FACTORS INFLUENCING MOSQUITO NET ACQUISITION/TREATMENT AND UTILIZATION AMONG CAREGIVERS OF UNDER FIVES IN MAKUENI DISTRICT, KENYA

BY

MALUSHA JAMES MWASHEMBE (HND)

REG NO.157/6032/2003

DEPARTMENT OF PUBLIC HEALTH

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF MASTER OF PUBLIC HEALTH IN THE SCHOOL OF HEALTH SCIENCES OF KENYATTA UNIVERSITY

SEPTEMBER 2007
DECLARATION

I Malusha James Mwashembe, hereby declare that this thesis is my original work and has not been presented for degree in any other university.

Signature .................................. Date 25/9/07

This thesis has been submitted for examination with our approval as university supervisors.

1. Signature.............................. Date..............
   Dr. Isaac Mwanzo
   Department of Public Health
   Kenyatta University

2. Signature.............................. Date..............
   Dr. Andre Yitambe
   Department of Public Health
   Kenyatta University

3. Signature.............................. Date..............
   Dr. Jenard Patrick Mbugi
   Department of Biological Sciences
   Kenyatta University
DEDICATION

This work is dedicated to my parents Mr. and Mrs. Johnson Malusha, and to my wife Peris Wughanga and my children Johnson, Gidnora and Salome.
ACKNOWLEDGEMENT

This research was made possible through support, assistance and guidance from various people and institutions. I wish to express special thanks to my supervisors Dr Isaac Mwanzo, Dr Andre Yitambe of the department of Public Health, and Dr Jenard P. Mbugi of Department of Biological Sciences, Kenyatta University, for their valuable technical support and guidance throughout the entire process of undertaking this research and in the preparation of the thesis. Further I am greatly indebted to the Chairman and staff of the Public Health Department, Kenyatta University for their useful support and guidance throughout the course of conducting research as well as during undertaking of the course work.

I am also very grateful to my research assistants Joseph Kavoi, Christopher Kyengo, Jackson Muia, and Elizabeth Mulwa for their assistance particularly in data collection. I am equally thankful to all the people who participated in focus group discussions and in the interviews, of which without their cooperation, this research work would not have been realized. I am equally grateful to Kenyatta University for granting me the chance to undertake MPH course.

I am greatly indebted to my employer, Ministry of Health for giving me permission and support to pursue this course, and in particular the Chief Public Health Officer Mr Alfred Langat, for his encouragement during the course.

Finally, I wish to thank all those who assisted me either directly or indirectly throughout the course and research work.
<table>
<thead>
<tr>
<th>ACRONYMS AND ABBREVIATIONS</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRO</td>
<td>Regional Office for Africa</td>
</tr>
<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
</tr>
<tr>
<td>CBS</td>
<td>Central Bureau of Statistics</td>
</tr>
<tr>
<td>DALYs</td>
<td>Disability Adjusted Life Years</td>
</tr>
<tr>
<td>DOMC</td>
<td>Division of Malaria Control</td>
</tr>
<tr>
<td>FGDs</td>
<td>Focus Group Discussions</td>
</tr>
<tr>
<td>GOK</td>
<td>Government of Kenya</td>
</tr>
<tr>
<td>KDHS</td>
<td>Kenya Demographic Health Survey</td>
</tr>
<tr>
<td>KNBS</td>
<td>Kenya National Bureau of Statistics</td>
</tr>
<tr>
<td>ITN</td>
<td>Insecticide Treated Net</td>
</tr>
<tr>
<td>LLIN</td>
<td>Long lasting insecticide treated net</td>
</tr>
<tr>
<td>MOH</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>NGO</td>
<td>Non Governmental Organization</td>
</tr>
<tr>
<td>NHSSP</td>
<td>National Health Sector Strategic Plan</td>
</tr>
<tr>
<td>NMS</td>
<td>National Malaria Strategy</td>
</tr>
<tr>
<td>PSI</td>
<td>Population Services International</td>
</tr>
<tr>
<td>RBM</td>
<td>Roll Back Malaria</td>
</tr>
<tr>
<td>RBMI</td>
<td>Roll Back Malaria Initiative</td>
</tr>
<tr>
<td>ROK</td>
<td>Republic of Kenya</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
</tr>
<tr>
<td>TDR</td>
<td>Tropical Disease Research</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations International Children Education Fund</td>
</tr>
</tbody>
</table>
DEFINITION OF TERMS

Compliance or adherence: One who’s net had been treated regularly or treated permanently and whose children slept under it always.

Caregiver: A person who is a biological parent of a child below five years and providing care to the child or a person (guardian) who provides care and support to a child who had lost both biological parents. Maids and other household servants providing care to children were excluded from interview.

Factor: Underlying dimension that positively or negatively influences other observed variables.

Insecticide treated bed net: A bed net impregnated with insecticide to protect a person sleeping under it against malaria from mosquito bites.

Insecticides: Chemical substances used to kill or inhibit insect vectors.

Net treatment: Impregnation of mosquito net with appropriate insecticide in recommended dosage and procedures.

Net re-treatment: Re-impregnation of mosquito nets with appropriate insecticide at regular intervals and in recommended dosages and procedures.

Household net coverage: The proportion of households with at least one net

Household insecticide treated net coverage: The proportion of households with at least one treated net.

Treated net use: Sleeping under ITN always for the purpose of preventing malaria from mosquito bites.
TABLE OF CONTENTS

Declaration ..............................................................i
Dedication ..............................................................ii
Acknowledgement ......................................................iii
Acronyms and Abbreviations ........................................iv
Definition of terms ....................................................v
Table of contents .....................................................vi
List of tables ..........................................................xi
List of figures ..........................................................xii
Abstract ..................................................................xiv

CHAPTER ONE: INTRODUCTION .................................1
1.1 Background ..........................................................1
1.2 Problem statement .................................................2
1.3 Justification and significance of the study .......................4
1.4 Research questions ...............................................5
1.5 Null hypothesis .....................................................5
1.6 Objectives ..........................................................6
  1.6.1 General objective ..............................................6
  1.6.2 Specific objectives ............................................6

CHAPTER TWO: LITERATURE REVIEW .......................7
2.1 Epidemiology of malaria .........................................7
CHAPTER THREE: MATERIALS AND METHODS .................................................. 24

3.1 The study area ................................................................................. 24

3.2 The study and target populations .................................................. 27

3.2.1 Inclusion criteria ....................................................................... 27

3.2.2 Exclusion criteria ........................................................................ 27

3.3 Study design .................................................................................. 27

3.4 Variables ....................................................................................... 28

3.5 Sample size determination ............................................................... 29

3.6 Sampling methods ......................................................................... 30

3.7 Data collection and research instruments ...................................... 31

3.8 Data management and analysis ..................................................... 32

3.8.1 Data storage and retrieval ......................................................... 32

3.8.2 Data analysis ............................................................................. 32

3.9 Ethical considerations .................................................................... 33
CHAPTER FOUR: RESULTS AND DISCUSSION .................................................. 34

4.1 Results .......................................................................................... 34

4.1.1 Socio-demographic characteristics of respondents .................................. 34

4.1.1.1 Sex of respondents ....................................................................... 34

4.1.1.2 Age of respondents ..................................................................... 35

4.1.1.3 Education level of respondents ...................................................... 35

4.1.1.4 Marital status of respondents ....................................................... 37

4.1.1.5 Occupational status of respondents .............................................. 38

4.1.1.6 Main source of income in household .............................................. 39

4.1.1.7 Household monthly income ......................................................... 39

4.1.1.8 Household size and children in household ..................................... 40

4.1.2 Perception of malaria and prevention behaviour .................................. 40

4.1.2.1 Perception and beliefs on transmission of malaria ........................... 40

4.1.2.2 Ways of preventing malaria ........................................................ 42

4.1.2.3 Action taken to prevent mosquito bites ....................................... 42

4.1.3 Knowledge and perception of insecticide treated net .......................... 44

4.1.3.1 Awareness of ITN and knowledge of net treatment ....................... 44

4.1.4 Mosquito net coverage and use ....................................................... 44

4.1.4.1 Household coverage with treated net and untreated net .................. 44

4.1.4.2 Mosquito net use in household .................................................... 46
4.1.4.3 Treated net use by children under five years ........................................... 47
4.1.5 Role of mosquito net in malaria prevention ................................................ 49
4.1.6 Treatment of mosquito nets with insecticides ......................................... 49
4.1.6.1 Status/interval of net treatment .............................................................. 49
4.1.6.2 Treatment rate of nets ............................................................................. 50
4.1.6.3 Reason for treating nets with insecticides ............................................. 51
4.1.7 Accessibility and costs of nets and insecticides for net treatment .................... 53
4.1.8 Factors affecting ownership, treatment and use of treated nets by children under five years ................................................................. 55
4.1.8.1 Factors affecting ownership of treated nets ........................................... 55
4.1.8.1.1 Hindrances to mosquito net ownership ............................................. 55
4.1.8.1.2 Relationship of ownership of treated nets with selected variables ................ 56
4.1.8.2 Factors affecting net treatment .............................................................. 64
4.1.8.2.1 Hindrances to net treatment ............................................................... 64
4.1.8.2.2 Relationship of frequency of net treatment with selected variables .............. 65
4.1.8.3 Factors affecting use of treated nets by children under five years ..................... 67
4.1.8.3.1 Hindrances to use of treated nets by children under five years ................. 67
4.1.8.3.2 Problems perceived to be associated with treated net use ....................... 68
4.1.8.3.3 Relationship of use of treated net by children under five years with selected variables ............................................................. 69
4.2 Discussion ..................................................................................... 73
4.2.1 Socio-demographic information ................................................................. 73
4.2.2 Perception of malaria and prevention behaviour ....................................... 74
8.1 Structured interview schedule for household .................................................. 103
8.2 Focus group discussion guide for community .................................................. 113
8.3 Kenyatta University Authorization ................................................................. 114
8.4 Ministry of Education Authorisation .............................................................. 115

LIST OF TABLES

Table 4.1 Age of respondents ................................................................................. 35
Table 4.2 Main source of income in household ....................................................... 39
Table 4.3 Estimated monthly income of households ................................................ 40
Table 4.4 Perception and beliefs on malaria transmission ...................................... 41
Table 4.5 Perception on appropriate methods of malaria prevention and control .... 42
Table 4.6 Action taken to prevent mosquito bite .................................................... 43
Table 4.7 Awareness of ITN and knowledge of net treatment ................................. 44
Table 4.8 Comparison of availability of any net and treated net in households ...... 46
Table 4.9 Number of children below five years in household who slept under treated net the previous night before interview ....................................................... 48
Table 4.10 Number of times mosquito net been treated ........................................ 51
Table 4.11 Knowledge of ITN Vs treated net ownership in household .................... 57
Table 4.12 Knowledge on net treatment Vs ownership of treated net in Household ................................................................. 57
Table 4.13 Marital status Vs ownership of treated net in household ...................... 58
Table 4.14 Occupation of caregiver Vs ownership of treated net in household ...... 59
Table 4.15 Level of education Vs ownership of treated net in household ............... 60
Table 4.16 Multiple comparison of mean number of treated nets Vs different Levels of education using tukey test .............................................61
Table 4.17 Household size Vs ownership of treated nets in household .................63
Table 4.18 Reasons for not treating nets with insecticides ..................................64
Table 4.19 Level of education Vs number of times mosquito net been treated in household .................................................................65
Table 4.20 Multiple comparison of mean number of times net had been treated Vs different levels of education using tukey test .........................66
Table 4.21 Reasons for child below 5 years not sleeping under ITN .....................68
Table 4.22 Problems perceived to be associated with treated net use ................69
Table 4.23 Knowledge of ITN Vs Children<5 years slept under ITN previous night to the interview .........................................................70
Table 4.24 Caregiver occupation Vs children under five years who slept under treated net the previous night to the interview .......................71
Table 4.25 Marital status Vs children under five years who slept under treated net previous night preceding the interview .................................72
LIST OF FIGURES

Figure 3.1 Map of study site ................................................................................. 26
Figure 4.2 Distribution of respondents by sex ..................................................... 34
Figure 4.3 Distribution of respondents by Level of education .............................. 36
Figure 4.4 Distribution of respondents by marital status ................................. 37
Figure 4.5 Distribution of respondents by occupation ....................................... 38
Figure 4.6 Proportion of Households with treated net, untreated net and with no treated net ......................................................................................... 45
Figure 4.7 Comparison on use of any net and treated net in household .............. 47
Figure 4.8 Respondents’ views on what mosquito net prevents .......................... 49
Figure 4.9 Status/interval of mosquito net treatment ....................................... 50
Figure 4.10 Most important reason for treating mosquito net .............................. 52
Figure 4.11 Sources/outlets of mosquito nets as reported by respondent .......... 53
Figure 4.12 Source of insecticide for net treatment ........................................... 54
Figure 4.13 Reasons for not having mosquito net in household ......................... 56
ABSTRACT

Insecticide treated nets (ITNs) have been identified as a key strategy in addressing malaria among young children and pregnant women. However, their ownership, treatment and use among under fives have been found to be low in Kenya. A cross-sectional study was therefore undertaken in Makueni district to identify factors affecting net acquisition, treatment and use among caregivers of under fives. The results showed that although majority (88.5%) were aware of ITNs, only 48.3% knew how to treat them with insecticides. The proportion of households with children below five years that owned mosquito net was 46.3%, out of which 69.2% were treated. The mean number of any nets per household was 0.9 while that of treated net was 0.62. The study found that, only 49.6% of any net and 52.2% of ITNs were used by under fives; and further only 68.5% of those with ITNs were reported to have slept under them the night preceding the interview. The results further showed that, only 43.9% of caregivers treated their nets regularly. The mean treatment rate of nets was 2.64 (SD=2.54). The main barriers to net acquisition, treatment and use were accessibility and cost of the nets. The results also showed that ownership of ITN was positively associated with knowledge of ITN (p<0.01), level of education (p<0.01), marital status (p=0.011), occupation (p<0.01), but negatively associated with household size (p=0.042). It was also positively correlated with household income (r=0.490, p<0.01), but household size was negatively correlated with ownership of ITNs (r=-0.103, p=0.01). The mean number of ITNs owned in household also differed significantly among the levels of education of caregiver (F 5,179 =4.889, P<0.01). Use of ITNs by under five children was positively associated with knowledge of ITN (p=0.024), marital status (p=0.018), occupation (p=0.043). Frequency of net treatment was positively associated with knowledge of net treatment (p<0.01), level of education (p<0.01), and positively correlated with income (r=0.242, p=0.001). The mean frequency of net treatment differed significantly among the different levels of education of caregiver (F 5,179 =4.889, P<0.01). The study concludes that factors such as level of education, knowledge of ITN, marital status, occupation, income and household size significantly influenced net acquisition, treatment and use among caregivers of under fives. Further, more interventions from Government, NGOs and other stakeholders are needed to increase ITN coverage by intensifying ITN promotion activities, increasing accessibility of subsidized long lasting treated nets including long lasting treatment kits for treating existing untreated nets, and educating caregivers on the importance of under fives always sleeping under treated net at night. Scaling up proper use of ITNs along with other initiatives can contribute significantly in reducing malaria.
CHAPTER ONE: INTRODUCTION

1.1 Background

Malaria is a major public health problem in many countries in the world affecting the lives of millions of people either directly or indirectly. For many years the disease has been the leading cause of morbidity and mortality in the tropics. It is estimated that nearly half of the world's populations live in countries with high risk of contracting malaria. Worldwide, 350-500 million malaria cases are estimated to occur each year resulting in over 1 million deaths, with 40% of the world's population being at risk of contracting the disease, and about nine out of ten of the global cases occurring in Africa (WHO, 2006). Sub-Saharan Africa constitutes over 60% of the world disease burden with over 300 million cases of malaria every year. It is further estimated that the disease kills almost one million children a year in Africa alone, and accounts for 4.5% of DALYs in children aged 0-4 years (WHO, 2006). Malaria has emerged as a serious threat to socio-economic development in countries inhabited by a third of the world's population, even in areas where the disease was once drastically reduced.

In Kenya, malaria is the leading cause of morbidity and mortality. It is estimated that millions of Kenyans are affected by the disease each year and that some 20 million (more than half the entire population) are regularly affected by the most deadly malarial parasite: *Plasmodium falciparum* (MOH-ROK, 2001). It is further estimated that over 70% of the population are at the risk of the disease that claims 26,000 children (about 72 per day) annually (MOH-ROK, 2005a). Malaria accounts for about 32% of outpatient cases, 19% of admissions in health facilities and 13% of all deaths reported in government hospitals thus contributing significantly to morbidity and mortality in Kenya.
(MOH-ROK, 2005a). It is indeed a disease of great concern to health service delivery thus making policy makers to think of new strategies of combating the menace. Its high prevalence has partly been attributed to low uptake of preventive interventions (including ITNs), despite good evidence that they are both effective and highly cost efficient (Hanson et al., 2004). Besides, the economic loss brought by malaria is enormous. For instance, Maneno (1998) estimated that 170 working days of workers are lost as result of the disease.

Although virtually everybody is at risk of contracting malaria, pregnant women and children below five years are more vulnerable because of their low level of immunity (Brewster et al., 1990; TDR/WHO, 2002). However, WHO (2002) further observed that the lives of a half a million African children might be saved every year by having them sleep under treated bed nets.

