



# **THE UNIVERSITY OF ZAMBIA**

## **SCHOOL OF MEDICINE**

### **HOUSEHOLD ITN ACCESSIBILITY AND AVAILABILITY IN KATONDO AND MAKULULU TOWNSHIPS OF KABWE**

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## Declaration

I hereby declare that this thesis is my own work and effort and that it has not been submitted at this University or any other University for an award.

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## **Dedication**

This study is dedicated to my late mother Saliya Kaswaya and late father Mr. Orage M. Kalulu, who tirelessly worked to make me what I am today.

You were so wonderful to me. (MYSRIP)...

I also dedicate this work to all my brothers and sister for their support.

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## Abstract

**Background:** Prior to the study, it was not possible to ascertain whether the ITN program in Kabwe that aimed to distribute ITNs to families with children younger than five was done according to the set targets. There were unconfirmed reports that Kabwe DHMT had been facing problems in implementing the ITN program. To date, research has not been done to look at accessibility and availability of ITNs in homes.

**Research Questions:** This study was designed to answer the following research questions: (i) What is the Level of ITN availability at household level? (ii) What is the level of ITN accessibility at household level? (iii) What are the sources of ITNS among Households and (iv) What Factors are responsible for ITN availability and accessibility

**Methodology:** A cross sectional study of 150 randomised households in two highly endemic malaria areas (Makululu and Katondo in Kabwe) and health care staff involved in the ITN program were studied. One focus group discussion was held with health care staff. A survey questionnaire was administered to heads of households and this was followed purposively with indepth interviews depending on what was found in the home.

**Results:** Majority of households had an insecticide treated bednet for every bed space. There was a differential availability of insecticide treated nets by township with Makululu having more bed spaces with insecticide treated nets than Katondo. The distribution of the insecticide treated nets to ensure household accessibility was rather slow and very sparse. Accessibility seemed to have doubled between 2009 and 2010. There was a differential accessibility of insecticide treated nets by township with Makululu having more insecticide treated nets than Katondo.

**Conclusion:** The data support the idea that ITN distribution programmes in Kabwe could have an important role in malaria prevention in Katondo and Makululu. On the basis of the researcher's evaluation the effect of the program appeared modest but less useful as part of a larger district malaria control strategy. The researcher recommends maintaining high coverage, there is need to consider ITN mass distribution in the two localities to be attained. It is also recommended that the Ministry considers undertaking operations research. Operations research would facilitate the integration of public health perspectives and community perspectives into a coherent promotional strategy. Such an approach becomes particularly important if ITNs are to be introduced to large populations.

## CHAPTER ONE- BACKGROUND

### 1.0 Introduction

Malaria has accompanied humankind for as long as 5,000 years, the first written evidence of the disease dating as far back as 2,700 BC in the Chinese medical classic *Nei Chin* (the Canon of Medicine) (Tyles, 1996). Malaria remains a major problem in many parts of the world. Approximately 500 million people are affected annually, and about three million, mostly children, die of falciparum malaria each year (Cook, 1992; Warrel, 1993; Olliaro et al., 1996). An estimated 3 billion people, almost half the world's population, live in areas where malaria transmission occurs. Malaria is endemic in 107 countries and territories in tropical and subtropical regions, with sub-Saharan Africa hardest hit. Between 350 million and 500 million cases of clinical malaria occur each year, leading to an estimated 1 million deaths and most of these occur in sub-Saharan Africa and among children under age five (WHO, 2005 a, b, c). Indeed, malaria is one of the leading killers of children under age five, accounting for almost 1 death in 10 (8 per cent) worldwide—and nearly 1 death in 5 (18 per cent) in sub Saharan Africa. Over 80 per cent of these deaths—or around 800,000 a year—occur among African children under age five. The human toll of malaria is staggering. Malaria is still the leading cause of morbidity and mortality in Zambia. It is estimated to account for 45 percent of outpatient visits, 45 percent of hospital admissions, and 50 percent of disease burden among children under 5 years of age (US Census Bureau, 2005).

