DETERMINANTS OF BED NET USE IN MALARIA PREVENTION FOR CHILDREN UNDER FIVE YEARS IN HOUSEHOLDS IN KENYA: A CASE OF BONDO SUB-COUNTY

BY

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DECLARATION

This research project report is my original work and has not been submitted to any other university for the award of a degree.

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This research project report has been submitted for examination with my approval as the university supervisor.

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DEDICATION

This research project report is dedicated to my wife Sarah and our daughters Blessing and Michelle for their inspiration to see me prosper.

ACKNOWLEDGEMENT

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ABBREVIATIONS AND ACRONYMS

ACTs - Artemisinin-Based Combination Therapies

DALYs - Disability Adjusted Life Years

FGDs – Focus Group Discussions

HBM- Health Belief Model

IEC - Information, Education and Communication

IEC/BCC - Information, Education, Communication/Behavior Change Communication

IPT - Intermittent Preventive Treatment

ITN - Insecticide-Treated bed Nets

KDHS - Kenya Demographic Health Survey

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KEMRI - Kenya Medical Research Institute

LLITNs - Long-Lasting Insecticide-Treated bed Nets

MCP- Malaria Control Program

MOH- Ministry of Health

NACOSTI- National Commission for Science, Technology and Innovation

NGO - Non Governmental Organization

NMCP - National Malaria Control Programme

OPD - Out-patient Department

RBM - Roll Back Malaria

SEF- Socio Ecological Framework

SSA - Sub-Saharan Africa

WHO - World Health Organization

ABSTRACT

Malaria is a global disease. The World Health Organization (WHO) latest estimates indicate that there has been a reduction in malaria mortality rates by 42% globally and 49% in the WHO Africa region between the year 2000 and 2012. The substantial reduction has been as a result of major scale-up of vector control interventions, diagnostic testing, and treatment with Artemisinin-Based Combination Therapies (ACTs). Most notably is the use of bed nets as a control recommendation against malaria. In Kenya, 25 million people out of a population of 34 million are at risk of malaria. The current bed net ownership of 0.8 per household in Kenya is below the universal access of 2 bed nets per household. This study therefore sought to investigate the determinants of bed-net use for malaria prevention in children under five years. These included household characteristics, level of education, and income of the caregivers, caregiver's perception and social support network. The study reviewed existing literature on bed net use using the socio-ecological model and identified a knowledge gap which was addressed through a cross-sectional household survey; targeting caregivers of children under five years. Descriptive research design and survey was used to collect the required information using an interviewer-administered questionnaire; which was piloted and pretested after which it was administered to all participants on consenting to be part of the research. Krejcie and Morgan's table was used to get sample size of 368 households from the four randomly selected clusters (sub-locations). The findings and results of the study were presented in order of the research objectives. The findings were presented in frequencies and percentages. It was found out that 49% of the households had three children under the age of five years; 54% of the respondents had completed secondary education; 82% of the respondents owned a bed net even though their monthly income was less than sh5,000; 64% of the respondents who discussed the use of bed nets with their partners largely agreed that they are key to preventing malaria transmission; caregivers' perception lean more towards believing that malaria is caused by other means than from mosquito bites. In summary, the study found out that that majority of the respondents 137 (43%) believe that caregivers' perceptions are key to bed net use, followed by social support 65 (20%) and then household characteristics 41 (13%). The last two factors were the caregivers' level of education and income 38 and 40 respectively; tying at 12%. Of the five objectives of the study four were found to have a significant influence on the use of bed nets namely: household characteristics, level of education, caregiver's perception and social support network. The level of education was found not to have any significant influence on the use of bed nets. It is therefore recommended that bed nets be distributed to the entire population to optimize usage; other control vectors like indoor residual spraying should be used to manage the mosquito population and members of the community need to be sensitized on malaria transmission.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The efficacy and cost-effectiveness of insecticide-treated nets (ITNs) in reducing malaria related morbidity and mortality is well-known and in recent years has led to massive efforts to distribute millions of free or highly subsidized ITNs to vulnerable populations in sub-Saharan Africa (Goodman *et al*., 1999). Effective application of insecticide-treated bed nets for malaria control comprises three main components including bed net acquisition or ownership, regular retreatment of bed nets with insecticide, and using bed nets correctly and/or consistently. The basic premise behind using insecticide-impregnated materials to control malaria is that they reduce human-vector contact and decrease the number of infective and infected mosquitoes by killing some or most of those that touch the treated material. The same reasoning is used to justify indoor house spraying with insecticides. However, impregnated materials have the advantage that they can be deployed at the local level, lend themselves to community participation efforts, and complement other currently used methods of vector and malaria control.

Two important core ITN indicators for malaria control programmes are the proportion of households owning an ITN and the proportion of vulnerable populations sleeping under an ITN. Using these measures, many studies have shown that efforts to increase ITN ownership have made tremendous progress; however, most sub-Saharan countries remain well below targets for ownership. In addition, these evaluations have consistently found ITN use (vulnerable groups sleeping under an ITN) lower than household ownership (Korenromp *et al*., 2003). In order to reach the goals for bed net coverage and increase ITN use, it will be useful for programmes to identify and address the determinants of ITN use and non-use.

In the World Malaria report 2013, the global malaria mortality rates have reduced by 42% globally and by 49% in the WHO African region between 2000 and 2012. Globally it is estimated that in the year 2010, there were 216 million cases of malaria and an estimated 655,000 deaths from malaria (WHO, 2011). Malaria incidence rates also declined by 25% around

the world and by 31% in the African region during the same period. The substantial reduction has been as a result of major scale-up of vector control interventions, diagnostic testing, and treatment with Artemisinin-Based Combination Therapies (Acts). Most notably is the use of bed nets as a control recommendation against malaria. Earlier estimates indicate that the burden of malaria exceeds 40 million disability adjusted life years (DALYs) (Lopez *et al*., 2006).

Malaria is preventable and treatable, and history shows that it can be eliminated. Less than a century ago, it was prevalent across the world, including Europe and North America but was eliminated in most of Western Europe by the mid-1930s; the United States achieved elimination of the disease in 1951. (www.gatesfoundation.org/.../Malaria).

Children under five years of age, together with pregnant women, have been identified as the most vulnerable risk group for malaria, with 88% of all deaths in sub-Saharan Africa attributed to malaria occurring in children under five (WHO: Malaria World Report, Geneva; 2010). In 2012, malaria took a total of 627,000 lives, most of them being children under the age of 5 years in Africa. This translates into 1300 young lives lost to malaria in a single day. It is a tragedy that most people are still dying of mosquito bites in the 21st Century.

In Nigeria, the current use of ITNs among pregnant women and children under 5 years is just 1%, according to the Nigeria Demographic and Health Survey (NDHS). In Equatorial Guinea, malaria is a major endemic disease, responsible for about 28% of the deaths in children under five in 2008 (UNICEF, 2008). Between 2004 and 2008 there has been a drastic reduction in the prevalence of infection with malarial parasites from 42% to 22% in children between two and five years of age in Bioko, Equatorial Guinea's main island, following comprehensive malaria control intervention. Malaria is one of the leading causes of morbidity and mortality in the Democratic Republic of the Congo (DRC), with approximately 180,000 deaths attributed to malaria each year. This is one fifth of the 863,000 malaria deaths reported worldwide by the World Health Organization in 2008. The large number of malaria cases in the DRC is due to high malaria transmission rates, and it is exacerbated by two decades of civil war that have decimated the health care infrastructure and the government's ability to deliver social services. (WHO, 2009).

Malaria is a leading cause of mortality among children in Sub-Saharan Africa. In 2000, among 111 million children in sub-Saharan Africa, 100 million lived in areas where malaria transmission occurred. About half (48 million) of these 100 million children lived in areas with the highest risk of dying from malaria rural areas in middle Africa with high-intensity transmission. During the same year, it is estimated that 680,000 children died of malaria (Rowe *et al.*, 2006).

Insecticide-treated nets (ITN) have been widely shown to be effective in reducing childhood morbidity and mortality through reducing mosquito bites while sleeping and ITNs have been shown to be the most cost-effective measure to reduce malaria transmission (Alonso *et al.*, 1991). However, the target of 80% coverage of children sleeping under a net by 2010 set by RBM (Roll Back Malaria) Programme is ambitious for most countries. According to the World Malaria Report (WMR) 2009, 31% of African households owned an ITN in 2008, and 24% of children slept under an ITN. The use of LLINs has been found to be effective against the control of malaria especially among children under the age of five years and pregnant women. In June 2006, an international non-governmental development organization in Uganda started on a project of distributing mosquito nets at a subsidized price to through health volunteers. The distribution whoever proved to be inadequate and the knowledge dissemination of the organization was insufficient for preventive actions such as the proper use of LLINs in the interruption of malaria transmission. (Ahmed & Zerihun, 2010).

There are four mechanisms of bed net distribution in Kenya; routine distribution through maternal and child health units to pregnant women and children under one year, periodic mass net distribution targeting all population living in malaria prone areas, social marketing and the commercial sector. There was a mass net distribution in 2011/2012 where about 67% of households achieved universal coverage. Between 2008 and 2010, a total of 294 million nets were distributed in sub-Saharan Africa. Funding for LLINs gradually increased from 2004 when 5.6 million nets were delivered, to 2010, when 145 million nets were delivered. However, funding for nets, and other malaria prevention and control interventions, is likely to plateau or even decline in the next few years due to the current economic situation. One way to maintain

net coverage is to increase the lifespan of LLINs. A recent study estimated that up to $3.8 billion could be saved over 10 years by increasing the lifespan of nets from 3 years to 5 years.

Malaria remains a leading cause of morbidity and mortality in Kenya. It accounts for 30-50% of all outpatient attendance and 20% of all admissions to health facilities. Malaria is also estimated to cause 20% of all deaths in children below the age of five. 25 million out of 34 million Kenyans are at a risk of malaria, with the most vulnerable group to malaria infections being pregnant women and children below the age of 5 years. An estimated 170 million working days are lost to the disease each year.

The Kenya Demographic and Health Surveys (KDHS) data collected since 1989 indicate that malaria prone areas have consistently recorded the highest childhood mortality rates. Malaria control programme information also indicates that malaria contributes to about 20 per cent of the deaths among children under the age of five. The 2009–2017 National Malaria Strategy is being implemented to reduce malaria morbidity and mortality. Its key interventions include: bed nets use; anti-malaria drugs use during pregnancy for prevention; and prompt treatment using anti-malaria drugs of children with fever. This study seeks to establish differentials in childhood mortality rates by these interventions in three malaria prone areas defined as highland epidemic, coast endemic and Lake Endemic. It also seeks to determine the effects of these interventions on childhood mortality.

LLINs have been associated with sharp decreases in malaria in countries where malaria programs have achieved high LLIN coverage. WHO now recommends that LLINs be distributed to and used by all people ("universal coverage") in malarious areas, not just by the most vulnerable groups: pregnant women and children under 5 years. LLINs are most commonly distributed through mass campaigns approximately every 3 years.

1.2 Statement of the Problem

Despite the recent advances in treatment and preventive measures, malaria is still a leading cause of morbidity and mortality especially in Sub-Saharan Africa. Proper and continuous use of long lasting insecticide treated nets (LLINs) could greatly reduce malaria cases in endemic areas. Studies have also shown that effective use of LLINs depends, in part, on the understanding of the causal factors associated with malaria. (Dye *et al*., 2010).

Children under five years of age, together with pregnant women, have been identified as the most vulnerable risk group for malaria, with 88% of all deaths in sub-Saharan Africa attributed to malaria occurring in children under five years (WHO Malaria World Report, Geneva; 2010). In 2012, malaria took a total of 627,000 lives, most of them being children under the age of 5 years in Africa. This translates into 1300 young lives lost to malaria in a single day. Despite the numerous efforts made in Kenya to distribute ITNs to pregnant women and children under five years to meet the universal coverage and numerous campaigns and awareness creation on the importance of ITN use, even when there are bed nets available in the households, these most vulnerable groups, do not always have access to them. Although previous studies have investigated the determinants of bed net utilization and ownership, the results still show that net use is still low; hence the reason to conduct this study in selected households in Bondo sub-county to investigate the determinants of ITN use for children under five years.