1.2 Problem statement

Net acquisition/ownership, treatment and use by under fives in Kenya is low. Yet a number of studies done have showed that ITNs are effective in reducing morbidity and mortality among the under fives (Neville et al., 1996; Lengeler et al., 2000; PSI, 2001). Moreover, Mugisha and others (2003) observed that net ownership and use among the under fives in Uganda is low, despite evidence on their effectiveness. Similarly, Goodman and others (2003) observed that adoption of ITN'S has been slow leading to low treatment and utilization of nets. Besides, it is noted that despite acquisition of nets,
some households might not treat them routinely and correctly with appropriate insecticides (Heggenhougen et al., 2003).

As a consequence, malaria is still a major public health problem among the under fives leading to high morbidity and mortality. The fact that the disease claims about 26,000 children in Kenya (about 72 per day) annually (MOH-ROK, 2004), is an indication that it is a serious problem among the under fives. Moreover, it negatively affects efforts to improve child survival.

In Kenya, ITN coverage is quite low. It is estimated that in 2003, only 22% of households had at least one net, out of which 6% were treated, while 15% of under fives used nets out of which 5% were treated (CBS-ROK, 2004). This indicates that a substantial proportion of under fives do not use ITNs, and hence are unprotected against malaria. There is also disparity on the use of nets among household members. For instance Ndieka and others (2003) observed that in some communities where households have ITNs, preference of net use is given to adults rather than children. This undermines efforts to promote ITN use among the under fives. It underscores the need for a study to explore factors leading to this undesirable situation taking into account regional, cultural and socio-economic variations of the different populations.

It is further presumed that low net ownership, treatment and use by under fives could largely be attributed to other factors existing within the communities households, which are less understood. For example, a study done in Uganda showed that increasing household net ownership did not increase their usage by under fives (Mugisha et al., 2003). The current study will therefore investigate factors influencing mosquito net
acquisition, treatment and use among the caregivers of under fives within households in Makueni district.

1.3 Justification and significance of the study

The study will be important and useful in identifying barriers contributing to slow progress in treatment and use of ITNs by under fives. This will illuminate certain aspects, which have not been clearly understood. The study will also help in determining ITN coverage and treatment rate of nets as well as compliance rate of net use among under fives in the study area. The study will also contribute to better understanding of the community needs by manufacturers of various types of nets and insecticides so that they can make products that are acceptable and affordable as well as tailored to suit usage by under fives.

The findings will also help the community to better understand socio-cultural and economic factors affecting ITN use by under fives in households and identify those that need to be discouraged and those that need to be promoted. This will contribute to increased net treatment and use by under fives. Specifically, factors leading to low net ownership, low treatment rate and low compliance rate in net use will be identified. This will go along way in increasing net ownership, treatment and use thus contributing to government target of scaling up ITN coverage to 60% or more by the year 2006 (MOH-ROK, 2001).

The study is anticipated to identify the factors affecting/hindering mosquito net acquisition, treatment, and use among the under fives. The findings from this study will
help policy makers, planners and program implementers to develop appropriate policies, interventions and strategies to overcome factors hindering net treatment and use.

At the district level, the results will assist in development of malaria control plans, which would reflect the populations’ socio-cultural and economic situation. By identifying factors affecting net treatment and use, better strategies could be developed to enhance net acquisition, treatment and use. Moreover, results will assist programs targeting ITNs use among the under fives. Consequently, this will contribute to increasing ITN coverage, treatment rate and compliance in net use among the target population. This will greatly contribute towards the ministry of health target of scaling up ITN coverage. Overall, the community will benefit from reduced morbidity and mortality among the under fives and this will contribute to improvement in socio-economic status.

1.4 Research questions

a) What is the percentage of ITN coverage in the study area?
b) What is the treatment rate of nets among the users?
c) What are the costs of ITNs (or nets and insecticides), and their accessibility?
d) What factors affect acquisition, use and treatment of nets?

1.5 Null hypothesis

Socio-demographic, cultural and economic factors do not influence mosquito net acquisition, treatment and use in Makueni District.
1.6 Objectives

1.6.1 General objective

To identify socio-demographic, cultural and economic factors influencing net acquisition, treatment and use among the caregivers of under fives in Makueni District.

1.6.2 Specific objectives

a) To assess ITN coverage in Makueni District.

b) To determine the rate of net treatment among the caregivers of under fives.

c) To determine accessibility and costs of nets and insecticides.

d) To identify socio-demographic and cultural factors affecting net acquisition, treatment and use in households.
CHAPTER TWO: LITERATURE REVIEW

2.1 Epidemiology of malaria

- The term ‘malaria’ is an Italian word meaning bad or poisonous air (The Welcome Tropical Institute, 1987). As a disease it is defined as a highly communicable, acute and chronic infection characterized by clinical symptoms which include fever, anaemia, headache, joint pains, chills, sweating, vomiting, nausea, loss of appetite, cough, diarrhea and respiratory distress. If not treated promptly, the disease may progress into complications such as icterus, coagulation defects, shock, renal and liver failure, acute encephalopathy, pulmonary and cerebral edema, coma and death (Chin, 2000). Untreated or incompletely treated malaria may also lead to recrudescence (Najera et al., 2000).

Malaria is a communicable disease caused by protozoa of genus Plasmodium. Four species causing malaria in humans have been identified namely: Plasmodium vivax, P. malariae, P. ovale and P. falciparum. The incubation period varies among the different species. It is 7-14 days for Plasmodium falciparum, 8-14 days for Plasmodium vivax and Plasmodium ovale and 7-30 days for Plasmodium malariae (Coluzzi et al., 1999; Chin, 2000).

The mode of transmission is by the bite of an infective female Anopheles mosquito. Although more than 350 species of genus Anopheles have been identified not all are important vectors of malaria. About 60 species are vectors of malaria and only 30 are of prime importance (Najera et al., 2000). The principal types of mosquito species that have been associated with the spread of malaria are Anopheles gambiae, A. funestus,
A. arabiesis and A. merus out of which Anopheles gambiae and A. funestus are the main vectors in Kenya (Gillies et al., 1987; Anderson et al., 1996; Constantin et al., 1999).

The majority of important malaria vectors feed at dusk or during the night and in Africa, female Anopheles mosquitoes predominantly feed late at night between 10.00 p.m. and 4.00 a.m (Curtis, 1997). After blood meal, the mosquitoes either rest indoors to digest their meal (endophily) or leave at dawn and rest out doors (exophily) (Gillies and Coetzee, 1987). After the blood meal has been digested, mosquitoes will seek a breeding place to lay eggs, after which they will be ready for another blood meal. The length of life cycle depends on temperature and in tropical regions with a mosquito life span of few to several weeks, it is as short as two to four days (Najera et al., 2000).

Malaria is a world wide problem and occurs mainly in tropical regions including Africa South of the Sahara, South and south east Asia, Oceania, and parts of Americas (WHO, 2000). It is a threat to more than 40% of the worlds population, and out of the more than 300 million acute cases each year between 1.1 and 2.7 million people die each year (WHO, 2002). The vast majority of malaria cases (90%) are in Sub-Saharan Africa, where malaria constitutes 10% of total disease burden (WHO, 2002).

Kenya’s ecology provides ideal conditions for the malaria-carrying mosquito, especially in the Coast and Lake Regions. Climatic conditions are also conducive to outbreaks of epidemic intensity in other areas, such as intensively farmed highlands and semi-arid North Eastern parts of the country, and such outbreaks are increasingly becoming frequent (Maneno et al., 1998). There are four major malaria ecologies in Kenya: seasonal intense transmission, acute seasonal transmission, highland malaria and perennial intense transmission (Snow et al., 1998; Abdinasir et al., 2003). Some 20
9

million Kenyans—more than half the entire population—are regularly affected by the most deadly malaria parasite: *Plasmodium falciparum* (MOH-ROK, 2001).

Makueni district, which is largely a semi arid area, has acute seasonal malaria transmission (Abdinasir *et al.*, 2003). Besides, the district falls into endemic stable malaria zone (MOH-ROK, 2001). Malaria is the leading cause of morbidity in the area accounting for 36.3% (MOH-ROK, 2006). This prevalence is almost similar to that of the lake region which has morbidity rate of about 37% (MOH-ROK, 2006), with intense perennial transmission (Abdinasir *et al.*, 2003).

2.2 Prevention and control of malaria

There are numerous ways, which have been reported to help prevent and control malaria. They range from personal protection, environmental management, and biological control to the use of insecticides (Cattan and Lenges, 1997). These preventive interventions that are available can further be classified into those that inhibit mosquito breeding, those that kill adult mosquitoes in order to reduce survival rate of adult mosquito population, those that isolate humans from mosquito biting and those that reduce malaria infections in humans (Hanson *et al.*, 2004).

The breeding of vector mosquitoes can be inhibited by environmental management to reduce breeding sources or by the destruction of mosquito larvae. Methods aimed against adult mosquitoes have focused on the use of insecticides for residual house spraying, and repellants. On the other hand methods for isolating humans from mosquito biting include insecticide treated materials (bed nets, curtains, hammocks and cloth) and domestic insecticides such as sprays, coils and repellants. Malaria infection and morbidity in
humans can further be prevented through the provision of chemoprophylaxis using antimalarial drugs and through intermittent presumptive treatment. Besides, an effective surveillance system to monitor changes in transmission and the incidence and prevalence of disease also forms an important part of control (Hanson et al., 2004).

In an effort to address the malaria problem effectively, these methods have further been elaborated into key approaches: (1) early diagnosis and prompt treatment by use of appropriate chemotherapy; (2) personal protection including use of ITNs and prophylaxis in pregnancy; (3) vector control including residual spraying with insecticides, environmental management and biological control; (4) early detection and containment or prevention of epidemics; and (5) strengthening local capacities in basic and applied research (WHO, 1993; WHO, 1999). However, owing to immense challenge posed by malaria, WHO further advocated an integrated approach in the use of these methods in combating malaria (WHO, 1999). Integrated approach involves adoption and implementation of various methods in the prevention and control of malaria.

Over the years, efforts to control malaria have focused on treatment of the sick, personal protection, mosquito control through environmental management, and spraying with insecticides. However it has been observed that despite some successes, the applications of these methods have not effectively reduced or even decelerated overall disease rates (MOH-ROK, 2001). As a result of this challenge different approaches are being developed at various levels aimed at addressing the malaria menace. One of the key approaches is the use of ITNs which have been found to be cost effective in malaria control and prevention (Hanson et al., 2004).
The African Heads of State Summit on Roll Back Malaria held in Abuja on April 2000 placed emphasis on accessibility and affordability of ITNs especially to pregnant women and children below five years who are at high risk of contracting malaria (WHO, 2000). The Government of Kenya in its commitment to implement the RBM initiative established the Division of Malaria Control (within the Ministry of Health) to spearhead the National Malaria Control Program. Further, the government in its National Health Sector Strategic Plan (NHSSP) of 2005-2010 emphasized prevention and treatment of malaria as a high priority (MOH-ROK, 2005b). The National Malaria Control Plan (a ten-year plan) was also developed in 2001 in line with WHO ‘Roll Back Malaria Initiative’ which spelt out specific approaches to address the malaria problem (MOH-ROK, 2001).

The National Malaria Control Plan supports overall Health Sector Reform Program and the governments Interim Poverty Alleviation Strategy, with the aim of reducing the level of malaria illness and death by 30% by the year 2006, and to further sustain that improved level of control (MOH-ROK, 2001).

The national key strategic approaches to malaria control as spelt out include (1) guarantee all people access to quick and effective treatment, to significantly reduce illness and death from malaria; (2) provide malaria prevention measures and treatment to pregnant women and young children; (3) ensure use of insecticide treated nets by at risk communities, to significantly reduce rates of disease; and (4) improve epidemic preparedness and response (MOH-ROK, 2001). However, following the recent declaration by WHO that DDT is safe, effective and cheap for indoor residual spraying when used properly (Neergard, 2006), the Government will have to reconsider the use of DDT, along with other interventions, in combating malaria.
Among the interventions to prevent and control malaria, ITNs have been found to be one of the key cost effective strategic interventions because of their usefulness in preventing mosquito bites as well as killing mosquitoes thus reducing the vector population (Lengeler, 2000; Lindblade et al., 2004).

2.3 Insecticide treated nets and their effectiveness

Mosquito nets have been used for centuries to protect people against insect bites, and are known to be common household items in some Sub-Saharan African countries. The earliest recorded use of mosquito nets goes as far back as the 6th century BC (Guyatt and Snow, 2002b). They constitute one of the methods of isolating humans from mosquito biting (Hanson et al., 2004). However, Lindsay (1988) observed that treatment of nets with insecticides is a relatively new innovation that was first tried in the 1930s. The use of mosquito nets treated with pyrethroid insecticides has been shown to provide effective protection against malaria in a wide variety of settings across Africa (MOH-ROK, 2001). Studies have shown that on average, a 17 % reduction in childhood mortality is associated with ITN use (Lengeler, 2000).

Over the last 15 years, ITNs have increasingly been advocated as an alternative method of preventing mosquito biting. The efficacy of ITNs for the control of malaria in children under five years of age has recently been demonstrated by several large scale trials, which found reductions in mortality ranging from 14% to 63% (Alonso et al., 1993).

A study conducted in Kilifi to assess the impact of ITNS on child survival under different epidemiological and cultural conditions showed that the introduction of ITNs
led to significant reductions in childhood mortality and severe life threatening malaria among children aged 1-59 months (Nevil et al., 1993). Another study carried out in selected districts in Kenya demonstrated that over 40% of severe life threatening malaria episodes in childhood could be prevented through the use of ITNs and childhood mortality could be reduced by 33% (PSI, 2001). But implementation of this intervention, despite immense evidence of effectiveness, remains limited in many countries owing to various factors, many of which have not been clearly understood. Besides, there is the issue of non-compliance on ITN use. For instance non-compliance of ITNs under trial conditions is estimated to be 35% and could be considerably higher under operational conditions (Hanson et al., 2004). In trial studies conducted in Tanzania, a linear relationship was assumed between compliance and effectiveness, such that zero compliance resulted in zero effectiveness (Chavasse et al., 1999). In this context full compliance of net use was defined as one whose net had recently been treated with insecticides and who always slept under the net.

2.4 Types of Mosquito nets

Mosquito nets are available in different types and designs aimed at catering for varied needs and thus enhance acceptability and usage. Hence they have been classified using some of the the following characteristics:

**Fabric**: Polyester netting is the most common among the users since it is light and does not absorb much water. Others used are cotton and synthetic materials such as polyethylene. Nylon nets are also preferred but they are relatively weak and can be destroyed during net treatment (Kroeger et al., 1999).
Mesh size: This can be in millimeters or in holes per square inch: 1.5 to 2 millimeters and 156 holes per square inch are preferred standards. Although some nets have larger mesh which allow better ventilation they can only offer protection as long as they are treated (WHO, 1997).

Denier: This is the unit of weight for estimating fineness of fibre and is used to indicate the strength of fibre used to make the net. For nets, denier of 100 is the strongest whereas anything below 70 is usually too weak and tears easily. The most available in the market are denier of 40, 75 and 100 (WHO, 1997).

Shape: The main shapes include 1) circular (conical) net suspended from single support, 2) rectangular or square net, 3) wedge shaped net, 4) hammock mosquito net, and 5) self-supporting net used to protect babies and infants. Circular (conical) and rectangular/square nets are the most common. There is less person to net contact under a square net but many people prefer the ease to hang conical net (Kroeger et al., 1999).

Colour: Nets are available in different colours including white, green, blue and pink. However, white colour is the most common. Owing to use of insecticides and the need for less frequent washing of nets, dark coloured nets are becoming more popular. Green, blue and pink nets are preferred as they overcome cultural problems associated with white nets (WHO, 1997).

Size: Nets are also available in different sizes ranging from small to large. Most nets from manufacturers may indicate the size of beds they will cover either in millimeters or feet while others just indicate small, medium and large or double nets (WHO, 1997). Whatever the case it is important that nets are large enough to cover the bed.
The availability of mosquito nets with different characteristics may influence or affect their acquisition, use and treatment.

2.5 Treatment of Nets with Insecticides

Mosquito bed nets are treated with synthetic pyrethroid insecticides, which repel and kill mosquitoes and so inhibit their feeding on humans (Goodman et al., 2003). There are various types of pyrethroid insecticides used for net treatment but the two commonly used ones are permethrin and deltamethrin (Goodman et al., 2003). Other suitable insecticides for net treatment cited by this author, though less commonly used, include lamdacyhalothrin, alpha-cypermethrin, cyfluthrin and etofenprox.

As regards efficacy, deltamethrin is effective for about a year, so annual treatments are adequate (assuming limited washing) but permethrin lasts only approximately 6 months; so more than one treatment is required per year if the transmission season is more than half a year (Lines et al., 1996). Although the effectiveness of nets treated with deltamethrin and permethrin has never been directly compared in epidemiological terms, the entomological evidence suggest that deltamethrin is at least as effective as permethrin (Curtis et al., 1992).

Pyrethroid insecticides recommended for use for net treatment have low toxicity (virtually non-toxic on contact on humans) when used according to recommended doses (Rozendaal, 1997; Zaim, 2000). Nevertheless, it is extremely important that during treatment of nets, safety precautions such as wearing gloves, facemasks, gumboots and overcoat are observed to avoid health hazards and risks. Further, it is recommended that one needs to wash his/her hands thoroughly after treating the nets and any excess diluted insecticides remaining after treatment are safely disposed of preferably in a pit latrine.
Treatment method and procedure for nets entail: 1) deciding on treatment method; 2) calculating net area and absorbency; 3) calculating the amount of insecticide concentrate required per unit volume of water; 4) mixing the treatment solution and treating the net; and 5) drying the net (Lines et al., 1996; Miller et al., 1999). Many available insecticides for net treatment have elaborate instructions explaining the procedure for carrying out the treatment. But the insecticides used require to be regulated, and a monitoring system to ensure that effective dosages are being provided may also be necessary. Whilst nets normally last for several years, the efficacy of the insecticide gradually wears off over time, so it is necessary for nets to be re-treated regularly. Hence, the conventional way to treat a net with pyrethroid insecticide is to apply standard dosage every 6-12 months (Miller et al., 1999).