The role of mosquitoes as vectors of transmission was demonstrated by Ross at the turn of the 20<sup>th</sup> century. Since then, the behavior of the malaria parasite and the mosquito vectors have been studied extensively and the knowledge gained has contributed immensely to various strategies for malaria control like protection techniques. Protection techniques against insects have been known for ages and were used long before the malaria transmission process was discovered (Lindsay et al., 1998). Among the oldest approaches to prevent mosquitoes from biting was the use of

bed nets and curtains which in the Roman and Greek ancient world simply meant the spreading of gauze and muslin curtains over places to protect. Additionally, the ancient Persians were said to destroy insects by using a powdered dried flower of a Dalmatian pyrethrum. In order to overcome the pending crisis in lack of adequate intervention methods, bed nets treated with insecticides were re-introduced in the latter part of the 1980s. Bed nets were to protect the user(s) against the bites of malaria-infectious mosquitoes, and hence contribute to a reduction of transmission risk. It was reported that untreated bed nets did not provide adequate protection, presumably because the mosquitoes could bite the occupants through the netting, or nets would often be torn because of excessive use, thus giving mosquitoes easy access to a blood host (Burkot *et al.* 1990). Treatment of nets with a small deposit of a long-lasting insecticide could overcome these problems, because mosquitoes landing on the net would be killed before having taken a blood meal, or they would be repelled by the insecticide, as is the case with synthetic pyrethroids. It was soon observed that the use of insecticide-treated bed nets (henceforth termed ITNs) provided adequate protection against malaria infections, particularly in children (Lengeler and Snow 1996). The World Health Organization has adopted the use of ITNs as one of the main strategies for malaria control in their Roll Back Malaria program (RBM, 1999). At present ITNs are being applied in many malaria-endemic regions. An insecticide-treated net is a bed net that repels, disables, and/or kills mosquitoes coming into contact with insecticide on the netting material. There are two categories of ITNs and these are conventionally treated nets and long-lasting insecticidal nets:

- A conventionally treated net is a net that has been treated by dipping in a WHO-recommended insecticide. To ensure its continued insecticidal effect, the net should be re-treated after three washes, or at least once a year.
- A long-lasting insecticidal net is a factory-treated net made with netting material that has insecticide incorporated within or bound around the fibers. The net must retain its effective biological activity without re-treatment for at least 20 WHO standard washes under laboratory conditions and three years of recommended use under field conditions.

ITNs have consistently been shown to be very effective and sustainable in reducing malaria morbidity and mortality in children of different malaria endemic areas by approximately 20% (Diallo et al., 2004; Lindblade et al., 2004; Lengeler, 2004; Müller et al., 2006). This translates to the prevention of almost 0.5 million deaths each year in Africa south of the Sahara. They have also been shown to be highly cost-effective and are actually one of the most affordable control tools (Müller et al., 2006). Moreover, the successful development of long-lasting ITNs avoids the regular re-treatment of ITNs, every 6 to 12 months, which was accompanied by a notoriously low compliance. ITNs are considered one of the most important interventions of the global "Roll Back Malaria" partnership (World Bank 1993; Nabarro and Tayler, 1998; Goodman et al., 1999).

The development of synthetic pyrethroids, in the 1970s, as a new class of highly potent insecticides with a relatively low toxicity for vertebrates and significantly fewer environmental effects compared with other classes of insecticides, caused renewed interest in the combined use of insecticides and ITNs for malaria control. Alaii *et al.* (2003) reported the successful use of parathyroid-treated nets for malaria control and Curtis et al., (2003) compared the efficacy of different insecticides available for this specific purpose. These early reports created a rapid interest in this potential method for malaria control, and soon numerous trials were undertaken to test the efficacy of ITNs for malaria control (Guillet et al., 2001). It was found that ITNs caused a significant reduction in malaria-attributable morbidity and mortality, especially in young children (D'Alessandro et al., 2001; Lengeler and Snow 1996). However, there were few or no effects on malaria prevalence, suggesting that ITN users continued to receive infectious bites at times when they were outside the nets. The evidence of ITN use as a successful disease control method was so great that WHO adopted this method as one of the cornerstones for its Roll Back Malaria program (RBM, 1999; Carter *et al.* 2000). The insecticides used for this purpose belong to the class of synthetic pyrethroids and include permethrin, deltamethrin, lambda-cyhalothrin and cypermethrin. In malaria endemic countries like Zambia the use of ITNs is being promoted as an effective method for reducing malaria transmission risk.

