DETERMINANTS OF USE OF BED NETS AMONG CHILDREN UNDER FIVE YEARS OLD AND THEIR EFFECT ON PARENTAL REPORT OF MALARIA IN KIBERA, NAIROBI

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Determinants of use of Bed Nets among Children under five years old and their effect on Parental report of Malaria in Kibera, Nairobi

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A Thesis submitted in Partial fulfilment for the Degree of Master of Science in Public Health in the Jomo Kenyatta University of Agriculture and Technology

2015

DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

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DEDICATION

I dedicate this thesis to my parents, Prof. Elijah Ndegwa and Mrs. Rosemary Ndegwa who have given me inestimable support all through.

ACKNOWLEDGEMENTS

I would like to acknowledge the kind assistance of my supervisors Prof Linus M. Gitonga of Karatina University (formerly at JKUAT), Dr Charles Mbakaya of KEMRI and Dr. Virginia Kimani of Pesticides and Agricultural Resource Centre (PARC).

In addition, I would like to acknowledge the assistance given by various staff members at the Centre of Public Health Research (CPHR), Kenya Medical Research Institute (KEMRI) and Jomo Kenyatta University of Agriculture and Technology (JKUAT).

I would also like to acknowledge the valuable assistance afforded by my research assistant Mrs Catherine Njeru of Diverse Gifts Community Based Organisation, Mama Emily and other members of the organisation.

I would like to recognise the moral support, encouragement and prayers afforded by my parents, Prof. and Mrs Ndegwa, my sisters Nyambura and Wanjiku and nephew Mathew.

I would also like to acknowledge the people in Kianda, Raila, Kambi Muru, Soweto West and Gatwekera villages in Kibera who willingly opened their homes and shared their experiences in dealing with malaria with me.

Most important, I recognise that it is God who has enabled me to complete this work. May He receive the glory.

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LIST OF ABBREVIATIONS

ACT	Atemisinin-based Combination Therapies
AL	Artemether-Lumefantrine
AMREF	African Medical Research Foundation
CBO	Community Based Organisation
CBS	Central Bureau of Statistics
CDC	Centers for Disease Control and Prevention
DDT	**D**ichroloro**D**iphenyl**T**richoloroethane
DHS	Demographic Health Survey
ERC	Ethical Review Committee
IIBN	Insecticide-impregnated bed net
IBN	Impregnated bed nets
IRIN	United Nations Office for the Co-ordination of Humanitarian Affairs
IRS	Indoor Residual Spraying
ITN	Insecticide Treated Net
KNBS	Kenya National Bureau of Statistics
LLIN	Long lasting insecticide treated net
MOH	Ministry of Health
MOPHS	Ministry of Public Health and Sanitation

MSF	*Medecins Sans Frontiers*
NGO	Non-Governmental Organisation
PIB	Permethrin-impregnated bed nets
RBM	Roll Back Malaria campaign
RDT	Rapid Diagnostic Test
NDH	National Department of Health (South Africa)
SP	Sulfadoxine-pyrimethamane
SPSS	Statistical Programme for Social Sciences
SSC	Scientific Steering Committee
UN	United Nations
UNICEF	United Nations Children Fund
WHO	World Health Organization

ABSTRACT

Malaria is one of the diseases that contribute to childhood morbidity and mortality in Kenya. In a longitudinal study in several areas in Kenya, the use of ITN to prevent malaria was associated with a 44% decline in child mortality. However, despite campaigns by the Government of Kenya and other stakeholders over several years that have increased the availability and accessibility to bed nets, their use by children under 5 years remains at about half the population in urban areas. These areas, having more access to media and health services, have had the greatest saturation of the beneficial effects of use of bed nets and yet complaints of malaria abound. The study was carried out in 5 villages of Kibera, an informal settlement in Kenya with a population of 170,000 people. The objectives of the study were to establish the extent to which bed nets are used by children under 5 years in Kibera, some of the factors affecting use of nets and what effect the use on nets has on parental reports of malaria among the children. The study surveyed households using questionnaires and observation of bed net use. The findings were that bed net use among children under 5 years is at 54% of the population. However, 75% of children under 5 years were reported to have had malaria in their lifetime in the study area. The major contributing factor appeared to be the fact that many of the available nets were used by more than the recommended number of people hence allowing mosquitoes to bite those at the edges. Bed nets with holes also allowed mosquito's access to those in the bed. These difficulties may be solved by ensuring that only long lasting insecticide treated nets are used since they are more durable, do not have to be retreated and are generally bigger in size. This will go a long way in eliminating the needless suffering that children experience when they are sick with malaria and the deaths that may result from the disease.

CHAPTER ONE

1.0 INTRODUCTION

Malaria is a parasitic disease characterised by fever, chills and headache, which recur at regular intervals. It is by far the world's most significant tropical parasitic disease, and is the second leading communicable disease in terms of deaths (WHO, 2006 a). Malaria is a public health problem in more than 90 countries, inhabited by 2.4 billion people who comprise 40% of the world's population (WHO, 2006 a). It is endemic in a total of 101 countries and territories (WHO, 2006 a). Worldwide prevalence of the disease is about 300-500 million clinical cases each year (WHO, 2006 a). However, more than 90% of all malaria cases occur in sub-Saharan Africa (WHO, 2006 a). Malaria is caused by four types of *Plasmodium* parasite: *Plasmodium falciparum* (the most dangerous), *Plasmodium vivax, Plasmodium ovale and Plasmodium malariae*. The *Anopheles* species of mosquito carries the malaria causing parasites. The primary malaria vectors in Africa include: *Anopheles gambiae* and *Anopheles funestus* which are strongly anthropophilic and, consequently, are two of the most efficient malaria vectors in the world (NDH, 2006). In areas of Africa where malaria is more stable such as in Angola, Malawi, Mozambique, Tanzania, and Zambia, *Anopheles gambiae* is the main vector (NDH, 2006). *Anopheles arabiensis* is the predominant vector particularly in the epidemic prone countries such as Botswana, Namibia, South Africa, Swaziland and Zimbabwe (NDH, 2006). There are 30 species of *Anopheles* mosquitoes that can transmit malaria (NDH, 2006). In Kibera, it was found that the main vector was *Anopheles gambiae* (R. Kimutai, Personal Communication, 9 July, 2000).

Urban malaria is an increasing danger in sub-Saharan Africa given that there are 300 million people living within these areas. The UN forecasts that by 2025, over 800 million people will live in urban areas in Africa. This will be about half the population of the continent (UN, 2002). A study by Robert *et al* that summarised various studies carried out on malaria transmission in about 40 African cities

surmised that there was evidence of urban malaria transmission (Robert *et al.*, 2003). Some of the factors influencing urban transmission include urban farming that increases vegetation which serves as vector resting areas. Another factor is collection of water in vessels such as tyres, potholes and holes excavated for building which harbour mosquito larvae (Robert *et al.*, 2003). The study by Robert *et al* also noted that the large number of people living in close proximity to mosquito habitats increases blood meals available for the mosquitoes and as a result, there is potential for a greater number of infective bites when mosquitoes are carrying the *Plasmodium* parasite.

Malaria has been one of the causes of high morbidity and mortality among children under 5 years in Kenya but there has been a gradual reduction of morbidity and mortality due to a concerted effort using various methods to reduce the disease burden among Kenyan children. One of the important steps in this reduction has been the use of Insecticide Treated Nets (ITNs).

A number of studies have demonstrated the protective efficacy and effectiveness in addition to the cost effectiveness of ITNs. Lengeler reviewed these studies, and assessed 81 trials and over 30 descriptive studies carried out in every type of malaria setting worldwide documenting the positive impact of ITNs on child and adult morbidity and mortality (Lengeler, 2004). Diallo *et al*. (2004) found that the probability of a child dying before his/her fifth birthday was reduced from 240 per 1000 to 170 per 1000, a difference of 29%, with the use of a bed net. The study surmised that few other child survival interventions are currently as effective. In a longitudinal study by Fegan *et al.* in several rural areas in Kenya, the use of ITNs was associated with a 44% decline in child mortality (Fegan *et al.*, 2007).

When this research commenced, the Kenya Demographic Health Survey (2003) was in use and it showed a low use of bed nets by children under 5 years in the whole

country with the highest use being 35% among urban dwellers (CBS, 2003). However, while this research was still in progress, new Demographic Health Survey results were released in 2010 (DHS 2010) which showed an urban bed net use rate of 64% (KNBS, 2010). Another study by Noor *et al*. (2007) had shown that bed net coverage has greatly increased even among rural communities, which had lagged behind in use of bed nets. This has been facilitated by the distribution of bed nets in clinics and free mass distribution of bed nets to the population at risk, resulting in coverage of over 65% in some rural areas by the year 2007. In addition, separate studies by Fegan *et. al* and Okiro *et al*. that have indicated a trend towards reduction of this rate of morbidity and mortality in several areas in Kenya, including Kisii, Bondo, Makueni and Kwale (Fegan *et al.*, 2007; Okiro *et al.*, 2007). However, a study of urban low income residential area coverage with bed nets during the same period has not been undertaken.

1.1 Statement of the problem

Malaria is one of the causes of high morbidity and mortality among children under 5 years in Kenya and accounts for 25% of deaths in this group (WHO, 2005 a). Malaria also continues to be a major health complaint among urban informal settlement dwellers (Ye *et al.*, 2007; IRIN, 2007). The extent of bed net use among informal settlement dwellers is not well documented. This is because the statistics in the Demographic Health Surveys are not disaggregated to bring out clearly the use of ITNs among this particular category of urban dwellers. This study, therefore, sought to investigate factors that influence daily use of bed nets by children under 5 years old in Kibera, the largest informal settlement in Kenya.

1.2 Justification

With ITN use, all cause-mortality in children has been shown to decline by 44% in Kenya (Fegan *et al.*, 2007). Based on findings such as these, the promotion of ITN use has become a central element of national and international efforts against malaria. There is a gap in information as to what factors influence the use of bed nets in informal settlement areas in Nairobi where malaria is perceived to be a significant problem by the dwellers. This research sought to assess how well the vulnerable groups are utilising the ITNs given that the ideal scenario was daily use and retreatment of ITNs every 6 months based on the government's ITN Strategy Paper when the study commenced (MOH, 2001). The more current Kenya National Malaria Strategy of 2009 notes that "The Ministry of Public Health and Sanitation 2008 – 2012 Strategic Plan considers malaria control a priority investment necessary for the realisation of Kenya Vision 2030"(MOPHS, 2009).

Kibera is home to 170,000 people (KNBS, 2010). This population represents a sizeable proportion of the low income residents of Nairobi. Reports from several informal settlement areas in Nairobi including Kibera, Viwandani and Korogocho have shown that malaria is perceived to be the highest cause of illness among the adult residents (IRIN, 2007; Ye *et al.*, 2007). The specific target of this study was children under 5 years old who are categorised as a vulnerable group. In addition, the study sought to find out if parental reports of malaria are accurate based on malaria diagnosis recorded in clinics and hospitals. The previous studies carried out among the informal settlement residents were based on self-reported cases of malaria. It has been found that in low transmission settings, such as Nairobi, as few as 1% of those given antimalarial treatment have parasites (Whitty *et al*., 2008). One of the objectives of the study, therefore, was to establish whether the parental report of malaria actually corresponds to clinical diagnosis of the same in Kibera.

1.3 Hypothesis

$H_{O:}$ Parents who used bed nets on their children who are under 5 years old and those who do not use bed nets on their children who are under 5 years old report the same prevalence of malaria.

H_A: Parents who use bed nets on their children who are under 5 years old report less prevalence of malaria than those who do not use bed nets on their children who are under 5 years old.

1.4 General Objective

To determine the extent of bed net use among children under 5 year old in Kibera, some of the factors affecting the use of bed nets and the effect the use of bed nets has on the parental report of malaria.

1.4.1 Specific objectives

1. To determine knowledge of the proper use of bed nets among parents of children under 5 years old in Kibera.
2. To ascertain the number of households with bed nets and the characteristics of those nets among parents of children under 5 years old in Kibera.
3. To determine knowledge of malaria among parents of children under 5 years old in Kibera.
4. To determine the parental report of malaria among children under 5 years old in Kibera.