In Kenya, malaria accounts for about 20% of childhood mortality (Malaria Fact Sheet; Ministry of Public Health and Sanitation, Nairobi; 2011). The country is classified into five zones or areas according to malaria transmission intensity and seasonality. These are: highland epidemic area; lake endemic area; coast endemic, semi-arid and seasonal areas; and, low risk area. Kenya conducts national demographic and health surveys every five years since 1989 as part of the world-wide Demographic and Health Surveys (DHS) program. All the data from these past surveys have shown that coast and lake endemic malaria areas have the highest infant and child mortality rates in Kenya (Kenya Demographic and Health Survey 2008-09).

1.3 Purpose of the Study

The purpose of this study was to investigate the determinants of bed net use in malaria prevention in children under five years in households in Kenya.

1.4 Objectives of the study

The objectives of this study were:

1) To explain how household characteristics determine bed net use in malaria prevention for children under five years in households in Bondo sub-county.

2) To assess how the level of education of caregivers determines bed net use in malaria prevention for children under five years in households in Bondo sub-county.

3) To establish how the level of income of the caregiver determines the bed net use in malaria prevention for children under five years in households in Bondo sub-county.

4) To establish how social support network determines bed net use in malaria prevention for children under five years in households in Bondo sub-county.

5) To explain how a caregiver's perception determines bed net use in malaria prevention for children under five years in households in Bondo sub-county.

1.5 Research Questions

This study set out to answer the following study questions:

1) To what extent do household characteristics determine bed net use in malaria prevention for children under five years in households in Bondo sub-county?

2) At what level does a caregivers' level of education determine bed net use in malaria prevention for children under five years in households in Bondo sub-county?

3) How does the level of income of the caregiver determine bed net use in malaria prevention for children under five years in Bondo sub-county?

4) To what extent does social support network determine bed net use in malaria prevention for children under five years in Bondo sub-county?

5) How does a caregiver's perception determine bed net use in malaria prevention for children under five years in Bondo sub-county?

1.6 Significance of the Study

Mortality rate of children under the age of five in Kenya recently declined from 115 per 1000 live births in 2003 to 74 per 1,000 in 2008/9 and there are indications that the reduction can partly be attributed to the impact of malaria intervention measures. However, very scanty information exists on the impact of malaria interventions and childhood mortality. Past review of studies on malaria and childhood mortality inter-linkages concluded that malaria gives rise to low birth weights in new born infants thus increasing the risk of neonatal mortality. The study sought to find out the reason as to why there is a decline in the use of bed nets despite being distributed.

Hence, it is hoped that findings from this study may be important in several ways. The findings and recommendations of this study may be useful to the government to review its policies on malaria control and prevention to increase the correct and consistent ITN use in households. It is also hoped that the findings may also form a significant reference material to researchers in studies on determinants of bed net use in malaria prevention.

1.7 Delimitation of the study

The study was delimited to households in Bondo sub-county and only caregivers of children under five years living in the selected households participated. The sample however is similar in nature to the population that is highly affected by malaria in other parts of Kenya where the results were generalized. The study was also delimited to determinants of bed net use in malaria prevention in children under five years in households in Kenya.

1.8 Limitations of the study

This study was limited to self-reported data which was likely to result to selective memory or lack of interest in the subject by the respondents. This was lessened by administering the questionnaires and probing for clarifications from respondents to obtain valid responses. For respondents who do not understand English the questions were translated to the local language.

Since this was a health-related study, participants were unwilling to give information out of fear but this was overcome by obtaining a permit from National Council of Research and Technology to authenticate the study as well as inform the respondents that all information was treated with utmost confidentiality.

1.9 Assumptions of the study

Both male and female respondents were targeted from the selected households and it was assumed that they were willing to participate in the study and would give sincere feedback. Another assumption was that the respondents who were interviewed slept under a bed net the previous night. This study also assumed that there was at least one caregiver of a child under five years in the sampled households. Another assumption of this study was that the caregivers in these households were available to answer the questions that guided this study. The last assumption was that the finances allocated for this study were enough to cover the scope and time allocated was enough to gather credible data.

1.10 Definition of significant terms used in the study

Bed net use - defined as the percentage of nets that were actually used the previous night over the total number of ITNs/LLINs surveyed. The analysis is restricted to households that own a bed net.

Caregiver's perception-defined as the caregiver's beliefs and attitude towards use of bed nets.

Caregiver - A family member who regularly looks after a child under the age of five.

Household - defined as a unit headed by a male or female with his ⁄ her dependents and spouse, and who share a cooking pot/common eating place and sleep under one roof.

Household characteristics-refers to the availability of beds and bed nets, number of sleeping rooms, size of the house e.t.c.

ITN - defined as any long-lasting insecticide treated net (LLIN) or a conventional net treated within the past 12 months. This word can also be used interchangeably with the word bed net.

Level of education-defined as the highest level of education attained by the caregiver.

Level of income-defined as the amount of money received by a caregiver per month.

Social support network-defined as assistance available to the caregiver from other people.

1.11 Organization of the Study

The study is organized in five chapters. Chapter one will deal with the background of the study, statement of the problem, purpose of the study and objectives of the research. It will also include research questions, significance of the study, assumptions of the study, limitations, delimitations and definitions of the significant terms. Chapter two will consist of literature review related to the determinants of bed net use in malaria prevention in children under- five years in households in Kenya, where these concepts; household characteristics, education level, occupation, caregiver's perception and social support network factors and will be discussed as well as the theoretical and conceptual frameworks of the study. Chapter three will include the research methodology, which will include the research design, target population, sample size, sampling technique, research instruments, their reliability and validity and procedures for data collection and analysis techniques. Chapter four will consist of data analysis, interpretation and presentation. The significant findings will be presented in tables of frequencies and percentages and interpreted. Chapter five will provide a summary of the research findings, conclusions and recommendations as well as suggestions for further research.

<center>**CHAPTER TWO**</center>

<center>**LITERATURE REVIEW**</center>

2.1 Introduction

This chapter consists of review of related literature. New knowledge was identified from the gaps that emerged from the literature review. The independent variables of the study that were focused on are: household characteristics, level of education, and level of income, social support network and caregiver's perception. The dependent variable was bed net use. A conceptual framework was used to explain the relationship between the variables. The variables were described and their measures and indicators well outlined. A theoretical framework looked at the theories that are related to the phenomenon under study.

2.2 Bed net use in malaria prevention in children under five years

The use of long lasting insecticidal nets (LLIN) is one of the main interventions to prevent malaria in young children resulting in the reduction of malaria episodes by 50% and child deaths by a 20% (Lengeler, 2004). A 2007 review of seven demographic surveillance sites in Africa found that the median age at death of children below the age of fifteen ranged from 1.01 to 1.65 years among the different sites (Abdullah *et al*., 2007).

One of the objectives of the Roll Back Malaria initiative launched by WHO in 1998 was to increase the use of bed net among vulnerable groups to over 60%. This was later revised to 80% usage by the year 2015 (www.who.int/malaria/wmr2008). High coverage of ITNs among vulnerable groups is the cornerstone of malaria prevention. There has been a rapid scaling up of ITNs coverage in African countries. In 2006, 7.1 million ITNs were distributed by the National Malaria Control Program (Noor *et al*., 2009). In Kenya, the Kenya Ministry of Health and Non Governmental Organizations have primarily distributed bed nets to pregnant women and children under the age of five. However, research shows that bed net use does not follow that of ownership. A study in Western Kenya found that 30% of bed net recipients did not adhere to the use due to environmental, social and cultural issues (Alaii *et al*., 2003).

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In Zanzibar, the decrease in malaria incidence was attributed to implementation ITN interventions, provision of free ACT in public health facilities and indoor residual spraying in residential homes (Bhattarai *et al*., 2007). There was a massive campaign to distribute long lasting insecticidal treated nets (LLIN) for free to all pregnant women and children under the age of five between 2005 to 2006. Approximately four months after the distribution, a survey was carried out in the North A district and it revealed that LLIN usage in children under the age of five was high (87%) and equitable. It was also shown that high effective coverage of LLINs largely relies on good access and adherence to their use. (Beer *et al*., 2010).

Togo was the first sub-Saharan African country to adopt the approach of integrated campaigns of child survival interventions to combat the leading causes of childhood mortality, malaria being one of them. In December 2004, Togo took advantage of a measles vaccination to distribute ITNs and to vaccinate children against polio. (CDC, 2005; Terlow *et al*., 2010; Wolkon *et al*., 2004). The distribution of ITNs improved possession rates of ITNs, while minimizing any duplication of delivery costs (Meuller *et al*., 2008). In December 2008, the ITNs were distributed again to pregnant women and children under the age of five years. During this time, the morbidity rate of malaria decreased from 53% in 2007 to 42% in 2008, whereas malaria mortality recorded in hospitals dropped from 23.1% in 1998 to 20% in 2008 (Stevens *et al*., 2013).

2.3 Household characteristics and bed net use

The number of individuals in a household reduces the likelihood that a young child sleeps under a net. In the larger sample, the addition of one household member reduces the likelihood of a child sleeping under a net by 17%. This is contrary to the results in which possession was the dependent variable. While larger families appear to increase the likelihood of owning a net, they may also decrease the likelihood of a young child sleeping under the net. The number of children in the household, on the other hand, increases the likelihood that a young child sleeps under a net. In all households, the addition of one child under five increases the likelihood of a child sleeping under a net by 80% (Eisele *et al*., 2009)

Net use for a young child, however, does appear to fall as the number of household members rises. This finding differs from Alaii *et al* (2003) and De La Cruz *et al* (2006), who concluded that the number of household members has no effect on the use of nets. Alaii *et al* (2003) studied the net use by all members of a household in Kenya, as opposed to just young children, and found no impact on net use as the number of household members rises. While this study by Alaii *et al* indicates that overall use in a household is unaffected, young children in Kenya may be affected differently from other household members as the household size increases. De La Cruz *et al* (2006) specifically studied the use of a net by children as household size increases in Ghana and also concluded that household size does not affect the use for young children. Kenya differs from Ghana and a larger household may reduce the access of young children to limited resources.

In a study conducted in five African countries bed net use was associated with age. (Baume & Marin, 2007). Among children under the age of five, there was a clear decline in use as the child grew older. The same decline in use is shown in children whose mothers sleep under a mosquito net in Uganda, and low use in children under five compared to individuals of other age groups was also found in the Western Kenya (Alaii *et al*., 2003).

Although ITNs are increasingly accessible in many Sub Saharan Africa (SSA) countries, getting people to correctly and consistently use ITNs has proven difficult. A previous multi-country assessment in SSA using national and sub-national household surveys between 1991 and 2001 found a considerable gap between use and possession among children. The analysis showed that household possession of ITNs ranged from 0.1% to 29%, whereas use by children younger than 5 years old ranged from 0% to 16%. Within households possessing at least one ITN, only 55% of children were found to have slept under an ITN the previous night (Korenromp *et al*., 2003). In another study using data from sub-national NetMark surveys conducted between 2000 and 2004, research showed that bed net use among children under the age of five within households with at least one bed net, ranged from 48% to 73%, while use among pregnant women ranged from 18% to 69% (Eisele *et al*., 2009).

In Luwero district, Uganda, the Ministry of Health improved the antenatal care package by introducing a strong commitment to increase the distribution of insecticide treated nets with the

aim of reducing the intolerable burden of malaria during pregnancy. The findings of the study illustrated the need to strengthen the capacity of the district to further improve uptake and use of mosquito nets (Kiwuwa & Mufubenga, 2008).