## 1.1 Malaria Policy and Plan

The Zambian National Malaria Control Center has a well-conceived and ambitious Five-Year Strategic Plan for 2006 - 2010. The overarching goal of the strategy is to reduce malaria incidence by 75% by the end of 2010, ultimately contributing to the reduction of all-cause mortality by 20% in children under five. The specific objectives for the NMCC Action Plan for 2010 are:

- To ensure 100% coverage of three ITNs per household (in non-IRS districts) and at least 85% of people sleep under ITNs in homes that have at least one ITN by December 2010;
- To ensure that at least 85% of the targeted structures in the 54 districts are covered by IRS by December 2010;
- To ensure that at least 80% of women have access to a package of interventions to reduce the burden of malaria in pregnancy by December 2010. The package of interventions will include three doses of IPTp, an ITN, and treatment of anaemia;
- To ensure that at least 80% of patients with suspected malaria are appropriately diagnosed and treated within 24 hours of onset of symptoms by December 2010;
- To ensure that at least 80% of the general population has positive behaviour to prevent malaria and seek care.

Zambia has identified ITNs as a key part of its malaria control effort and the distribution of ITNs has been rapidly scaled up through a free mass distribution campaign strategy. This strategy focuses on ensuring that each sleeping space in the household is covered by an ITN. Nets are also distributed through antenatal care (ANC) and Expanded Program on Immunization (EPI) clinics as well as smaller distributions through an equity program that targets vulnerable groups such as orphans and people living with HIV/AIDS (PLWHA), the World Bank's COMBOR program, and commercial sales. The chart below estimates the percent of nets that are distributed typically through each program:

**Table 1.1.1 Distribution of LLINs in Zambia**

LLIN Distribution methods	Estimated proportion of nets distributed
Mass distribution of free nets	
Through ANC clinics and EPI programs	60%
Equity programmes to vulnerable people	30%
CMBOR	3%
Commercial sales	2%
Total	100%

NMCC (2010)

The strategy for LLINs distribution in Zambia is part of a larger plan to provide malaria prevention services to cover all Zambians. This will be achieved through IRS in urban and peri-urban areas and ITN distribution in rural areas.

ITN needs and gaps by districts are developed by considering a consistent set of criteria that includes:

- Population and household demographics by district
- Number of ITNs already received by district
- Coverage of IRS operations within the district
- Maximizing ITN availability in areas not covered by IRS
- Prioritizing ITN distribution in high malaria transmission areas

Calculating the need for nets in light of increasing IRS coverage in Zambia is complicated by the adoption of a policy of universal coverage where all persons at risk of malaria are to be protected. When calculating the overall ITN need in Zambia, the MOH/NMCC considers two different approaches: 1) if sufficient funds are available, they will pursue universal coverage where all households will receive at least three LLINs or 2) if less funds are expected, they will cover only houses not sprayed with IRS. The chart below outlines the two different approaches to calculating the net need in Zambia:

Table 1.1.2 LLIN Needs in Zambia

Category	Universal coverage	ITN/IRS Coverage
Population estimate	13,200,000	13,200,000
Households (HH) @ 5.0 persons each	2,640,000	2,640,000
Number of (HH) not covered by IRC per NMCC		977,500
Estimated number of (HH) not covered by IRC per NMCC		1,662,500
LLIN need at 3/HH	7,920,000	4,987,500