Long lasting treated nets (LLINs) which are treated only once at factory level with insecticide incorporated directly into the fibres, with average efficacy lasting 4-5 years, are now commercially available (WHO, 2004; Hanson et al., 2004). The LLINS eliminate the need for regular retreatment, thus providing good prospects for implementation of ITN programmes. However, it may be argued that availability of LLINs will deny people a chance to learn how to treat nets and hence not appreciate the value of treated nets.

Approaches to net treatment include: 1) individual treatment using single kit insecticide as in households; 2) bulk treatment as in mass treatment of nets by communities and; 3) fixed or mobile re-treatment services. In an effort to encourage treatment of mosquito nets, some nets are sold together with a pack of single kit of insecticide for treatment at home. However, it has been observed that greater use of
individual rather than community dipping of nets and the introduction of "dip-it-yourself" kits would make the overall cost to be higher (Lines, 1996). This is an indication that mass treatment of nets by communities may be more cost effective compared to individual treatments. However it has been observed that many people seem to be uncomfortable about bringing their dirty nets to a public place for communal treatment (Winch et al., 1997).

Treated bed nets have been observed to offer several advantages compared to untreated bed nets. These advantages include: 1) mosquitoes seeking blood meal do not wait in the room—they are either killed or repelled after contact; 2) humans under net act as a bait trap; 3) mosquitoes fail to find holes to enter; 4) mosquitoes die or are incapacitated after landing on the net; and 5) people sleeping in the same room without a net may receive fewer bites (Rozendaal, 1997). Besides, untreated net acts merely as a 'trap' rather than a protective device. In fact it is assumed that untreated nets provide half protection of ITN, and that treated nets have both private and public good characteristics (Hanson et al., 2004). Hence advantages of treated nets have contributed significantly towards making ITN use a cost-effective intervention in malaria prevention and control.

Among the other benefits cited for using insecticide treated bed nets include their long term durability and utility, their ability to protect against biting organisms other than mosquitoes, and to enhance privacy, as well as their relatively low cost (Sexton, 1994).

2.6 Insecticide treated nets coverage and utilization

Mosquito nets are not a new idea in most malarious areas. However, although they have been in use for many years, their coverage vary enormously from place to place and in
In many countries it is still quite low (Hanson et al., 2004). For example, 58% of beds in rural Gambia had a net and in Congo Brazzaville, 73% of households owned at least one net. However data from Sierra Leone, Burkina Faso and northern Ghana showed fewer than 10% of people using nets, and low rates were also found in Kenya, Tanzania and Malawi (Zimicki, 1996).

In Kenya, although there are no figures to show national usage, some research studies done in various parts of the country suggest the use of nets by children or pregnant women to be as low as 5-10%. Very few of these nets are treated with insecticide and availability of net treatment services is often limited to NGO project areas (MOH-ROK, 2001). According to KDHS (2003), more than 20% of the households have been reported owning at least one mosquito net. However, the report observed that only 6% of households had an insecticide treated net (CBS-ROK, 2004).

The report further observed that, although 14% of children under five years and 15% of women of reproductive age were reported to have slept under a mosquito net the night prior to the interview, less than 5% slept under a treated bed net. While ministry of health estimated in 2000 that 5% of people were using nets (MOH-ROK, 2001), the KDHS (2003) report estimated bed net coverage in 2003 to be 22%, and majority of these nets were untreated (CBS-ROK, 2004). Hence another key challenge concerning use of ITNs is the issue of treatment which has been observed to be very low (Goodman et al., 2003).

2.7 Efforts to increase ITN coverage and treatment rates

Availability of nets and insecticides for treatment are crucial for increasing ITN coverage and retreatment rates. This can be enhanced through effective delivery mechanisms to
appropriate outlets that are accessible to the community. In this connection, four models of public sector or NGO involvement in delivery of nets and insecticides can be distinguished: purely public sector delivery, Community based projects, social marketing, and encouraging development of private sector (Hanson et al., 2004).

However none of the approaches in the above models is ideal and all have limitations. Besides, it has been reported that ITN coverage and re-treatment rates (after initial treatment) are generally low in many countries in Africa. Thus, there is need to address the challenges of equity and sustainability with a more strategic approach to public and private sector collaboration to increase ITN coverage and retreatment rates.

This situation has prompted WHO/AFRO to start supporting mass re-treatment of community owned nets in some areas where usage of nets is relatively high (Goodman and Coleman, 2003). The regional office has initiated mass mosquito net treatment campaign in a few selected countries with the intention of providing over a period of time re-treatment services to communities to treat all nets available and in use. Kenya is one of the countries selected in the sub-region that was identified for scaling up ITN activities including re-treatment of community owned nets (MOH-ROK, 2001). WHO is also urging member states to consider lowering taxes and tariffs on nets as subsidies to encourage net availability and ownership (WHO, 2001).

The policy of Kenya government through Ministry of Health is to increase access to insecticide treated net services among the people at risk of malaria, especially young children and pregnant women (MOH-ROK, 2001). It has, therefore, in its National Malaria Strategy (NMS) set a target of achieving 60% of the at risk population sleeping under nets and having at least 50% of these nets regularly treated with insecticides.
The government acknowledges that without substantial help from external donors, it does not have the resources to provide nets and insecticide free of charge to everyone at risk (MOH-ROK, 2001). Nevertheless, its long-term vision is to ensure that within a period of 10-20 years, ITN will become a social norm in most malaria areas in Kenya. To achieve this the government intends to facilitate an environment that allows access to a variety of goods, reflecting the varied needs, desires and economic status of ITN using Public.

The Division of Malaria Control (DOMC) therefore recognizes that private-sector growth must be complemented by partially subsidized net and re-treatment promotion and distribution programmes. This will include expansion of present ITN social marketing programs and setting up appropriate strategies. Another key issue is in increasing acceptability and demand for nets and insecticide treatment by communities as well as protecting the economically vulnerable groups. Goodman and others (2003) observed that ITNs could be more narrowly targeted by restricting the distribution and treatment of nets to vulnerable groups, such as children under five and pregnant women.

In an effort to increase net use and treatment, Goodman and others (2003) recommended further operational research on ways to encourage net ownership to a level where a treatment program would be feasible. Similarly, Ndieka and others (2003) recommended further research to identify factors leading to use of mosquito nets by adults instead of children in some communities. The same authors further recommended studies on misconceptions about causes of malaria and consequently its prevention in order to come up with appropriate control measures to reduce malaria transmission.
2.8 Net acquisition, treatment and use

The acquisition and use of ITNs in a household have a bearing on malaria prevention and control. However, their adoption, treatment and use are influenced by various factors such as socio-cultural and economic (Winch, 1997). Ahorlin and others (1997) also observed that introduction of ITNs in a community required consideration of key issues such as epidemiological, socio-cultural, economic as well as infrastructural. Considering that ITN coverage is quite low in spite of wide publicity in some areas, it is an indication that there are other factors affecting their adoption and use that need to be explored and addressed.

When promoting ITNs, therefore, it is important to understand the various barriers limiting their use and treatment. The beliefs and perceptions of the causes and control of malaria in the community are important areas of consideration. For instance, some people may consider mosquitoes a nuisance but do not link them to malaria transmission. A study carried out in marshland in Zimbabwe showed very limited knowledge of protection against malaria while other studies in Ghana revealed that only 21-47% of the community members understood that malaria is transmitted by mosquito bites (Vundule et al., 1996).

The same study revealed that 82% of the respondents did not take any measures to protect themselves from malaria. In some communities the males are given preference as mosquito net users. For this reason, net use among the household members should be considered during distribution of ITNs (Shelley et al., 1998).
Another crucial consideration is the economic aspects that affect affordability of bed nets and insecticides for treatment. Given the fact that acquisition of nets has cost implications, it is evident that cost influences their use and treatment. Hill (1999) observed that prohibitive costs of buying nets locally affect net acquisition and use. The number of nets needed to cater for the entire family is also an issue of economic concern in ITN acquisition.

The economic status of the people also determines their willingness as well as their ability to pay in order to acquire ITNs. This is also influenced by their perception of utility of the nets. Donaldson (1999) observed that the greater the utility to be obtained from the good the greater the willingness to pay. It has also been observed that with ITNs, households may be unwilling to pay for the insecticide component because its value is relatively difficult for them to perceive. For instance in Gambia, when insecticide was distributed free, about 80% of nets were retreated but when charges were introduced retreatment rates fell to less than 20% (Goodman et al., 2003). Chavasse and others (1999) pointed out that financial concern such as costs of nets and insecticides were central to successful sustained ITN programmes in a community.

Besides, technical decisions concerning nets and insecticides such as type, source and supply must take into account the local circumstances (Rozendaal et al., 1997). This is an indication that availability and accessibility of nets and insecticides for treatment are important issues for consideration. Hanson and others (2004) observed that long distances to sources of nets increase overall costs of acquisition and hence limit ITN use. Similarly the authors observed that low treatment rates of nets might also be due to inaccessibility of treatment points and the inconvenience associated with communal retreatment.
Equally important for consideration is the environmental or epidemiological factors which have been reported to influence ITNs use (WHO, 2001). For instance, some people use ITNs when they notice presence or increase of mosquitoes. Hence, knowledge of the ecology and biting habits of the local mosquito species and of the behaviour of the people is essential in ITN intervention.

Lack of information has also been identified as a cause of inadequate demand for preventive measures, particularly ITNs (Hanson et al., 2004). This underscores the need for public information about the benefits of ITNs use in order to promote demand. Moreover, public information messages may be more effective if they are tailored to suit the local situation.

Therefore, when promoting net treatment and use, it is important to consider various issues such as environmental, socio-cultural, existing patterns of net use, community perceptions about nets and net treatment, availability of nets and insecticides, payment for acquisition and treatment of nets, as well as other factors affecting use of treated nets. This will help in addressing barriers hindering or slowing acquisition, treatment and usage of ITNs by under fives.

In summary, therefore, mosquito nets have been in use in some communities for many years but their treatment with insecticides for added protection against mosquitoes causing malaria is a relatively new innovation. They have been found to be effective in controlling malaria when used consistently, and have therefore been identified as a key strategy in addressing this problem. However, their ownership and use in households is low, and majority of them are either not treated or are treated infrequently. A number of factors including socio-cultural and economic factors have been reported to affect
CHAPTER THREE: MATERIALS AND METHODS

3.1 The Study Area

The study was conducted in Wote Division, Makueni District of Eastern Province (Figure 3.1). Makueni district lies between latitude 1°35' south and longitude 37° 10' east and covers an area of 7,965.8 Km² (MOPND-ROK, 2003), and according to 1999 population census it had a population of 771,545 which was projected to increase to 849,285 by the year 2004 (CBS-ROK, 2001). The land rises slightly below 600m above sea level in Tsavo at the southern end of the district to an altitude of 1900m at Mbooni and Kilungu hills. The district experiences two rain seasons, namely: the long rains occurring in March/April while the short rains occur in November/December, averaging 800-1200mm per year. The mean temperature ranges from 20.2° C to 24.6° C averaging at 22.4° C. Administratively, the district is divided into sixteen divisions with sixty-six locations and a hundred and eighty-seven sub-locations.

Wote Division, which is the study area, falls in Makueni District and is one of the sixteen divisions that form the district. It covers an area of 7965.8 square Km (MOPND-ROK, 2003). Wote Division is sub-divided into two locations and eight sub-locations. It has a projected population (2005) of 47,735 people and 7744 households (CBS-ROK, 2001).

Some of the key health indicators include crude birth rate 44.7/1000, population growth rate 2.8%, crude death rate 7/1000, infant mortality rate 45/1000, under five mortality rate 90/1000, total fertility rate 4.7%, maternal mortality rate 5.9% and average household size is six (CBS-ROK, 2003). The absolute poverty in the district is estimated to be 73% (MOPND-ROK, 2003).
household size is six (CBS-ROK, 2003). The absolute poverty in the district is estimated to be 73% (MOPND-ROK, 2003). Makueni district was chosen for study because it is one of the districts in Kenya with endemic malaria with comparatively higher prevalence (MOH-ROK, 2001). Besides, malaria is one of the main health problems in the area and the leading cause of morbidity and mortality accounting for 35.0% and 36.3% outpatient morbidity in 2005 and 2006, respectively (MOH-ROK District annual reports, 2005 and 2006). The area is therefore presumed to have some considerable level of community awareness of the problem under study. Besides, it is a typical rural area with some unique environmental, socio-cultural and economic characteristics that pose a challenge to malaria control. In addition, a study focusing on mosquito net acquisition, treatment and use by under fives had not been conducted in this area.
Figure 3.1 Map of Study Site
3.2 The study and target populations

The study population comprised caregivers of children below five years, while accessible population for study comprised caregivers of under fives within households in Wote division who met eligibility criteria. Target population comprised caregivers of under fives in Makueni district since the district has largely similar socio-cultural and economic characteristics as well as environmental/ecological conditions. Reference population comprised caregivers of children below five years in Kenya.

3.2.1 Inclusion criteria

The study included all caregivers of children below five years who were above 18 years of age and living in households within the study area. The study also included community informants who accepted to be involved in the study.

3.2.2 Exclusion criteria

The study excluded caregivers who were below 18 years (save for mothers of under fives). Caregivers who did not have children below five years were also excluded for interview.

3.3 Study design

This was a cross-sectional study to determine factors influencing mosquito net acquisition, treatment and use among the caregivers of under fives in Makueni district.
3.4 Description of variables

Dependent variables

Treated net ownership: This refers to number of treated nets owned in household and it was measured by asking caregivers/respondents whether they owned a net and whether it was treated or not treated, and how many they owned.

Net treatment: This refers to impregnation of nets with insecticides and the respondents were asked whether they had treated their nets and if yes the number of times the nets had been treated and how often it was treated.

Treated net use by under fives: This refers to sleeping under treated net always at night. It was measured by asking respondents whether a child/children slept under treated net the night preceding the interview.

Independent Variables

These variables were chosen because they were thought to have some aspects which might influence health behaviour towards ownership, treatment and use of nets.

Age: Age determines maturity of a person and quite often it is believed to influence decision making including issues regarding health. This variable was measured by asking respondents to state their age.

Education level: Education increases general knowledge and awareness and is believed to influence health behaviour of a person. This variable was measured by asking respondents to state the highest level of education reached.

Knowledge of ITN: Knowledge of a product is believed to influence its acquisition and use. Hence an ITN being a product its knowledge of it might influence it acquisition and
use. This variable was measured by asking respondents whether they knew existence of ITN.

**Marital status:** Parents have joint responsibility for giving care to their children. There is a common belief that if married they might jointly provide intimate care to children, than when they are single parents. They can also pool their resources and efforts together for the good of their children. This variable was measured by asking respondents their marital status.

**Occupation:** Occupation often constitutes source of income and different occupations have different incomes. It might also influence understanding on certain issues and hence influence behavior. It was measured by asking respondents what they do to earn a living.

**Income:** As net and insecticides have cost implications, it is expected that income in a household will have a bearing on net acquisition and treatment. This variable was measured by asking respondents to state their total household income in a month.

**Household size:** The size of household has economic implications depending on the number of dependants in the household. Larger households require more income than smaller households for maintenance and other needs. As nets and insecticides have cost implications, their acquisition might be affected by size of households. This variable was measured by asking respondents the number of people residing in the house and sharing meals and other needs.

### 3.5 Sample Size Determination

The sample size was determined using a formula as used by Fisher and others (1998):
N = \frac{z^2 \cdot pq}{d^2}

Where n = desired minimal sample size (Where population > 10000)
Z = Standard normal deviate which is 1.96 at 95% confidence level
P = Proportion of the target population estimated to have a particular characteristic being measured. In this case it is estimated to be 0.2
q = 1 - p = 1 - 0.2 = 0.8
d = degree of accuracy = 0.05
Thus
N = \frac{1.96^2 \times 0.2 \times 0.8 \times 1}{0.05^2} = 246 which is approximately 250.

Therefore the minimum sample size required for the study was 250.

3.6 Sampling Methods
Wote Division was randomly chosen among the 16 divisions in the district using lottery method. Cluster sampling followed by simple random sampling was then used to select a representative sample. First, the number of households sampled in each of the 8 sub-location were selected proportionally to the size of the sub-location. Therefore the proportion of households sampled in each sub-location was obtained by dividing the population of households in a sub-location by total households in the study area and then multiplying this by required sample size of 400. Hence using this method, 97 household were sampled from Unoa, 72 from Kamunyolo, 24 from Kambi mawe sub-location, 40
from Kikumini, 17 from Kitonyoni, 45 from Muvau, 51 from Mumbuni and 54 from Kako sub-locations.

Second, villages in sub-locations were selected using Cluster sampling procedure. A lottery method was used by writing names of all the villages in the sub-location in slips of paper, folded to conceal the names and mixed well in a container, and then picking one slip at random and unfolding it to read the village name. The picked village was the starting village in that sub-location.