Results from the within-country logistic regression analyses, among ITN-owning households, showed that intra-household access to ITNs (the ratio of household members per ITN) was the strongest and most consistent household factor associated with ITN use among children, while controlling for child's age, mother's education, and socioeconomic status, sex of child, urban / rural residence, and ethnicity. Across the 15 national surveys analyzed, children in ITN-owning households with better intra-household access to an ITN (lower ratio of household members per ITN) were between 2.1 and 5.5 times more likely to have slept under an ITN the night before the survey, except in Ethiopia, where this ratio was not significantly associated with child ITN use (Baume *et al*, 2009). Additionally, in 7 of the 15 countries analyzed, the odds that a child slept under an ITN the night before the survey increased significantly among infants compared with older children 1–5 years old, while controlling for the covariates noted above. Mother's education was not a consistent predictor of ITN use among children in net-owning households, after controlling for intra-household access to ITNs, socioeconomic status, and the other potential confounders noted above. Socioeconomic status, sex of child, urban/ rural residence, and ethnicity were not significantly associated with ITN use among children in ITN-owning households in any of the 15 countries (Eisele *et al*., 2009).

The other important factors associated with bed net use were the numbers of beds and rooms in the house. These results are comparable to those from other studies. As the number of rooms increased, the role of each room became clearer: it is common to use one room as a living room when a house has more than two rooms and the others as bedrooms. Residents who sleep on the floor in living rooms would have less attachment to nets compared with nets hung over beds in bedrooms, as the living room nets are most likely taken down every morning. Consequently, having more bedrooms increases both privacy and the space available for beds, which in turn increases the number of sites that are suitable for hanging nets, thereby increasing net use especially for children under five years since they're the most likely to sleep on the floor; exposing them to mosquito bites (Toe *et al*., 2009).

Net use by age group surprisingly showed that children below the age of five are not the group with highest net use: persons older than 24 years were more likely to use nets in both surveys, although the association was only statistically significant for the 25-49 year old age group in the 2006 survey. It is clear that children and young adults aged 5-24 years use nets much less frequently than children under five years or persons over 24 years. Less frequent use by school-age children has been observed in many other African counties and it would be interesting to conduct a study of net use in which children's own school attendance, access to nets, and knowledge are taken into account, rather than using proxies from women in their households. It is critical that more attention is paid to increasing net use in children, teenagers and young adults (e.g. perhaps by school-based education campaigns and activities), since they likely contribute significantly to transmission and are at risk of severe disease, if infected (Graves *et al*., 2011).

A study based on secondary analyses of the Demographic and Health Survey in Uganda concluded that young children were sleeping under a net only because their mothers were using the net (Mugisha *et al*., 2003). Several other studies focusing on who uses the household net were intervention studies where nets were given free to those living in a research area in Kenya (Alaii *et al* 2003) or to pregnant women attending antenatal clinics in Kenya, or where nets were acquired via vouchers distributed to pregnant women in Tanzania (Tami *et al*., 2006).

2.4 Caregiver's level of education and bed net use

In the Democratic Republic of Congo, malaria is the most prominent disease. To that effect long lasting insecticide treated nets have been distributed since 2006. A total of 142 households were surveyed using a standard questionnaire. The study concluded that education was the most important factor affecting the use of bed nets in the villages outside Kinsasha. Development of an education program was therefore necessary to reduce misconceptions and increase the prevalence on bed net use among all age groups (Ndjinga & Minakawa, 2010).

Education about malaria transmission and the benefits and proper use of bed nets should eliminate the misconceptions about bed nets use. Results reported here demonstrate that the education level of the family head of household was associated with bed net use among family members in the surveyed villages. A previous study in Kinshasa also reported that women who

had secondary school or higher education were 3.4 times more likely to own and 2.8 times more likely to use a bed net compared with women with less education (Pettifor *et al*., 2008). A mother's education level and adequate knowledge about malaria transmission are also associated with their use of bed nets in other countries. As a majority of children less than 5 years of age sleep with their parents in Africa, their protection from malaria depends on parents' perception of bed nets (Eisele *et al*., 2009).

This study also found a lower prevalence of net use among children less than 5 years of age and among adults, and a greater prevalence of use among school children aged 5 to 15. This result was unexpected, as several studies have reported lower use of bed net use among school children. Mothers and infants are primary targets for net distribution, and their use of nets should be high. In recent years, primary and secondary schools have focused on education in disease prevention and sanitation, including bed net use in the district where the surveyed villages in this study are located. This systematic education program may explain the high prevalence of nets use among children 5 and 15 years of age in these villages (Eisele *et al*., 2009).

A study conducted by Gosling *et al*. (2012) in Balaxia in China, one village head commented, "Providing information on the risk of mosquitoes such as transmission of malaria and other communicable diseases, communicating on the benefits of the bed nets, especially ITNs and LLINs and providing free bed nets will promote the use of nets". Results of showed that bed net use was not associated with head of household's knowledge about malaria transmission; however it was closely related to the knowledge that the bed nets prevent malaria infection, where those who knew bed nets preventing malaria were significantly more likely to use nets. A village health worker in Balaxia, the site of a malaria outbreak in 2000, said, "In the malaria outbreak, many people contracted malaria. The outbreak improved awareness and knowledge of malaria among the villagers. They know bed nets are effective in preventing malaria. Currently, in our village, bed nets are available in every house and most people use them. Furthermore, bed net use has become part of our normal living habits. Most of the villagers, including those living in modern houses, always sleep under the nets". The village head of Balaxia commented "Not only do nets prevent mosquito bites, but they also prevent nuisances caused by other pests such as

cockroaches, bedbugs and fleas. Additionally, the nets are dustproof, windproof and preserve warmth in the winter".

2.5 Caregiver level of income and bed net use

In a study among Jinuo ethnic majority in China, a survey on the use of bed nets and the factors influencing the use of bed nets was carried out on 352 households. It emerged that high net availability does not necessarily mean higher coverage of bed net use. Household income, house type and the knowledge of the ability of nets to prevent malaria were found to influence the use of bed nets (Xu J-W *et al*., 2014).

Occupational status of the household head and family size were among the factors affecting the ownership of ITN in research studies. In one study in Ethiopia, government employees and self-employed traders were less likely to own a net (Haileselassie & Ali, 2008). In this study, family size was associated with the possession of net. Similarly in Tanzania a unit increase in family size increased the odds of ownership of a net more than twice while controlling for all other variables, where for households who had at least one under five child the odds of owning any net was about 60% higher than those with no children under the age of five. In another study, women's and head of household's education, head of household's occupation, marital status, household size, household wealth, living in rural areas, and expenditure on other malaria prevention products and practices were found to be associated with ITN ownership (Matovu *et al*., 2009).

Many socio-economic variables including, distance to health facility, wealth, income and region of residence proved significant in predicting bed net utilization. On the contrary, Goesch *et al*. (2008) reported a strong relationship between socio-economic factors such as presence of running water, flush toilet in residence and highest income score on one hand and on the other hand, bed net use. The authors attribute the inverse relationship to the 'insect nuisance hypotheses' in which bed net might be used to avoid excessive noise created by the insects but not necessarily for preventing mosquito bites. Hence, richer households are less prone to the insect and nuisance relative to poor households who often do not have nets in their windows as a first step of prevention. Other studies have shown that poor households may have lower or

simply insufficient willingness to pay for bed nets (Ozochukwu, *et al*. 2004). Even households that are willing to pay may not be able to do so if they lack the cash at hand and do not have access to credit. In Kenya, Noor *et al*. (2006) reported that homestead travel time to nearest market centers and mother's education were significantly associated with use of retail sector nets by children aged less than five years. The literature also shows ample evidence that gender, occupation, place of residence, relationship with household head and other socio-demographic factors significantly contribute to sleeping under a mosquito net (Wiseman, 2007; Ng'ang'a *et al*. 2009).

According to different settings and study protocols regarding the overall pattern, the occurrence of malaria or its consequences was usually associated with a low socio-economic status or its substitute measures, while the possession of bed nets, the willingness to pay for them or their actual use were associated with factors in favor of a higher socio-economic status. In contrast, in the present study which measured the actual use of bed nets in the age group of children between three and 24 months, the use of bed nets was inversely related to the socio-economic status of the mother or caretaker: the percentage of bed net users was significantly higher among families that were living under very simple conditions in a bad economic situation (Goesch *et al*., 2008).

This is most likely due to the fact that the maintenance of bed nets costs money, and that poor families cannot afford to replace their bed nets regularly when they are worn out. These families would largely benefit from free distribution or social marketing interventions offering ITNs to subsidized prices, such as 1997 in Tanzania, where the ratio of net ownership among the poorest to least poor increased from 0.3 to 0.6 in 2000 after the introduction of a social marketing programme or in Eritrea, where after a large-scale ITN distribution programme in 2002 and 2003 the Abuja target was exceeded with 76% of children under five years sleeping under ITNs (Eisele *et al*., 2006).

In a study carried out in Mukono District, it was emphasized that the cost of ITNs followed by their non-availability were constraints to their use. Similarly, over half of participants in all the 10 FGDs thought that chemicals used to treat the nets were very harmful to adults, children and pregnant women (Mbonye *et al.*, 2005). The difference between treated and non-treated nets was also not known. People believed that all nets were treated with a chemical. Over half of the

participants in all FGDs seemed to believe that ITNs are treated with chemicals which affect pregnant women, especially their breathing and that if the chemicals can kill mosquitoes instantly, they can also kill people. This perception was held by non-users mainly, although users also believed that it in addition causes feeling of excessive heat and suffocation at night due to use of ITNs (Mbonye at al 2005). This study investigated the caregivers in households with children under five in regard to acceptability of ITNs.

2.6 Social support network and bed net use

As expected, possession and use of bed net are positively correlated with a mother being married. Mugisha *et al* (2003) reported that children with a married mother are over 3 times as likely to sleep under a net. Further, Noor *et al* (2006) found that a child with a married mother was 2.7 times more likely to sleep under a net than a child of an unmarried mother.

In their study in Tanzania Koenker *et al*. (2012), found that having fewer children under the age of seven in a household appeared to impact net use rates among individual children. In the households where there was only one child under the age of seven years, there was a 67% greater likelihood of using a net compared to households where there were four or more children. Households that had two or three children also had a great likelihood of bed net use than in the households with four or more children.

In the study conducted in Mukono district about preventing malaria in pregnancy, participants knew that mosquito nets were a useful preventive measure against malaria and that pregnant women and children were supposed to sleep under nets since they are the most vulnerable groups. However the availability and use of nets in this community was found to be very low. Over three quarters of participants in all the FGDs and key informant interviews reported that very few people in the community use mosquito nets (Mbonyi *et al*., 2005)

In the same study, another constraint to ITNs access was the cost and uncaring husbands. Over three quarters of women in this study complained that men did not care about the health of their wives and their children. Men were reported not to prioritize the issue of health. Women thought that men use their money on items like alcohol and forget about buying nutritious foods and providing health care to their families. Women participants at Kimenyedde sub-county said that

they fear to buy mosquito nets because their husbands would question them about the source of the money. This is because women in this community are not expected to have money, or if they have money, the husbands feel obliged to know its source. More than half of the women participants in all the FGDs expressed fear that if a woman bought a net, the husbands would suspect that she got the money from another man (Mbonyi *et al*., 2005). This study specifically investigated affordability of ITNs to under fives within the household setting which was not covered in the previous studies.

This study reported that the participants discussed friends and family members in the context of trusted informal sources of health information; and saw these significant others as sources of encouragement to pursue healthy lifestyles and stay up-to-date with health screenings. Recent research also indicates that social isolation and lacking the social support network system of family and friends to discuss health issues was associated with lower levels of net-use in sub-Saharan Africa (Mbonyi *et al*., 2005).