NMCC (2010)

At the present time Zambia is pursuing a dual strategy to use IRS in urban and peri-urban areas and ITNs in the rural areas and/or in areas where it is difficult to conduct IRS operations. It is anticipated that a more detailed strategy between IRS and ITNs will be included in the next five-year National Malaria Strategic Plan. Until that strategy is fully implemented we assume that the need for nets will be based roughly on one third of the households in Zambia receiving an IRS application and two thirds of the households requiring nets. This assumption reveals that approximately 5 million nets are needed in Zambia to provide universal coverage with malaria vector protection.

## 1.2 Statement of the Problem

There is a claim (without any empirical evidence) by the ministry of health staff that bed nets have been distributed in Kabwe's Makululu and Katondo townships. However, there is a contradiction between the claims by staff and what parents are saying on the ground. Given this situation, there are problems that need answers. For instance, we cannot ascertain whether the ITN program in Kabwe that aimed to distribute ITNs to families with children younger than five was done according to the set targets. Since 2005 to date ITN distribution figures indicate that every under five child by now could have been sleeping under the ITN, but the problem is malaria seems not to be

decreasing. There are unconfirmed reports that Kabwe DHMT has been facing problems in implementing the ITN program. To date, research has not been done to look at accessibility and availability of ITNs in homes.

### **1.3 Overarching Research Question**

Following the ITN roll out in Kabwe in 2002, what is the level of ITN accessibility and availability in Katondo and Makululu among households that have Under Five Children?

#### *Specific Questions*

1. What is the Level of ITN availability at house hold level?
2. What is the level of ITN accessibility at house hold level?
3. What are the sources of ITNS among Households and
4. What Factors are responsible for ITN availability and accessibility

### **1.4 Research Aim and Objectives**

#### ***Aim:***

To determine household ITN accessibility and availability in two townships in Kabwe that have high levels of malaria.

#### ***Specific Objectives***

1. To determine the level of ITN availability in Katondo and Makululu
2. To find out the sources of ITNs among households
3. To determine what problems if any Kabwe DHMT has faced in implementing the ITN program?

## CHAPTER TWO - LITERATURE REVIEW

### 2.0 The Magnitude of the Problem

Malaria has been noted to be one of the most severe public health problems worldwide. It has been one of the leading causes of death and disease in many developing countries, where young children and pregnant women are the groups most affected (WHO, 2005).

Table 2.1 Leading Causes of Death in Children Under Five Years of Age

Leading Causes of Death in Children Under Five Years of Age, Estimates for 2000-2003			
Rank	Cause	Numbers (thousands per year)	% of all deaths
1	Neonatal causes	3,910	37
2	Acute RTI	2,027	19
3	Diarrheal diseases	1,762	17
4	Malaria	853	8
5	Measles	395	4
6	HIV/AIDS	321	3
7	Injuries	305	3
8	Other causes	1,022	10
<b>Total</b>		<b>10,596</b>	<b>100.0</b>

(Source: World Health Organization, the World Health Report 2005)

An estimated 3.2 billion people, almost half of the world's population, live in areas where malaria transmission occurs (Hay et al., 2004) Malaria is endemic in 107 countries and territories in tropical and subtropical regions, but there are substantial geographic disparities in the disease burden. Sub Saharan Africa is the hardest hit region (see appendix I).

The human toll of malaria is staggering. Between 350 million and 500 million episodes of clinical malaria occur each year, leading to an estimated 1 million deaths, most in

sub-Saharan Africa and among children under age five. Indeed, malaria is one of the leading killers of children under age five, accounting for almost 1 death in 10 (8 per cent) worldwide—and nearly 1 death in 5 (18 per cent) in sub-Saharan Africa (WHO and UNICEF, 2003; WHO Report, 2005) (See Appendix II).