1.5 Study Assumptions

The study assumption was that given the large body of information available on the usefulness of bed nets in preventing malaria, more people will want to use bed nets for personal protection. This is based on the Health Belief Model, which is driven by the premise that behaviour change must be preceded by knowledge change (Macintyre *et al.*, 2002).

1.6 Expected Utilisation of Results

This research study was primarily to fulfil the requirements leading to the award of a Master of Science in Public health. It also generated material that was used to submit an article published in the African Journal of Health Science (Jan-March 2014, ISSN 2306-1987, vol 27, no.1, issue no. 47). However, the study would also be of interest to the Government of Kenya, which considers malaria a public health concern and thus includes prevalence of bed net and ITN use in the Demographic Health Surveys (DHS). It will also be useful in determining the progress of Kibera in achieving the targets set by Kenya Vision 2030 which considers malaria control a priority. It would also be of interest to the Roll Back Malaria (RBM) program within the World Health Organisation, which monitors the use of all methods used in reducing the morbidity and mortality associated with malaria. It would be of use to non-governmental organisations involved in the field of malaria control.

1.7 Study limitations

The research was based on anticipated truthful responses about bed net use among the study group and not direct observation of the children while asleep and therefore, errors could have been introduced. The study sought to control these errors by asking two independent questions to verify the information provided by the respondents. These questions were whether the child uses a net and whether the

child used the net the previous night. There could also have been recall bias since frequency of bed net use is one of the questions that was asked and it requires accurate recall of how many times the bed net has been used in the past.

CHAPTER TWO

2.0 LITERATURE REVIEW BACKGROUND

Dealing with malaria in the urban context is critical given the high rate of urbanization in Africa (UN, 2002). It has been noted that transmission is taking place in a large number of African cities (Robert *et al.*, 2003). The malaria problem is further compounded by the development of *Plasmodium falciparum* resistance to chloroquine and sulfadoxine-pyrimethamane (SP), the high cost of replacement anti-malarials, and vector resistance to the cheaper insecticides such as DDT, in addition to the limited use of indoor residual spraying (Shiff, 2002). The diagnosis and treatment of malaria are costly processes though subsidized to the public by the government. Indeed, a study by White *et al.* comparing the cost of diagnosis and treatment of malaria with ITN distribution showed that the cost of ITN distribution was cheaper than diagnosis and treatment (White *et al*, 2011). The use of bed nets therefore would save the economy a great deal of money and save many children from the trauma of going through malaria and the attendant complications.

2.1 Malaria in children under five years

Malaria results in 8% of under 5 year old deaths worldwide, which amounts to 776,000 child deaths annually (UNICEF, 2007). In sub-Saharan Africa, malaria accounts for about one death in every five children (UNICEF, 2007). In Kenya, in the earlier years of the millennium, it was estimated that 25% of children under 5 years experienced malaria each year (WHO, 2005 a). The symptoms of malaria among children include lack of appetite, dullness, headache, high fever followed by sweating and chills, vomiting and muscle aches (WHO, 2006 b). Malaria therefore contributes to a decrease in a child nutritional status since nutritional status is affected by vomiting and lack of appetite during bouts of malaria and malaria related anaemia. In children who experience repeated bouts of malaria, the ensuing

vomiting and lack of appetite can cause malnutrition which is an underlying cause in more than half of deaths among children under 5 years (Bates *et al.*, 2004).

2.2 Malaria in Urban Areas

The United Nations has noted that the urban population in Africa will stand at 800 million by the year 2025 (UN, 2002). This projection and the warming trends in many high altitude areas could lead to more vector density meaning that malaria transmission could become more serious (Pascual *et al.*, 2006). Because they are poor, many migrants to urban areas live in crowded poorly constructed homes. It has been noted that human-mosquito contact is influenced by housing type and materials used in building (Robert *et al.*, 2003). Because many of the poor live in houses that are made of mud, have gaps between the wall and the roof and have windows with no screens, they allow for free entry of mosquitoes. The poor also live in areas that lack good sanitation and drainage facilities, which increase vector breeding and human-vector contact (Martens & Hall, 2000). This is the case in Kibera where there is no set place for solid waste disposal or good drainage. In addition, in urban areas, the poor cultivate plots along watercourses thereby exposing themselves to mosquitoes that inhabit such areas. In Kibera, there is cultivation taking place in "islands" formed on Nairobi dam where siltation has taken place and also along the course of the Mbagathi River.

A study documented by Bhattacharya in West Africa showed that malaria was being transmitted in cities through urban agriculture. The study in Kumasi, Ghana showed that 33% of children had malaria despite having no recent history of travel, which suggested that the infection had been transmitted in the city (Bhattacharya, 2004).

Nairobi is considered a region with a low prevalence of malaria (Zurovac *et al.*, 2008). This is because of its urban environment and its location at an altitude of 1600 metres above sea level, which leads to cool conditions (IRIN, 2007). However,

in 1999, a Walter Reed Research centre study in 12 health centres in Nairobi found that more than 40% of children were microscopically diagnosed as having malaria even though they had no history of having left the city during the previous three months. Many infected children came from Kibera. An investigation in the area found that the predominant vector was *Anopheles arabiensis* ((R. Kimutai, Personal Communication, 9 July, 2010).

2.3 Awareness of Malaria

Due to an extensive education campaign all over the world with the Roll Back Malaria (RBM) campaign, many parents are aware of the symptoms associated with and causes of malaria. This has been found to be the case in studies carried out in Kenya and Uganda (Hamel *et al.*, 2001; Ndyomugyenyi *et al.*, 2006). This awareness, however, has not led to the increased use of bed nets among children under 5 years old universally because of various reasons, some to do with the parents, the children and the house setting (Alaii *et al.*, 2003). In addition, whereas most parents know the symptoms of malaria, they do not take children to hospital promptly. According to the WHO 2006 guidelines, children should be taken to hospital within 24 hours of onset of fever (WHO, 2006 b). A majority of the children were taken to hospital after two days on average when home treatment with fever-reducing medicine or antimalarial drugs had failed to reduce the fever (Hamel *et al.*, 2001; Kemble *et al*.; 2006; Abuya *et al.*, 2007). Many parents also treated children with medicines bought over the counter rather than prescribed by doctors, as well as drugs which had been left over from previous episodes of malaria or fever. This could lead to problems of under-dosing or overdosing (Hamel *et al.*, 2001; Abuya *et al.*, 2007).

Studies by the United Nations and Yé *et al*. have indicated that a large number of people especially in informal settlement areas perceive malaria to be a health problem in Nairobi (IRIN, 2007; Yé *et al*., 2007). It is not clear whether this

perception of malaria corresponds to actual presence of malaria parasite in an area of low prevalence. Other studies by Reyburn *et al* and Chandler *et al*. have noted that over diagnosis of malaria is a problem even in clinical settings (Reyburn *et al*., 2004; Chandler *et al.*, 2008). This situation leads to fever from other infections not being appropriately treated, with detrimental results to the child. Whereas many parents perceive their febrile children as having malaria, it could be that they do not actually have malaria. In the clinical setting, presumptively treating for malaria in a low prevalence setting may result in a large waste of resources on drugs that are not required (Joshi *et al.,* 2008).

2.4 Methods used to control malaria

One of the methods used to control malaria in Kenya is chemotherapy. Mortality is reduced by using medication to treat microscopically confirmed or rapid diagnostic test (RDT) positive cases of malaria. The recommended drug to treat malaria is artemether-lumefantrine (AL), one of the Artemisinin-based combination therapies (Whitty *et al*, 2008). In addition, vulnerable groups such as pregnant women are treated with sulfadoxine-pyrimethamane (SP) under the intermittent preventive treatment regime (Zurovac *et al.*, 2008). However, chemotherapy by itself is not a means of controlling malaria since it is mostly reactive not proactive. It also involves constant vigilance for resistance to treatment, which requires a lot of resources. This is because of increasing resistance of the *Plasmodium* parasite to drugs such as chloroquine and SP due to inappropriate and ineffective use of the drugs (Talisuna *et al.,* 2004)). Artemisinin-based combination therapies (ACT) are also not available for use in the most vulnerable groups including infants below five kilogrammes in weight and pregnant women in the first trimester (Zurovac *et al.*, 2008). Furthermore, these drugs cost 10-15 times more than chloroquine and SP (IRIN, 2006). However, this cost is borne by the government since treatment for malaria is free in all government hospitals. Nevertheless, the cost is higher to the populace since government revenue comes from taxes. In addition, there have been

some disturbing discoveries of fake ACT drugs mostly in Asia and also in East Africa which could have serious repercussions if widespread (Newton *et al.*, 2006).

Other methods used to control transmission of malaria have an effect on both morbidity and mortality. They include indoor residual (IRS) spraying with insecticides, destroying mosquito larva breeding areas and the use of insecticide treated nets (WHO, 2001). IRS has been a major method of malaria control in many countries since the early parts of the twentieth century when DDT was discovered (WHO, 2001). It is effective against the *Anopheles* mosquitoes because they rest indoors. IRS, however, requires considerable resources on the part of the authorities and is disruptive to people in the houses (WHO, 2001). On a large scale, IRS has been seen to be more cost effective for the individual as the cost is borne by the government (Guyatt & Snow., 2002). However, for sustainability, the cost has to be manageable. In 2008, the government of Kenya used Ksh. 1.4 billion (US$ 19 million) for IRS in 16 highland epidemic prone districts (J. Sang, Personal communication, 21 May, 2010). These sums of money are difficult for a government in a developing country to set aside just for one disease.

Destruction of mosquito larva breeding areas has also been used with some success. However, the *Anopheles* species of mosquitoes are opportunistic breeders and will breed in any open sunlit pool or small stream making it difficult to target all of them (Omlin *et al.*, 2007). The adaptability of the *Anopheles* mosquito to oviposition in various settings such as ground pools and tree holes has also been demonstrated, further illustrating the difficulty of dealing with all mosquito larva-breeding areas (Omlin *et al.*, 2007).

Other methods used to control malaria include use of aerosol sprays, mosquito coils and burning herbs, among others. The pricing of these products in Kenya (2002) was that a packet of 10 mosquito coils cost Ksh. 30 (equivalent to US$.38 cents), and a

single coil was available at Ksh. 3.50 each. Aerosol sprays such as Doom™ cost between Ksh. 120 and 220 (US$1.50 to $2.82), while bed nets cost between from Ksh. 350.00 to 750.00 (US$4.50 to $10.00) (Macintyre *et al.*, 2002). The people in poor households in the Macintyre *et al* study reported using coils or sprays more often than those in the richer households. Cumulatively, these methods are more expensive in the long run. The respondents from richer household used bed nets more and as can be deduced from the pricing above, they are cheaper in the long run (Macintyre *et al.*, 2002).

Use of Insecticide Treated Nets (ITNs) also referred to as insecticide-impregnated bed nets (IIBNs) or impregnated bed nets (IBNs) or Permethrin-Impregnated Bed nets (PIB) has been shown to be effective whereby the net serves as the vehicle for the insecticide (Lengeler, 2004). However, ITN effectiveness requires extensive coverage and proper treatment of nets with insecticide (Shiff, 2002).

2.5 Use of bed nets

In Africa, a survey in several countries done by Monasch *et al*. found that the use of any net for children less than five years old was less than 40% overall in all but The Gambia, Guinea-Bissau and Sao Tome and Principe. The survey found that in 23 countries, ITN use for children less than five years old was at or less than 5% (Monasch *et al.*, 2004). In Kenya, estimates of ITN coverage from the Demographic Health Survey (DHS) 2003 indicated that Under 5 ITN use was highest in the urban population. Under 5 year old net use was about 35% in urban areas and 10% in rural areas (CBS 2003). The use of bed nets, however, improved considerably in five years so that the DHS 2008 indicated that urban bed net use had risen to 64% (KNBS, 2010). Studies in Eritrea have shown that the greatest benefit of nets is realised when there is one ITN per two people based on the assumption that on average, two people share one bed (Macintyre *et al*., 2006).

In the early part of the new millennium, the Government of Kenya committed to increasing the use of ITNs according to the targets set by the Roll Back Malaria initiative. At the beginning of the year 2000, the United Nations declared the years 2001 – 2010 to be the United Nations decade to Roll Back Malaria (WHO, 2005b). The long-term vision of the Ministry of Health Insecticide Treated Nets Strategy 2001 – 2006 was to ensure that within 10 - 20 years ITN use would become a social norm in most parts of Kenya affected by malaria (MOH, 2001). According to the World Malaria Report 2013, we find that ITNs were by far the greatest item of the Kenyan government expenditure in 2012. Furthermore, the government plans to double the amount spent on malaria prevention strategies by 2017 compared to the amount spent on case management (MOPHS, 2009).