2.7 Caregiver's perception and bed net use

The use of be nets is driven by a variety of factors including availability of nets within the household, mosquito density, seasonality, risk perception, social structures and practical issues. Non-use of nets has most often been reported to be due to perceived low mosquito density and to discomfort due to heat (Pulford *et al*., 2011). If prevention of malaria is the sole message promoting net use, little remains to encourage individuals to use their nets in a context of reduced malaria incidence.

In September 2008, LLINs were distributed in Lurambi, Western Kenya as part of an integrated prevention campaign organized over one week's time. An assessment was then carried out two months after the campaign. Most of the participants believed that mosquitoes were the major cause of malaria. However some participants while implicating mosquitoes as the cause of malaria also indicated cold weather, rain, consumption of bad food and stagnant water. Some of the participants also mentioned that they generally feel warmer and comfortable when they used LLINs. Other claimed that the use of LLINs caused their skin to itch (Dye *et al*., 2010).

In a study in Tanzania showed that the caregivers generally felt that malaria was no longer a common disease since there was a reduction in malaria transmission. Susceptibility to malaria was strongly linked to mosquito density, and was considered higher when mosquitoes were more prevalent. Susceptibility was also considered greater in children. There were also religious beliefs about the role of God and spirits in the prevention of malaria and illnesses included the idea that mosquitoes are brought by God or that malaria are caused by bad spirits (Beer *et al.*, 2012).

2.8 Theoretical Framework

In this study, the Health Belief Model (HBM) was used to explain health related behavior. The model was initially developed in an effort to explain the widespread failure of people to participate in programs to prevent or to detect disease (Hochbaum, 1958). The HBM is based on value-expectancy concepts. These values were reformulated in the health-related behavior and translated as follows: i) the desire to avoid illness or to get well soon (value); and ii) the belief that a specific health action available to an individual would prevent illness (expectation). Expectancy was further described in terms of an individual's estimate of personal susceptibility to, and severity of an illness, and of the likelihood of being able to reduce that threat through personal action (Strecher & Rosenstock, 1997).

The model was further modified to suggest that decision-makers make a mental calculus about whether the benefits of a promoted behavior change outweigh its practical and psychological costs or obstacles. That is, individuals conduct an internal assessment of the net benefits of changing their behavior, and decide whether or not to act. The model identifies four aspects of this assessment: perceived susceptibility to ill-health (risk perception), perceived severity of ill-health, perceived benefits of behavior change, and perceived barriers to taking action. The concept of self-efficacy, or the perceived ability to actually take a recommended action, was later recognized as an important component or factor (Green *et al.*, 2002)

This study was also explained using the socio-ecological model. The social ecological perspective on health emphasizes the contextualized nature of health and health behaviors in terms of how individuals, their health, and their surrounding physical and social environments

interact at multiple levels of a health problem and are interdependent. This type of multi-systems framework is grounded in the work of human ecology and development pioneers such as Urie Brofenbrenner. The ecological perspective has essentially two key propositions being, 1. Behavior both shapes and is shaped by multiple levels of influence and 2. Individual behavior affects and is affected by the surrounding social environment (Novilla *et al*., 2006).

Community is the context in which health behaviors take place and one of the primary settings for health promotion resources, making it a strategic entry point for collaboration and intervention. Research supports the notion that health promotion interventions should also be multi-domain, multidisciplinary, and be grounded in a social ecological framework (SEF) in order to have the maximum reach, impact, and potential for sustainability (Novilla *et al*., 2006).

SEF overcomes the limitations of other health behavior models by incorporating a focus on individual-level health behavior change with an understanding of the reciprocal relationship between personal choices, biology, and determinants of heath and health behaviors at the level of social networks, communities, and policies that impact health (Novilla *et al*., 2006). SEF proposes that social and environmental interactions can combine to affect health or each level of influence can be a factor in supporting or inhibiting health actions and outcomes (Stokols, 1995).

Those multiple levels of influence which impact health related behaviors and conditions are outlined as: 1. Intrapersonal factors such as individual attitudes, behaviors, knowledge, and skills; 2. Interpersonal processes such as social networks made of family, friends, or colleagues that provide support; 3. Institutional factors such as formal or informal organizations which may have rules or expectations which impact health behaviors; 4. Community factors such as informal or formal networks and norms among individuals, families, or groups/organizations; 5. Public policy such as local, state, and federal laws or regulations which promote or inhibit certain health practices which impact disease prevention, control, or management (Gregson *et al*., 2001). Applying these ecological levels of influence to an analysis of malaria prevalence in children under five years' bed net use in households in Kenya can provoke further inquiry into

why and where these disparities occur and which levels of influence should be targeted for intervention. These factors are illustrated.

Table 2.1: Social Ecological Theoretical Framework: Levels of Influence

Levels of Influence	Description
Intrapersonal	Personal attributes such as attitudes, beliefs, and knowledge that shape health behaviors.
Interpersonal	Relationships with family, friends, colleagues, and others which contribute social support network and help to define identity.
Organizational	Groups to which one belongs and/or informal social institutions and processes which influence health behaviors.
Community	Formal or informal systems with corresponding social norms among people, groups, and organizations.
Public Policy	Laws and practices at the local, state, and national levels that promote or regulate health behavior.

(Source: Robinson, 2008, p. 398)

2.9 Conceptual Framework

This study was centered on this perceived conceptual framework on the relationship between the independent and dependent variables on how they determine bed net use in malaria prevention for children under five years in households in Kenya.

Independent Variables
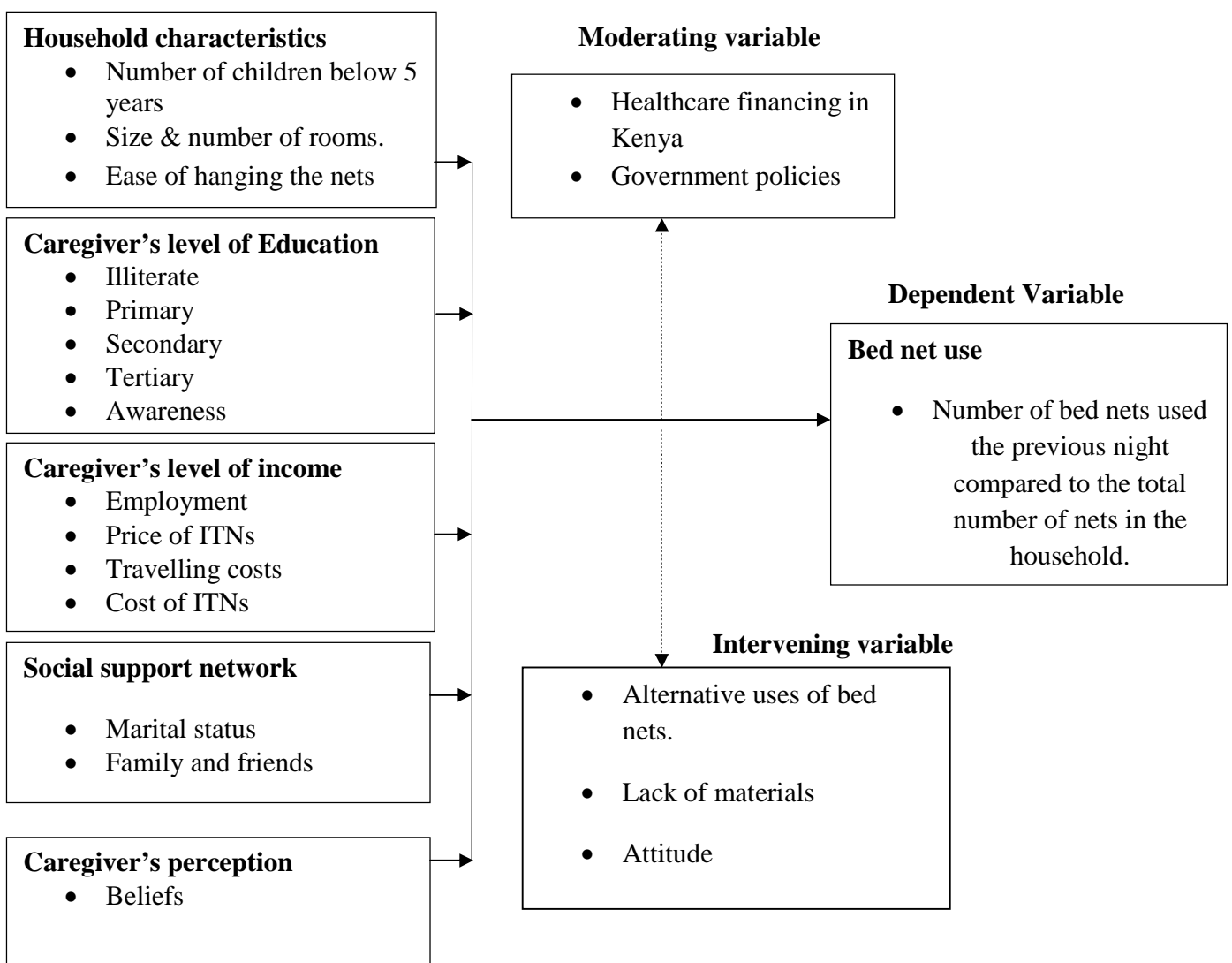
Figure 1: Conceptual Framework

The perceived conceptual framework covered the determinants of bed net use in malaria prevention for children under five years encompasses variables and their patterns of influence on each other and eventually how they affect bed-net use in households in Kenya.

Household characteristics and bed-net use

To examine the relationships of bed net use at the household level with bed availability, bed net availability, house size, number of rooms, bed net use was defined as the ratio of the number of residents who slept with nets to the number of those who slept without nets in a house. The variables of bed availability, net availability, number of rooms are importance because past studies found that these variables affect bed net use. As house size may affect bed availability and number of rooms, this variable was also included.

Caregiver's level of education and bed-net use

Educational level also depicts how well information is assimilated. It may be argued that the higher the educational level, the better the awareness of issues concerning the children, the need for malaria prevention and the important role of bed nets play as a preventive measure. On the other hand, awareness of issues could simply be attributed to individual's interest, access to information and position in society.

Caregiver's level of income and bed-net use

Occupational status of the household head and family size were among the factors affecting the ownership of ITN in research studies. Many socio-economic variables including, distance to health facility, wealth, income and region of residence proved significant in predicting bed net utilization. Strong relationship between socio-economic factors such as presence of running water, flush toilet in residence and highest income score on one hand and on the other hand, bed net use.

Social support network and bed-net use

Marriage provides some form of stability in the society as well as encourages procreation. Research to date suggests that women are more likely to use bed nets. Females with partners are

said to be more likely to participate in prevention activities, because partners will take care for each other and women will show risk-adverse behavior. Being married may increase the resources/income of a household and may provide for owning and using a mosquito net. On the other hand, a male may be less inclined to use income for owning and using a mosquito net in the house in which case it may decrease the probability.

Caregiver's perception and bed net use

A caregiver's perception has an influence on the use of bed nets. This includes beliefs that malaria are caused by other reasons other than mosquitoes or that malaria is caused by bad spirits. This may undermine the use of bed nets thereby putting the vulnerable groups at risk. On the other hand, those who believe that the use of bed nets leads to general well-being of the family member end up consistently using bed nets.

Given the above studies, it is clear that many studies had been carried out on utilization of ITNs. However, none of these studies specifically focused on utilization of ITNs among the under fives with emphasis on the intra-household factors which this study will address. This study aimed at bridging the information gap on the status of ITN utilization among the children under the age of five years and determining the factors within the household that predict utilization.

2.10 Knowledge gaps

These and other similar studies provide evidence that the correlation of bed-net use and malaria prevention in children under five years is key. More research is needed to show the barriers and facilitators of bed-net use for underserved high risk populations like children under five years. This study intends to address gaps in the literature which do not account for how deaths from malaria among this population related health behaviors are determined by factors in the social environment.