Third, households were then selected randomly from sampled villages using simple random sampling procedure. The researcher spanned a bottle at the centre of the sub-cluster to get the direction of households to be interviewed. The starting household was obtained by numbering all households in that direction in slips of paper, folded to conceal the numbers and then mixed well in a container, and one picked at random among the mixed pack. From starting household all households along that direction up to the boundary of the cluster were interviewed. If the required number of households was not obtained in the sampled village, the same cluster sampling procedure was followed to select another village. The same sampling procedure was applied until the right number of households in a sub-location was obtained. The same procedure was followed in all sub-locations in the study area.

3.7 Data Collection and Research instruments

Pre-tested structured household interview schedules were used to collect data that included socio-demographic characteristics, net acquisition/ownership, knowledge of treated nets and net treatment, knowledge of net and insecticide availability and
accessibility, and use of nets in households. These were administered to caregivers of under fives in the households. Focus group discussions, comprising 15 caregivers of under fives per group, were conducted in eight sub locations to obtain more qualitative information from the community under study to corroborate data collected using interview schedules. The discussions focussed on net availability, acquisition/ownership, treatment and use among under fives in households.

To ensure quality of data, research assistants were practically trained on the use of the interview schedule as well as involved in pretesting of the instrument. They collected data under close supervision of the researcher. After data collection, the entire completed interview schedules were handed over to the researcher, checked for accuracy in the field and then taken for subsequent coding and analysis.

3.8 Data management and Analysis

3.8.1 Data storage and Retrieval

Completed interview schedules were received from research assistants on daily basis and stored safely for immediate processing. The interview schedules were edited, coded and entered into computer using Ms Excel software. Back up storage was done in diskettes. All the raw data were stored safely by the researcher.

3.8.2 Data Analysis

The analysis of data was carried out using Statistical Package for Social Sciences (SPSS). Analyzed data (results) were presented using percentages, frequency tables and bar
charts. Descriptive statistics such as frequencies and means were applied in order to group and summarize data to facilitate presentation.

Chi-square test for independence was used to determine association of categorical variables e.g. age, education, occupation, knowledge of treatment (independent); treated net ownership, treatment, use (dependent). Analysis of Variance (ANOVA) was used to compare means (e.g. number of nets treated) and where means were significant tukey test which is powerful for multiple comparisons was applied.

Correlation coefficient was used to analyze relationship of quantitative variables e.g. income, household size (independent); number of treated nets owned, frequency of net treatment (dependent). For all statistical tests a 2-sided $p<0.05$ was considered statistically significant.

3.9 Ethical considerations

The study adhered to the ethical principles of research, which include obtaining permission from relevant authorities as well as informed consent from respondents. Clearance was obtained from Ministry of Science and Technology, Kenyatta University and local Provincial Administration. Informed consent was obtained from respondents prior to interview. Confidentiality of the information provided by informants was ensured.
CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 RESULTS

Although the minimum sample size required for the study was 250, a total of 400 caregivers (respondents) were interviewed so as to further reduce the sampling error. The caregivers comprised mothers or guardians (in the absence of mother) of children below five years in sampled households.

4.1.1 Socio-demographic characteristics of respondents

4.1.1.1 Sex of respondents

Of the 400 respondents interviewed, the majority 355 (88.7%) were female while 45 (11.3%) were male. Figure 4.2 shows distribution of respondents by sex (n=400).

![Figure 4.2 Distribution of respondents by sex](image)
4.1.1.2 Age of respondents

The age of respondents varied considerably and was categorized into: below 18 year, 18-30 (youth), 31-40 years (young adults), 41-50 years (middle adults), 51-60 years (adults) and over 60 years (old/elderly). Majority of respondents 262(65.5%) were aged between 18 to 30 years, followed by 96(24.0 %) aged between 31 to 40 years. Table 4.1 shows age categories of respondents.

Table 4.1 Age distribution among respondents

<table>
<thead>
<tr>
<th>Age category</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 18 years</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>18-30 years</td>
<td>262</td>
<td>65.5</td>
</tr>
<tr>
<td>31-40 years</td>
<td>96</td>
<td>24.0</td>
</tr>
<tr>
<td>41-50 years</td>
<td>27</td>
<td>6.8</td>
</tr>
<tr>
<td>51-60 years</td>
<td>9</td>
<td>2.3</td>
</tr>
<tr>
<td>Over 60 years</td>
<td>4</td>
<td>1.0</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The mean age was 30.8 years (S.D. =8.9) with a range of 17 to 71 years.

4.1.1.3 Education level of respondents

About 126 (31.5%) of respondents had completed primary education followed by 25.5%(102) with secondary level of education. Few respondents had either some primary education 75(18.8%) or some secondary education 52(13.0%). Those with post secondary
tertiary education were 6.8% (27) while those with no formal education (never been to school) were 4.5% (18). Figure 4.3 shows distribution of respondents by level of education (n=400).
4.1.1.4 Marital status of respondents

Of the 400 respondents, the majority 302 (75.5%) were married while the single/never married and divorced accounted for 60(15.0%) and 14 (3.5%), respectively. Those separated were 12 (3.0%) and widowed 12 (3.0%). Figure 4.4 shows distribution of respondents by marital status (n=400).

![Distribution of respondents by marital status](image-url)
4.1.1.5 Occupational status of respondents

The respondents belonged to different occupations. The main occupation was farming 168 (42.0%), followed by business 88(22%). Few respondents were either skilled 44(11.0%) or unskilled 30 (7.5%) employees. Seventy (17.5 %) respondents had no occupation. Figure 4.5 shows distribution of respondents by occupational status (n=400).

Figure 4. 5 Distribution of respondents by occupation
4.1.1.6 Main source of income in household

The main source of income among the households was farming 189 (47.3%) followed by business 85 (21.3%), salary 75 (18.7%) and casual/temporary jobs 51 (12.7%) in that order. Table 4.2 shows main source of income in the household.

Table 4.2 Main source of income in household

<table>
<thead>
<tr>
<th>Source of income</th>
<th>Frequency</th>
<th>percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farming</td>
<td>189</td>
<td>47.3</td>
</tr>
<tr>
<td>Business</td>
<td>85</td>
<td>21.3</td>
</tr>
<tr>
<td>Salary</td>
<td>75</td>
<td>18.7</td>
</tr>
<tr>
<td>Casual/temporary jobs</td>
<td>51</td>
<td>12.7</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
<td>100.0</td>
</tr>
</tbody>
</table>

4.1.1.7 Household monthly income

The majority 207 (51.7%) of households had a monthly income of between Kshs 1 to 2500, while a considerable proportion 106 (26.5%) had income ranging between Kshs 2500 to 5000. Fifty (12.5%) had income ranging between Kshs 5001 to 10000, whilst 27 (6.8%) had income ranging between Kshs 10001 to 20000. Those with income above Kshs 20000 were fewer 10 (2.5%). Table 4.3 shows estimated monthly income of households.
Table 4.3 Estimated monthly income of households

<table>
<thead>
<tr>
<th>Income category</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kshs 1 to 2500</td>
<td>207</td>
<td>51.7</td>
</tr>
<tr>
<td>Kshs 25001 to 5000</td>
<td>106</td>
<td>26.5</td>
</tr>
<tr>
<td>Kshs 5001 to 10000</td>
<td>50</td>
<td>12.5</td>
</tr>
<tr>
<td>Kshs 10001 to 20000</td>
<td>27</td>
<td>6.8</td>
</tr>
<tr>
<td>Above Kshs 20000</td>
<td>10</td>
<td>2.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>400</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

The estimated median monthly income of respondent’s household was Kshs 2500.00 with a range of Kshs 500 to 40,000. Considering that household income of less than Kshs 2650 is termed as absolute poverty (KNBS-MPND, 2007), this indicated that the majority of households were poor.

4.1.1.8 Household size and children in household

The average size of households interviewed was 5 (range =2-13) and the mean number of children was approximately 3 (mean=3.2, SD=1.9) with a range of 1 to 9. However, the mean number of children below five years in household was approximately 2 (mean=1.5, SD=0.73) with a range of 1 to 5.

4.1.2 Perception of malaria and prevention behaviour

4.1.2.1 Perception and beliefs on transmission of malaria

Caregivers were interviewed on their perception and beliefs on causes of malaria transmission, and they gave multiple responses. Most of the responses 390(97.5%) cited mosquitoes as the transmitter of malaria. Those who associated malaria with eating
mangoes were 133 (33.2%), by rain 68 (17.0%), by cold 49 (12.2%), eating raw fruits 29 (7.3%), washing with cold water 20 (5.0%), witchcraft 14 (3.5%), eating green maize 10 (2.8%), dirty water 3 (0.8%), and by air 2 (0.5%), Only one person accounting for 0.3% did not know the transmitters. Table 4.4 shows responses given on perception and beliefs on malaria transmission.

Table 4.4 Perception and beliefs on malaria transmission.

<table>
<thead>
<tr>
<th>Transmission of malaria</th>
<th>Responses</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>By mosquitoes</td>
<td>390</td>
<td>97.5</td>
</tr>
<tr>
<td>Eating mangoes</td>
<td>133</td>
<td>33.2</td>
</tr>
<tr>
<td>By rain</td>
<td>68</td>
<td>17.0</td>
</tr>
<tr>
<td>By cold</td>
<td>49</td>
<td>12.2</td>
</tr>
<tr>
<td>Eating raw fruits</td>
<td>29</td>
<td>7.3</td>
</tr>
<tr>
<td>Washing with cold water</td>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>Witchcraft</td>
<td>14</td>
<td>3.5</td>
</tr>
<tr>
<td>Eating green maize</td>
<td>10</td>
<td>2.5</td>
</tr>
<tr>
<td>Dirt water</td>
<td>3</td>
<td>0.8</td>
</tr>
<tr>
<td>Air</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>Don’t know</td>
<td>1</td>
<td>0.3</td>
</tr>
</tbody>
</table>
4.1.2.2 Ways of preventing malaria

The majority of respondents 391(97.8%) reported that they knew ways of preventing malaria while 9 (2.2%) did not know. Regarding what they perceived to be appropriate ways/methods of malaria prevention and control, most respondents 253(63.2 %) perceived sleeping under mosquito net as the most appropriate method, while 89(22.2 %) believed in eliminating/preventing breeding sites. Other methods perceived to be appropriate, though by few, were taking medicine 39(9.7%), use of repellants/mosquito coils 9(2.3%) and wearing long clothes 5(1.3%). Only 2(0.5%) reported that they did not know of any method. Table 4.5 shows methods perceived to be appropriate in malaria prevention and control.

Table 4.5 Perception on appropriate methods of malaria prevention and control

<table>
<thead>
<tr>
<th>Method of prevention/control</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleeping under mosquito net</td>
<td>253</td>
<td>63.2</td>
</tr>
<tr>
<td>Eliminating/preventing breeding site</td>
<td>89</td>
<td>22.2</td>
</tr>
<tr>
<td>Taking medicine</td>
<td>39</td>
<td>9.7</td>
</tr>
<tr>
<td>Repellants/mosquito coils</td>
<td>9</td>
<td>2.3</td>
</tr>
<tr>
<td>Wearing long clothes</td>
<td>5</td>
<td>1.3</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>0.8</td>
</tr>
<tr>
<td>Don’t know</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
<td>100.0</td>
</tr>
</tbody>
</table>
4.1.2.3 Action taken to prevent mosquito bites

When asked about action taken to prevent mosquito bites, a relatively higher proportion 119(29.8%) reported that they slept under treated mosquito net, 66(16.5%) reported that they slept under untreated mosquito net, 100(25.0%) used repellants/mosquito coils, 34(8.5%) used local herbs, 28(7.0%) wore long clothes, 11(2.8%) burnt cow dung, 9(2.3%) reported that they cover with blanket, and 6 (1.5%) reported that they chase with hands. About 28(7.0%) took no action to prevent mosquito bites. Table 4.6 shows the various actions taken by respondents to prevent mosquito bites.

Table 4.6  Action taken to prevent mosquito bite

<table>
<thead>
<tr>
<th>Action taken to prevent mosquito bite</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep under treated mosquito net</td>
<td>119</td>
<td>29.8</td>
</tr>
<tr>
<td>Use mosquito coils/repellants</td>
<td>100</td>
<td>25.3</td>
</tr>
<tr>
<td>Sleep under untreated mosquito net</td>
<td>66</td>
<td>16.5</td>
</tr>
<tr>
<td>Use of local herbs</td>
<td>34</td>
<td>8.5</td>
</tr>
<tr>
<td>Wear protective clothing</td>
<td>28</td>
<td>7.0</td>
</tr>
<tr>
<td>Burning cow dung</td>
<td>11</td>
<td>2.8</td>
</tr>
<tr>
<td>Cover with blanket</td>
<td>9</td>
<td>2.3</td>
</tr>
<tr>
<td>Chasing with hands</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td>No action</td>
<td>25</td>
<td>6.3</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
<td>100.0</td>
</tr>
</tbody>
</table>
4.1.3 Knowledge and perception of insecticide treated mosquito net

4.1.3.1 Awareness of ITN and knowledge on net treatment

Majority 354 (88.5%) of respondents were aware of insecticide treated mosquito nets (ITNs). Regarding knowledge of treatment (impregnation) of net with insecticide, more than half 207 (51.7%) of respondents said they did not know how to treat mosquito net, while 193 (48.3%) confessed knowing how to treat mosquito net. Table 4.7 shows respondents awareness of ITN and knowledge of net treatment.

Table 4.7  Awareness of ITN and Knowledge of net treatment

<table>
<thead>
<tr>
<th>Response</th>
<th>Knowledge of ITN</th>
<th>Knowledge on net treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>Yes</td>
<td>354</td>
<td>88.5</td>
</tr>
<tr>
<td>No</td>
<td>46</td>
<td>11.5</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
<td>100.0</td>
</tr>
</tbody>
</table>

4.1.4 Mosquito net coverage and use

4.1.4.1 Household coverage with treated nets and untreated nets

In all households interviewed 128 (32.0%) had at least a treated net, while 57 (14.2%) had untreated net. Hence households with at least a net (either treated or untreated) were 185, giving coverage of 46.2%. The majority of households 215 (53.8 %) had no net at all. Out of the 185 households with any net (either treated or untreated), only 69.2%
(128/185) had treated net while 30.8% (57/185) had untreated net. Figure 4.6 shows the proportion of households with treated net, untreated net and no net.

![Figure 4.6 Proportion of Households with treated net, untreated net and with no treated net (%).](image)

Some households had more than one net (multiple net ownership). Thus, for any net, the total numbers of nets found in households were 383. Households with 1 net were 75 (18.7%), 2 nets 67 (16.7%), 3 nets 28 (7.0%), 4 nets 10 (2.5%) and 5 nets 5 (1.3%). The total number of households with more than one net was 110 accounting for 27.6% of all households. The highest number of nets owned in one household was 5. The mean number of any nets in a household was 0.9 (SD 1.18) with a range of 0 to 5.

Similarly, some households had more than one treated net. Households with 1 treated net were 47 (11.7%), 2 treated nets 52 (13.0%), 3 treated nets 20 (5.0%), 4 treated nets 7
(1.8%), and 5 treated nets 2 (0.5%). Hence the total number of treated nets in all households was 249. The mean number of treated nets in household was 0.62 (SD=1.053) with a range of 0 to 5. Table 4.8 shows availability of any net and treated nets in households.

Table 4.8  Comparison of availability of any net and treated net in households

<table>
<thead>
<tr>
<th>Number of Nets in household</th>
<th>Households with any net</th>
<th>Households with treated net</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>----</td>
<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td>0</td>
<td>215</td>
<td>53.8</td>
</tr>
<tr>
<td>1</td>
<td>75</td>
<td>18.7</td>
</tr>
<tr>
<td>2</td>
<td>67</td>
<td>16.7</td>
</tr>
<tr>
<td>3</td>
<td>28</td>
<td>7.0</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>2.5</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>1.3</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
<td>100.0</td>
</tr>
</tbody>
</table>

4.1.4.2 Mosquito net use in household

Analysis on use of any net by household members showed that 49.6%(190) were availed for use by children under five years whilst 50.4%(193) were availed for use by those over five years, indicating that a higher proportion of nets were used by older children and adults. The results further indicated that not all treated nets in household were made available for use by under fives. Of the 249 treated nets available in the household, only
130 (52.2%) were for the under fives while 119 (47.8%) were used by children over five years and adults. Figure 4.7 shows utilization of any net and treated net in household (%).

Figure 4.7 Comparison on use of any net and treated net in household

4.1.4.3 Treated net use by children under five years

About 58 (31.5%) households had no child who slept under treated net, 90 (48.9%) had one child who slept under treated net, 31 (16.9%) had 2 children who slept under treated net, 4 (2.2%) had 3 children who slept under treated net, and 1 (0.5%) had 4 children who slept under treated net, the previous night to the interview. Regarding those who slept
under untreated net, 31 (36.0%) of households had no child who slept under untreated net, 37 (43.0%) had one child who slept under untreated net, 16 (18.7%) had 2 children who slept under untreated net, and 2 (2.3%) had 3 children who slept under untreated net. Table 4.9 shows the number of children below five years in the household who slept under treated net the previous night to the interview.

Table 4.9 Number of children below five years in household who slept under net the previous night to the interview.

<table>
<thead>
<tr>
<th>Number of under fives slept under net</th>
<th>Slept under treated net</th>
<th>Slept under untreated net</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>0</td>
<td>58</td>
<td>31.5</td>
</tr>
<tr>
<td>1</td>
<td>90</td>
<td>48.9</td>
</tr>
<tr>
<td>2</td>
<td>31</td>
<td>16.9</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>2.2</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Total</td>
<td>184</td>
<td>100.0</td>
</tr>
</tbody>
</table>

In some households with more than one child below five years not all children slept under treated net. In this study, only 30.25% (121/400) of households with treated nets had all their children below five years slept under ITN the night preceding the interview.