In addition to preventing malaria and other mosquito borne diseases, there are collateral benefits associated with using ITNs. These nets also kill bedbugs, cockroaches, lice and fleas. They keep away rats and snakes and also prevent roof debris from falling on the sleeping person. They are also used for decoration and privacy (Aikins *et al.*, 1994).

2.6 Challenges in the use of ITNs

In one study in Kenya, a number of factors negatively affecting use of bed nets were identified including: it being too hot under the net, there being no mosquitoes, disruption of sleeping arrangements, the child's net being used by another person, forgetting to put up the net, the child being sick, the child usually being at another house, the child fearing that ants would climb up the net, there being no room to hang the child's net, house reconstruction affecting net use, the net being too small for the bed or mat, the roof leaking so the net could not be spread out, the child's net being mended, the net being torn, the net being washed and the net being lost or stored (Alaii *et al.*, 2003). Another study indicated that the a lower level of education by the head of household, the child not recently having been sick and

having more children under the age of five in a household resulted in a lower use of bed nets among children under 5 years old (Basteiro-Garcia *et al*, 2011)

It has also been found that nets, especially untreated ones, must be free of many large holes since these allow mosquitoes in. One study found that a net would be considered to be in bad condition if it has 7 large holes with a diameter greater than 2 cm and it would, therefore, be of very little use in preventing mosquito bites (Erlanger *et al*., 2004). The net must also be hung in such a way as to cover the whole bed and be of a suitable size for the bed so as to prevent bites through the net since it acts as a barrier to mosquito bites.

Before the universal acceptance of LLIN as the gold standard in bed nets, another consideration for a good bed net was treatment with an insecticide to enhance its effectiveness against mosquitoes. However, an Armstrong-Schellenberg study found that only 5 – 30% of people who had ITNs re-treated their nets (Armstrong-Schellenberg *et al.,* 2002). Some of the factors implicated included resistance of *Culex quinqefasciatus*, a nuisance biter, to pyrethroids, which demotivated people from re-treating their nets since their primary motivation for having a net was to avoid disturbance from mosquitoes and not to prevent malaria (Armstrong-Schellenberg *et al*., 2002). Some people were also concerned about toxicity of the insecticide to children. There were also some side effects such as nasal irritation, sneezing and running nose associated with use of *lambdacyhalothrin* on the nets when they had been freshly retreated (Erlanger *et al*., 2004). Some other factors involved cost which came into play when one had a large number of nets to be retreated in the household and also the inconvenience of the added time required to treat the net after washing (Erlanger *et al*., 2004).

The development of bed nets pre-treated with insecticide, the Long Lasting Impregnated Nets (LLINs), that lasts the life span of the net, was the solution to the difficulty of the low retreatment rates of bed nets (WHO, 2005 b). The LLINs

reduced the environmental impact of insecticides as compared to ITNs by limiting the release of insecticide into water bodies during washing. Human exposure to insecticides was also reduced thus eliminating the irritation that arose during treatment of ITNs (WHO, 2005 b). The fact that LLINs can be washed and the level of insecticide remains effective against mosquitoes was an important consideration.

2.7 The gold standard of a bed net

In general, synthetic materials (polyester, nylon) are preferred because:

1. they are generally cheaper than cotton materials;
2. they are easier to impregnate with insecticide;
3. they absorb less insecticide;
4. less insecticide is lost during washing and drying;
5. they are more durable; and
6. they allow more aeration to the net users (WHO, 2005 b).

When selecting nets, the other important factors to be considered are:

a) Mesh – the number of holes per square inch. For example, a 156 mesh net has 12x13 holes per sq. inch, and a 196 mesh net has 14x14 holes per sq. inch. A wider mesh allows better ventilation. The 156 mesh is considered the standard for bed nets (WHO, 2005 b).

b) Denier – the strength of the thread expressed as the weight of 9,000 metres of thread in grams. Three options, 40, 75 and 100 deniers are available at present. Of these, the 40 and 75 denier nets are considered too fragile (WHO, 2005 b).

The 100 denier 156 mesh net is therefore the best bed net as it is the strongest and provides more durability against wear, tear and use. The extra cost for this compared to the lower denier ones is considered worthwhile (WHO, 2005 b).

The best net is one that has the above mentioned characteristics and is enhanced by impregnation with insecticides resulting in a long lasting insecticide treated net (LLIN) such as those in the Table 2.1.

Table 2.1 PCPB registered LLINs in Kenya

Trade Name	**Insecticide impregnated with**
Dawa Plus LLIN	Deltamethrin 80mg/m^2
Duranet LLIN	Alphacypermethrin 0.55% w/w
Interceptor LLIN	Alphacypermethrin 180 – 220 mg/m^2
MagNet LLIN	Alphacypermethrin 5.8g/kg
Net Protect LLIN	Deltamethrin 60mg/m^2
Olyset Classic/Olyset Net	Permethrin 2% w/w
Permanet LLIN	Deltamethrin 55gm/m^2
Santeroi Net	Permethrin 2% w/w
Yarkool LLIN	Deltamethrin 55gm/m^2

(Source Pest Control Products Board, www.pcpb.or.ke)

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study Location

The study was carried out in the Kibera area of Nairobi in 2010. This is a low-income residential area with a high population density. Plate 3.1 illustrates the dense clustering of the structures in Kibera. There are several sub locations within Kibera Division including Mugumoini, Laini Saba, Nyayo Highrise and Silanga. The villages within these sub locations are Laini Saba, Kianda, Kisumu Ndogo, Lindi, Makina, Mashimoni, Soweto East and Soweto West, Silanga Raila, Kambi Muru and Gatwekera. A sketch of the area villages is shown in Figure 3.1. According to the National Census of 2009 and contrary to many previous estimates, the population of Kibera was reported to be 170,000 people (KNBS, 2011).

This study was conducted in five of the villages in order to obtain a balanced view of the factors of interest to the study. The villages were Raila, Kianda, Gatwekera, Soweto West and Kambi Muru. A combination of the clustered sampling method and random sampling method were used. The villages represented the clusters and simple random sampling was used to select the first household in each cluster. A systematic sampling method was used after identifying the first house based on the availability of respondents.

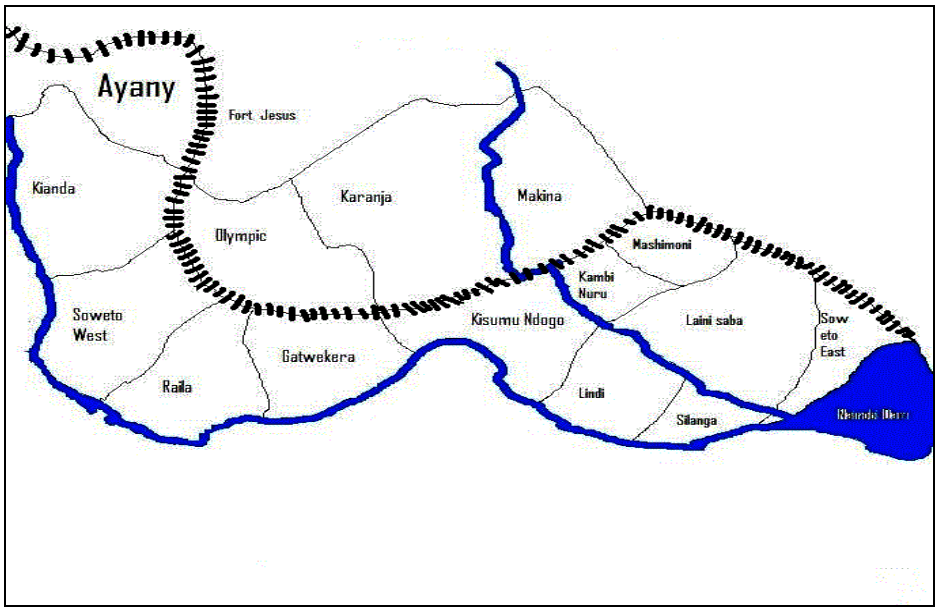

Figure 3.1: A sketch of Kibera villages

Plate 3.1: Dense clustering of structures in Kibera

Plate 3.2: Poor housing and sanitation facilities characteristic of Kibera

The characteristics of this area include lack of sanitation facilities such as running water, sewage system or defined solid waste disposal sites. As is demonstrated by Plate 3.2, the sanitation facilities are not of a good quality and much of the sewage is disposed of by being washed away by rain into the rivers. The Plate also displays the cost of using the sanitation facilities. Since a number of people are too poor to afford the pay per use facilities available, there are problems of human waste disposal resulting in "flying toilets" in the area.

Plate 3.3: Waste disposal in undesignated areas in Kibera

Plate 3.4: Kibera waste washed into Nairobi Dam by flood water

Plate 3.3 shows how a lot of the solid waste is disposed of on the walk ways. Garbage is also disposed of into the trenches, gullies and streams crisscrossing the

villages and ends up in rivers and Nairobi Dam. Plate 3.4 shows how waste from Kibera is washed into Nairobi Dam when it rains. The Dam borders Soweto East and Silanga villages in Kibera and when it rains the solid waste and sewage in the area is washed through trenches and gullies within the villages into the dam. The dam creates a suitable environment for mosquitoes to breed as it has thickets surrounding it. In addition the dam has areas where siltation has created tracts of land and "islands". These areas have thickets and agriculture is also taking place creating suitable mosquito breeding sites. At the other end of Kibera is the Mbagathi River which is another drainage area for waste water, sewage and solid waste from several villages such as Kianda and Raila. This river is more like a slow moving stream as it is clogged with garbage and waste material. However, thickets surrounding it also create potential breeding and hiding places for mosquitoes.

3.2 Study Design

The study was cross sectional. Questionnaires were administered by the investigator to access the extent and use of bed nets in February 2010 (Appendix 1 and 2). The questionnaires had been pretested by the investigator among friends and family members with children under 5 years old. An observation of the presence of nets within the household (Appendix 3), their placement (whether they adequately covered the bed) and condition (the number of holes and their size), was also undertaken while the interview was on going. The study also involved an enumeration of the cases of malaria among the children less than five years at the time of the study. In addition, a history of incidents of malaria and history of the use of bed nets was taken. Questionnaires were administered to the head of household when they were available or to any other adult with the children at the time. One questionnaire per household was administered and data collected on the youngest child in the households. To verify report of malaria among the children, medical records were also examined from two health centres in the Kibera area: Ushirika Clinic in Kianda Village and Mbagathi District Hospital. The validity and reliability of the data was ensured by using these multiple independent sources of data.

3.3 Study Population

The study sought to get information on the under 5-year age group but also assessed the total household bed net use. The sample covered the villages of Kianda, Soweto West, Raila, Gatwekera, and Kambi Muru, which are adjacent to each other in an eastward direction. Furthermore, since the study was carried out partially within the membership of certain Community Based Organisations (CBOs), a number of respondents from these CBOs were incorporated into the study since they fitted within the inclusion criteria. When the required sample size was attained, no further questionnaires were administered in subsequent villages. These villages all have environmental factors that encourage mosquitoes to thrive such as open drains and dumpsites in various places.

3.3.1 Inclusion Criteria

Households where consent was provided
Households with children below 5 years of age

3.3.2 Exclusion Criteria

Households where consent was not given
Households with no children below 5 years of age

3.4 Sample Size Calculation

The following formula from Cochran's (1977) book *Sampling Techniques* was used to determine the sample size. A 90% level of confidence was used in this research as this is an acceptable level in scientific studies (Duflo *et al.*, 2006).

$$\mathbf{n} = \frac{\mathbf{Z^2pq}}{\mathbf{d^2}}$$

Where n = sample size

Z = 1.645 (corresponding to a 90% confidence level)

p = 0.35 (anticipated proportion of population that will have characteristic under study. The DHS 2003 indicate a bed net use of about 35% among the urban population)

q = 1 – p = 0.65

d = 0.1 (margin of error)

Therefore $n = \frac{1.645^2 \text{ X } 0.35 \text{ X } 0.65}{0.1^2} = 62$

A 10% non-response rate was assumed so the total number of households to be sampled was 68. However, to incorporate members of the afore mentioned CBOs into the study, twenty seven respondents who were residents of Kibera and fit the inclusion criteria, were randomly sampled and included leading to a total sample size of 95.

