy decision with an aim of improving strategies and focus energies for efficient programme implementation to enable eliminate illness and death attributable to malaria.

Please inform the respondent of the following and request the respondent to provide verbal consent.

1. Please note that confidentiality will be maintained and the information will be used strictly for the purposes of this study.
2. The interview will take approximately 30-45 minutes of your time.

KII

1. What is your name and which position do you hold in this community?

2. In your opinion, what are some of the preventive strategies of malaria that you know in this community?

3. Discuss the effectiveness of these strategies?

4. In your opinion, what influence do these strategies have on malaria prevalence in this community?

(**In addition to the above questions, this is to be asked the health worker at the nearest health facility**)

5. What is the frequency of reported cases of fever in this facility?

Thank you for your time and cooperation

APPENDIX IV: TABLE FOR DETERMINING SAMPLE SIZE

Table 5.2 Table for determining sample size from a given population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Note. "N" is population size & "S" is sample size

Source. Krejcie & Morgan, (1970). "*Determining Sample Size for Research Activities*", Educational and Psychological Measurement

APPENDIX V: NAMES OF VILLAGES IN MFANGANO ISLAND

Table 5.3 The names of villages found in the 6 Sub locations in Mfangano Island

WAWARE	WAKULA NORTH	SOKLO	WAKINGA	WAKULA SOUTH	SOKLO SOUTH
Masisi	Kiwari B	Lukoma	Sena	Kiumbwe	Nyangicha
Kakrigu	Mukungala West	Kaswanga	Wasiambe	Sango	Mudunga
Kakimba A	Mukungala East	Kiwari	Takawiri	Uozi	Ukande A
Kakimba B	Rinya A	Gulwe	Myamnyuywa	Ugina beach	Ukande B
Wariga	Kandiege A	Ugosia	Makira	Lubanga	Ndawi
Nyakweri	Kandiege B	Gondia	Kitawi	Ndianga	Kiko
Ramba			Malamasa	CBD	
Wakiangata			Mrungo	Nairobi	
Yokia			Kitenyi	Singla	
				Ugina Sofia	
				Mauta east	
				Mauta West	
				Kijiji	
				Wamai East	
				Wamai West	
				Nyahera	
				Kisasi	

Source: Ministry of Health-Polio Microplan (2013)

APPENDIX VI: RESEARCH AUTHORIZATION LETTER

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 310571, 2219420
Fax: +254-20-318245, 318249
Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No.

Date:

12th August, 2014

NACOSTI/P/14/0596/2628

Francis Owuor Ouma
University of Nairobi
P.O.Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Influence of Malaria Preventive Strategies on Disease Prevalence in Mfangano Island, Mbita Sub County, Kenya,"*** I am pleased to inform you that you have been authorized to undertake research in **Homabay County** for a period ending **24th October, 2014.**

You are advised to report to **the County Commissioner, the County Director of Education and the County Coordinator of Health, Homabay County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR. S. K. LANGAT, OGW
FOR: SECRETARY/CEO

Copy to:

The County Commissioner
The County Director of Education
The County Coordinator of Health
Homabay County.

APPENDIX VII: RESEARCH CLEARANCE PERMIT

CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit
2. Government Officers will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one(1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No. A 2817

CONDITIONS: see back page

THIS IS TO CERTIFY THAT:
MR. FRANCIS OWUOR OUMA
of UNIVERSITY OF NAIROBI, 0-40100
Kisumu,has been permitted to conduct research in *Homabay County*

on the topic: *INFLUENCE OF MALARIA PREVENTIVE STRATEGIES ON DISEASE PREVALENCE IN MFANGANO ISLAND, MBITA SUB COUNTY, KENYA*

for the period ending:
24th October,2014

Permit No : NACOSTI/P/14/0596/2628
Date Of Issue : 12th August,2014
Fee Recieved :Ksh 1,000

Applicant's Signature

Secretary
National Commission for Science, Technology & Innovation