Sharing of nets among caregivers and children was practiced in some households. This study found that 35.9% (65/185) caregivers were sharing nets with their child/children.
4.1.5 Role of mosquito net in malaria prevention

Majority 277(69.3%) reported that nets prevented mosquito bites, 25(6.3%) reported that they prevented malaria, 89(22.3%) reported they prevented both mosquito bite and malaria, and 9(2.3%) reported they did not know what they prevented. Figure 4.8 shows respondents’ views on what mosquito net prevents.

![Graph showing the percentage of respondents' views on what mosquito net prevents]

Figure 4.8  Respondents’ views on what mosquito net prevents

4.1.6 Treatment of mosquito nets with insecticides

4.1.6.1 Status/interval of net treatment

Only 56 (43.8%) of respondents had their nets treated within the recommended period of six months, while 20 (15.6%) treated their nets every three months and 4 (3.1%) treated
their nets after one year. About 41 (32.1%) said they did not retreat their nets at all. Although long lasting treated net was a recent innovation envisaged to overcome problems of re-treatment of nets, only 6(4.4 %) of households had long lasting treated nets. Figure 4.9 shows the status/interval of net treatment.

![Figure 4.9 Status/interval of mosquito net treatment](image)

4.1.6.2 Treatment rate of nets

Regarding the frequency of net treatment (number of times the nets were treated), the mean frequency of net treatment was 2.64 (SD= 2.54). The minimum number of treatments was 1 while the maximum number of treatments was 10. Table 4.10 shows number of times the nets had been treated from the time it was acquired.
Table 4.10  Number of times mosquito net had been treated

<table>
<thead>
<tr>
<th>No. of times net treated from the time it was acquired</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>15.6</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>14.1</td>
</tr>
<tr>
<td>3</td>
<td>33</td>
<td>25.8</td>
</tr>
<tr>
<td>4</td>
<td>23</td>
<td>18.0</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>9.4</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>7.8</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>3.1</td>
</tr>
<tr>
<td>9</td>
<td>3</td>
<td>2.3</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>3.1</td>
</tr>
<tr>
<td>Total</td>
<td>128</td>
<td>100.0</td>
</tr>
</tbody>
</table>

4.1.6.3 Reason for treating nets with insecticides

Knowledge and appreciation of importance of treating nets is crucial for one to be able to treat his/her net frequently. In this study when respondents were asked to state the most important reason for treating nets, 221(55.3 %) said to kill/repel mosquitoes, 103(25.8%) said to prevent mosquito bites, 27(6.8%) said to prevent malaria and 47(11.8%) did not
know. Figure 4.10 shows respondents’ perception on most important reason for treating mosquito net.

Figure 4.10 Respondents most important reason for treating mosquito net
4.1.7 Accessibility and costs of nets and insecticides for treatment

It was found out that majority 110 (59.5%) of respondents purchased/obtained their mosquito nets from the shops, 41 (22.2%) obtained nets from health facilities, 18(9.7%) from NGO dealing with mosquito control, 9 (4.9%) from women groups selling nets, and 7(3.8%) Bamako initiative centres. Figure 4.11 shows sources/ outlets of mosquito nets as reported by respondents.

![Bar chart showing sources of mosquito nets as reported by respondents]

**Figure 4.11. Sources/outlets of mosquito nets as reported by respondents**

Insecticides for net treatment were also obtained from diverse sources/outlets. The majority of caregivers 63 (49.2%) purchased/obtained insecticide bundled together with the net, 46(35.9%) reported that they obtained insecticides from shops/chemists, and 17 (13.3%) obtained from health facilities. Figure 4.12 shows sources/outlets of insecticides...
Although nets and insecticides were found to be available in some shops and health facilities in the study area their costs varied enormously. Caregivers responses showed that the prices of nets ranged from Kshs 50 to 800 with a mean of 284 (median=300, SD=133.5). Information from vendors regarding the current prices of nets in retail outlets in Wote market indicated that a family or double size net including its single kit insecticide for treatment ranged between Kshs 300 and 350 (personal communication with the vendors).

Similarly, prices of insecticides for net treatment varied considerably. Based on caregivers responses the cost of insecticide for treatment of one net ranged from Kshs 20 to 100 with a mean of 52 (median=50, SD=16.8). The current cost of permethrin
insecticide (branded K-O TABS) for a family or double size net is between Kshs 30 and 50 in a retail outlet in Wote market in the study area (personal communication with the vendors). However public health facilities supported by an NGO population service international (PSI), have been promoting ITN use by providing nets at subsidized price of Kshs 50 (including insecticide) for pregnant women and children below five years of age.

4.1.8 Factors affecting ownership, treatment and use of treated nets by children under five years

4.1.8.1 Factors affecting ownership of treated net

4.1.8.1.1 Hindrances to mosquito net ownership

Various reasons were given by caregivers for not having a mosquito net in the household. The majority 175 (80%) cited lack of money to buy net, 29 (13%) said they are expensive, 8 (4 %) said they were not available, minority 4 (2%) considered them not important while 2 (1%) had no reason. Figure 4.13 shows reasons given for not having mosquito net in household.
4.1.8.1.2 Relationship of ownership of treated nets with selected variables

Various variables were found to be associated with ownership of treated net in household. Caregiver knowledge of ITN was significantly positively associated with treated net ownership. Table 4.11 shows association between knowledge of ITN and ownership of treated net in household.

Figure 4.13  Reason for not having mosquito net in household
Table 4.11 Knowledge of ITN Vs treated net ownership in household

<table>
<thead>
<tr>
<th>Knowledge of ITN</th>
<th>Availability of treated net in household</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>124</td>
<td>230</td>
</tr>
<tr>
<td>No</td>
<td>4</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>128</td>
<td>272</td>
</tr>
</tbody>
</table>

(Chi-square = 12.973, df = 1, p = 0.000*). * 0.00 …… 1. Highly significant

Similarly, there was significant positive association between caregiver knowledge on net treatment and ownership of treated net. Table 4.12 shows association between knowledge on net treatment and ownership of treated net in household.

Table 4.12 Knowledge on net treatment Vs ownership of treated net in household

<table>
<thead>
<tr>
<th>Knowledge on how to treat net</th>
<th>Ownership of treated net in household</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>121</td>
<td>72</td>
</tr>
<tr>
<td>No</td>
<td>7</td>
<td>200</td>
</tr>
<tr>
<td>Total</td>
<td>128</td>
<td>272</td>
</tr>
</tbody>
</table>

(Chi-square = 161.474, df = 1, p = 0.000*). *0.00 …… 1. Highly significant.
Marital status of caregiver was significantly positively associated with ownership of treated net in household. Table 4.13 shows association between marital status and ownership of treated net in household.

**Table 4.13 Marital status Vs ownership of treated net in household**

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Ownership of treated net</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Married</td>
<td>87</td>
<td>215</td>
</tr>
<tr>
<td>Single/never married</td>
<td>31</td>
<td>29</td>
</tr>
<tr>
<td>Divorced</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Separated</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Widowed</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>128</td>
<td>272</td>
</tr>
</tbody>
</table>

(Chi-square =13.078, df=4, p=0.011)

Occupation of caregiver was also significantly positively associated with ownership of treated net in household. Table 4.14 shows association between occupation and ownership of treated net in household.
Table 4.14 Occupation of caregiver Vs ownership of treated net in household

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Ownership of treated net in household</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Farming</td>
<td>19</td>
<td>149</td>
</tr>
<tr>
<td>Business</td>
<td>46</td>
<td>42</td>
</tr>
<tr>
<td>Skilled employee</td>
<td>32</td>
<td>12</td>
</tr>
<tr>
<td>Unskilled employee</td>
<td>8</td>
<td>21</td>
</tr>
<tr>
<td>None/house wife</td>
<td>23</td>
<td>48</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>128</strong></td>
<td><strong>272</strong></td>
</tr>
</tbody>
</table>

(Chi-square =83.966, df=4, p=0.000*). * 0.00......1. Highly significant.

There was positive significant association between level of education of caregiver and ownership of treated net in household. Table 4.15 shows association between level of education and ownership of treated net.
Table 4.15. Level of education Vs ownership of treated net in household

<table>
<thead>
<tr>
<th>Level of education</th>
<th>Ownership of treated net in household</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Never been to school</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>some primary education</td>
<td>9</td>
<td>66</td>
</tr>
<tr>
<td>Completed primary education</td>
<td>28</td>
<td>98</td>
</tr>
<tr>
<td>Some secondary education</td>
<td>18</td>
<td>34</td>
</tr>
<tr>
<td>Completed secondary education</td>
<td>50</td>
<td>52</td>
</tr>
<tr>
<td>Education</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td>Education/tertiary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>128</td>
<td>272</td>
</tr>
</tbody>
</table>

(Chi -square=56.974,df=5, p=0.000*). *0.00……1. Highly significant

When the mean number of treated nets in households was compared with the different levels of education of caregivers using a one way ANOVA statistical test, the mean difference was found to be significant at 0.05 level (F 4,177=7.239, p=0.000*).

A tukey test was performed to determine which level of education contributed significantly to mean differences in number of treated nets. Table 4.16 shows the
different levels of education that were found to have significant mean number of treated nets.

**Table 4.16 Multiple comparison of mean number of treated nets Vs different levels of education using tukey test**

<table>
<thead>
<tr>
<th>Comparison of means of different levels of education</th>
<th>Mean diff.</th>
<th>p-value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never been to school Vs post secondary education</td>
<td>1.67</td>
<td>0.000*</td>
<td>-2.51 to -0.83</td>
</tr>
<tr>
<td>Some primary education Vs completed secondary education</td>
<td>0.60</td>
<td>0.001</td>
<td>-1.02 to -0.18</td>
</tr>
<tr>
<td>Some primary education Vs post secondary education</td>
<td>1.73</td>
<td>0.000*</td>
<td>-2.35 to -1.11</td>
</tr>
<tr>
<td>Completed primary education Vs completed secondary education</td>
<td>0.50</td>
<td>0.002</td>
<td>-0.86 to -0.13</td>
</tr>
<tr>
<td>Completed primary education Vs post secondary education</td>
<td>1.63</td>
<td>0.000*</td>
<td>-2.22 to -1.05</td>
</tr>
<tr>
<td>Some secondary education Vs post secondary education</td>
<td>1.33</td>
<td>0.000*</td>
<td>-1.98 to -0.67</td>
</tr>
<tr>
<td>Completed secondary education Vs post secondary education</td>
<td>1.73</td>
<td>0.000*</td>
<td>-1.73 to -0.54</td>
</tr>
</tbody>
</table>

* 0.00.....1. Highly significant
The age of caregiver did not affect ownership of treated net as the association was not significant (Chi-square=5.593, df=5, p=0.348). Knowledge of malaria transmission was also not significantly associated with ITN ownership (chi-square=1.238, df=3, p=0.744).

There was a positive significant correlation between income and number of treated nets in the household (Pearson r=0.490, df=398, p=0.000*).

Household size was found to affect net ownership, as there was significant negative association between household size and ownership of treated net. Table 4.17 shows the association between size of household and ownership of treated nets in household.

*0.00......1. Highly significant.
Table 4.17 Household size Vs ownership of treated nets in household

<table>
<thead>
<tr>
<th>No. of household members</th>
<th>Ownership of treated net in household</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>14</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>27</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>51</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>30</td>
<td>57</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>29</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>77</td>
<td>13</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>18</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>4</td>
<td>14</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>8</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>128</td>
<td>272</td>
<td>400</td>
<td></td>
</tr>
</tbody>
</table>

(Chi-square=18.203, df=11, p=0.042)

Household size was also negatively correlated with number of treated nets in household (r=-0.103, p=0.01).
4.1.8.2 Factors affecting net treatment

4.1.8.2.1 Hindrances to net treatment.

The 57 households with untreated nets or nets not treated regularly had diverse reasons for not (re) treating their mosquito nets. The majority of caregivers 17 (29.8%) reported that they cannot afford insecticide, 10 (17.5%) reported that they did not know the insecticide to use, 9 (15.8%) reported that insecticides were not available/accessible, 9 (15.8%) reported that they did not see the importance of treating nets, 7 (12.3%) did not like the smell of insecticides, and 5 (8.8%) reported that insecticides were harmful. Table 4.18 shows the various reasons given by caregivers for not treating their nets.

Table 4.18 Reasons for not treating nets with insecticides

<table>
<thead>
<tr>
<th>Reason for not treating net</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot afford insecticide</td>
<td>17</td>
<td>29.8</td>
</tr>
<tr>
<td>Don't know the insecticide to use</td>
<td>10</td>
<td>17.5</td>
</tr>
<tr>
<td>Insecticides are not available/accessible</td>
<td>9</td>
<td>15.8</td>
</tr>
<tr>
<td>Don't see the importance of treatment</td>
<td>9</td>
<td>15.8</td>
</tr>
<tr>
<td>I don't like the smell of insecticides</td>
<td>7</td>
<td>12.3</td>
</tr>
<tr>
<td>Insecticides are harmful</td>
<td>5</td>
<td>8.8</td>
</tr>
<tr>
<td>Total</td>
<td>57</td>
<td>100.0</td>
</tr>
</tbody>
</table>
4.1.8.2.2 Relationship of frequency of net treatment with selected variables

Some factors were found to be associated with frequency of net treatment in household.

The association between level of education of caregiver and number of times net treated was positively significant. Table 4.19 shows association between level of education and number of times net treated.

Table 4.19 Level of education Vs number of times mosquito net been treated in household.

<table>
<thead>
<tr>
<th>Level of education</th>
<th>Number of times mosquito net been treated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Never been to school</td>
<td>1</td>
</tr>
<tr>
<td>some primary education</td>
<td>5</td>
</tr>
<tr>
<td>Completed primary education</td>
<td>12</td>
</tr>
<tr>
<td>Some secondary education</td>
<td>9</td>
</tr>
<tr>
<td>Completed secondary education</td>
<td>23</td>
</tr>
<tr>
<td>Education</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>52</td>
</tr>
</tbody>
</table>

(Chi-square=130.886, df=55, p=0.000*). *0.00......1. Highly significant.
Further, when the mean number of times the net had been treated was compared with the different levels of education using one way ANOVA, the mean difference was found significant at 0.01 level ($F_{5,179} = 4.889, P=0.000^*$). A tukey test was performed to determine which means were significant against different levels of education of caregiver. The mean number of times the nets had been treated differed significantly among the different levels of education of caregivers. There were significant differences between those who had never been to school Vs those who completed primary education, those who completed primary education Vs those with post secondary education, and those who completed secondary education Vs those with post secondary education. Table 4.20 shows multiple comparison of mean number of times net had been treated Vs different levels of education using tukey test.

<table>
<thead>
<tr>
<th>Comparison of means of different levels of education</th>
<th>Mean diff.</th>
<th>p-value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never been to school vs completed primary education</td>
<td>4.59</td>
<td>0.019</td>
<td>0.48 to 8.70</td>
</tr>
<tr>
<td>Completed primary education vs post secondary education</td>
<td>2.39</td>
<td>0.003</td>
<td>-4.19 to -0.59</td>
</tr>
<tr>
<td>Completed secondary education vs post secondary education</td>
<td>1.68</td>
<td>0.040</td>
<td>-3.31 to -0.04</td>
</tr>
</tbody>
</table>
Further analysis showed no significant association between marital status and frequency of net treatment (chi-square=40.580, df=40, p=0.445). Similarly, there was no significant association between age of caregiver and frequency of net treatment (chi-square=35, df=40, p=0.679). The association between knowledge of ITN and frequency of net treatment was also not significant (Chi-square=9.120, df=10, p=0.381).

Correlation between income and the number of times the net had been treated (frequency of net treatment) was highly significant (Pearson r=0.242, df=398, p=0.001). Hence income was positively correlated with frequency of net treatment in household. However there was no significant correlation between age and frequency of net treatment (Pearson r=0.070, p>0.05). Occupation of caregiver was not significantly associated with number of times mosquito net been treated (chi-square=48.467, df=40, p=0.168).

4.1.8.3 Factors affecting use of treated nets by children under five years

4.1.8.3.1 Hindrances to use of treated nets by children under five years

Caregivers whose child/children did not sleep under ITN gave various reasons. The majority 204 (72.3%) cited lack of mosquito nets, followed by 23 (8.2%) who reported that they could not afford insecticide. Others reasons though cited by fewer respondents but had negative impact on net use were: no mosquitoes 9 (3.2%), treatment of net not important 14 (5.0%), do not know how to treat net 12 (4.3%), mosquito net cause suffocation 7 (2.5%), insecticides are not available 7 (2.5%), and insecticides are harmful 3 (1.1%). Table 4.21 shows reasons given for children not sleeping under ITN.
Table 4.21  Reasons for child below 5 years not sleeping under ITN

<table>
<thead>
<tr>
<th>Reason for &lt; 5 not sleeping under ITN</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No mosquito net</td>
<td>204</td>
<td>72.3</td>
</tr>
<tr>
<td>Cannot afford insecticide</td>
<td>23</td>
<td>8.2</td>
</tr>
<tr>
<td>Treatment of net not important</td>
<td>14</td>
<td>5.0</td>
</tr>
<tr>
<td>Do not know how to treat net</td>
<td>12</td>
<td>4.3</td>
</tr>
<tr>
<td>No mosquitoes</td>
<td>9</td>
<td>3.2</td>
</tr>
<tr>
<td>Mosquito net cause suffocation</td>
<td>7</td>
<td>2.5</td>
</tr>
<tr>
<td>Insecticides are not available</td>
<td>7</td>
<td>2.5</td>
</tr>
<tr>
<td>Insecticides are harmful</td>
<td>3</td>
<td>1.1</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>1.1</td>
</tr>
<tr>
<td>Total</td>
<td>282</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Given that households interviewed had an ITN, the reason “no mosquito net” implies that ITNs were inadequate or they were not availed for use by under fives.