Table 2.2 Knowledge Gaps

Variable	Literature Source	Findings	Knowledge gap
Household characteristics	Alaii J.A., Hawley W.A., Kolczak, M.S., Kuile, F.O., Gimnig, J.E., Vulule, J.M., Odhacha A., Oloo A.J., Nahlen, B.L., & Phillips-Howard, P.A. (2003). Factors affecting use of permethrin-treated bed nets during a randomized controlled trial in western Kenya. The American Journal of Tropical Medicine and Hygiene, 68(4 suppl), 137-141.	Net use for a young child appears to fall as the number of household members rises.	The study did not focus on the value of awareness creation on net use as the number of nets increases.
Caregiver's level of education	Eisele, T. P., Keating, J., Littrell, M., Larsen, D., & Macintyre, K. (2009). Assessment of insecticide-treated bednet use among children and pregnant women across 15 countries using standardized national surveys. The American journal of tropical medicine and hygiene, 80(2), 209-214.	A mother's education level and adequate knowledge about malaria transmission are also associated with their use of bed nets.	There could be other factors hindering women from using nets for their children.
Caregiver's level of income	Xu, J. W., Liao, Y. M., Liu, H., Nie, R. H., & Havumaki, J. (2014). Use of bed nets and factors that influence bed net use among Jinuo ethnic minority in Southern China. PLoS ONE 9(7)	Household income, house type and the knowledge of the ability of nets to prevent malaria were found to influence the use of bed nets.	Some of households use nets not just to prevent malaria, but to keep away the "nuisance" from other insects.
Social support network	Noor, A. M., Kirui, V. C., Brooker, S. J., & Snow, R. W. (2009). The use of insecticide treated nets by age: implications for universal coverage in Africa.BMC Public Health, 9(1), 369.	Children with a married mother were reported to be over 3 times as likely to sleep under a net.	Being married may increase the income of a household hence may lead to owning and using a mosquito net. On the other hand, a male may be less inclined to use income for the same
Caregiver's perception	Beer, N., Ali, A. S., de Savigny, D., Al-Mafazy, A. W. H., Ramsan, M., Abass, A. K., Omari RS, Bjorkman A., & Källander, K. (2010). Research System effectiveness of a targeted free mass distribution of long lasting insecticidal nets in Zanzibar, Tanzania. Malar J 2010, 9:173.	Studies showed that some of the participants' use of bed nets was influenced by religious beliefs.	People may have different religious beliefs.

2.11 Summary of the reviewed literature

Literature supports respective connections between many health behaviors and stimuli in the social environment. In light of this increasing body of knowledge on how social and ecological conditions affect health and health behaviors, more studies are needed to understand how such interactions operate for medically and socially underserved populations like children below five years in rural Kenya. This study is hoped to be significant to both health-related social work and public health research and practice as it has the potential to advance the understanding of how social contextual factors in the daily lives of families facilitate their ability to take actions known to prevent malaria.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter consists of the research methodology including data collection and the procedures under the following subheadings: research design, the target population, sample and sampling procedures, the research instruments, validity and reliability of the instruments, data collection procedures and data analysis.

3.2 Research Design

Descriptive survey design was used in this study as it enables data to be gathered from a relatively large number of subjects at a particular time. This study was a survey design as it systematically gathered information that described the characteristics of respondents for the purpose of building generalizations about the population they represent. The determinants of bed net use in malaria prevention in children under five years in households in Kenya was a cross-sectional study and used a quantitative research approach.

3.3 Target Population

This was a household study targeting male and female caregivers of children under five years since this age group is the most affected by malaria. Bondo sub-county was selected because it represents a typical rural area in Kenya; and current studies show that malaria morbidity and mortality rates in children under five years is high in rural areas. Caregivers were randomly sampled to represent similar areas in the country. There are 33,590 people in the 8,334 households in Bondo sub-county according to Kenya National Bureau of Statistics (2009).

3.4 Sample Size

The sample size was obtained by using the Krejcie and Morgan Table (1970) as it is flexible and easy to manipulate. In this study, a sample of 368 households was used. This sample was large enough to serve as an adequate representation of the population about which the research findings were generalized and small enough to be selected economically.

The technique used should ensure that it is the representative of a population and not biased in any way (Gay (1992). However, the larger the sample, the smaller the sampling error, hence it is

recommended that a minimum sample of 20% is adequate for educational research of less than a thousand participants.

3.5 Sampling Procedure

For administrative convenience and reduction of costs such as transport, interviewer time and supervision, a random selection was made from multistage (cluster) sampling. This was a complex form of cluster sampling. Bondo sub-county is made up of three divisions (Maranda, Nyang'oma and Usigu) and Usigu was purposively selected for this study. It is made up of five locations (Central Yimbo, East Yimbo, Mageta Island, North Yimbo and West Yimbo) .The sub-locations (clusters) were randomly picked using the probability proportional to size (PPS) sampling. Got Agulu, Mahanga, Nyamonye and Usenge sub-locations (sub-clusters) with a total population of 33,590 and 8,334 households were therefore be picked. Further, two villages from each of these sub-clusters were be selected. This means that the final sample size was drawn from eight villages. Microsoft excel table of random numbers and a household listing was drawn on contacting the local administration on the ground. Krejcie and Morgan Table was used to select respondents from the sub-clusters to make a total of 368 respondents. (APPENDIX III)

3.6 Research Instruments

Quantitative data on the determinants of bed net use in malaria prevention in children under five years in households in Kenya was collected using a structured questionnaire in order to allow for descriptive analysis from the responses. The questionnaire contained both structured and unstructured questions meaning it had both open-ended and close-ended questions. The choice for the questionnaire as a data collection tool was founded on the fact that it is suitable for collecting a large amount of data from respondents within a short period of time.

It contains three major sections: section one contains questions on the respondents' socio-demographic characteristics; section two with questions based on the four themes derived from the study objectives namely: household characteristics, level of education, level of income, caregiver's perception and social support network.

For the closed-ended questions, a Five-point Likert Scale was used and included: (1) Strongly agree, (2) Agree, (3) Uncertain (4) Disagree and (5) Strongly disagree. The strongly agree

responses were scored at 5 for direct positive high scores while those of strongly disagree were scored at 1 for direct low/ negative responses. Closed ended questions were included because they are easier to administer and to analyze. There was also an interview schedule for the key informants. The key informants were the community health workers in the area. Open-ended questions were used in the questionnaires that were administered to key informants. These open-ended questionnaires assisted to get more information from the community health workers on the study being conducted. The questionnaires facilitated the evaluation of the determinants of bed net use in malaria prevention in children under five years in households in Kenya. The procedure for data collection ensured compliance to the rules and regulations as stated by the National Science and Technology Council. Permission to collect data was sought from the local administration i.e. the chief of the sub-location.

3.6.1 Piloting the Instruments

Piloting ensured that the questionnaire was free from ambiguity and that the data generated was meaningfully analyzed in relation to the stated research questions. This was done by administering the questionnaire to caregivers of children under five years in one of Bondo's neighboring sub-counties which contains similar characteristics as the study area. A sample of 20 households was used. After piloting, adjustments were made in order to address any areas of concern. Orodho (2004) states that piloting helps to establish whether the questions measure what they are supposed to measure, the respondents interpret all questions in the same manner, the wording is clear and also helps eliminate potential research bias.

3.6.2 Validity of the Questionnaire

Content validity of the instruments was used to measure the degree to which the items represented specific areas covered by the study. Validity was ascertained by checking that the questions measure what they are supposed to measure such as the clarity of wording and whether the respondents interpreted all questions in the similar ways to eliminate areas likely to cause confusion and ambiguity.

To enhance the questionnaire validity, the research instruments were appraised by the supervisor to evaluate the applicability and appropriateness of the content and adequacy of the instruments from a research perspective. The corrections on the identified questions

were incorporated in the instrument and a field test was conducted with a pilot randomly selected households that were not part of study to ensure validity of the research instrument. The questionnaires were then be dispatched to the field and administered by experienced research assistants.

3.6.3 Reliability of the Instruments

Reliability refers to extent to which instruments yield measurements that are consistent each time it is repeated to the same people. Reliability answers the question, "Are scores stable over time when the instrument is administered a second time?" (Creswell, 2003). To ensure reliability, split-half technique was used to calculate reliability coefficient (Spearman coefficient) which should be within the recommended reliability coefficient of 0.7-1 (Nachmias & Nachmias, 1996). This involved scoring two-halves of the tests separately for each person and then calculating a correlation coefficient for the two sets of scores. The instruments were split into the odd items and the even items. The scores were entered into the SPSS software and using the Spearman Brown prophecy formula, a correlation coefficient of 0.821 was obtained.

The Spearman Brown prophecy formula is:

Pxx' = 2 Pyy, / 1 + Pyy,

Where: - Pxx' is the reliability projected for the full-length test/scale,

   - Pyy` is the correlation between the half-tests.

   - Pyy, is also an estimate of the reliability of the test/scale if it contains the same number of items as that contained in the half-test.

If the two halves of test/scale are not parallel, the reliability of the full-length test/scale is calculated using the formula for coefficient α for split halves:

α = 2 [ó2 x - (ó^{2}y1 + ó^{2}y2)] 1 / ó^{2}x

Where: - ó^{2}y1 and ó^{2}y2 are the variances of scores on the two halves of the test,

   -   ó^{2}x is the variance of the scores on the whole test, with X = Y_1 + Y_2.

3.7 Data Collection Procedure

To generate data for this research study, a letter of introduction was obtained from the University of Nairobi which was taken to the sub-county officer of Bondo sub-county for permission after securing a permit from the National Council for Science and Technology. The sampled

households were visited to establish rapport and make appointments with the local administration. Information from respondents was collected with the help of trained research assistants on the dates agreed upon through direct contact after obtaining informed consent. Instructions were carefully explained to the respondent prior to the interviews after assuring them that the information given was confidential and was used only for the purpose of the study. Adequate time was accorded each respondent to obtain appropriate answers to the questions after which the completed questionnaires were checked for completeness and accuracy. The data collection exercise was expected to take approximately 10 days after which the data was entered into a Microsoft Excel database and cleaned to remove errors.

3.8 Data Analysis Technique

Data collected from this study was entered in to a Microsoft Excel database and cleaned to ensure completeness and accuracy. Statistical Package for Social Sciences (SPSS) Version 22.0 was used to analyze the data and presented using descriptive statistics like frequency distributions, percentages and averages. The qualitative data was analyzed using descriptive statistics such as mean, standard deviation and percentages. Inferential statistics such as correlation were used. The significance level was set at $p < 0.05$ for every statistical set. Content analysis was used to analyze open ended questions. Standard deviation was computed for each research question to test for consistency and the variability of responses across the study participants.

3.9 Ethical Issues

Obtaining a research permit from Kenya National Council for Science and Technology to carry out this research authenticated the study. The letter of transmittal was given to the respondents, seeking to explain what the study was about and assured the respondents that the research was purely for academic purposes. Consent was sought before the exercise began and study observed confidentiality on the information shared by the respondents (i.e. names were not written on the questionnaires) and the information gathered was only used for the purposes of this study. The personal right of choice to participation in this study was ensured by informing the respondents of their voluntary participation and to withdrawal from the study anytime they wished. The findings were shared with respondents who wished to know the outcome of the research.

3.10 Operationalization of Variables

This is a table that in more explicit ways shows the variables and their operational indicators

Operationalization of the study variables will be according to the objectives of the study:

To explain how household characterizes determine bed net use in malaria prevention for children under five years in households, to assess how the level of education of caregivers determines bed net use in malaria prevention for children under five years in households; to establish how the level of income of the caregiver determines bed net use in malaria prevention for children under five years in households; to establish how social support network determines bed net use in malaria prevention for children under five years in households and to explain how caregiver's perception determines bed net use in Bondo sub-county. These study variables are as shown in this table.