These figures do not take into account malaria's indirect impact on child mortality. Malaria contributes to child malnutrition, an underlying cause in more than half of deaths among children under age five globally. Although the precise causal links are unclear, nutritional status is affected by vomiting and appetite suppression during bouts of malaria and by malaria-related anemia (Bates et al., 2004) In addition, the overlap between malaria and HIV infection in sub-Saharan Africa should be considered when designing prevention and treatment programs for those most affected by malaria.

From a micro-epidemiologic perspective malaria is a very dynamic infection and disease. Many forces are at play: malaria transmission is extending to affect new populations and geographic regions, the malaria parasite's biology is evolving, particularly with respect to susceptibility to drugs, and recent research has identified previously poorly understood facets of the health impact of malaria illness, especially as it interfaces with emerging public health threats such as AIDS. Despite considerable effort for eradication or control during this century, malaria is still the most prevalent and, from the public health standpoint, the most devastating disease in the tropics. While some countries have successfully managed the threat of malaria, there has been a dramatic, worldwide increase in malaria-related illness and death over the past two decades. In many parts of the globe, malaria is not only a major threat to public health, but is a major impediment to development through excessive public health costs, lost productivity and impaired individual growth (Bates et al., 2004; Hay et al., 2004).

*Plasmodium falciparum* infections present one of the most pressing public health challenges in the developing world. This malaria species can produce overwhelming disease, characterized by a severe central nervous system syndrome (cerebral malaria) and lethal pathology in the kidneys and lungs. Immunity to *Plasmodium* infections

accrues slowly in survivors, and the immune response, while very active, is not capable of protecting from re-infection. The health impact of *P. falciparum* malaria is greatest in individuals who lack adequate immunity: young children, pregnant women, and persons of any age who have not had prior malaria exposure (WHO, 2005, Bates et al., 2004; Crawley et al., 2007). Even in persons who have acquired malaria immunity, chronic parasitaemia may have potent, deleterious effects. Studies in Africa have shown that *P. falciparum* parasitaemia is a major contributor to severe anemia in children, which has become a prominent cause for hospitalization and blood transfusion in African health facilities. Blood transfusion is a leading cause of HIV transmission in children during the post-neonatal period.

Regional differences and changes in malaria epidemiology while malaria is a global problem, the epidemiology and public health impact of the disease differ among the major geographic regions (Appendix III).

Malaria occurs mostly in poor, tropical and subtropical areas of the world. The area most affected is Africa south of the Sahara, where an estimated 90% of the deaths due to malaria occur. This is due to a combination of factors (Bates et al., 2004).

- A very efficient mosquito vector (*Anopheles gambiae*) assures high transmission
- The predominant parasite species is *Plasmodium falciparum*, which causes the most severe form of malaria
- Local weather conditions often allow transmission to occur year round
- Scarce resources and socio-economic instability hinder efficient malaria control activities.

In other areas of the world malaria is a less prominent cause of deaths, but can cause substantial disease and incapacitation, especially in rural areas of some countries in South America and Southeast Asia. In Africa, where 90% of all malaria cases occur, children under the age of 5 years and pregnant women are the most vulnerable to the disease. Nearly 30% of all childhood deaths in Africa are attributable to malaria, with African children frequently experiencing more episodes of fever annually, about one-half

due to malaria. Among African newborns, an estimated 3 million suffer complications from low birth weight, including death, arising from maternal malaria infection during pregnancy. Other than Africa, Latin America and southern Asia continue to have extensive areas with malaria transmission, although the public health impact has been focal and unpredictable. Movement of individuals for economic reasons into areas with tremendous potential for malaria transmission has had some disastrous consequences, and ominous trends have recently taken hold in the two regions (Carlos 1997:325). However, implementation of malaria control in Africa Programming of malaria control in Africa has progressed in the 1980s, due to increasing commitments by national governments of African nations and modest infusions of external resources principally through child survival programs (Campbell, 1997).