4.1.8.3.2 Problems perceived to be associated with treated net use

About 76 (19.0%) of respondents reported that insecticides might be harmful to net users, 22 (5.5%) reported that treated nets cause sleep disturbance, 20 (5.0%) said they cause dizziness. A lower but significant proportion 17 (4.2%) said children might die due to heavy sweating when sleeping under treated net. Only 47 (11.8%) did not know any of the problems. Table 4.22 shows various problems perceived to be associated with net treatment and use.
Table 4.22 Problems perceived to be associated with treated net use

<table>
<thead>
<tr>
<th>Problem</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insecticide may be harmful to net users</td>
<td>76</td>
<td>19.0</td>
</tr>
<tr>
<td>Cause sleep disturbance</td>
<td>22</td>
<td>5.5</td>
</tr>
<tr>
<td>Cause dizziness</td>
<td>20</td>
<td>5.0</td>
</tr>
<tr>
<td>Children may die due to heavy sweating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When sleeping under net</td>
<td>17</td>
<td>4.2</td>
</tr>
<tr>
<td>Don’t know</td>
<td>47</td>
<td>11.8</td>
</tr>
<tr>
<td>None</td>
<td>218</td>
<td>54.5</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
<td>100.0</td>
</tr>
</tbody>
</table>

4.1.8.3.3 Relationship of use of treated nets by under fives with selected variables

Some factors were found to be significantly associated with use of ITNs by children under five years. Knowledge of ITN by caregiver was significantly positively associated with use of ITN by children below five years. Table 4.23 shows association between knowledge of ITN and use of ITNs by children under five years in household.
Table 4.23 Knowledge of ITN Vs Children<5 years slept under ITN previous night to the interview

<table>
<thead>
<tr>
<th>Children&lt;5yrs slept</th>
<th>Knowledge of ITN</th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>under treated net</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>previous night</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>48</td>
<td>10</td>
<td></td>
<td>58</td>
</tr>
<tr>
<td>1</td>
<td>87</td>
<td>3</td>
<td></td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>1</td>
<td></td>
<td>31</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>170</td>
<td>14</td>
<td></td>
<td>184</td>
</tr>
</tbody>
</table>

(Chi-square = 11.255, df=4, p=0.024)

There was also significant positive association between occupation of caregiver and use of ITNs by children under five years. Table 4.24 shows association between occupation and use of ITNs by children under five years in household.
Table 4.24 Caregiver occupation Vs children under five years who slept under treated net the previous night to the interview.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Children under years slept under treated Net previous night</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Farming</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td>Business</td>
<td>15</td>
<td>38</td>
</tr>
<tr>
<td>Skilled employee</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Unskilled employee</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>None/house wife</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>58</td>
<td>90</td>
</tr>
</tbody>
</table>

(Chi-square=32.008, df=16, p=0.043)

Similarly, there was significant positive association between marital status of caregiver and use of ITNs by children under five years. Table 4.25 shows association between marital status and use of ITNs by children under five years.
Table 4.25 Marital status Vs children under five years who slept under treated net previous night preceding the interview.

<table>
<thead>
<tr>
<th>Marital status</th>
<th>Children under years slept under treated Net previous night</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Married</td>
<td>46</td>
<td>59</td>
</tr>
<tr>
<td>Single/never married</td>
<td>9</td>
<td>24</td>
</tr>
<tr>
<td>Divorced</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Separated</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Widowed</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>58</td>
<td>90</td>
</tr>
</tbody>
</table>

(Chi-square=29.915, df=16, p=0.018)

However, the association between age of caregiver and use of ITNs by children under five years was not significant (chi-square=12.902, df=16, p=0.68). Similarly, there was no significant association between level of education and use of ITNs by under five children (chi-square=28.007, df=20, p=0.109). Knowledge of cause of malaria was also not significantly associated with use of ITNs by under fives (chi-square=6.596, df=12, p=0.883).
4.2 DISCUSSION

4.2.1 Socio-demographic information

This study has shown that majority of caregivers of under fives in household were female, thus comparing favourably with a study done by Ahorlu and others (1997) in southern Ghana which found out that over 80% of caregivers of children were female. This finding confirms that women are primary caregivers of children in many households and supported the view of Rashed (1999) that women had primary responsibility for health of their children and that they are presumed to be more aware of children’s vulnerability to malaria.

Although the age groups of caregivers varied considerably, majority (65.5%) were youthful or young adults aged between 18 and 30 years. Most of the caregivers were fairly literate having either primary or secondary education. The results also revealed that the vast majority (75.5%) were married, and farming appeared to be the main occupation probably because the vast part of the area is rural. The main source of income was small scale farming, and the majority of caregivers were earning monthly income between Kshs 0 to 2500, thus supporting the view that this area is poverty stricken with majority of the people (about 73%) being absolute poor (MOPND-ROK, 2003).

The average size of household was 5 which is slightly higher than the national average of 4.4(CBS-ROK, 2004), while the mean number of children was 3 which is almost consistent with the national average of desired family size of 3.2 (CBS-ROK, 2004). However, the mean number of under five children in household was 2 which is consistent with the findings of a study done in Uganda on sleeping arrangements and mosquito net
use among under fives by Mugisha and others (2003), who found that the average number of children was close to 2 (1.8) per household.

4.2.2 Perception of malaria and prevention behaviour

Association of malaria with mosquitoes can greatly contribute towards its prevention and control. In this study, overwhelming majority (97.5%) of caregivers were aware that malaria is transmitted by mosquitoes. This closely conforms to findings of a study done in Nyamira by Osero and others (2005) which found out that 91.8% of respondents associated malaria with mosquitoes. However, results from the current study further indicated that some beliefs concerning transmission of malaria still existed. The main beliefs associated with malaria transmission were by eating mangoes, raw fruits, green maize, and by rain, cold, dirty water and witchcraft. This was consistent with observation by Espino (1997) that people from different communities often held various beliefs, seemingly contradictory, about malaria. Although these beliefs did not appear to be of serious magnitude, they however to some extent supported the view that traditional beliefs concerning malaria do exist in some communities. Hewitt and others (1996) observed that such beliefs might affect use of ITNs and treatment of nets with insecticides. If mosquitoes and malaria transmission are not cognitively linked, people may not perceive the need to appreciate and use ITNs. In such a situation, if the mosquito population declines or when the nets make sleeping uncomfortable nets are put away.
4.2.3 Level of knowledge on malaria prevention and Insecticide treated net

Knowledge of ways of preventing malaria is important in adoption and utilization of ITNs. It helps one in making an informed choice of the method of preventing malaria from various options available. Besides, one can choose a method, which he/she can afford. For instance Ziba and others (1994) found that in Malawi, use of malaria prevention measures (bed nets, insecticides, mosquito coils, other insect repellants, spreading or burning dung, or burning wood fires) was dependent on income and awareness on ways of prevention of malaria. The results showed that the vast majority of caregivers (97.8%) were aware of various ways of preventing malaria. For instance, sleeping under ITN, use of mosquito coils/repellants was perceived by caregivers as some of the appropriate methods of preventing malaria. These methods were also associated with the prevention of mosquito bites.

Similarly, knowledge of ITN is crucial for its acceptance and use. It helps one to understand and appreciate the importance of ITNs in malaria prevention. The results showed high level of awareness of ITNs among caregivers (88.5%), and a significant majority perceived it as the appropriate method of preventing malaria. This was an indication that community awareness about ITN was considerably high, a fact that was supported by participants during FGDs. Most participants in FGDs said that they had heard about ITNs although few had used them. Some even did manage to recall the brand names of nets and insecticides used for net treatment, namely “supanet” and “power tab” (locally referred to as ‘ndawa ya net’).

The majority of participants in FGDs also confessed that they understood very well how ITNs worked. This observed high level of awareness of ITNs might contribute
greatly in their acquisition, acceptance, treatment and use. The study also found out that considerable proportion of caregivers were using other anti-mosquito methods such as mosquito coils, local herbs, cow dung etc to prevent mosquito bites. This is noteworthy when considering ITN promotion since use of other anti-mosquito methods might reduce acceptance of ITNs (Heggenhougen et al., 2003). Besides, a study done in Tanzania revealed that use of other anti-mosquito products was negatively associated with net ownership (Kikumbih et al., 2005).

4.2.4 Insecticide treated net coverage and use

4.2.4.1 Insecticide treated net coverage

The coverage of household that owned any mosquito net was 46.2%, while that of ITN was 32.0%. Hence proportion of households covered with untreated was 14.3% (difference between any net and treated net). This coverage is slightly higher than that of a study conducted in Nyamira district which found coverage of 33.3% and 23.8% for any net and treated net, respectively (Osero et al., 2005). It is also higher than the national average of 22% for any net and 6% for treated net (CBS-ROK, 2004). However, this coverage is still below the Abuja target of 60% coverage of vulnerable groups by 2006 (WHO, 2000; MOH-ROK, 2001).

Moreover, the mean number of nets per household which was found to be 0.9 for any net and 0.62 for treated net falls far short of estimated requirement of three nets in household of average size of six as estimated by Guyatt and others (2002a).

The results from this study have shown that high level of awareness of ITN was not matched with high coverage as the results indicated that household coverage with any net
was 46.2% while that of ITN was 32.0%. This suggests that other strategies need to be explored to increase ITN ownership because for children to use ITNs they should be available in the household. Their availability in the household may be considered as a potential factor influencing their use by under five years children. Besides, sometimes it is assumed that knowledge of caregiver may increase ITN use by under fives, when the net is available in the household. For instance, Mugisha and others (2003) reported that when the net was available in household and the mother or guardian was exposed to knowledge and had a higher understanding, her children were more likely to sleep under the mosquito net. This observation can only be true if caregiver knowledge is positively associated with net use. Agyepong and others (1999) observed that knowledge and practice did not necessarily have a positive linear relationship.

4.2.4.2 Use of treated nets by children under five years

The main concern on ITN use has been how well the child is protected against malaria, and especially in relation to other household members, since not all nets available in household are used by under fives. This study revealed that whereas 49.6% of any nets (treated and untreated) in household were reportedly used by under five children, 52.2% of treated nets were used by same age group. The relatively higher usage of treated nets by under fives could have been attributed to the intensive promotional campaigns that had been focusing on ITNs use by under fives.

Regarding treated net use by under fives (indicated by those who slept under treated net on the night preceding the interview), not all children below five years used them despite being available in the household. Only 68.5% slept under treated net the previous
night giving ITN non-compliance rate of 31.5% which is slightly lower than the average 35% achieved under trial conditions in Gambia (Hanson et al., 2004). These finding are close to those of a study done by Korenromp and others (2003) which monitored ITN coverage in Africa, and found out that out of the households that owned ITN, only 55% of children slept under it.

In some situations, where households had more than one child and had inadequate ITNs, the age of a child determined who slept under the net. It emerged during FGDs that if there was more than one child in a household preference was given to the youngest child: “youngest child is given preference because of being tender and weak”, remarked one woman from Kivandini village.

In some households that owned nets, caregivers were found to be sharing nets with children. In such a situation, children used mosquito nets because they happened to share a bed with the caregiver, thus giving these children a comparative advantage over the others. Mugisha and others (2003) noted that a child who shared a bed with the mother was 21 times more likely to use a mosquito net than his/her counterpart. Since a younger child was likely to share a bed with parents, it implies that a younger child was more likely to sleep under net if it was available.

4.2.5 Role of mosquito net in malaria prevention

The results have indicated that prevention of mosquito bites was viewed by the majority (69.3%) as the main reason for using mosquito nets. Few caregivers (6.3%) viewed mosquito net as preventing malaria. Similarly, killing mosquitoes and preventing mosquito bites were the main reasons for treating nets, and this was evident during FGDs.
This finding is consistent with that of Mugisha and others (2003) who found out that majority of people were using ITNs for the purpose of preventing mosquito bites.

This finding further supports the view held in some communities that the primary concern for using nets may be to avoid the nuisance of bites by mosquitoes (so as to have uninterrupted sleep), over and above the fear of malaria (Winch et al., 1997). Thus there was no direct association of net use with malaria prevention. Yet the primary role of mosquito net is to prevent malaria by preventing contact with mosquitoes (D’Alessaro et al., 1995; WHO, 1997), and when treated it repels and kills mosquitoes (Winch et al., 1997).

The findings also indicated that mosquito nets might be acquired for other purposes as well. Focus group discussions revealed that nets might simply be considered for their decorative value or used as a sign of prestige in some households: “houses which have nets are progressive” (commented a woman from Malivani village). Similarly, it emerged that mosquito nets prevented other nuisance insects/objects that might disturb a person while sleeping.

Understanding and appreciating what a mosquito net prevents is important for its acceptance and use, since even if money is available in a household buying bed net may not be a priority in some households. For instance, in Ghana, Aikins and others (1994) found a low level of bed net usage and related this to reduced value attached to their acquisition.

This suggests that there is a need for intensive health education on the importance of ITNs in malaria prevention, focussing mainly on the connection between malaria and
mosquitoes. This will positively contribute towards increasing acceptance of ITN intervention.

4.2.6 Treatment of nets with insecticides

Mosquito nets treated with insecticide have an added efficacy in protection against malaria compared to untreated nets as they repel and kill mosquitoes (D’Alessandro et al., 1995). Moreover treating nets with insecticides provides double protection: not only does it safeguard a person (or people) inside a net, but it also kills most insects that alight (Heggenhougen et al., 2003).

The results from this study indicated that majority of nets available in households were not re-treated or were treated infrequently. Only 43.8% of caregivers re-treated their nets regularly after 6 months as recommended. This indicated that re-treatment rate was below the national target of having 50% of all nets re-treated regularly by 2006 (MOH-ROK, 2001). Besides, the mean treatment rate of 2.64 of available nets in household was substantially low. These findings are consistent with those from studies conducted on ITN trials or social marketing projects which indicated that nets were often not re-impregnated or impregnated with insecticides frequently as recommended (Monasch et al., 2004).

The findings are also consistent with those from a study done in Tanzania which showed that, only a third of ITN users had treated their nets in the last six months (Guyatt et al., 2002b). Even in most operational projects with a cost recovery element, only 5% to 30% of nets were re-treated (Chavasse et al., 1999). This observation suggests that re-treatment of nets is a problem in many areas. The low re-treatment rate implies that apart
from financial and logistical factors, the use of insecticides might not have been well accepted and its value appreciated. Winch and others (1997) noted that if the insecticide is not accepted along with the bed nets, retreatment of nets might be low, and therefore the nets would offer scant protection from malaria even though the nets may be used over time. As treating net has cost implications, for people to accept to treat their nets, they will need to gain enough appreciation for the insecticide in order to convince them to invest in its added costs.

There was low knowledge on net treatment among the caregivers interviewed. Focus group discussions also provided evidence of low knowledge on net treatment as participants cited the need to be shown how to treat nets: “how can we treat the net if we are not shown”, reported a woman from Mumbuni village. The observed low use of ITN and insecticide treatment appears to support the view that knowledge alone may not be sufficient to encourage ITN usage and re-treatment. Agyepong and others (1999) found out that knowledge and practice do not necessarily have a linear relationship. In their study they found that knowledge of association between mosquitoes and malaria was not related to literacy or formal education, and did not predict bed net usage, and net treatment.

The recently introduced deltamethrin KO TAB 123 long lasting insecticide treatment kit, which will make the net effective in killing and repelling mosquitoes for up to 20 washes or approximately 3 years, will contribute towards alleviating problems of irregular retreatment (personal communication with Mr. Kiilu of PSI).
4.2.7 Accessibility and cost of nets and insecticides

The majority (59.8%) of caregivers purchased their nets and insecticides from shops located mainly in Wote town and a substantial proportion (21.7%) obtained them from the district health facility located in the same town. Availability of nets in some areas also emerged as an issue during FGDs: “Even for the few who can afford to buy a net they must travel to Wote which is far away from here”, commented a woman from Kikumini village.

Costs of nets and insecticides were also cited by some caregivers to be a hindrance to their acquisition. A number of participants in FGDs felt that although nets were subsidized for pregnant women and under fives, the Kshs 50 was not affordable for some very poor vulnerable groups: “If one has no food in the house where will he/she get Kshs 50 to buy a net” lamented a woman from Kako village. This suggests that, there is a need for the nets to be issued free to the very poor. Evidence from these results as well as the findings of ministry of planning and national development have indicated that majority of the people were poor (MOPND-ROK, 2003).

4.2.8 Factors affecting net ownership treatment and use by children under five years

4.2.8.1 Factors affecting ownership of treated net

The results showed that a number of barriers tended to hinder or slow net acquisition. The main reason that was cited for not having ITNs in households was lack of money followed by costs of nets. Costs especially of nets were considered as being a hindrance to acquisition of nets, particularly to pregnant women and under five children, even though they were subsidized. This is probably attributed to the prevailing high levels of
poverty. Evidence from these results as well as the findings of ministry of planning and national development indicated that majority of the people were poor (MOPND-ROK, 2003). Therefore, ownership of treated nets was low, and this supports the observation by Kikumbih et al. (2005) who reported that income may influence demand of nets as well as be a constraint in net ownership. Further, as purchasing a net entails substantial outlay of cash which may be a great burden to many people (Heggenhougen et al., 2003), low income coupled with high cost of nets might hinder acquisition of nets.