3.5 Sampling Procedures

Out of the households randomly selected, a door knock campaign was undertaken. Data was collected on the observed nets and the questionnaire administered to the head of household if available or any other adult with the children at the time (See Appendix 1 and 2 for the questionnaire and Appendix 3 for the net observation form).

3.6. Outcome Variables

3.6.1 Independent Variables

1. Awareness of cause of malaria
2. Awareness of how to prevent malaria
3. Village of residence

4. Holes on bed net
5. Use of other mosquito repellents

3.6.2 Dependent Variables

1. Parental report of malaria
2. Malaria report in health institutions in Kibera

3.7 Data Collection

To determine the first objective of the study which concerned proper use of bed nets an assessment was made of good or poor knowledge based on an aggregation of responses to various questions. To determine the second objective of the study, the presence, condition and placement of the net were ascertained by observation. The third objective involved knowledge of malaria which was determined by several questions and an assessment made of good or poor knowledge was based on an aggregation of responses. To address the fourth objective of the study on parental report of malaria, report of malaria in the youngest child in the household was requested at the time of the study. A perusal of medical records at nearby health facilities was also undertaken.

3.8 Data Management and Analysis

Data was collected and recorded in the questionnaires. It was entered into a Microsoft Excel database then imported into SPSS after validation. Percentages and frequencies were used to analyse the distribution of single variables whereas Fisher's Extract and Chi square (χ^2) tests were used to summarise the distribution of two variables such as to compare the results of report of malaria among parents who use nets and those who do not use nets, to compare use of bed nets among parents with a

good knowledge of malaria versus those without good knowledge and to compare report of malaria among parents whose bed nets had holes and those which did not have holes. Storage of data was done on computer hard drive and flash disk.

3.9 Ethical Considerations

Approval to carry out the research was provided by the Scientific Steering Committee (SSC) of KEMRI (Appendix 10) and KEMRI National Ethical Review Committee (ERC) (Appendix 11) in addition to the District Commissioner, Langata.

All participants received a consent explanation form (Appendix 4 and 5), consent form (Appendix 6 and 7) and the questionnaire (Appendix 1 and 2). All information they provided was held in confidence and no names were required, only identification numbers. Participation in the study was entirely voluntary. Observation of net use was minimally intrusive as the study was carried out during the day when people were not asleep. Participants also received a health information sheet on the benefits of using bed nets and ITNs in particular (Appendix 8 and 9).

CHAPTER FOUR

4.0 RESULTS, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

4.1 Results

4.1.1 Demographics of the Respondents

The survey commenced in Kianda which is at the furthest west end of Kibera and 44 respondents were available to complete the questionnaire. Moving east in a systematic manner, only 3 respondents were available in Soweto West. In Raila, 24 respondents were available to complete the questionnaire. Only 3 respondents were found in Gatwekera because it was considered to be unsafe and so was Kisumu Ndogo which is next to it in an easterly direction. The next village was Kambi Muru where the required number of respondents was found and the required sample was achieved. Fig 3.1 illustrates the layout of the villages. Table 4.1 gives a breakdown of the villages and the bed net use and it can be seen that there is no statistically significant association between village of residence and use of bed net.

Table 4.1: Association of village of residence and the use of bed net

Village of residence and use of bed net				
	Use of net			
Village of residence	**Yes**	**No**	**Total**	**Chi Square**
Raila	13	11	**24**	**0.06**
Kianda	20	24	**44**	**2.27**
Kambi Muru	14	7	**21**	**1.91**
				Fishers Extract
Gatwekera	2	1	**3**	**p = 1**
Soweto West	2	1	**3**	**p = 1**
Total	51	44	**95**	

Note: $\chi^2 > 2.71$ and $p < 0.1$ at a 90% confidence

The median age of the children in the study was 18 months. The percentages and number of children in each household are indicated in Table 4.2.

Table 4.2: Number of children under 5 years old in each household

Number of children in the household	Frequency of respondent	Percent of total response
1	54	56.8
2	33	34.7
3	8	8.4
Total	95	100.0

4.1.2 Perception of cause and symptoms of malaria

To assess knowledge of malaria, an aggregation of responses to several questions was used. They included what causes malaria, what the signs are that a child has malaria, who is most vulnerable to malaria and how malaria is prevented. Getting three and above answers right out of four was considered to indicate good knowledge whereas getting two or less answers right was considered bad knowledge. The percentage of respondents who had good knowledge of malaria was 88% (n = 84/95).

To illustrate the results of an assessment of knowledge of malaria versus bed net use, an aggregate of the responses that indicated good knowledge or bad knowledge was tabulated against the use or non-use of bed nets as shown in Figure 4.1.

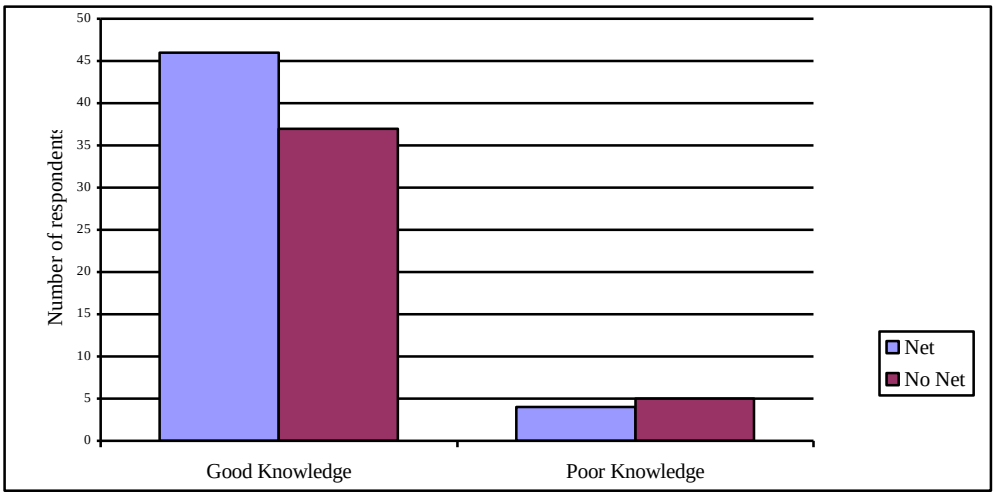

Figure 4.1: Knowledge of malaria versus bed net use among Kibera residents

The key question in assessing good knowledge of malaria was "what causes malaria?" Figure 4.2 illustrates, 85 parents representing 90% of the respondents correctly indicated that mosquito bite as the cause. Some responses given to the question on causes of malaria in the category "other" included waste water in the environment and unclean air.

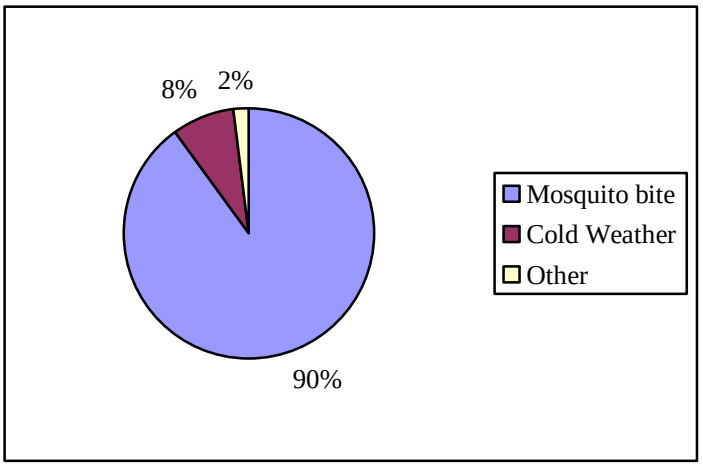

Figure 4.2: Awareness of cause of malaria among Kibera residents

Table 4.3: Kibera residents knowledge of the symtomps of malaria

Symptoms of malaria	Frequency of respondent	Percent of total response
Fever and chills	52	54.7
Muscle ache and headache	19	20.0
Cough and running nose	4	4.2
Diarrhoea and vomitting	8	8.4
Several of the reasons	12	12.6
Total	95	100.0

Some respondents also cited dullness and lack of appetite in a child as signs they associated with malaria.

Eighty two parents representing 88% of respondents were aware that malaria can be prevented by use of bed nets. Some of the symptoms parents associated with malaria are tabulated in Table 4.3. .

In addition, 55% of the respondents were aware that pregnant women and children were most vulnerable to malaria. Most of the respondents (56/95) got the information they had about malaria from a healthcare provider while 26% got their information from the media.

An analysis of whether awareness of what causes malaria had any bearing on the use of nets, it was found that there is a statistically significant difference in the use of net among those who identify mosquitos as what causes malaria as opposed to other reasons (Table 4.4). This is indicated by a Fisher's Extract p = 0.03 since some of the values in the 2 X 2 table are less than 5. A p-value of < 0.10 was considered significant for a 90% confidence level.

Table 4.4: Association of bednet and parental awareness of cause of malaria

Use of bed net and parental awareness of causes of malaria			
	Awareness of causes of Malaria		
Net Use	**Mosquito**	**Other**	**Total**
Yes	48	3	**51**
No	34	10	**44**
Total	82	13	**95**
Fisher's Extract			**p = 0.03**

An analysis of whether knowledge of how to prevent malaria has any bearing on the use of bed nets showed that there was no statistically significant difference in the use of bed net among those who identified bed nets as a malaria prevention tool and those who did not. This is indicated by a Fisher's Extract p = 0.33. A p-value of < 0.10 was considered significant for a 90% confidence level (Table 4.5).

Table 4.5: Association of bed net and parental knowledge of malaria prevention

Use of bed net and parental knowledge of how to prevent malaria			
	Knowledge of prevention of Malaria		
Net Use	**Net**	**Other**	**Total**
Yes	47	4	**51**
No	37	7	**44**
Total	84	11	**95**
Fisher's Extract			**p = 0.33**

4.1.3 Bed net use

As is indicated in Figure 4.3, 54% (n = 51/95) of respondents used bed net on their children under 5 years of age. As a follow-up to the question about bed net use, the respondents were asked if the child under 5 years had slept under a net the previous night and 50% responded that the child had indeed slept under a net the previous night.

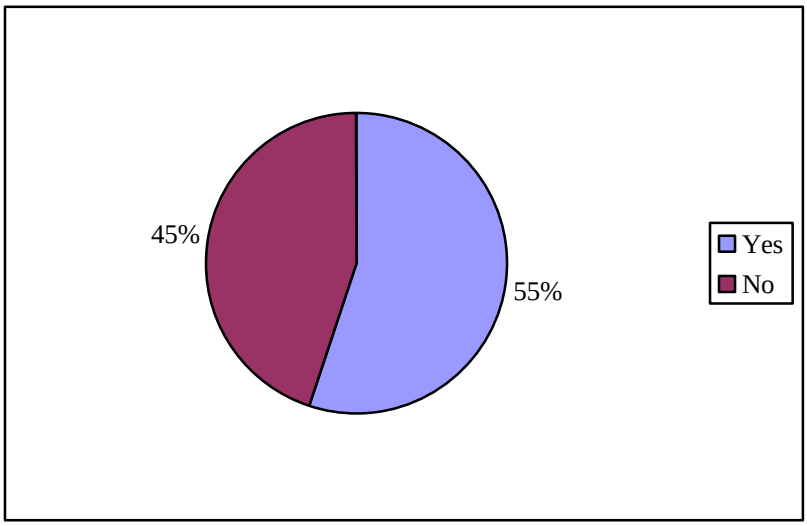

Figure 4.3: Bed net use by children in Kibera

Data on the origin of the bed net is shown in Table 4.6.

Table 4.6: Origin of bed nets used among Kibera residents

Net obtained from where	Frequency	Percent
Bought	32	59.3
Clinic/hospital	19	35.2
Antenatal clinic	3	5.5
Total	54	100.0

Respondents who had nets had a mean of 1.38 (S.D = 0.576) nets in each household. Bed nets were the most frequently used mosquito deterrent. Some respondents used mosquito coils as a mosquito deterrent. Of those who used them, the mean number used was 2 (S.D = 1.203). Nevertheless 76% (71/95) of respondents did not used mosquito coils as they cited respiratory irritation as a result of using the coils.