Table 3.1 Operationalization of variables

Objectives	Variable	Indicators	Measurement	Scale	Data collection Method	Data Analysis
1. To explain how household characteristics determine bed net use in malaria prevention for children under five years	**Independent variable** -Awareness	.Number of children below 5 years .Size & number of rooms. .Ease of hanging the nets	Ease of hanging the nets	Ordinal	Questionnaire	Mean, standard deviation, frequencies and percentage
2. To assess how bed net use in malaria prevention for children under five years	**Independent variable** - Education	Highest academic qualification	Academic qualification	Ordinal	Questionnaire	Mean, standard deviation, frequencies and percentage
3. To establish how the level of income of the caregiver determines net use in malaria prevention for children under five years	**Independent variable** -Level of Income	.Amount spent on healthcare .Cost of the bed nets	Cost of healthcare and bed nets	Ordinal	Questionnaire	Mean, standard deviation, frequencies and percentage
4. To establish how social support network determines bed net use in malaria prevention for children under five years in households	**Independent variable** Social support network	. Marital status .Support from family and friends	Marital status and support	Ordinal	Questionnaire	Mean, standard deviation, frequencies and percentage
5. To explain how caregiver's perspective determines bed net use in malaria prevention for children under five years in households.	**Independent variable** Caregiver's perception	Number of households who believe that malaria is caused by other means other than mosquitoes	Number of households that do not use nets for fear of side effects of the insecticide.	Ordinal	Questionnaire	Mean, standard deviation, frequencies and percentage
6. Bed net use in malaria prevention for children under five years in households.	**Dependent variable** Bed net use	Number of households correctly and consistently using bed nets	Number of households with bed nets and importance of malaria prevention	Ordinal	Questionnaire	Mean, standard deviation, frequencies and percentage

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter presents the findings and results of the study in the order of the research objectives which were: to explain how household characteristics determine bed net use in malaria prevention for children under five years; to assess how the level of education of caregivers determines bed net use in malaria prevention for children under five years; to establish how the level of income of the caregiver determines the bed net use in malaria prevention for children under five years; to establish how social support network determines bed net use in malaria prevention for children under five years and to explain how a caregiver's perception determines bed net use in malaria prevention for children under five years in households in Bondo sub-county. It begins by analyzing the demographic characteristics of the sample and then investigates the factors that determine the use of bed nets in children under five years in households. The results are based on a response rate of 87% (n=368).

4.2 Questionnaire Response Rate

The questionnaire response rate for this study was 87% as shown on the Table 4.1

Table 4.1 Questionnaire Response Rate

Category	Frequency	Percentage
Returned	321	87
Not returned	47	13
Total	**368**	**87**

The Table 4.1 shows a total of 321 (87%) of the respondents responded to the questionnaires while only 47 (13%) did not respond. The high response rate was attributed to using 10 research assistants and personally going to the field to collect data. A response rate of 70% is scientifically acceptable (Mugenda and Mugenda, 1999). Since this was a health-related survey involving questions of a personal nature, the 47 questionnaires that were not returned were those from respondents who opted not to participate in the study.

4.3 Demographic characteristics of the respondents

The study on the determinants of bed net use for malaria prevention in children under five years in households looked at the respondent's characteristics of age, sex, marital status, household characteristics, social support, level of income, level of education and caregiver perceptions. These themes were discussed in the following sections.

4.3.1 Distribution of Respondents by Age

The distribution of the respondents by age is shown in the Table 4.2.

Table 4.2 Distribution respondents by age

Category	Frequency	Percentage
18 - 24 years	36	11
25 - 35 years	183	57
36 - 45 years	64	20
46 - 55 years	38	12
Total	321	100

These results show that 57% of the respondents belonged to the 25-35 years category, followed at 20% by those from 36-45 years, then at 12% from the 46-55 years and the last was 11% from the 18-24 years category. The high response rate by 183 (47%) respondents represented by the second age-group was attributed to the group being the child-bearing age and more likely to be the care-givers.

4.3.2 Distribution of Respondents by Gender

The distribution of the respondents by gender is as shown in Table 4.3

Table 4.3: Distribution of Respondents by Gender

Category	Frequency	Percentage
Female	239	74
Male	82	26
Total	**321**	**100**

The study sought to find out the gender of the respondents. Table 4.3 shows that majority of the respondents were female 239 (74%) while the male respondents constituted 82 (26%) of the

sample; meaning that there were more female caregivers of children under five years than their male counterparts.

4.3.3 Distribution of Respondents by Marital Status

The distribution of the respondents by marital status is shown in the Table 4.4

Table 4.4: Distribution of Respondents by marital status

Category	Frequency	Percentage
Married	205	64
Divorced	42	13
Widowed	20	6
Single	33	10
Separated	21	7
Total	**321**	**100**

The majority of respondents were married at 205 (64%), followed by the divorced at 42 (13%), widowed at 20 (6%), never married at 33 (10%) and lastly the separated 21 (7%).

4.4 Household characteristics and bed net use in children under five years

Studies have shown that the number of children in a household increases the likelihood that a young child sleeps under a net. Table 4.5 shows the details.

Table 4.5: Household characteristics and bed net use in children under five years

Category	Frequency	Percentage
None	1	0%
One	25	8%
Two	109	34%
Three	157	49%
More than three	29	9%
Total	**321**	**100**

The majority of households had three children under the age of five years at 157 (49%), followed by those with two children at 109(34%), then by those with more than three 29(9%), those with only 1 at 25(8%), and lastly by only 1 household with no children under five years. This shows that the household targeting was done properly as the majority were reached during this period of study. Further, the study found out that majority of the surveyed households had at least 4

sleeping spaces and owned at least 3 bed nets. This can be said to contribute to net use since they are available.

4.5 Level of Education and bed net use in children under five years

Education is said to enhance the demand for preventative health services by raising awareness of the importance of undertaking regular health check-ups and may also improve the ways in which individuals understand information regarding medical tests, use of bed nets to prevent malaria, communication with health practitioners, and interpreting results. Table 4.6 gives the details.

Table 4.6: Level of Education and bed net use in children under five years

Category	Frequency	Percentage
Post graduate	2	1%
College/university	21	7%
Secondary	168	54%
Primary	94	30%
None	27	9%
Total	**312**	**100**

The study sought to find out the academic qualifications of the respondents. Table 4.3 shows that majority of the respondents of had completed secondary education 168(54%), followed by those with primary school education 94(30%), those without at 27(9%). College/university and post graduates were 21(7%) and 2(1%) respectively. Since majority of the respondents have completed secondary school education, it is safe to assume that it will be easy to create more awareness on the importance of net use for children under five years; since education is said to contribute significantly to message uptake and motivation.

4.6 Level of income and bed net use in children under five years

The cost of health care and bed nets and other health services is said to be very key to access to these services. Many socio-economic variables including, distance to health facility, wealth, income and region of residence proved significant in predicting bed net utilization as indicated in Table 4.7.

Table 4.7: Level of income and bed net use in children under five years

Category	With a bed net and has at least 3 children below 5 years N=219 Frequency	Without a bed net and has at least 3 children below 5 years N=102 Frequency	Percentage
Below 5,000	113	20	18
Between 5,000 and 20,000	93	47	51
Above 20,000	13	35	37
Total	219	102	

Table 4.7 shows that 113(82%) of the respondents own a bed net and have at least 3 children below 5 years. They also have the least monthly income compared to the other groups in this study.

4.7 Social support and bed net use in children under five years

Social support from male partners, friends and relatives has been proven to increase demand in seeking for health services. Females with partners are said to be more likely to participate in prevention activities like bed net use in their households, and social networks act as trusted informal sources of health information and encouragement to pursue healthy lifestyles. Table 4.8 shows the details.

Table 4.8 Social support and bed net use in children under five years.

Category	Discussed bed net use with Partner (N=205) Frequency	Did not discuss bed net use with Partner (N=116) Frequency
Strongly Agree	44	11
Agree	97	53
Uncertain	10	3
Disagree	49	30
Strongly disagree	5	19
Total	**205**	**116**

Table 4.8 shows respondents 205 (64%) who discussed the use of bed nets with their partners largely agree that they are key to preventing malaria transmission, and supported by those who

did not discuss with their partners. This clearly shows that information sharing on net use for children under five years is key and should be encouraged within the social structure.

4.8 Caregiver perception and bed net use in children under five years

Studies show that caregivers' perceptions on bed net use for children under five years is crucial to malaria prevention. Their religious beliefs about the role of God and spirits in the prevention of malaria need to be addressed for sustainable net use for the target group. Table 4.9 shows the scores.

Table 4.9 Caregiver perception and bed net use in children under five years

Category	Malaria is caused by other means other than from mosquito bites	Insecticides used in mosquito nets is harmful
	Frequency	**Frequency**
Strongly Agree	96	89
Agree	78	80
Uncertain	14	91
Disagree	39	30
Strongly disagree	94	31
Total	**321**	**321**

This table shows that caregivers' perceptions on bed net use lean more towards believing that malaria is caused by other means other than from mosquito bites and that insecticides used in mosquito nets is harmful to the children. These perceptions can be largely attributed to the low net use even among households with a higher income level that can afford to buy a net.

4.9 Bed net use in children under five years

Respondents were asked what they thought about the following key factors that determine the use of bed nets for children under five years as shown in table 4.10.

Table 4.10 Bed net use in children under five years

Category	Strongly Agree Frequency	Agree Frequency	Uncertain Frequency	Disagree Frequency	Strongly Disagree Frequency	Total
Household characteristics	13	9	5	5	9	41
Level of education	10	6	9	7	6	38
Level of income	5	12	7	6	10	40
Social support network	15	15	10	10	15	65
Caregiver's perception	42	35	18	29	13	137
Total	85	77	49	57	53	321

Table 4.10 shows that majority of the respondents 137 (43%) believe that caregivers' perceptions are key to bed net use, followed by social support 65 (20%) and then household characteristics 41 (13%). The last two factors were the caregivers' level of education and income 38 and 40 respectively; tying at 12%.

Table 4.11 Logistic Regression Analysis

Table 4.11 is a logistic regression analysis that explains the relationship between the independent variables and the dependent variable.

Variable	Category	Frequency (Percentage)	Unadjusted odds ratio (95% confidence interval)	p_value
Household characteristics	None One Two Three More than three	1 (0) 25 (8) 109 (34) 157 (49) 29 (9)	2.02(1.21 - 5.11)	0.00125
Level of education	Post graduate College/university Secondary Primary None	2 (1) 21 (7) 168 (54) 94 (30) 27 (9)	0.18 (0.17 - 1.22) 1.47 (0.19 - 11.59)	0.02101
Level of income	Employment Price of ITNs Travelling costs	133 (41) 140 (44) 48 (15)	1.22 (0.55 - 2.69) 0.45 (0.24 - 1.32)	0.6289
Social support network	Marital status Family and friends	112 (35) 209 (65)	0.54 (0.10 - 2.82) 1.55 (0.60 - 3.96)	0.03
Caregiver's perception	Attitudes Beliefs	321 (100)	0.13 (0.13 - 5.19) 0.69 (0.26 - 8.03)	0.01

Table 4.11 indicates that there was a highly significant relationship (p value =0.00125< 0.05) between household characteristics and bed net use in children under five years. Further, those households with at least 2 children were 2 times more likely to use a bed net compared to families with more than 2. This means that households with more than two children need to be encouraged to use bed nets. There was a significant relationship (p value =0.02101< 0.05) between the caregivers' level of education and bed net use in children under five years and those with at least primary school education were 2 times more likely to use bed nets for children under five years. There was no relationship between the caregivers' level of income and bed net use in children under five years (p value = 0.6289> 0.05).

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There was a significant relationship (p value = 0.03 < 0.05) between social support and bed net use in children below five years of age, as well as between caregivers' perceptions on bed net use (p value = 0.01 < 0.05). This means we accept the 1st 2nd, 4th and 5th research questions, reject the 3rd research question as it was partially supported. This, however, does not mean that household income is not important in bed net use in children under five years as other compounding factors and previous studies support this factor.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of findings of the research, discusses the results, draws conclusions and makes recommendations for use bed net use in children under five years in prevention of malaria.