The results from this study have also indicated that factors such as knowledge of ITN, knowledge of net treatment, education, marital status, occupation, income and household size affected ownership of ITNs in a household. Knowledge of ITN was found to be positively associated with ownership of treated mosquito net in household (p<0.01). This finding is consistent with that of a study done by Kikumbih et al. (2005) who found out that knowledge of ITN was significantly associated with ownership of treated net in household. Knowledge on net treatment was positively associated with ownership of treated net (p<0.01), implying that caregivers who had knowledge on net treatment were more likely to own ITNs.

The results further showed significant positive association between level of education of caregiver and ownership of treated net in household (P<0.01). Further, the results showed significant differences between the levels of education of caregivers and mean number of nets owned in household (p<0.01). In particular there were significant differences in mean number of nets between: caregivers who had never been to school and those with post secondary education, between those with some primary education
and those who had completed secondary education, and between those with some primary education and those with post secondary education.

There were also significant differences in mean number of nets owned between caregivers who had completed primary education and those who had completed secondary education, between those who had completed primary education and those with post secondary education, between those with some secondary education and those who had post secondary education, and between those who completed secondary education and those with post secondary education. These findings suggest that the level of education of the caregiver might contribute significantly to ITN ownership in the household.

The results also indicated that marital status affected ITN ownership as there was significant positive association between marital status of caregiver and ownership of treated net (p=0.011), indicating that caregivers who were married were more likely to own ITNs. Similarly, occupation of the caregiver positively affected ownership of ITN (p<0.01). This supports the view by Mugisha and others (2003) that households whose mothers had vocational training had the highest net ownership.

The results showed significant positive correlation between income of household and number of ITN owned (r=0.490, p<0.01), indicating that caregivers households with relatively higher income had more nets than those with lower income. This finding is consistent with that of Mugisha and others (2003) who noted that a higher proportion of children in the wealthiest 20% of the households used mosquito nets compared to poorest 20% of the households. It further supports finding of a study done in Tanzania by (Kikumbih et al., 2005) who reported that income may influence demand of nets.
Household size was also a factor in ITN ownership. Evidence from results indicated negative association between household size and ownership of treated net (p=0.042), implying that size of household affected ITN ownership. Similarly, there was negative significant correlation between household size and number of treated nets in household (r=-0.103, p=0.01). This finding implies that larger households had fewer ITNs compared to smaller households, thus supporting a case for small family size.

However results indicated that factors such as age and knowledge on causes of malaria did not affect ownership of ITN. There was no significant association between age of caregiver and ownership of treated net in household (p>0.05). Similarly, knowledge on causes of malaria was also not significantly associated with ITN ownership. This could be due to poverty or lack of appreciation of the role of ITN in malaria prevention.

4.2.8.2 Factors affecting treatment of nets

The results have showed that there were barriers that affected treatment of nets. The main hindrances were unaffordability of insecticides, lack of or inadequate knowledge of insecticide to be used, and to a lesser extent unavailability/inaccessibility of insecticides. In most cases re-treatment of bed nets usually entailed an extra cost over the initial purchase price. It was also evident, as expressed by few, that households with more than one net could not afford enough insecticides to treat all the nets. These constraints affected (re) treatment of nets.

Appreciation of the importance of treating nets is also crucial for re-treatment of nets. Winch and others (1997) in their study at Bagamoyo in Tanzania reported that it
was more difficult for villagers to appreciate the benefits of insecticides than those of the nets. In Ghana Aikins and others (1994) found a low level of bed net usage and related this to reduced value assigned to their acquisition. Therefore, there is need to place great emphasis on the insecticide and its beneficial effects for any program of net treatment to be sustainable.

Another issue of concern that appeared to be a hindrance to net treatment was the perceived safety of ITNs. Few caregivers did not like the smell of insecticides or considered them harmful. This poses a challenge to ITN acquisition as well as their treatment and use. In such a situation some people might be prompted to use untreated nets which offer less protection. The observed side effects of the insecticides were minimal (WHO, 1997; Winch et al., 1997; Heggenhougen et al., 2003), and do not appear to be a major reason for people not to re-treat their nets (Winch et al., 1997).

Perhaps the precautions given to people treating nets such as wearing gloves, and not to touch insecticide might cause heightened concern over toxicity, and make people think treated nets are harmful. For instance, during FGDs some participants felt that since they were advised to take stringent precautions when treating nets including burying the bag carrying treated net, they might have considered the insecticides used to have harmful effects to young children when they come into contact with the net. This view concurs with findings by Heggenhougen and others (2003), who observed that “what worried villagers was being told to burn or bury the bag used to carry bed net home because it implied the toxicity of bed net and possible negative effect on any child who might come into frequent contact with it”. These perceived problems might be overcome by vigorous
and sustained health education aimed at dispelling such fears as well as emphasizing on
the advantages and benefits of use of treated nets compared to untreated nets.

The results also showed that treatment of nets with insecticides was affected by factors
such as educational status and income. Level of education was positively associated with
frequency of net treatment \( (p=0.023) \), suggesting that caregivers with relatively higher
educational status were more likely to retreat their nets in household. The results also
showed significant differences between levels of education and mean frequency of net
treatment \( (p<0.01) \). Specifically, there were significant differences between caregivers
who had never been to school and those who had completed primary education, between
those who had completed primary education and those with post secondary education,
and between those who had completed secondary education and those with post
secondary education. This implies that caregivers with higher educational status are more
likely to treat their net(s) in household compared to those with lower educational status.

The results also showed significant positive correlation between income and
frequency of net treatment \( (r=0.242, p=0.001) \), indicating that caregivers household with
higher income had their nets treated more frequently than those with lower income.

However some factors such as age, education, knowledge of ITN, knowledge of net
treatment, occupation and marital status did not affect frequency of net treatment. Age
was not significantly associated with frequency of net treatment \( (p>0.05) \). Similarly, there
was no significant association between knowledge of ITN and frequency of net treatment
\( (p>0.05) \). This could be due to unaffordability or inaccessibility of insecticides or lack of
appreciation of the value of treated nets.
The results further showed no significant association between knowledge on net treatment and frequency of net treatment (number of times net been treated), \( p > 0.05 \). There was also no significant association between marital status of caregiver and frequency of net treatment \( (p=0.445) \) suggesting that marital status did not affect net treatment. Association between occupation of caregiver and frequency of net treatment was equally not significant \( (p=0.168) \), implying that frequency of net treatment is not affected by occupational status. This could be due to association of regular treatment of nets with harmful effects.

Making accessible and affordable permanently treated nets, with long lasting insecticidal efficacy, might overcome problems of failure to treat nets or infrequent treatment of nets, as well as problems perceived to be associated with treatment of nets.

### 4.2.8.3 Factors affecting use of ITNs by children under five years

There were barriers that affected use of ITNs by under fives. Although studies have shown that treated nets are safe and have no adverse effects (WHO, 1997; Winch et al., 1997), their use have been perceived to be associated with some problems. In this study, caregivers perceived use of ITNs to be associated with dizziness, sleep disturbance or discomfort due to heavy sweating that resulted when one slept under ITN. This perception might reduce adherence or compliance rate of ITN use by under five children. Conversely, a study conducted in Uganda by Mugisha and others (2003) revealed that children in cold climates used nets to keep them warm. Availing nets made of light materials like nylon or polyester could overcome discomfort experienced in use of nets in hot and dry climates.
The results have also indicated that the use of ITNs was affected by several factors such as knowledge on ITNs, marital status, and the occupation of caregiver. Knowledge on ITN was positively associated with the use of ITNs by under five children (p=0.024). The implication of this finding is that, children whose caregivers were aware of ITN were more likely to sleep under net than children whose caregivers were not aware of them. Likewise, there was significant positive association between marital status and use of ITN by under five children (p=0.018). The implication of this finding is that those caregivers who were married were more likely to own ITNs, and their children were more likely to sleep under nets compared to those who were not married or living together with their partners. These findings support the observation by Mugisha et al.(2003), that children of married mothers or those mothers who were living with their partners were more likely to use mosquito nets compared to children whose mothers were never married.

Similarly, there was a significant positive association between occupation and use of ITNs by children (p=0.043). This finding indicated that occupation of caregiver had a positive effect on ITN use by under fives, and was contrary to the view by Mugisha and others (2003) that households whose mothers had vocational training, their children were less likely to use mosquito nets.

However, results showed that age, level of education, as well as knowledge of causes of malaria did not affect ITN use by under fives. There was no significant association between age and use of ITN by children under five years (p>0.05). Similarly, there was no significant association between level of education and use of ITNs by under fives (chi-square=28.007, df=20, p=0.109). Knowledge of causes of malaria was also not
significantly associated with use of ITN by under fives (p=0.883). This could be due to lack of appreciation of the value of ITN in Malaria prevention.
CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This study has provided data on factors that influenced net treatment and use among children aged less than five years in Makueni district. The results have shown that awareness of ITN was overwhelmingly high among the caregivers of under fives, but knowledge of net treatment was low. Though ITN coverage was slightly higher when compared with the national average, it was still below the Abuja target of 60% coverage of under five group projected by the year 2006. Although about a half of treated nets available in household were available for use by under fives, only about two-thirds of under fives were reported to have slept under net the night preceding the interview. This implies that even if adequate nets are available in the household, compliance on their use was a problem. The primary reason for using ITNs was perceived to be prevention of mosquito bites, other than malaria, implying that the role of mosquito net has not been properly linked to malaria prevention.

The results have shown that majority of nets had not been re-treated or were treated infrequently. The main barriers to net use by under fives appeared to be the cost of nets making them unaffordable to the poor and their inaccessibility especially in the rural areas, as well as lack of knowledge on net treatment. Some caregivers associated net treatment with problems such as insecticides for net treatment being harmful or having unpleasant smell. Similarly some thought that sleeping under ITN might cause suffocation or discomfort. These may have negative implications on net treatment and use among under five children.
However, availability of permanently treated nets, which are long lasting, might help in addressing problems of failure to treat nets or infrequent treatment of nets as well as problems perceived to be associated with treatment of nets, and hence contribute to increased use of treated nets.

The results from this study also indicated that factors such as knowledge of ITN, knowledge of net treatment, education, marital status and occupation positively affected ownership of treated nets while income and household size negatively affected ownership of ITNs in households. The results indicated that age and knowledge on causes of malaria did not affect ownership of ITNs. The results have further indicated that use of ITNs by under fives was positively affected by factors such as knowledge of ITN, marital status, and occupation of caregiver. However, results showed age, knowledge of malaria as well as knowledge of its transmission did not affect ITN use by under fives. The results have further shown that treatment of nets with insecticides was positively affected by factors such as educational status and income. However, factors such as age, knowledge of ITN, knowledge of net treatment, occupation and marital status did not affect frequency of net treatment.

Increasing ITN use by addressing factors affecting their ownership and use, coupled with implementation of other initiatives such as indoor residual spraying with DDT, which was recently sanctioned by WHO, might greatly contribute in reducing malaria.
5.2 Conclusion

The results have shown that although ITN coverage was slightly higher when compared with the national average, it was still below the Abuja target of 60% coverage of under five group projected by the year 2006. The results have also shown that majority of nets had not been re-treated or were treated infrequently. But this problem might be overcome by making accessible and affordable permanently treated nets, which do not require retreatment. The main barriers to ITN use by under fives appeared to be the cost of nets making them unaffordable to the poor and their inaccessibility especially in the rural areas.

Based on the findings of this study, there is no enough evidence to support the null hypothesis that socio-demographic, cultural and economic factors do not influence net acquisition, treatment and use by under fives. But there is evidence from these results to conclude that some socio-demographic, cultural and economic factors do influence their acquisition, treatment and use among under fives.

The findings from this study provide valuable information for those involved in implementing programs and activities for increasing ITN coverage, net treatment, and use among under fives in Makueni district and in other malarious areas of Kenya. In addition it provides important information for those involved in providing care for children below five years. Further, results point out to the fact that any step to increase net ownership, treatment and usage among under fives should take into consideration prevailing socio-cultural and economic factors at household level such as education, occupation, marital status, income and size of household. These findings are also important for future
sustainability of ITN use among the under fives, since even if ITNs are provided free or are highly subsidized, this would not guarantee their usage.

Information from this study will therefore be useful to malaria control planners and implementers in addressing barriers and factors hindering or slowing net acquisition, treatment and use among under fives, and hence contribute towards their scaling up. This, along with other initiatives such as indoor residual spraying, will greatly contribute in reducing malaria.

5.3 Recommendations

The following are recommendations for future planning and implementation, and for further research.

5.3.1 Future planning and implementation

a) Government and NGOs should intensify ITN promotion activities including use of electronic and print mass media such as posters so as to scale up ITN coverage to above 60%.

b) Programs promoting ITN use need to focus on educating caregivers of under fives on benefits of using ITNs (and retreating them regularly if not permanently treated) and their proper usage as well as assuring them that there are no harmful effects associated with use of treated nets.

c) Permanently treated nets (or nets and insecticides for net treatment) should be made more accessible especially in the rural areas, and should also be made affordable by the Government and NGOs through subsidies in order to reduce prices for the poor,
and vulnerable groups such as young children and pregnant women should be given free.

d) Government and NGOs should continue promoting and facilitating enhancement of education and economic status of the people as these have been found to have positive influence on net ownership treatment and use in households.

e) Issuance of free or highly subsidized nets should be accompanied with comprehensive health education and be closely monitored to ensure that they are used by under fives since some nets were found to be used by other family members other than the under five year children.

f) Caregivers should ensure that children under five years always sleep under ITN at night in order to prevent malaria infection.

5.3.2 Further research

a) Factors affecting insecticide net treatment and use among under fives in other parts of the country, and particularly focussing on why some under five do not always sleep under ITN despite being available in households.

b) Comparison on factors influencing ITN use among caregivers of under fives in urban and rural areas.

c) The influence of environmental and epidemiologic factors on ITN use among under fives.

d) Comparison between use of free or highly subsidized ITNs and non-free or unsubsidized ITNs among caregivers of under fives with a view of determining future sustainability of ITNs use, when subsidization or free issuance of ITNs ceases.
REFERENCES


Donaldson, C. (1999), Valuing the benefits of publicly provided health care: does ability To pay’ preclude the use of ‘willingness to pay’? Social Science and Medicine, Health Economics Research Unit, University of Aberdeen, UK.


Lindsay, S.W., and Gibson, M.E. (1988) Bed Nets revisited-Old idea, new angle.


7.0 APPENDICES

### 7.1: STRUCTURED INTERVIEW SCHEDULE FOR HOUSEHOLD

The researcher is a student from Kenyatta University carrying out a study on insecticide treated mosquito nets. The purpose of this study is to collect data that will assist to scale up ITN use in order prevent and control malaria. The information provided will be confidential and used for the purpose of the study only.

**District:**

**Division:**

**Location:**

**Sub location:**

**Village:**

**Household code No:**

Interview the caregiver of under fives in a household.

#### 1. PART ONE: BACKGROUND INFORMATION

**SOCIO-DEMOGRAPHIC DATA**

<table>
<thead>
<tr>
<th>1. Sex of respondent: 1. Male ☐</th>
<th>2. Female ☐</th>
</tr>
</thead>
</table>

| 2. Age of respondent in years | |

<table>
<thead>
<tr>
<th>3. What is your highest level of education?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Never been to school (no education) ☐</td>
<td></td>
</tr>
<tr>
<td>2. Some primary education ☐</td>
<td></td>
</tr>
<tr>
<td>3. Completed primary education ☐</td>
<td></td>
</tr>
<tr>
<td>4. Some secondary education ☐</td>
<td></td>
</tr>
<tr>
<td>5. Completed secondary education ☐</td>
<td></td>
</tr>
<tr>
<td>6. Post secondary/tertiary education ☐</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Marital status:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Married ☐</td>
<td></td>
</tr>
<tr>
<td>2. Single/never married ☐</td>
<td></td>
</tr>
<tr>
<td>3. Divorced ☐</td>
<td></td>
</tr>
<tr>
<td>4. Separated ☐</td>
<td></td>
</tr>
<tr>
<td>5. Widowed ☐</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. What is your religious affiliation?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Non-religious (Atheists) ☐</td>
<td></td>
</tr>
<tr>
<td>2. Catholic ☐</td>
<td></td>
</tr>
<tr>
<td>3. Protestant ☐</td>
<td></td>
</tr>
<tr>
<td>4. SDA ☐</td>
<td></td>
</tr>
<tr>
<td>5. Other Christians ☐</td>
<td></td>
</tr>
<tr>
<td>6. Traditional religion ☐</td>
<td></td>
</tr>
<tr>
<td>7. Muslim ☐</td>
<td></td>
</tr>
<tr>
<td>8. Other specify</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6. How many children do you have?</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>7. How many children are five years and below</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>8. What is your occupation?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Farming ☐</td>
<td></td>
</tr>
<tr>
<td>2. Business ☐</td>
<td></td>
</tr>
<tr>
<td>3. Skilled employee ☐</td>
<td></td>
</tr>
<tr>
<td>4. Unskilled employee ☐</td>
<td></td>
</tr>
<tr>
<td>5. None/house wife ☐</td>
<td></td>
</tr>
<tr>
<td>6. Others specify</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9. What is the main source of income in the household?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Farming ☐</td>
<td></td>
</tr>
<tr>
<td>2. Business ☐</td>
<td></td>
</tr>
<tr>
<td>3. Salary ☐</td>
<td></td>
</tr>
<tr>
<td>4. Casual/temporary jobs ☐</td>
<td></td>
</tr>
<tr>
<td>5. Others specify</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10. What is the estimated income for this household per month? Kshs</th>
<th></th>
</tr>
</thead>
</table>
Range of respondents income (indicate the amount above and tick appropriate category below)

1. Kshs 0 to 2500 □
2. Kshs 2501 to 5000 □
3. Kshs 5001 to 10000 □
4. Kshs 10001 to 20000 □
5. Above Kshs 20000 □

PART TWO
SECTION A: PERCEPTION ON MALARIA AND HEALTH SEEKING BEHAVIOUR

11. Do you know a disease called malaria?
   1. Yes □
   2. No □

12. If yes, what was your source of information?
   1. Health personnel □
   2. Mass media (radio, TV, News papers) □
   3. Relative and friends □
   4. School □
   5. Public/social meetings □
   6. Churches/places of worship □
   7. Others specify ...................................
   8. Not applicable □

13. How is malaria transmitted?
   1. By mosquitoes □
   2. By air □
   3. By rain □
   4. Through food □
   5. Dirt water □
   6. By cold □
   7. Witchcraft □
   8. Others specify ...................................