To assess knowledge of proper use of bed nets an aggregation of responses to several questions was used. They included whether a net is used, if it was used the previous night, why a net is used, when a net should be used and how often a net should be retreated. Getting four and above answers right out of five was considered to indicate good use whereas getting three or less answers right was considered bad use. Eighty eight percent (n = 45/51) of the respondents had good knowledge of proper use of bed nets. Figure 4.4 shows the report of malaria compared to the good or poor use of bed net.

Figure 4.4: Knowledge of proper use of bed net versus report of malaria among residents of Kibera

The main objective of the study was to determine whether the use of bed nets had an effect on the report of malaria among the children under 5 years old. The statistical analysis on the history of malaria in the child's life showed that there was no difference in the report of malaria among those who used nets versus those who did not use nets (Table 4.7).

Table 4.7: Association between use of bed nets and parental report of malaria in the child's life

Use of bed nets and parental report of malaria in the child's life			
	Use of Net		
Ever treated for malaria	**Yes**	**No**	**Total**
Yes	36	34	**70**
No	15	10	**25**
Total	51	44	**95**
Chi-square			**0.60**

This is indicated by a Yates corrected Chi square of 0.60 which is less than the threshold of 2.71 required to prove an association with a 90% confidence. The critical value of Yates corrected Chi Square for comparing two proportions with a 90% confidence level is 2.71 indicating less than a 10% probability that the differences in the proportions arise due to sampling error (Martin, Meek & Willeberg, 1987).

4.1.4 Factors related to bed net use

Of those who had nets, 29/51 parents representing 58% of respondents used them to prevent malaria while 20 parents representing 40% of respondents used them to prevent mosquito bites (Figure 4.5).

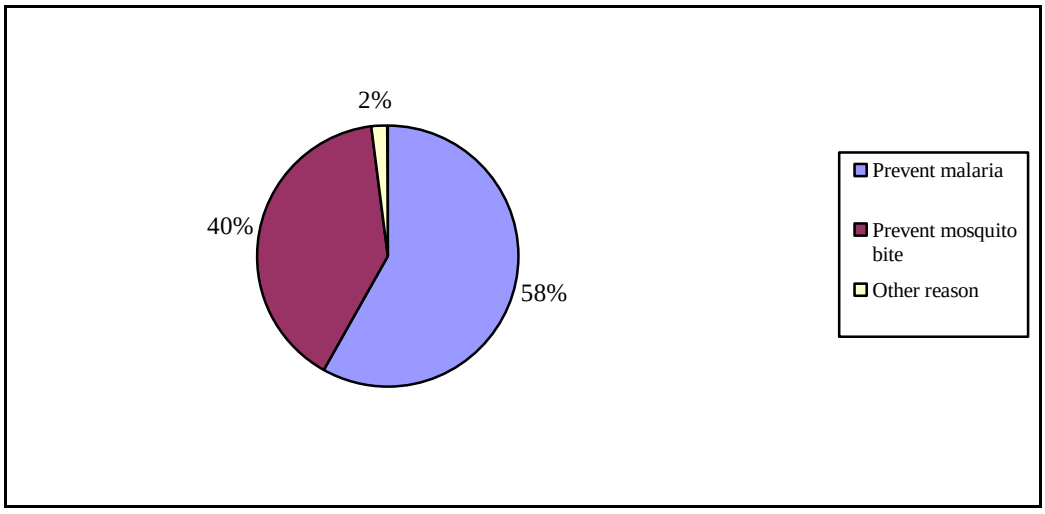

Figure 4.5: Reason for bed net use among respondents in Kibera

The respondents had various responses on how much they were willing to spend on a net but the greatest number (n = 15/64) indicated that Ksh. 300 was the amount they would spend (Table 4.8). The mean amount the respondents were willing to spend was Ksh 180.

Table 4.8: Kibera residents suggested price of bed net (2010)

How much willing to spend on net (KSh)	Frequency of response	Percent of respondent
350	4	6
300	15	23
250	5	8
200	7	11
Various amounts	33	48
Total	64	100

Note: 31 respondents did not indicate how much they were willing to spend on a bed net

It was found that 78/95 parents, representing 93% of the respondents, regardless of whether they had a net or not, were aware that the correct use of bed net was to use it every night. Of those who had nets 31% had used them for over one year while 41% (n = 21/51) had used them for over two years. Among those who had nets, all the members of the family used the bed net in 80% (n = 41/51) of the cases while 20% were used only by the children. Of those with nets, 80% (n = 41/51) of the houses had 3 or more occupants, but only one net for use by all the occupants (26/51).

Another factor considered in the use of bed nets was the use of other mosquito repellents such as mosquito coils or insecticidal sprays (Table 4.9).

Table 4.9: Association of use of bed net and the use of other mosquito repellents

Use of bed net and the use of other mosquito repellents			
	Use of bed nets		
Use of other mosquito repellents	**Yes**	**No**	**Total**
Yes	4	17	**21**
No	47	27	**74**
Total	51	44	**95**
Fisher's Extract			**p = 0.0004**

An analysis of whether use of other mosquito repellents has any bearing on the use of bed nets showed that there is a statistically significant difference in the use of net among those who use other mosquito repellents and those who did not. This is indicated by a Fisher's Extract p = 0.0004. A p-value of < 0.10 was considered significant for a 90% confidence level.

Another factor considered was whether the use of bed nets is related to a parent buying medicine for the child when the child has malaria like symptoms (Table 4.10).

Table 4.10: Association between use of bed net and parental medication of child

Use of bed net and parental medication of child			
	Use of bed nets		
Parent buys medication	**Yes**	**No**	**Total**
Yes	20	16	**36**
No	31	28	**59**
Total	51	44	**95**
Chi-square			**0.12**

An analysis of whether a parent who buys medication for their child as opposed to taking them to hospital has any bearing on the use of bed nets showed that there is no statistically significant difference in the use of net among those who buy medicines and those who did not. This is indicated by a Yates corrected Chi square of 0.12 which is less than the threshold of 2.71 required to prove an association at a 90% confidence level.

4.1.5 Net condition and placement

Of those with nets, 85% (n = 43/51) of the respondents said they used them and they were hanging over the bed. However, 63% (n = 32/51) of the sample had holes (Figure 4.6) with the mean number of holes with a diameter greater than 2cm per net being 3.46 (S.D = 2.56). Most of the respondents stopped using nets when they got many holes.

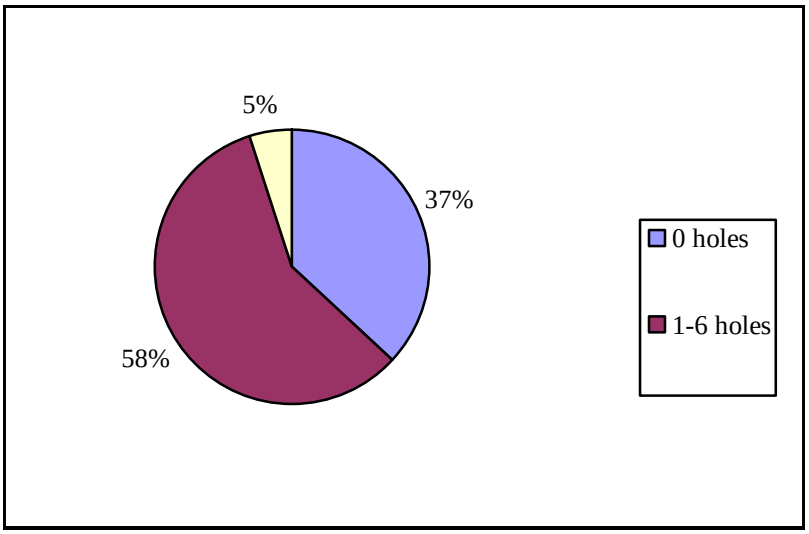

Figure 4: 6: Number of holes on bed nets among Kibera residents

The statistical analysis in Table 4.11 was done to determine whether holes on the bed net had a bearing on parental report of malaria and it was found that there was a

statistically significant difference in the report of malaria between those whose bed nets had holes and those whose nets did not have holes.

Table 4.11: Association of holes on bed net and parental report of malaria

Holes on bed net and parental report of malaria in the child's life			
	Holes on net		
Ever treated for malaria	**Yes**	**No**	**Total**
Yes	25	12	**37**
No	5	9	**14**
Total	30	21	**51**
Fisher's Extract			**p = 0.06**

This is indicated by a Fisher's Extract p = 0.06. A p-value of < 0.10 was considered significant for a 90% confidence level.

In the study, 70% (n = 36/51) of the sample were hung from the ceiling. Furthermore, 61% (n = 31/51) of the sample were of an adequate size for the bed. The determination of adequacy of bed net was based on the net covering the upper part of the bed when spread out since the rest of the body was covered by beddings.

Over 98% of respondents (n = 88/90) had heard about ITNs such as Supernet but an approximately equal number had not bought an ITN in the past year. Five respondents did not give an answer to this question hence the total of 90 and not 95.

4.1.6 Parental report of malaria among children

As Figure 4.7 indicates, 75% (n = 71/95) of the respondents said that their children under 5 years had been treated by a doctor for malaria during their lifetime.

The study found that the biggest concern for parents when their children had malaria was the expense of treatment and this accounted for 43% (n = 31/71) of the respondents. However, stress or emotional cost was a close second concern for parents at 35% (n = 25/71).

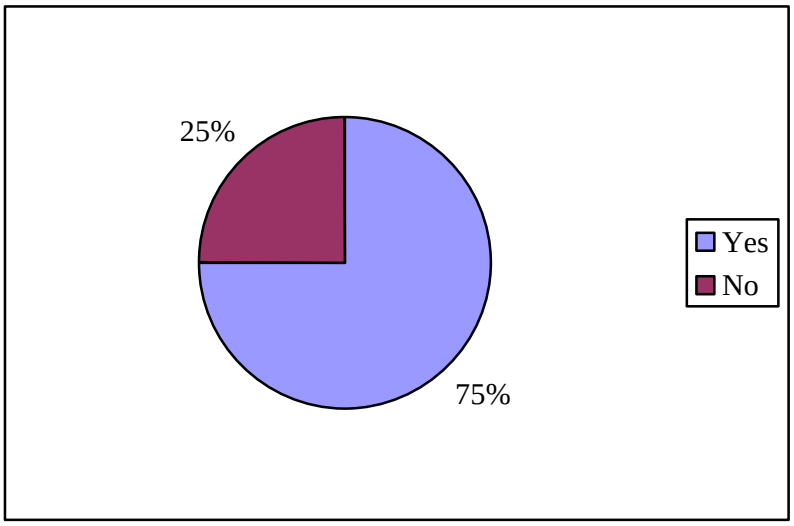

Figure 4.7: Parental report of children treated by a doctor for malaria

A number of respondents whose children had experienced malaria could state whether they were in Nairobi or out of town when the child got malaria. Of those who could recall where they believed the child acquired the disease, 33 respondents stated the child got malaria while in Nairobi while 16 stated the child got malaria while upcountry.

4.1.7 Report of malaria in medical facilities

Table 4.12: Report of malaria among children at Mbagathi District Hospital

Month	Clinical malaria	Microscopically confirmed malaria
January 2009	64	54
February 2009	78	0
March 2009	111	14
April 2009	142	0
May 2009	133	113
June 2009	234	40
July 2009	175	38
August 2009	170	2
Total	**1107**	**261**

A downward trend in malaria report was seen as 1368 cases of confirmed and clinical malaria were reported in 2009 down from 2490 in 2008, 3222 in 2007 and 4213 in 2006. This was attributed by the Records Officer as being due to increased knowledge of malaria as there had been an intense campaign in the previous two years (L. Kigo, Personal communication, 21 September 2009).

Table 4.13: Report of malaria among children at Ushirika Clinic (MOH 240)

Month	Microscopically confirmed malaria	Other diseases
April 2009	14	
May 2009	58	
June 2009	55	
July 2009	42	
August 2009	30	
September 2009	26	
October 2009	46	
November 2009	46	
December 2009	28	
January 2010	24	
Total	**369**	**214**

At Ushirika Clinic, 63% of children (369/583) were diagnosed as having malaria (MOH 240).