5.2 Summary of Findings

Significant findings that arose from the study on the determinants of bed net use in children under five years in households in the prevention of malaria; were on the respondents' demographic factors, where 57% of the respondents belonged to the 25-35 years category, and 239 (74%) were female, 205 (64%) were married and majority of the households had three children under the age of five years at 157 (49%).

On the household characteristics, the majority of households had three children under the age of five years at 157 (49%), followed by those with two children at 109(34%), then by those with more than three 29(9%), those with only 1 at 25(8%), and lastly by only 1 household with no children under five years. This shows that the household targeting was done properly as the majority were reached during this period of study. Further, the study found out that majority of the surveyed households had at least 4 sleeping spaces and owned at least 3 bed nets. This can be said to contribute to net use since they are available.

On the level of education, the results show that majority of the respondents have completed secondary education 168(54%), followed by those with primary school education 94(30%), those without at 27(9%). College/university and post graduates were 21(7%) and 2(1%) respectively. Since majority of the respondents have completed secondary school education, it is safe to assume that it will be easy to create more awareness on the importance of net use for children under five years since education is said to contribute significantly to message uptake and motivation.

Education is said to enhance the demand for preventative health services by raising awareness of the importance of undertaking regular health check-ups and may also improve the ways in which individuals understand information regarding medical tests, use of bed nets to prevent malaria, communication with health practitioners, and interpreting results. The study sought to find out the academic qualifications of the respondents.

On the level of income, the results show that 113(82%) of the respondents own a bed net and has at least 3 children below 5 years. They also have the least monthly income (sh 5,000 per month) compared to the other groups in this study. Many socio-economic variables including, distance to health facility, wealth, income and region of residence proved significant in predicting bed net utilization.

On social support network, the study shows that 205 respondents (64%) who discussed the use of bed nets with their partners largely agree that they are key to preventing malaria transmission, and supported by those who did not discuss with their partners. This clearly shows that information sharing on net use for children under five years is key and should be encouraged within the social structure. Females with partners are said to be more likely to participate in prevention activities like bed net use in their households, and social networks act as trusted informal sources of health information and encouragement to pursue healthy lifestyles.

On caregiver's perception, this study shows that caregivers' perceptions on bed net use lean more towards believing that malaria is caused by other means other than from mosquito bites and that insecticides used in mosquito nets is harmful to the children. These perceptions can be largely attributed to the low net use even among households with a higher income level that can afford to buy a net. Their religious beliefs about the role of God and spirits, as well as the belief that mosquito nets contain harmful insecticides need to be addressed for sustainable net use for the target group.

Respondents were asked what they thought about the key factors that determine the use of bed nets for children under five years it emerged that majority of the respondents 137 (43%) believe that caregivers' perceptions are key to bed net use, followed by social support 65 (20%) and then

household characteristics 41 (13%). The last two factors were the caregivers' level of education and income 38 and 40 respectively; tying at 12%.

5.3 Discussions of the Study

In common with other studies in African countries, the older the child, the less likely he/she was to sleep under a bed net the night prior to the survey. When there are only a limited number of bed nets, it could be that priority is given to the younger children, or perhaps, as the children grow older and experience fewer episodes of malaria, there may be a false sense of protection, leading to lower utilization of bed nets. This suggests that an increased awareness of risk brought about by being sick may translate into better compliance with malaria protection. This finding suggests the need for education as a means of achieving increased and appropriate bed net utilization especially in children under five years.

From the bivariate analysis of factors associated with bed net use, household characteristics determine bed net use in children under five years in households in Kenya; hence we accept this first research question. Investigation on the whether caregivers' level of education determines bed net use in children under five year, there was a significant influence, hence the observation that is was a significant determinant. On evaluating the influence of caregivers' level of income and bed net use in children under five years, there was no significant influence, hence we reject the influence of this factor, but this can be concluded that it was partially supported.

5.3.1 Household characteristics and bed net use

The study sought to investigate whether household characteristics determine bed net use among children under five years and the observation was that majority of households had three children under the age of five years at 157 (49%), followed by those with two children at 109(34%), then by those with more than three 29(9%), those with only 1 at 25(8%), and lastly by only 1 household with no children under five years. This shows that the household targeting was done properly as the majority were reached during this period of study. Further, the study found out that majority of the surveyed households had at least 4 sleeping spaces and owned at least 3 bed nets. This can be said to contribute to net use since they are available.

This is in line with a study by Eisele *et al*., (2009) which showed that while larger families appear to increase the likelihood of owning a net, they may also decrease the likelihood of a young child sleeping under the net. The number of children in the household, on the other hand, increases the likelihood that a young child sleeps under a net. In all households, the addition of one child under five increases the likelihood of a child sleeping under a net by 80%. (Eisele *et al*., 2009)

Net use for a young child, however, does appear to fall as the number of household members rises. This finding differs from Alaii *et al* (2003) and De La Cruz *et al* (2006), who conclude that the number of household members has no effect on the use of nets. Alaii *et al* (2003) studied the net use by all members of a household in Kenya, as opposed to just young children, and found no impact on net use as the number of household members rises. While this study by Alaii *et al* indicates that overall use in a household is unaffected, young children in Kenya may be affected differently from other household members as the household size increases. De La Cruz *et al* (2006) specifically studied the use of a net by children as household size increases in Ghana and also concluded that household size does not affect the use for young children. Kenya differs from Ghana and a larger household may reduce the access of young children to limited resources.

5.3.2 Caregivers' level of education and bed net use

The study sought to find out the academic qualifications of the respondents. The results show that majority of the respondents had completed secondary education 168(54%), followed by those with primary school education 94(30%), those without at 27(9%). College/university and post graduates were 21(7%) and 2(1%) respectively. Since majority of the respondents have completed secondary school education, it is safe to assume that it will be easy to create more awareness on the importance of net use for children under five years; since education is said to contribute significantly to message update and motivation.

These findings are in line with those of a study carried out in the Democratic Republic of Congo where malaria is the most prominent disease. To that effect long lasting insecticide treated nets have been distributed since 2006. A total of 142 households were surveyed using a standard questionnaire. The study concluded that education was the most important factor affecting the

use of bed nets in the villages outside Kinsasha. Development of an education program was therefore necessary to reduce misconceptions and increase the prevalence on bed net use among all age groups. (Ndjinga & Minakawa, 2010).

Education about malaria transmission and the benefits and proper use of bed nets should eliminate the misconceptions about bed nets use. Results reported here demonstrate that the education level of the family head of household was associated with bed net use among family members in the surveyed villages. A previous study in Kinshasa also reported that women who had secondary school or higher education were 3.4 times more likely to own and 2.8 times more likely to use a bed net compared with women with less education (Pettifor *et al*., 2008).

5.3.3 Caregivers' level of income and bed net use

Many socio-economic variables including, distance to health facility, wealth, income and region of residence proved significant in predicting bed net utilization. The results show that 113(82%) of the respondents own a bed net and has at least 3 children below 5 years, and have the least monthly income compared to the other groups in this study compared to those without one. The statistical test on the relationship between caregivers' level of income and bed net use showed there was no relationship between the caregivers' level of income and bed net use in children under five years (p value = 0.6289> 0.05).

This is supported by results in a study among Jinuo ethnic majority in China, a survey on the use of bed nets and the factors influencing the use of bed nets was carried out on 352 households. It emerged that high net availability does not necessarily mean higher coverage of bed net use. Household income, house type and the knowledge of the ability of nets to prevent malaria were found to influence the use of bed nets. (Xu J-W *et al*., 2014).

Occupational status of the household head and family size were among the factors affecting the ownership of ITN in research studies. In one study in Ethiopia, government employees and self-employed traders were less likely to own a net (Haileselassie & Ali, 2008). In this study, family size was associated with the possession of net. Similarly in Tanzania a unit increase in family size increased the odds of ownership of a net more than twice while controlling for all other

variables, where for households who had at least one under five child the odds of owning any net was about 60% higher than those with no children under the age of five. In another study, women's and head of household's education, head of household's occupation, marital status, household size, household wealth, living in rural areas, and expenditure on other malaria prevention products and practices were found to be associated with ITN ownership (Matovu *et al.*, 2009).

5.3.4 Social support and bed net use

Social support from male partners, friends and relatives has been proven to increase demand in seeking for health services. This study showed that respondents 205 (64%) who discussed the use of bed nets with their partners largely agree that they are key to preventing malaria transmission, and supported by those who did not discuss with their partners. This clearly shows that information sharing on net use for children under five years is key and should be encouraged within the social structure.

Women participants at a study in Kimenyedde sub-county by Koenker *et al.* (2012), their study in Tanzania said that they fear to buy mosquito nets because their husbands would question them about the source of the money. This is because women in this community are not expected to have money, or if they have money, the husbands feel obliged to know its source. More than half of the women participants in all the FGDs expressed fear that if a woman bought a net, the husbands would suspect that she got the money from another man (Mbonyi *et al.*, 2005). This study specifically investigated affordability of ITNs to under-fives within the household setting which was not covered in the previous studies.

This study reported that the participants discussed friends and family members in the context of trusted informal sources of health information; and saw their significant others as sources of encouragement to pursue healthy lifestyles and stay up-to-date with health screenings. Recent research also indicates that social isolation and lack of social support network system of family and friends to discuss health issues was associated with lower levels of net-use in sub-Saharan Africa.

5.3.5 Caregivers' perception and bed net use

Studies show that caregivers' perceptions on bed net use for children under five years is crucial to malaria prevention. Their religious beliefs about the role of God and spirits in the prevention of malaria need to be addressed for sustainable net use for the target group. This study shows that caregivers' perceptions on bed net use lean more towards believing that malaria is caused by other means other than from mosquito bites and that insecticides used in mosquito nets is harmful to the children. These perceptions can be largely attributed to the low net use even among households with a higher income level that can afford to buy a net.

This is in line with a study done in September 2008, where LLINs were distributed in Lurambi, Western Kenya as part of an integrated prevention campaign organized over one week's time. An assessment was then carried out two months after the campaign. Most of the participants believed that mosquitoes were the major cause of malaria. However some participants while implicating mosquitoes as the cause of malaria also indicated cold weather, rain, consumption of bad food and stagnant water. Some of the participants also mentioned that they generally feel warmer and comfortable when they used LLINs. Other claimed that the use of LLINs caused their skin to itch (Dye *et al*., 2010).

5.4 Conclusions

It should be recognized that household dynamics in bed net use with children under five years is complex and influenced by various social, economic and cultural realities. The success of utilization largely depends on how households are able to cope with these realities and how policy makers and implementing organs understand these realities. Distribution of nets without proper knowledge on these dynamics will continue to offer little success in prevention of malaria. More awareness on the importance of the use of bed nets can be created since majority of the respondents have completed secondary education. There is need for a mass distribution of bed nets to optimize the use of bed nets across all income groups. Information sharing on net use for children under five years is key and should be encouraged within the social structure. Their religious beliefs about the role of God and spirits in the prevention of malaria need to be addressed for sustainable net use for the target group

5.5 Recommendations

The research reported that studies have demonstrated the feasibility of bed net use in households with children under five years. The study also suggests there is a need for:

1. Based on these findings, bed net use in this region could be increased, if information, education and communication (IEC) messages on malaria transmission were strengthened either through community health workers or net provider programs to encourage participants to use nets they already possess.

2. Since the analyses found that there were disparities in net use across age groups, the current distribution of free nets to the entire population may optimize coverage as well as help increase bed net use in children under five years.

3. In addition to providing protection to individuals against the bites of malaria infected mosquitoes, vector control interventions can also have a substantial effect on mosquito population dynamics; especially when caregivers report that nets should only be used during rainy seasons, the introduction of insecticide-treated nets or indoor residual spraying can be introduced as it has been proven as one of the most effective methods for controlling malaria transmission besides bed net use.

4. Members of the community need to be encouraged to share ideas on health among themselves or existing community groups or welfare associations or church groups.