14. Do you consider malaria to be a common problem in your area?
   1. Yes □
   2. No □

15. If yes, how serious is the malaria problem?
   1. Very serious □
   2. Serious □
   3. Not serious □
   4. N/A □

16. Do people die of malaria?
   1. Yes □
   2. No □
   3. Don’t know □

17. Have you ever suffered from malaria?
   1. Yes □
   2. No □
   3. Don’t know □

18. Have any of your children five years and below in the family suffered from malaria during the past one month?
   1. Yes □
   2. No □

19. What do you do when you suspect your child to have malaria?
   1. Take medicine that are in the house □
   2. Buy drugs from shop/chemist □
   3. Visit a government health facility □
4. Visit a private health facility
5. Consult a traditional medicine man
6. Take herbal medicine
7. Did not consider it severe to take action
8. Others specify

20. If no action was taken, what was the main reason?
   1. Long distance to health facility
   2. Restricted by culture
   3. Restricted by religion
   4. Lack of money
   5. Others specify
   6. N/A (action was taken)

21. For how long had your child been ill before the action was taken?
   1. Less than a day
   2. Two days
   3. One week
   4. Two weeks
   5. One month
   6. Two month
   7. Others specify
   8. Don’t know

22. How many times have your child had malaria in the last 3 months?
(If the respondent has not had malaria indicate “0”)
   1. Yes
   2. No
   3. Can’t remember

23. The last time your child had malaria did he/she receive treatment?
   1. Yes
   2. No
   3. Can’t remember

24. If yes, where did you obtain treatment?
   1. Health facility
   2. Traditional medicine practitioner/herbalist
   3. Bought drugs from shop/chemist
   4. None
   5. Others specify
   6. Not applicable

25. How much money did you spend on this treatment? Kshs

26. Which group is mostly affected by malaria?
   1. Children
   2. Pregnant women
   3. Pregnant women and children
   4. Aged/Elderly
   5. Children and aged/elderly
   6. Everybody
   7. Others specify

27. Are there traditional beliefs in your community that explain the cause of malaria?
   1. Yes
   2. No

28. If yes, which are they?
   1. Being rained on
   2. Exposure to cold weather
   3. Eating mangoes
   4. Eating raw fruits
   5. Washing with cold water
   6. Witchcraft
   7. Others specify
   8. N/A

29. How can malaria be best prevented/controlled?
   1. By taking medicine
2. By sleeping under bed nets
3. Eliminating/preventing breeding sites
4. Using repellants/mosquito coils
5. Wearing long clothing
6. Don’t know
7. Others specify

30. Where do mosquitoes breed most?
   1. In discarded containers
   2. Ponds
   3. Bushes
   4. Maize stalks
   5. Dirty water
   6. Pit latrine
   7. Don’t know
   8. Others specify

31. Where do you mostly find mosquitoes in your house?
   1. On walls
   2. On the ceiling/roof
   3. On hanged clothes
   4. Under the bed
   5. Dark places
   6. Others specify

32. What time do mosquitoes bite?
   1. Early in the morning
   2. During the day
   3. Evening
   4. At night
   5. Anytime
   6. Other specify

33. What action do you take to protect child/children from mosquito bites/contact?
   1. Wear protective clothing
   2. Sleep under bed net
   3. Sleep under treated bed net
   4. Use repellants e.g. mosquito coils
   5. House screening
   6. Use of local herbs
   7. Others specify
   8. No Action

SECTION B: USE OF ITNs IN MALARIA PREVENTION/CONTROL

34. Do you know of any ways of preventing malaria?
   1. Yes
   2. No
   3. Don’t know

35. If yes, which method do you commonly/mostly use?
   1. Spray house with insecticides
   2. Mosquito proof house by screening
   3. Use repellant (mosquito coils)
   4. Use repellants (local herbs)
   5. Take preventive medication
   6. Sleeping under mosquito net
   7. Don’t use anything for prevention
   8. Not Applicable
   9. Others specify...
36. Do you know of an insecticide treated mosquito net (ITN)?
   1. Yes ☐
   2. No ☐

37. If yes, where did you get information?
   1. Mass media (Radio, TV, Newspapers) ☐
   2. Relative and friends ☐
   3. School ☐
   4. Public/social meetings ☐
   5. Churches/places of worship ☐
   6. Health personnel ☐
   7. Others specify

38. What does a mosquito net prevent?
   1. Mosquito bites ☐
   2. Malaria ☐
   3. Both mosquito bites and malaria ☐

39. Do you have a mosquito net in the household?
   1. Yes ☐
   2. No ☐

40. How many mosquito nets do you have in your household? (If no net indicate ‘0’)

41. If you do not have a mosquito net what are the reasons.
   1. Lack of money to buy a net ☐
   2. They are expensive ☐
   3. They are not available/accessible ☐
   4. Others specify

42. Of the mosquito nets you have, how many are treated with insecticide? (N/A ☐
   (indicate ‘0’ if no net treated)

43. If none of your net(s) is treated, what is the main reason?
   1. I cannot afford insecticide ☐
   2. Insecticides are not available ☐
   3. Insecticides are harmful ☐
   4. I don’t like the smell of insecticide ☐
   5. Don’t know the insecticide to use ☐
   6. Others specify

44. Where did you obtain your mosquito net? (If more than one, ask the source of the most recent one)
   1. Purchased from the shop ☐
   2. Health facility ☐
   3. Women groups selling nets ☐
   4. Bamako initiative center (BI) ☐
   5. NGO dealing with malaria control ☐
   6. Others specify

45. How much did you pay for your net? (If more than one the most recent one)
   Paid Kshs ☐
   Given free ☐

46. If your net is treated, where did you obtain insecticide?
1. Purchased from a shop/chemist  
2. Health facility  
3. Purchased together with the net  
4. Others

specify

47. What was the cost of insecticide you used to treat your net? (If more than one, the recent one)
Paid Kshs........  
Given free  
Not applicable (no net)

48. Who among your family members use mosquito nets?
1. Mother/Female guardian and children only  
2. Children only  
3. Mother/Female guardian only  
4. Father/Male guardian only  
5. Father and mother (parents) only

49. Did you sleep under mosquito net last night?
1. Yes  
2. No

50. If yes, was the net treated?
1. Yes  
2. No  
3. Don’t know

51. If you did not sleep under net the previous night what is the reason?
1. No money to buy net  
2. No mosquitoes around the house  
3. Do not have a net  
4. Cannot afford enough nets  
5. Mosquito nets not accessible  
6. Not informed on the importance of nets  
7. It was too hot  
8. Others specify....

52. How many of your children five years and below slept under treated mosquito net last night?

53. Did all children below five years sleep under treated mosquito net last night?
1. Yes  
2. No  
3. Not applicable (no net)

54. If the response is NO to the question above, How many children of five years and below slept under untreated net last night?

55. How many children below 5 years did not sleep under net at all?

56. If none of your children below 5 years slept under treated mosquito net what are the reasons?
1. No mosquito net  
2. No mosquitoes  
3. Do not know how to treat net  
4. Not applicable (all children slept under treated net)
3. Mosquito nets cause suffocation □
4. Cannot afford insecticide □ 7. Others specify........................
57. During your last pregnancy (if respondent is female) were you sleeping under a treated mosquito net?
   1. Yes □ 4. Didn’t have a net □
   2. No □ 5. N/A □
   3. Sometimes □
58. Are you pregnant now? (if respondent is female)
   1. Yes □ 3. Don’t know □
   2. No □ 4. Not applicable □
59. Which part/season of the year do you usually use mosquito net?
   1. During rain season □
   2. During dry season □ 6. Not applicable (no net) □
   3. When I see mosquitoes □
   4. Throughout the year □
60. Since your child started sleeping under mosquito net has there been a reduction in Malaria attacks?
   1. Yes □
   2. No □
   3. Not applicable (no net) □

SECTION C: BARRIERS TO NET TREATMENT AND USE
61. Do you know how to treat mosquito net with insecticide?
   1. Yes □
   2. No □
62. Has your mosquito net(s) been treated?
   1. Yes □
   2. No □
   3. N/A (No net) □
63. How often do you treat your mosquito net(s)? (If not long lasting treated net)
   1. Every 3 months □
   2. Every 6 months □
   3. After one year □
   4. Others specify........
64. How many times has your mosquito net been treated?.................. Not applicable (no net or net permanently treated)
   (Indicate ‘0’ if the net has never been treated)
65. Why should mosquito nets be treated? Tick the one considered most important.
   1. To prevent mosquito bites □ 4. Don’t know □
   2. To kill/repel mosquitoes □
   3. To prevent malaria □
66. Which problems are associated with use of treated mosquito net among the children?
   1. Insecticides may be harmful to net users □
   2. Cause dizziness □
   3. Cause sleep disturbance □
   4. People may die due to heavy sweating when sleeping under mosquito net □
   5. None
   6. Others specify..........................
67. Which other factor/barrier hinder acquisition, treatment and use of mosquito nets?

1. Mosquito nets are expensive, hence unaffordable
2. Insecticides are expensive
3. Mosquito nets are not available/accessible
4. Insecticides are not available/accessible
5. They are not considered a priority/not important
6. Lack of knowledge on net treatment
7. Others specify

68. Which approach of net treatment do you prefer? (state the approach even if no net)

1. Individual home treatment (nets with treatment kit)
2. Communal mass treatment (bulk treatment)
3. Others specify

69. Why do you prefer the approach you have chosen or specified above?

70. What are your feelings about this statement? “Consistent and proper use of ITNs which are regularly re-treated with insecticides can greatly prevent and control malaria.”

1. Strongly agree
2. Agree
3. Undecided (neutral)
4. Disagree
5. Strongly disagree

SECTION D: TYPES OF MOSQUITO NETS AND THEIR AVAILABILITY

71. Which type of mosquito net do you have? (If more than one, the one recently obtained)

1. Circular net
2. Rectangular net
3. Wedge shaped net
4. Both circular and rectangular
5. Not applicable (no net)
6. Others specify

72. If you do not have a net which one would you prefer if asked to choose one?

1. Circular net
2. Rectangular net
3. Wedge shaped net
4. Others specify
5. N/A (Has a net)

73. Why do you prefer this particular net you stated either in Q71 or Q72 above?

1. It offers better protection
2. It is easier to hang
3. It is relatively cheap
4. It lasts long
5. It is attractive
6. It is more available
7. Others specify

74. What is the colour of your mosquito net? (If more than one the colour of the most recent one)

1. White
2. Yellow
3. Green
4. Blue
5. Not applicable (no net)
6. Others specify
75. If you do not have a mosquito net, which colour would you prefer if asked to choose?

1. White 4. Blue
2. Yellow 5. Others specify............................

76. Why do you prefer this particular type of colour you have stated either in Q74 or Q75 above?

1. Easier to clean 5. Lasts longer
3. Protects better against mosquito bites 7. Others specify..............
4. Easier to see mosquitoes inside

77. What is the size of the mosquito net you have? 1. Small 2. Medium
3. Large

78. a) How long do you take on foot to reach the nearest place where you can obtain/buy a net?

........... hrs.
1. Less than one hour 4. Six to ten hours
2. One to two hours 5. More than ten hours
3. Three to five hours 6. Don’t know

b) How long do you take by bicycle to reach the nearest place where you can obtain/buy a net?

........... hrs.
1. Less than one hour 4. Six to ten hours
2. One to two hours 5. More than ten hours
3. Three to five hours 6. Don’t know

79a) How long can you take on foot to reach the nearest place you can obtain/buy insecticide for net treatment?........... hrs.

1. Less than one hour 4. Six to ten hours
2. One to two hours 5. More than ten hours
3. Three to five hours 6. Don’t know

b) How long can you take by bicycle to reach the nearest place you can obtain/buy insecticide for net treatment?........... hrs.

1. Less than one hour 4. Six to ten hours
2. One to two hours 5. More than ten hours
3. Three to five hours 6. Don’t know

80. Give suggestion on the most effective way to increase net treatment and use among the under fives in your community?..........................................................
81. Interview the respondent and fill the table below. Confirm by observing

<table>
<thead>
<tr>
<th>HOUSEHOLD MEMBERS</th>
<th>USE OF MOSQUITO NETS</th>
<th>TOTAL NO. OF NETS</th>
<th>TOTAL NO. OF NETS TREATED</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5y</td>
<td>&gt;5y</td>
<td>Pregnant</td>
<td>&lt;5yrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not treated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

82. What is the size of the household? (No. of household members) 

ANY COMMENTS/OBSERVATIONS


7.2: FOCUS GROUP DISCUSSION GUIDE FOR COMMUNITY

1. What are the main health problems in the community?
2. Do you know of a disease called malaria? And what are its local names?
3. Is malaria a problem in this area? If yes, how serious is it?
4. Who are mostly affected by malaria in this community?
5. How is malaria transmitted?
6. What time of year is malaria a problem?
7. What do you do when a child falls ill with malaria?
8. What can be done to prevent and control malaria?
9. What is currently being done to prevent and control malaria in this community?
10. Do you know insecticide treated bed nets? What are its local names, and that for insecticide used for net treatment?
11. If yes, where did you get information?
12. Are ITNS accepted and used in this community?
13. Are they (re) treated with insecticides and how often? On average how many times per year?
14. How often are they washed after treatment and/or before next treatment?
15. Who makes a decision on net acquisition, treatment and use among under fives in a household?
16. Which category of people use ITNs in household and why? Is sharing use of nets a common practice in the area and who shares with who? Is gender an issue in use of ITNs among under fives?
17. What problems are associated with net treatment and use of treated nets among the under fives?
18. What are the barriers hindering net treatment and use among the under fives in this community?
19. Are their any socio-cultural factors affecting net treatment and use among the under fives in this community? If yes which are they?
20. Are the various types of nets and insecticides for treatment readily available and accessible, and at what are their costs?
21. What are your feelings about costs of ITNs compared to costs incurred in other common control methods such as mosquito repellants, spraying etc.?
22. What approaches should be adopted in net treatment (individual or mass communal treatment) and why?
23. Which vulnerable groups should be considered for assistance with nets when available and why?
24. Are there any organizations, institutions or programs that assist people with nets and insecticides for their treatment, for use among the under fives in this community?
25. What can be done to enhance net treatment and use among the under fives in this community?
FROM: Dean
Graduate School

TO: Malusha James Mwashembe
Dept., of Public Health

REF: 157/6032/03

DATE: 23rd May, 2006

SUBJECT: APPROVAL OF YOUR RESEARCH PROPOSAL TITLE

This is to acknowledge receipt of your amended research proposal title. I am glad to inform you that it has now been approved.

J.C. IFUKHO
Dean: GRADUATE SCHOOL.

Cc Registrar (Academic)
Dean, Graduate School – to see on file
Chairman, Dept., of Public Health
Dean, School of Health Sciences
Supervisors: Dr. I. Mwanza
Dr. A. Yitambe
Dr. J.P. Mbugi

J01/wm
7.4 MINISTRY OF EDUCATION AUTHORIZATION

MINISTRY OF SCIENCE & TECHNOLOGY

Telegrams: “SCIENCE TEC”, Nairobi
Fax No. MOS&T 13/001/36C/328/2
Telephone No: 318581
When replying please quote
JOGOO HOUSE “B”
HARAMBEE AVENUE
P.O. Box 60209-00200
NAIROBI
KENYA

James M. Malusha
Kenyatta University
P. O. Box 43844
NAIROBI

Dear Sir

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ‘Factors influencing mosquito net treatment and use among care givers of under fives in Makueni District, Kenya’

I am pleased to inform you that you have been authorized to carry out research in Makueni District for a period ending 31st December 2006.

You are advised to report to the District Commissioner, the District Education Officer and the Medical Officer of Health Makueni before commencing your research project.

It is noted that the research is a requirement in part fulfillment for the award of Masters Degree in Public Health of Kenyatta University.

On completion of your research, you are expected to submit two copies of your research report to this office.

Yours faithfully,

B. O. ADEWA
FOR: PERMANENT SECRETARY

Copy to: The District Commissioner - Makueni District
The District Education Officer - Makueni District
The Medical Officer of Health - Makueni District