As malaria control programming expands in Africa, it will be important to capitalize on the logical commonalities in implementation of malaria control with other developing health-care initiatives. The incorporation of malaria case management with acute respiratory infections and control of diarrheal diseases programs as sick child management will strengthen each component. Malaria prevention in the prenatal period should be merged with programs to improve tetanus immunization and pregnancy risk assessment in pregnant women. Where bed nets produce significant malaria control, their distribution and maintenance will require community-based initiatives common to those required to support water and sanitation in the home. Malaria intervention strategies need to become an integral part of child survival and maternal and child health activities. Such an integration of services will permit a shared implementation of activities for diagnosing, treating and preventing disease syndromes in children and mothers, syndromes that are related to malaria clinically, epidemiologically and operationally (Carlos 1997:323).

## **2.1 Effects of Malaria**

Malaria imposes substantial costs to both individuals and governments. There are costs to the family and governments and the gravity of the problem on children is enormous.

The description below attests to these tolls. Costs to individuals and their families include: purchase of drugs for treating malaria at home; expenses for travel to, and treatment at, dispensaries and clinics; lost days of work; absence from school; expenses for preventive measures; expenses for burial in case of deaths. Costs to governments include: maintenance of health facilities; purchase of drugs and supplies; public health interventions against malaria, such as insecticide spraying or distribution of insecticide-treated bed nets; lost days of work with resulting loss of income; and lost opportunities for joint economic ventures and tourism. Such costs can add substantially to the economic burden of malaria on endemic countries and impede their economic growth. It has been estimated in a retrospective analysis that economic growth per year of countries with intensive malaria was 1.3% lower than that of countries without malaria (Snow et al., 1999).

Malaria accounts for one in five of all childhood deaths in Africa. Anemia, low birth-weight, epilepsy, and neurological problems, all frequent consequences of malaria, compromise the health and development of millions of children throughout the tropical world. Yet much of the impact of malaria on the world's children could be prevented with currently available interventions (Snow et al., 1999).

Over 40% of the world's children live in malaria-endemic countries. Each year, approximately 300 to 500 million malaria infections lead to over one million deaths, of which over 75% occur in African children < 5 years infected with *Plasmodium falciparum*. The rapid spread of resistance to ant malarial drugs, coupled with widespread poverty, weak health infrastructure, and, in some countries, civil unrest, means that mortality from malaria in Africa continues to rise. The tragedy is that the vast majority of these deaths are preventable (Snow et al., 1999).

Malaria has been shown globally that in pregnancy it leads to low birth weight and premature delivery, both of which are associated with an increased risk of neonatal death and impaired cognitive development. In many parts of the developing world, specialist care for low birth weight babies is very limited, and untreated hypoglycemia

(low blood glucose, a common problem in low birth weight babies) may cause brain damage (Hay et al., 2004).

Approximately 7% of children who survive cerebral malaria (a severe form of the disease, characterized by coma and convulsions) are left with permanent neurological problems. These include weakness, spasticity, blindness, speech problems and epilepsy. The limited availability of specialized educational provision and equipment for such children means that opportunities for subsequent learning, and for attainment of independence, are compromised even further. Recent evidence suggests that some children who appear to have made a complete neurological recovery from cerebral malaria may develop significant cognitive problems (attention deficits, difficulty with planning and initiating tasks, speech and language problems), which can adversely affect school performance (Holding et al., 1999).

## **2.2 The tools to 'Roll Back Malaria'**

There are a number of evidence-based, cost-effective interventions which, if brought to scale in malaria-endemic countries, could have a significant impact on both morbidity and mortality from malaria.

ITNs have been shown to reduce all-cause mortality among children < 5 years by approximately 20%. This translates to the prevention of almost 0.5 million deaths each year in Africa south of the Sahara. ITNs also protect against the development of anemia in both pregnant women and young children, the groups at highest risk from malaria and malarial anemia. Nets can cost as little as US\$ 1.7, while a year's supply of insecticide to re-treat a net costs from US\$ 0.3 to US\$ 0.6. The recent development of long-lasting, wash-resistant ITNs, which will remain effective for up to four years, will avoid the current need to re-treat nets with insecticide every 6 to 12 months, which has proved extremely difficult to sustain (Carlos 1997:325; Bates et al., 2004).