5. Members of the community also need to be sensitized so that they can avoid or minimize the negative perceptions that they have on the use of bed nets. This can be done through community health workers.

5.6 Suggestions for Further Research

There are other factors that determine bed net us in children under five years that need further investigations. This study suggests the following research priorities:

1. Understanding individual and community-level barriers to uptake of bed net use,

2. Improving healthcare worker performance by identifying effective methods for training, supporting and supervising community health care workers,

3. There is also need to find out why households, irrespective of whether they are urban or rural, their awareness, academic and income levels are not heavily involved in preventive health care despite the easy access to free or highly subsidized and free mass net distribution of nets; including campaigns at the household level by community health workers.

5.7 Contribution to the body of knowledge

No.	Objective	Contribution
1	To explain how household characteristics determine bed net use in malaria prevention for children under five years in households in Bondo sub-county	Household characteristics alone are not helpful unless caregivers as individuals and as a community understand the need and will to use the bed nets. The presence of many and or equipped health facilities and preventive health care in the vicinity without educating the masses on their usefulness is not productive. For demand of health care to shift from being sick/ill to adopting preventive health care, in addition to availability of facilities, caregivers need the knowledge on the importance of consistent bed net use.
2	To assess how the level of education of caregivers determines bed net use in malaria prevention for children under five years in households in Bondo sub-county	Education can enhance the demand for preventative health services by raising awareness of the importance of undertaking regular health check-ups and may also improve the ways in which individuals understand information regarding bed net use, communicate with the health practitioners, and interpret results. It also enhances the inclusion of individuals in society, improves self-efficacy and confidence. All these determinants may increase service uptake if caregivers are targeted in development programs.

3	To establish how the level of income of the caregiver determines the bed net use in malaria prevention for children under five years.	Financial and geographic access to health care alone do not necessarily influence caregivers demand for bed net use in children under five years; unless they have health literacy to take advantage of the available resources to promote health.
4	To establish how social support network determines bed net use in malaria prevention for children under five years in households in Bondo sub-county	Social support from spouses, family and friends is crucial to adopting healthy lifestyle in regards to malaria prevention in children under five years. More effort is required to strengthen social networks as they play a major role in providing a trusted source of information and encouragement in malaria prevention.
5	To explain how a caregiver's perception determines bed net use in malaria prevention for children under five years in households in Bondo sub-county	Caregivers' perceptions on bed net use for children under five years is crucial to malaria prevention. Their religious beliefs about the role of God and spirits in the prevention of malaria and need to be addressed for sustainable net use for the target group

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APPENDIX I

LETTER OF TRANSMITTAL OF DATA COLLECTION INSTRUMENTS

<div align="right">

REUBEN ODONGO OMOLLO

P O BOX 278 00600

NAIROBI
Telephone: 0720738631
September 15, 2015

</div>

Dear Respondent**,**

RE: <u>**DETERMINANTS OF BED NET USE IN MALARIA PREVENTION FOR CHILDREN UNDER FIVE YEARS IN HOUSEHOLDS IN KENYA**</u>

I am a post graduate student at the University of Nairobi carrying out a research project on the determinants of bed net use in malaria prevention in children under five years in households in Bondo sub-county. As part of my course, I am required to carry out a research on the above topic.

I will be grateful if you could spare sometime from your busy schedule and fill in the questionnaire. All the information provided will be purely used for academic purposes and your identity will be treated with utmost confidentiality.

Thank you for your cooperation.

Kindly do not write your name anywhere on the questionnaire.

Yours faithfully,

L50/61501/2013

Odongo, Omollo Reuben

QUESTIONNAIRE FOR CAREGIVERS

DETERMINANTS OF BED NET USE IN MALARIA PREVENTION IN CHILDREN UNDER FIVE YEARS QUESTIONNAIRE

Read to respondent: "I would like to ask you some questions about yourself" Do not read out answers unless stated. Allow for unprompted responses and circle the corresponding the answer.

SECTION 1: DEMOGRAPHIC CHARACTERISTICS

1. Please state your age.

   a) 18 – 24 years   b) 25-35 years   c) 36- 45 years   d) 46- 55 years

2. Please state your gender.

   a) Male   b) Female

3. What is your marital status?

   a) Married   b) Divorced   c) Widowed   d) Single

SECTION 2: HOUSEHOLD CHARACTERISTICS

4. How many children below 5 years live this household?

   a) None   b) One   c) Two   d) Three   e) More than three

5. How many people live in this household?

   a) Between 2 and 3   b) Between 3 and 4   d) Between 4 and 5   e) Between 5 and 6

6. How many sleeping spaces are there in this household?

   a) Two   b) Three   c) Four   d) Five   e) More than five

7. How many mosquito nets are there in this household?

   a) None   b) One   c) Two   d) Three   e) More than three

8. Do you know how to hang the nets?

   a) Strongly agree   b) Agree   c) Uncertain   d) Disagree   e) Strongly disagree

SECTION 3: LEVEL OF EDUCATION

9. What is the highest level of education you have completed?

    a)None   b) Primary   c) Secondary d) College/University e) Post graduate

SECTION 4: LEVEL OF INCOME

10. Are you currently?

    a) Employed full-time   b) Employed part-time   c) Self-employed

    d) Retired   e) Unemployed

11. How much is your monthly level of income? (In Kenya shillings)

    a)   Below 5,000   b) Between 5,000 and 10,000   c) Between 10,000 and 15,000

    d) Between 15,000 and 20,000   e) Above 20,000

12. What is the main occupation of the male head/spouse?

    a) Self-employed   b) Employed full time c) Employed part time   d) No male head/spouse   e) Does not work

13. How much did your bed net cost? (In Kenya shillings)

    a)   Free   b) Between 50 and 500   c) Between 500 and 1000 d) Don't know

    e) Other (specify)_____

14. What would you say about cost of treating malaria services in health facilities?

    a)Very Expensive b) Expensive   c) Affordable d) Fairly Cheap   e) Very Cheap

SECTION 5: SOCIAL SUPPORT NETWORK

16. During the past one year, did you and your partner discuss bed net use for children under five years?

    a) Yes   b) No

17. Have you ever talked with your mother, daughter, or friend about the importance of sleeping under an ITN?

    a) Strongly agree   b) Agree   c) Uncertain   d) Disagree   e)Strongly disagree

18. Do you think that social support network determines bed nets use for children under five years?

      a) Strongly agree   b) Agree   c) Uncertain d) Disagree   e) Strongly disagree

SECTION 5: CAREGIVER'S PERCEPTION

19. Malaria is caused by other means other than from mosquito bites.

      a) Strongly agree   b) Agree   c) Uncertain d) Disagree   e) Strongly disagree

20. The insecticide used in mosquito nets is harmful (may cause the skin to itch).

      a) Strongly agree   b) Agree   c) Uncertain d) Disagree   e) Strongly disagree

SECTION 6: BED NET USE

21. To what extent do you think the following are key factors that determine the use of bed nets for children under five years? Please rank between 1-5 (5 being the highest priority)

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
Household characteristics					
Level of education					
Level of income					
Social support network					
Caregiver's perception					

QUESTIONNAIRE TO BE ADMINISTERED TO KEY INFORMANTS (COMMUNITY HEALTH WORKERS)

1. What are the sources of information about malaria? What kind of information about malaria do you give to the community?

_____

_____

_____

2. What does the community perceive as the most effective vector control for malaria?

_____

_____

_____

3. What can the community do to prevent and control malaria? Are there specific times when malaria is a problem?

_____

_____

_____

4. Are there specific activities or projects in the area that contribute to the fight against malaria?

_____

_____

_____

_____

5. Does the community take malaria as a serious problem?

_____

_____

_____

6. How can the community better organize to improve malaria control and prevention in the village?

_____

_____

_____

7. What are the challenges faced by the community in regards to the use of bed nets?

_____

_____

_____

_____

APPENDIX III

KREJCIE AND MORGAN TABLE

Table for Determining Sample Size for 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

Sampling Frame – Probability Sampling Proportionate to Size

Location	Sub location	Male	Female	Total	Households
WEST YIMBO	GOT AGULU	2726	2779	5505	1338
MAGETA ISLAND	MAHANGA	2433	2190	4623	1211
NORTH YIMBO	NYAMONYE	3442	3819	7261	1643
WEST YIMBO	USENGE	7964	8237	16201	4142

APPENDIX V

LETTER FROM THE UNIVERSITY

UNIVERSITY OF NAIROBI
COLLEGE OF EDUCATION AND EXTERNAL STUDIES
SCHOOL OF CONTINUING AND DISTANCE EDUCATION
DEPARTMENT OF EXTRA-MURAL STUDIES
NAIROBI EXTRA-MURAL CENTRE

Your Ref:

Our Ref:

Telephone: 318262 Ext. 120

Main Campus
Gandhi Wing, Ground Floor
P.O. Box 30197
N A I R O B I

1st October, 2015

REF: UON/CEES//NEMC/22/357

TO WHOM IT MAY CONCERN

RE: REUBEN ODONGO OMOLLO -L50/61501/2013

This is to confirm that the above named is a student at the University of Nairobi, College of Education and External Studies, School of Continuing and Distance Education, Department of Extra- Mural Studies pursuing Master of Arts in Project Planning and Management.

He is proceeding for research entitled **"determinants of bed net use in malaria prevention for children under five years in households in Kenya.** A case of Bondo Sub-County.

Any assistance given to her will be appreciated.

CAREN AWILLY
CENTRE ORGANIZER
NAIROBI EXTRA MURAL CENTRE
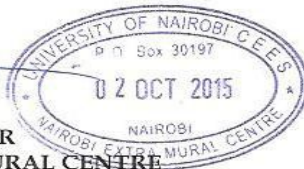
APPENDIX VI

LETTER FROM NACOSTI

**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.
NACOSTI/P/15/67513/8317

Date:

3rd November, 2015

Reuben Odongo Omollo
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on *"Determinants of bed net use for malaria prevention in children under the age of five years in households in Kenya. A Case Of Bondo Sub-County,"* I am pleased to inform you that you have been authorized to undertake research in **Siaya County** for a period ending **3rd November, 2016.**

You are advised to report to **the County Commissioner, the County Director of Education and the County Coordinator of Health, Siaya 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.
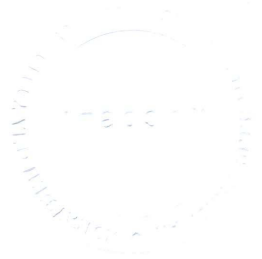
**SAID HUSSEIN
FOR: DIRECTOR GENERAL/CEO**

Copy to:

The County Commissioner
Siaya County

The County Director of Education
Siaya County.

National Commission for Science, Technology and Innovation is ISO 9001: 2008 Certified

The County Coordinator of Health
Siaya County.

# APPENDIX VII

RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MR. REUBEN ODONGO OMOLLO
of THE UNIVERSITY OF NAIROBI,
278-600 Nairobi,has been permitted to
conduct research in *Siaya County*

on the topic: *DETERMINANTS OF BED NET USE FOR MALARIA PREVENTION IN CHILDREN UNDER THE AGE OF FIVE YEARS IN HOUSEHOLDS IN KENYA. A CASE OF BONDO SUB-COUNTY.*

for the period ending:
3rd November,2016

Permit No : NACOSTI/P/15/67513/8317
Date Of Issue : 3rd November,2015
Fee Recieved :Ksh 1,000

....
Applicant's
Signature
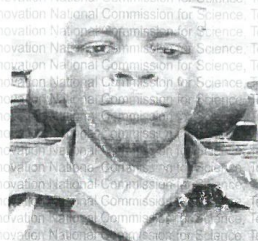
....
Director General
National Commission for Science,
Technology & Innovation

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

NACOSTI

National Commission for Science,
Technology and Innovation

RESEARCH CLEARANCE
PERMIT

Serial No. A 7050

CONDITIONS: see back page