4.1.8 Parental action to malaria-like symptoms

In response to the question of what the parents did when their child was experiencing fever and chills, 65% (n = 58/95) of respondents, took them to hospital while 30% of respondents bought medicine (Fig 4.8). Of those who took their children to hospital, the most common reason for doing so was that they did not know the cause of the problem and thus would not want to medicate the child before tests had been conducted. In the study 90 % (n = 80/95) of respondents took their child to hospital within one to three days of symptoms being manifested.

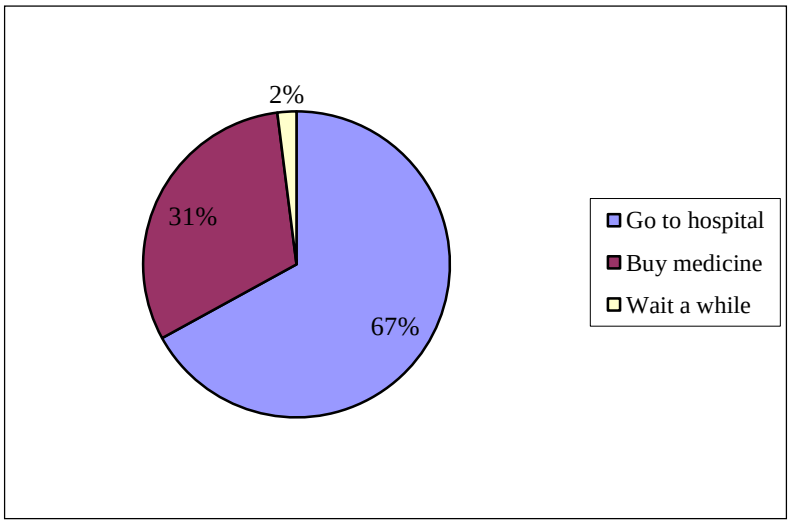

Figure 4.8: Parental action to malaria like symptoms among Kibera residents

Of the parents who bought medication, 53% bought fever reducers (n = 19/36), 19% bought pain killers and 14% bought malaria medicine.

4.2 Discussion

In seeking to determine the use of bed nets and their effect on parental report of malaria in children under 5 years old in Kibera, the research had four objectives which will now be discussed in greater detail.

4.2.1 Parental knowledge of the proper use of bed nets

The first objective of the study was to determine the parent's knowledge of the proper use of bed nets on their children under 5 years old. The residents of Kibera have come to identify bed nets as a useful tool in preventing mosquito bites and thus malaria among their children. This has been shown in Figure 4.5. Though they are low income people, most have bought their nets as is indicated in Table 4.6. Only a very small number have never owned a net out of the whole sample. Furthermore, a number of those who were not using nets at the time of the research had previously had nets.

One of the ways to determine proper use of bed net was to assess bed net use on a daily basis. This assessment was based on the use of bed nets the previous night. Fifty one percent of those who had nets said they had used it the previous night. This was a follow-up question to one that asked if they used bed nets on their children. The study found that use of bed nets among the residents of Kibera is above the average use among urban dwellers enumerated in the DHS 2003. The DHS 2003 study found that 30% of children under 5 among urban dwellers used bed nets (CBS, 2003). This had come up to 64% in the DHS 2008 study (KNBS 2010). In Kibera, the net use among children under 5 years for the sample taken was 54% (Figure 4.3). Since this study was based on the DHS 2003 report, we can see that the parents had a higher than average use of bed nets at the time and this shows a good knowledge of

proper use of bed nets. It can be extrapolated from the more current DHS figures that the use of bed nets has also gone up in Kibera.

Another tool used to determine knowledge of the proper use of bed nets was to assess how many people use the available nets. It was found that half of the respondents only had one net and this net was used by more than three people in 70% of the household. This is not in agreement with the findings documented in a study by Macintyre *et al*, (2006) that recommends that two people may effectively share one bed net. However, because of the small size of houses in Kibera, most respondents had one bed which was shared by all the members of the house and 80% of nets were used by all the members of the house. Since the house sizes are unlikely to change, the solution might be in getting bigger nets that can sufficiently cover many people. Here we find that the proper use of bed nets is constrained by economic factors which may be beyond the ability of the respondents to surmount.

Another factor in assessing proper use of bed nets is their treatment with insecticides. Before the onset of universal use of LLIN, retreatment of ITNs was important in enhancing the benefits of bed nets. The study found that 70% of those with nets did not retreat them. This finding corresponds with the study by Armstrong-Schellenberg *et al.* (2002) that showed that re-treatment of nets was not done by a majority of their owners. Only 20% of respondents with nets could accurately respond that nets are to be retreated every six months (see Table 4.12). This could be the reason why 66% of respondents did not re-treat nets, whereas only 18% had LLIN which do not require retreatment. This is further compounded by the fact that retreatment tablets are not readily available in the shops within Kibera or even in supermarkets in the greater Nairobi area. An untreated net's effectiveness is that it acts as a barrier against mosquito bites but if you sleep on it or next to it, you can be bitten through it. We see here that some social factors and others factors related to lack of knowledge that inhibited the proper use of bed nets among the respondents.

We can therefore conclude that the respondents have a good knowledge of the use of bed nets but this is diluted by some factors related to the social, economic and knowledge of the respondents. Figure 4.4 and Table 4.7 however indicate that there is no difference in malaria report among those with proper knowledge of bed net use and those without proper knowledge.

4.2.2 Households with bed nets and characteristics of the nets

The second objective of the study was to ascertain the number of households with bed nets and the characteristics of those nets. The research found that the bed net use among children under 5 years was 54% (Figure 4.3). When broken down further, it was found that 20% of nets were used by children only while 80% were used by the whole family. This finding is mostly related to the fact that most houses are one roomed and have one bed for all of the family members.

Another finding was that among 85% of those with nets, the nets were hanging over the bed and the respondents had found ingenious ways of hanging them. Most of the houses in Kibera are one roomed and many are divided by a curtain into the sleeping and sitting areas. The string on which the curtain is hung was in many cases one of the tools used to hold up the net. The poles on which the metal roof was hammered onto were another means used to hold up the nets. Those with nets were more likely to use them if they were hanging over the bed as opposed to if they had to set them up each night before use. Actual use at night could not be verified in this study and the possibility of untrue report of bed net use, which could cause a bias in the results, arises. The finding on use of bed nets however is in contrast to that by Alaii *et al. (*2003) and Osero *et al.* (2005) who had found that many people who had nets were not using them.

The presence of holes on the bed nets in use was another tool used to assess the characteristics of the nets (Figure 4.6). It was found that most respondent's bed nets

had holes but not to the extent described by the study by Erlanger (2004) that would render them totally ineffective. However, the statistical analysis showed that the difference in the prevalence of malaria among those whose nets had holes and those whose nets did not have holes was statistically significant (Table 4.11). A bed net in good condition clearly reduces the report of malaria.

Another characteristic of the bed nets was the adequacy of the size of net for the bed. The research found that in 70% of households the net was adequate as measured by the fact that it covered at least half the bed whereas the rest of the body would be covered by beddings. Further, another characteristic of the bed nets was the duration of use and the study found that 41% of the respondents had their bed net for over 2 years. The respondents use their bed nets consistently only stopping to use them when they are in bad condition. Many of those which were still in good condition were the LLIN type especially *Olyset* which is made from durable fibre. In respect to the second objective, we therefore find that most people use bed nets which are adequate for their bed size and have been used for a length of time hence giving more protection to the children.

4.2.3 Parental knowledge of malaria

The third objective of the study was to determine parental knowledge of malaria. A majority of the parents have good knowledge of malaria being aware of the causes of malaria and the symptoms associated with the disease (Table 4.3). Mosquitos were identified as the cause of malaria and since these questions were directed to lay people, this was considered the correct answer though the scientifically correct answer would be the *Plasmodium spp*. parasite. Knowledge of mosquito as the cause of malaria, in particular, resulted in higher bed net use (Figure 4.1 and Table 4.4). This finding is in contrast to the study by Alaii *et al. (*2003) in Western Kenya which showed that though people know what causes malaria, they still do not use nets.

In further assessing parental knowledge of malaria, it was found that 88% (82/95) of people identified bed nets as a malaria prevention tool. They could distinguish between prevention and treatment of malaria as very few of them (3%) identified taking antimalarial tablets as a preventative tool. The primary motivation for use of bed nets as indicated by 58% of the respondents was prevention of malaria. This finding is in contrast to a study that reported that most people used nets to prevent the nuisance caused by being bitten by mosquitoes as opposed to preventing malaria (Erlanger *et al*. 2004). However, knowledge of how to prevent malaria did not result in higher bed net use (Table 4.5).

Another factor in determining knowledge of malaria was where the respondents got their knowledge from. More than twice the number of respondents (56/95) got the information they have about malaria from clinics or hospitals compared to the media (25/95). Based on these findings, the government, therefore, needs to continue encouraging visits to antenatal clinics by pregnant women and follow up visits for infants and children as these provide the healthcare information most respondents pay attention to. With respect to the third objective therefore, it was found that the respondents had good knowledge of malaria mostly coming from health care providers and this resulted in a higher use of bed nets.

4.2.4 Parental report of malaria

The fourth objective of the study was to determine the report of malaria among parents of children under 5 years old. Most children under 5 years (75%) have experienced malaria in their life time based on the parent's report of treatment by a doctor (Figure 4.5). Moreover, twice the number respondents indicated that they got malaria within Nairobi (33/49) as opposed to out of Nairobi (16/49). There continues to be debate as to whether transmission of malaria actually takes place within Nairobi. Whereas this research did not seek to answer that question, the

respondents themselves could state where they believed their children acquired malaria from.

There are special characteristics in Kibera as with other unplanned settlements that expose residents to higher risks of malaria. The presence of garbage dumped in many undesignated places gives opportunity for pools of water to form, for example in plastic bags. There are also many drainage trenches within the villages that have waste water running in them and spills from them form pools. These conditions of poor sanitation and drainage create breeding sites for mosquitoes as demonstrated by a study by Martens and Hall (2000). There are also many opportunities for human-mosquito contact. The structure of the houses is one of the contributory factors in that there are gaps between the wall and the roof and many of the walls have chinks in the mud walls that can allow mosquitoes in. The role of housing type on mosquito-human contact has been demonstrated by a study by Robert *et al* (2003).

To further confirm reports of malaria among the children in Kibera, the study also included a perusal of the MOH laboratory register (MOH 240) at Ushirika Clinic. The Clinic is located in Kianda where half of the respondents of the study were from. Laboratory confirmed malaria was the primary diagnosis among children in 2009 constituting 63% of the morbidity (Table 4.12). Moreover, Mbagathi District Hospital, which is in close proximity to Kibera, had also reported 1107 cases of clinical malaria among children between January - July 2009 (Table 4.13). According to their statistics, malaria is the 3rd highest cause of paediatric morbidity at the hospital contributing to 12% of all illness (Kigo, Personal Communication).

In further assessing the report of malaria, the research found that most parents with feverish children did not keep them at home but took them to hospital. It was found that the health message that a child should be taken to hospital and not treated at home has been very well adopted by the parents in Kibera. Twice the number of parents (65/95) take their children to hospital when they are experiencing fever and

chills than buy medicine for the child (30/95). This finding was in contrast to studies done by Hamel *et al.* (2001), Kemble *et al.* (2006) and Abuya *et al.* (2007) who had found in their studies that many parents treated their children at home. The availability of government health facilities at the premises of the provincial administration such as the Clinic at the District Officer's office at Otiende and at the District Commissioner's (Langata) Office in addition to the Mbagathi District Hospital in close proximity to Kibera could be a factor in seeking prompt treatment. In addition, there are many clinics and treatment centres in close proximity to homes.

Some of the private clinics parents indicated they took their children to include Yes to Kids (Y2K) on Kabarnet road, the AMREF Clinic in Laini Saba, Dr Wanga's Clinic in Laini Saba, Wema Clinic, Ushirika Clinic in Kianda, PAG Clinic in Gatwekera, Tumaini Clinic in Gatwekera, CDC Clinic in Soweto, the MSF Clinic, St Mary's Karanja Clinic and the Catholic Sisters Clinic among others. Given that many of these clinics are run by charitable or non-profit making organizations, the charges are low. The respondents identified cost as their biggest concern when their child has malaria so low cost treatment would most likely result in more hospital visits. On average, most parents took their children to hospital within three days of onset of fever. However, over 65% took their children to hospital as soon as they noticed the child was feverish, dull or had no appetite. This is in line with the WHO guidelines that fevers in children below 5 years old should be attended to by a doctor within 24 hours (WHO 2006 b).