Evidence has accrued that household use of pesticide-impregnated curtains and bed nets decreases the chance of malaria occurring in individuals and families. Randomized

controlled trials have shown reductions in levels of malaria morbidity and mortality because of community-wide provision of ITNs (Maxwell et al., 2002; Lengeler, 2004; Phillips-Howard et al. (2003). It has been shown that approximately six child deaths are prevented each year per 1000 children provided for (Lengeler, C. (2004). There have been hopes that ITNs will become a major component in the attempt to bring malaria under control, especially in its heartland in tropical Africa (Monasch, R. et al. 2004; UN Millennium Project 2005). Hence, this approach is advised for special communities with a high degree of interest in and resources for supporting personal protection measures and that are located in zones of intense malaria transmission.

Malaria-infected mosquitoes bite at night, and these nets provide a sleeping individual a physical barrier against the bite of an infected mosquito. In addition, a net treated with insecticide provides much greater protection by repelling or killing mosquitoes that rest on the net—an additional and important protective effect that extends beyond the individual to the community. The protective effect to non-users in the community is difficult to quantify but seems to extend over several hundred meters (WHO, 2005). A mosquito net is classified as an insecticide-treated net if it has been treated with insecticide within the previous 12 months. Long-lasting insecticidal nets, a recent technological innovation, are nets that have been permanently treated with insecticide that lasts for the useful life of a mosquito net, defined as at least 20 washes and at least three years under field conditions (Bates et al., 2004). WHO now recommends that national malaria control programs and their partners purchase only long lasting insecticidal nets (Crawley et al., 2007).

Since 2004 the number of insecticide-treated nets produced worldwide has more than doubled— from 30 million to 63 million in 2006, with another large increase expected by the end of 2007. Still an estimated 130 million to 264 million insecticide-treated nets are needed to achieve Roll Back Malaria's 80 per cent coverage target for pregnant women and children under age five at risk of malaria in Africa (Miller et al., 2007). This increase in the production of nets, coupled with increased resources, has led to a rapid rise in the number of nets procured and distributed within countries. For example, UNICEF—one

of the largest procurers of insecticide-treated nets worldwide—has significantly increased its procurement and distribution in recent years as part of its integrated strategy to improve child survival through accelerated programming efforts (WHO, 2007). The number of nets procured by UNICEF has more than tripled in only two years—from around 7 million in 2004 to nearly 25 million in 2006. And UNICEF’s procurement of nets is 20 times greater today than in 2000. The Global Fund to Fight AIDS, Tuberculosis and Malaria—a major source of funding for procurement and distribution of nets—has also greatly increased support for insecticide-treated nets in recent years, with its distribution of nets increasing around thirteen fold in only two years (from 1.35 million in 2004 to 18 million in 2006) (Miller et al., 2007).

As these efforts have only recently begun, some countries have not yet conducted household surveys that capture these higher coverage rates. Indeed, for some countries information presented in this report reflects survey data collected prior to major distributions of nets. For example, more than 10 million insecticide treated nets have been distributed in Kenya since its 2003 Demographic and Health Survey (PSI, 2006) and more than 18 million have been distributed in Ethiopia since its 2005 Demographic and Health Survey (Teklehaimanot et al., 2007). The next round of surveys in these countries is thus expected to show much higher coverage rates of key malaria control interventions.

In recent surveys (Gikandi et al., 2008; Noor et al., 2008), about two-thirds of the nets were rectangular, white and synthetic, of various origins and sold in the local markets. The materials are usually imported from Europe or Asia, and the nets produced by local tailors. Some were locally made nets and curtains, made from thick cotton. These were particularly preferred by older individuals, as a means to provide warmth during the colder periods of the year. Most nets were used for more than 3 years (58%). Most of households had devices on their walls (75%) and/or ceiling beams (62%) for fixing nets. Seventy three percent of respondents used their nets only during the raining season; only 12% used their nets throughout the year. Adult men were the group who reportedly

used nets most often (34%), followed by mothers with young children (19%) and elderly persons (17%).