4.3 Conclusions

The research sought to determine the association between report of malaria and the use of nets. When it came to the prevalence of malaria in the child's lifetime and the use of net, the difference between users and non-users did not reach the threshold of significance (Table 4.7 and Figure 4.4). This may be explained by the fact that the history of bed net use can be difficult to accurately recall beyond a certain period of

time. In addition, there could be misrepresentation of the actual use of bed net with a higher report than is factual. Furthermore, the high reported prevalence of malaria seems to contradict the above average bed net use. This may be explained by the fact that children are bitten by mosquitos through the nets or are bitten before they get to bed. Some respondents could also be using bed nets with holes that allow mosquitoes access to bite them.

The alternate hypothesis that there is a difference in report of malaria among children who use bed nets and those who do not use bet nets is thus rejected. This research accepts the null hypothesis that there is no difference in report of malaria between those who use bed nets and those who do not use bed nets.

Various factors were considered to determine the true predictors of bed nets use. Knowledge of the cause of malaria was found to be a true predictor of bed net use. Those who had good knowledge used their bed nets more than those who had poor knowledge (Table 4.1). Another predictor was not using other mosquito repellents whereby those who did not use other mosquito repellents used bed nets more (Table 4.9). This has been shown by Macintyre *et al*, (2002) to be cheaper in the long run.

4.4 Recommendations

1. It is recommended that the government should ensure that only treated nets are sold. While the government only distributes LLINs, untreated bed nets are still available in the retail sector. In addition, while this study does not seek to endorse a particular brand of net nor does it have a vested interest in any net manufacturer, it was found that *Olyset* nets performed well in this particular setting. Because of their size, they covered most beds adequately. They are also made of a high calibre denier which makes them very durable. Some respondents had been using these nets for up to 4 years and they did not have any holes yet. Since Sumitomo Chemical Company, the manufacturer of *Olyset* nets, has commissioned Vector Health International in Tanzania to

manufacture the nets, they should be easily accessible to people in Kenya given the open market environment in East Africa.

2. A further recommendation is that the government reconsiders the malaria treatment policy for Nairobi. The current policy is treatment within 24 hours of malaria onset since it is a low malaria intensity area (E. Juma, Personal Communication, 12 August, 2010). However from the findings in this research and Kimutai *et al*, it appears that there is localized high infection in Kibera and other studies have found this to be the case for other informal settlement areas in Nairobi (Ye *et al.*, 2007; IRIN, 2007). Therefore, the provision of free or subsidized nets as is the policy in malaria epidemic and endemic areas is recommended for people living in informal settlements rather than treatment after infection. From a public health perspective, prevention rather than treatment for malaria is recommended.

3. A public education campaign specifically targeting low income, highly populated areas especially in Nairobi could also be helpful in reducing the prevalence of malaria as they seem most affected by the disease.

Areas of future research could include a study documenting if actual transmission of malaria does take place within Kibera given the high reports of the disease. It could also be of interest to have studies to determine if the treatment being offered at the various clinics in the area follows the MOH recommended dosages of artemeter-lumefantine.

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APPENDIX ONE: QUESTIONNAIRE

1	Identification number	
2	Age of child in months	

If there is more than one child below 5 years, give information only about the youngest child

3	Number of children under 5 years within the household	

		Mosquito bite	Cold weather	Hot weather	Other
4	What causes malaria?				

		Fever & chills	Muscle ache & headache	Cough & running nose	Diarrhoea & vomiting
5	What are the signs that one has malaria?				

		Men	Women	Pregnant women	Children
6	Who do you think is most vulnerable to malaria?				

		Mosquito nets	Tablets	coils/herbs	other
7	How do you prevent malaria?				

		Media-radio/TV	Health care provider	Relatives	other
8	Where do you get your information about malaria from?				

		Yes	No
9	Has your child below 5 years ever been treated for malaria by a doctor?		

		Time off work to care for child	Expense	Stress or emotional cost	Other
10	How is malaria in your child a problem for you?				

		Yes	No
11	Is your child right now having chills, fever, muscle aches or headache?		

	Take temperature if child has fever

		Yes	No
12	Has your child below 5 years been treated by a doctor for malaria in the last 6 months?		

		Yes	No
13	If yes to the above, did the child finish the medication they were given at hospital?		

		Yes	No
14	Do you usually stop giving the child medicine when their condition improves?		

		Yes	No
15	Do you use mosquito net on your child?		

		200	500	800	other
16	How much would you spend on a net? (if you do not have one now)				

		Yes	No
17	Did the child under 5 years old sleep under the net yesterday?		

		Bought	Clinic/Hospital	NGO/Project	Antenatal clinic
18	If you have a net, where did you get net from?				

		Prevent mosquito bite	Prevent malaria	Keep off vermin/debris	Keep warm/privacy
19	If you have a net, why do you use it on your child?				

		Too tired	No place to hang it	It is too much work	Other
20	If you have a net and do not use it on the child, why not?				

		Use during the rainy season	Use when there are many mosquitoes	Use every night	Do not know
21	What is the correct use of mosquito net?				

		Husband	Wife	Child	Other
22	Who uses mosquito nets in your home?				

23	How many people do you have living in the house?	

24	How many nets do you have in the house?	

25	How many nets are used by children under 5 years old?	

		6 months	12 months	24 months	Other
26	How long have you had the net for the child?				

		Yes	No
27	*Did the child under 5 years sleep in a mosquito net yesterday night?*		

		Yes	No
28	*Does he/she sleep under a mosquito net every day?*		

		Occasionally	When mother remembers	When there are mosquito	Other
29	*If not every day, how frequently?*				

		Yes	No
30	Do you know what insecticide treated nets are?		

		Yes	No
31	Have you bought one or retreated one in the past year?		

		Yes	No
32	Have you seen or heard the advertisements for Supernet or KO Tab?		

33	When did you last wash your net? (if ITN)	

		Yes	No
34	When you washed it, did you treat it with insecticide?		

		Every 3 months	Every 6 months	Every year	Never
35	How often should ITNs be treated?				

		50	100	200	other
36	How much money would you be willing to spend to retreat your net each month?				

		Yes	No
37	Do you know about long lasting insecticide treated nets (Permanet/Olyset)?		

		Yes	No
38	Do you have a long lasting insecticide treated net?		

		Yes	No
39	Do you use mosquito coils or burn herbs to keep away mosquitos?		

		1	2	3	other
40	How many coils per day do you use?				

41	How much do you spend on coils per day? (if they use)	

		Yes	No
42	Do you use insect repelling sprays e.g doom/raid?		

43	How much do you spend on sprays per month?	

		Buy medicine	Wait for a while	Take them to hospital	other
44	If your child below five years is experiencing fever and chills, what do you usually do?				

		Fever reducers	Malaria medicine	Pain killers	Others
45	If you buy medicine, which kind do you buy?				

		1 day	3 days	1 week	Other
46	If you usually wait for a while, how long do you wait?				

		Nearby clinic	Private hospital	District hospital	Other
47	If you usually take the child to hospital, which kind do you go to?				

Italicised questions are for the other children in the household

APPENDIX TWO: MASWALI

1	Nambari ya Kitambulisho	
2	Umri wa mtoto kwa miezi	

Ikiwa kuna watoto kadhaa chini ya umri wa miaka tano, toa habari kuhusu mtoto yule mdogo

3	Una watoto wangapi wa umri wa chini wa miaka mitano?	

		Kuumwa na mbu	Baridi	Joto	Kinginecho
4	Nini kinasababisha malaria?				

		Homa (joto na baridi ya mwili)	Maumivu ya viungo	Kohozi na Makamasi	Kuhara na Kutapika
5	Ni dalili gani zinaonyesha mto ana malaria?				

		Wanaume	Wanawake	Wanawake wajawazito	Watoto
6	Unafikiri ni kina nani wanaweza kupata malaria rahisi?				

		Kutumia neti	Kumeza vidonge vya dawa	Kuchoma majani	Kinginecho
7	Unazuia malaria kivipi?				

		Radio/ Runinga	Hospitali	Familia	Kwingineko
8	Unapata habari kuhusu malaria kutoka wapi?				

		Ndio	La
9	Mtoto wako wa umri chini ya miaka mitano amewahi kutibiwa na daktari kwa sababu ya malaria?		

		Kupoteza wakati hospitalini	Garama ya tiba	Jakamoyo/ Mawazo mengi	Kinginecho
10	Tatizo la mtoto kuwa na malaria linakuathiri kivipi?				

		Ndio	la
11	Mtoto wako sasa hivi ana joto ya mwili, maumivu ya kichwa au misuli?		

	Kama jibu ni ndio, joto ya mtoto itapimwa	

		Ndio	La
12	Mtoto wako wa umri chini ya miaka mitano ametibiwa na daktari kwa sababu ya malaria katika miezi sita iliyopita?		

		Ndio	La
13	Kama ni ndio, mtoto alimaliza dawa alizopatiwa hospitalini?		

		Ndio	La
14	Huwa unawacha kumpatia mtoto dawa akisikia nafuu?		

		Ndio	La
15	Unatumia neti kwa kitanda cha mtoto wako?		

		200	500	800	Kinginecho
16	Kama hauna neti kwa wakati huu, unaweza kutumia pesa kiasi gani kuinunua?				

		Ndio	la
17	Mtoto wako wa umri wa chini ya miaka mitano alilala chini ya neti jana?		

		Kununua	Hospitalini	NGO/mradi	Kliniki ya Wajawazito
18	Kama una neti ya mtoto, uliipata wapi?				

19	Kama una neti ya mtoto, unaitumia kwa nini?	Kuzuia kuumwa na mbu	Kujikinga na malaria	Kuzuia wadudu na takataka	Kuhifadhi joto/faraga

20	Kama unaneti lakini hauininginizi kwa kitanda cha mtoto, ni kwasababu gani?	Kuchoka	Hakuna mahali pa kuninginiza	Ni kazi nyingi	Kinginecho

21	Ni jinsi gani bora ya kutumia neti?	Kutumia katika msimu wa mvua	Kutumia kukiwa na mbu wengi	Kutumia kila usiku	Sijui

22	Nani anatumia neti kwa nyumba yako?	Bwana	Bibi	Mtoto	Mtu Mwingine

23	Kuna watu wangapi wanaoishi kwa nyumba hii?	

24	Kuna neti ngapi zinazotumika?	

25	Ni neti ngapi zinatumiwa na watoto wa umri wa chini ya miaka mitano?	

		Miezi 6	Miezi 12	Miezi 24	Kinginecho
26	Umekuwa na neti ya mtoto kwa muda gani?				

		Ndio	La
27	*Mtoto wenu wa chini ya umri was miaka mitano alitumia neti jana usiku*?		

		Ndio	La
28	*Mtoto huyo hulala chini ya neti kila usiku*?		

		Mara kwa mara	Mama akikumbuka	Kukiwa na mbu	Kinginecho
29	*Kama hatumii neti kila usiku, anatumia neti wakati upi*?				

		Ndio	La
30	Unajua neti iliyotibiwa na dawa au ITN ni nini?		

		Ndio	La
31	Umenunua ITN au kutibu neti ya mtoto katika muda wa mwaka mmoja uliopita?		

		Ndio	La
32	Umeona au kusikia tangazo la matumizi ya Supernet au Power/KO Tab?		

33	Kama una neti ya ITN, uliiosha lini?	

		Ndio	La
34	Ulipoiosha, uliitibu na dawa?		

		Kila miezi 3	Kila miezi 6	Kila mwaka	Haitibiwi
35	Kama una neti ya ITN, inafaa kutibiwa baada ya muda upi?				

		50	100	200	Kinginecho
36	Ikiwa uko na ITN, unauwezo wa kutumia pesa kiasi kipi kuzitibu kila mwezi?				

		Ndio	La
37	Unajua neti iliyotibiwa na dawa ya kudumu au LLIN kama vile Permanet/Olyset ni nini?		

		Ndio	La
38	Ukona na neti ya Permanet au Olyset?		

		Ndio	La
39	Unatumia koil au kuchoma majani kufukuza mbu?		

		1	2	3	Kinginecho
40	Unatumia koil ngapi kwa usiku?				

41	Kama unatumia koil, unatumia kiasi gani cha pesa kwa siku kununua koil?	

		Ndio	La
42	Unatumia dawa za pulizia wadudu kama vile doom au raid?		

43	Kama unatumia dawa hizi, zinakugarimu pesa kiasi kipi kwa mwezi?	

		Kununua dawa	Kungoja muda	Kumpeleka hospitali	Kinginecho
44	Mtoto wako akiwa anaugua na homa (joto na baridi ya mwili), mazoeya yako ni yapi?				

		Za kupunguza joto	Za kutibu malaria	Za kupunguza uchungu	Zinginezo
45	Kama unanunua dawa, ni za aina gani unazonunua?				

		Siku 1	Siku 3	Wiki 1	kinginecho
46	Kama unangoja muda, muda huo ni wa urefu upi?				

		Kliniki ya Mtaa	Hospitali ya Kibinafsi	Hospitali ya Mkoa	ingineyo
47	Kama unampeleka hospitali, unaenda kwa hospitali ya aina gani?				

Maswali yaliyo na maandishi tofauti yataelekezwa kwa watoto wakubwa nyumbani

APPENDIX THREE: OBSERVATION OF NET

		Yes	No
1	Net in Use?		
2	Net hanging over the bed?		
3	Holes on net?		
4	How many holes larger than 2 cm?		
5	How many nets in use in the house?		
6	Description of method used to hang net? (I.e. from ceiling, from wall, what devices used to hang etc)		
7	Size of net adequate for bed?		

APPENDIX FOUR: MAELEZO KUHUSU UTAFITI

Kwa Mwenye Nyumba,

Ujumbe unaofuata unaelezea utafiti ambao tunaofanya. Tumetayarisha habari hizi ili kukuwezesha kuelewa utafiti huu. Pia tunakuomba ruhusa ya kuingia kwenye nyumba yako ili kukagua hali ya neti zilizomo. Tunakuomba pia usahihishe fomu tutakayokupa inayo kuuliza maswali kuhusu malaria na matumizi ya neti kwa mtoto wako wa umri wa chini ya miaka mitano.

Jina la mtafiti:	Wambui Ndegwa
Simu:	0723-656667
Kituo atokacho:	Kenya Medical Research Institute (KEMRI) 020-2722541 Jomo Kenyatta University of Agriculture and Technology (JKUAT) 067-52711

Maelezo kuhusu uhusika kwenye utafiti:

1. Kushiriki kwenye utafiti huu ni kwa hiari yako
2. Unaweza kuacha kushiriki kwenye utafiti huu wakati wowote ingawa tungependa kushirikiana nawa kwa muda wote
3. Kukataa kushiriki kwenye utafiti huu hakuta athiri haki zako zozote
4. Habari zozote utakazo zitoa kwa watafiti hazitafichuliwa kwa mtu yeyote mwingine

Maelezo

Malaria ni ugonjwa hatari kwa watu wote lakini zaidi kwa watoto kwa sababu kinga dhidi ya magonjwa kwa mili yao haijakomaa. Ingawa kwa mtu mzima malaria itamwathiri kiasi, kwa mtoto mchanga, malaria inaweza kusababisha kifo.

Jinsi utafiti utakavyofanywa

Tutakuja kwa nyumba yako na kukuomba kusahihisha fomu ya maswali. Tutaomba kuona mahali ambapo unaninginiza neti ya mtoto.

Athari na faida ya utafiti huu

Hatutarajii athari yoyote kutokea kwa uhusika wako kwa huu utafiti. Bali, utafaidika kwa kupata habari kuhusu jinsi ya kuzuia malaria. Pia ukiwa unahisi kuwa mtoto wako ana malaria, tutampima bila malipo.

APPENDIX FIVE: CONSENT EXPLANATION FORM

To the Head of Household,

The following information explains the research being carried out. It is also to request permission to enter your house in order to examine the bed nets you have. We also request that you fill the form we have provided which contains questions on malaria and the use of bed nets among children under five years old in your household.

Name of the Investigator:	Wambui Ndegwa
Phone number:	0723-656667
Institution the investigator is from:	Kenya Medical Research Institute (KEMRI) 020-2722541
	Jomo Kenyatta University of Agriculture and Technology (JKUAT) 067-52711

Explanation on the research:

1. Participation in this study is purely voluntarily.
2. You may withdraw from participation in the study at any time you wish, though we would request you to participate until completion.
3. Refusal to participate in the study will not result in the loss of any benefit.
4. All the information you provide during the study is entirely confidential.

Explanation

Malaria is a dangerous disease to everyone but more so to children because their immune system is not fully developed. In adults, malaria may result in sickness and death but among children under five years of age the chances of death from a bout of malaria are higher.

Procedures

We will come to your home and ask you to complete our questionnaire. We shall request to see the place where your bed net is hanging.

Risks and benefits associated with the study

We do not foresee any dangers associated in your participation in the study. The study will be of benefit to you in various ways. You will receive information on how to prevent malaria. In case you feel your child is experiencing malaria, we shall test them for the disease at no cost.

APPENDIX SIX: INFORMED CONSENT FORM

Title: Determinants of use of Bed Nets among Children under five years old and their effect on Parental report of Malaria in Kibera, Nairobi

Head of Household identification number: ----------

I have read the consent explanation sheet concerning this study and I understand what is required of me if I take part in the study. I have also been given the opportunity to ask questions to my satisfaction

I agree to take part in this study

Signature: ----------

Date: ----------

APPENDIX SEVEN: FOMU YA KUSAHIHISHA

Jina la utafiti: Utafiti kuhusu matumizi ya neti za kuninginiza kitandani kwa watoto wa chini ya umri wa miaka mitano na uhusiano wa matumizi na visa vya malaria kadri ya ripoti za wazazi katika mtaa wa Kibera, Nairobi

Nambari ya kitambulisho cha mwenye nyumba _____

Nimesoma maelezo kuhusu utafiti huu na naelewa ninachopaswa kufanya ikiwa nitashiriki katika utafiti huu. Nimepatiwa nafasi ya kuuliza maswali kuhusu utafiti huu na nimetosheka na majibu

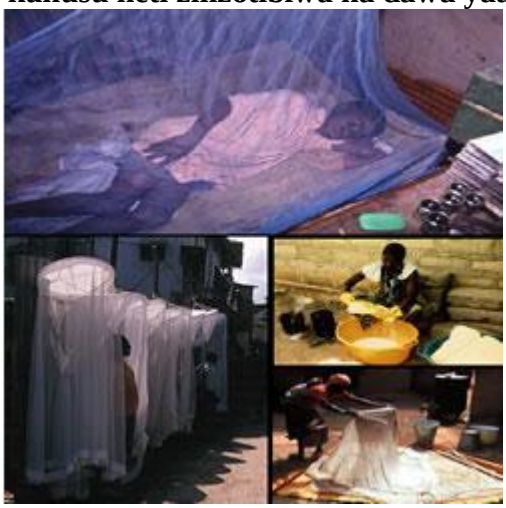
Nimekubali kushiriki kwenye huu utafiti

Sahihi _____

Tarehe _____

APPENDIX EIGHT: HABARI KUHUSU ITN

Habari kuhusu neti zilizotibiwa na dawa yaani ITN



Neti zilizotibiwa na dawa yaani ITN ni jinsi ya kujikinga na malaria ambazo imedhihirishwa kupunguza visa vya ugonjwa au vifo kutokana na malaria.

Neti za kuninginizia kitanda za kawaida ambazo hazijatibiwa na dawa zinaweza kuzuia kuumwa na mbu. Lakini, mbu wanaweza kuuma mtu ikiwa neti iko na mashimo hata kama ni madogo. Kwa sababu hi, kutibu neti na dawa kunaongeza ubora wake. Dawa hiyo inayowauwa mbu, pia inauwa wadudu wengine.

Madawa yaliyokubalika kutumika kutibu neti hayana madhara kwa binadamu lakini yanaua mbu haraka sana. Pia madawa haya yanadumu kwa neti amabayo haijaoshwa au kuwekwa kwa jua.

Kudumisha manufaa ya ITN, neti inafaa kutibiwa kila miezi sita ikitegemea neti imeoshwa mara ngapi. Kutibu ni rahisi kwa vile mtu anatengeneza mchanganiko wa dawa na maji, kuweka neti halafu kuitoa na kuiwacha ikauke mahali ambapo pana kivuli. Dawa za kutibu neti zinapatikana kwa maduka mengi

Neti zingine zilizowekwa dawa ya kudumu ambazo zinaitwa LLIN kama vile Permanet na Olyset ni bora zaidi kwa vile hazitibiwi mara kwa mara. Zinaweza kudumisha dawa kwa miaka mitano hata kama zinaoshwa.

APPENDIX NINE: ITN INFORMATION

ITN Information sheet

Insecticide-treated bed nets (ITNs) are a form of personal protection that has repeatedly been shown to reduce severe disease and death due to malaria in areas that have malaria.

Untreated bed nets form a protective barrier around persons using them. However, mosquitoes can feed on people through the nets, and nets with even a few small holes provide little, if any, protection. The application of an insecticide greatly improves the protective effects of bed nets. The insecticides used for treatment kill mosquitoes and other insects. The insecticides also have properties that keep away mosquitoes so they reduce the number of mosquitoes that enter the house and try to feed.

The insecticides accepted for use on ITNs have very low toxic effects to humans and other animals but are highly toxic to insects and have a rapid knock-down effect, even at very low doses. These insecticides remain for a long time on the net and do not easily break down unless washed or exposed to sunlight.

Some nets have long lasting insecticide treatment such as Permanet and Olyset. These nets are preferable to ITNs because you do not have to treat them every six months. They retain the insecticide for upto 5 years even when they are washed.

APPENDIX TEN: SSC APPROVAL

KENYA MEDICAL RESEARCH INSTITUTE

P.O.Box 54840 - 00200 NAIROBI, Kenya
Tel: (254) (020) 2722541 , 2713349, 0722-205901, 0733-400003; Fax: (254) (020) 2720030 E-mail: kemri-hq@nairobi.mimcom.net: director @ kemri.org; website: www.kemri.org

29th **April, 2009**

ESACIPAC/SSC/4451

Wambui Ndegwa

Thro'
Director, CPHR
NAIROBI

Received 10/06/09

REF: SSC **No.1558 (Revised) - An investigation into the extent and determinants of use of ____mosquito bed nets among children under 5years old in Kibera, Nairobi.**_____

I am pleased to inform you that the above-mentioned proposal, in which you are the PI, was discussed by the KEMRI Scientific Steering Committee (SSC), during its 155th **meeting** held on **1st April 2009** and have since been approved for implementation by the SSC.

The SSC however, advises that work on this project can only start when ERC approval is received

C. Mwandawiro, PhD
SECRETARY. SSC

APPENDIX ELEVEN: ERC APPROVAL

KENYA MEDICAL RESEARCH INSTITUTE

P.O. Box 54840 - 00200 NAIROBI, Kenya Tel: (254) (020) 2722541, 2713349, 0722-205901, 0733-400003; Fax: (254) (020) 2720030
E-mail: director@k8mri.org info@kemri.org Website:www.kemri.org

KEMRI/RES/7/3/1 December 17, 2009

TO: MS. WAMBUI NDEGWA (PRINCIPAL INVESTIGATOR)

THROUGH: DR. YERI KOMBE,
THE DIRECTOR, CPHR,
NAIROBI

Forwarded 17/12/09

RE: SSC PROTOCOL NO. 1558: AN INVESTIGATION INTO THE EXTENT AND DETERMINANTS OF USE OF BED NETS AMONG CHILDREN UNDER 5 YEARS OLD AND THEIR EFFECT ON PARENTAL DIAGNOSIS OF MALARIA IN KIBERA, NAIROBI

Make reference to your letter dated 17 December, 2009. Thank you for your response to the issues raised by the Committee. This is to inform you that the issues raised during the 167th meeting of KEMRI/National Ethics Review Committee held on Tuesday 16th June 2009, have been adequately addressed.

Due consideration has been given to ethical issues and the study is hereby granted approval for implementation effective this 17th **day of December 2009,** for a period of twelve (12) months.

Yours sincerely,

R, C. KITHINJI,
FOR: SECRETARY,
KEMRI/ NATIONAL ETHICS REVIEW COMMITTEE