Ninety-five percent of households owning nets used them as a measure against the nuisance of mosquitoes. Only a minority stated other reasons, such as privacy, protection against cold, flies and falling debris (8%). Acceptability of insecticide-impregnated nets among the respondents owning nets, (41%) had ever heard about the method of treating nets with insecticide. Of these, (31%) obtained the information from health personnel, (26%) from friends and neighbors, and (42%) from the media (radio, television, newspapers). Most respondents were interested in the future use of treated nets, mostly because they felt it would provide them with better protection against mosquitoes (87%). Only a minority stated that treated nets would provide them with better protection against illnesses (3%). When asked about how much money they would be willing to spend on net treatment, the majority did not want to spend more than 0.5–1 US\$ on treatment (Noor et al., 2008).

Most rural and urban respondents stated that they would prefer to have mosquito net treatment services close to their home (76%); a few wanted to have such services to be established centrally and the surrounding health centers (21%). Asked about the type of assistance needed to enable them to acquire new nets and/or to get existing ones treated with insecticide, (87%) of respondents wanted them for free, (9%) indicated their preference for reduced prices, and (4 %) preferred the nets to be provided on credit (Noor et al., 2008).

In 2000, only 1.7 million (1.8%) African children living in stable malaria-endemic conditions were protected by an ITN and the number increased to 20.3 million (18.5%) by 2007 leaving 89.6 million children unprotected. Of these, 30 million were living in some of the poorest areas of Africa: 54% were living in only seven countries and 25% in Nigeria alone. Overall, 33 (83%) countries were estimated to have ITN coverage of less than 40% in 2007. On average, we noted a greater increase in ITN coverage in areas where free distribution had operated between survey periods (Noor et al., 2008). Across

sub-Saharan Africa about one-quarter (26 per cent) of households own at least one mosquito net of any type.<sup>1</sup> Many countries, particularly those with more recent data, have much higher coverage levels, for example, Guinea Bissau (79 per cent in 2006), Congo (76 per cent in 2005) and Niger (69 per cent in 2006).

The proportion of households across sub Saharan Africa with at least one insecticide treated net is lower, at 12 per cent.<sup>15</sup> Again, several countries have recently achieved much higher coverage rates, including The Gambia (50 per cent in 2006), Zambia (44 per cent in 2006), Guinea-Bissau (44 per cent in 2006), Niger (43 per cent in 2006) and Togo (40 per cent in 2006). Recent years have also seen more focus on distributing long-lasting insecticidal nets, a technological innovation in which the insecticide lasts for the expected lifelong of the net and retreatment is not required. While survey data on household ownership of long-lasting insecticidal nets are limited, seven sub-Saharan African countries with recent survey data show that more than 80 per cent of nets in households that own at least one insecticide-treated net are long-lasting insecticidal nets. Similarly high rates of long-lasting insecticidal net ownership would be expected in many other malaria-endemic countries if data were available (Bates et al., 2004).

Across sub-Saharan Africa 15 per cent of children sleep under any type of mosquito net<sup>2</sup>, with some countries showing much higher coverage rates, including Guinea-Bissau (73 per cent in 2006), Congo (68 per cent in 2005), The Gambia (63 per cent in 2006) and São Tomé and Príncipe (53 per cent in 2006). Several countries with low household use of insecticide-treated nets have a large proportion of their population living in non-malarias areas. National-level estimates as presented in this report may, therefore, obscure higher coverage levels in endemic sub national areas targeted by national malaria control programs. The proportion of children across sub-Saharan Africa sleeping under insecticide-treated nets is 8 per cent. However, the regional average for sub-Saharan Africa is driven in part by a few populous countries with low insecticide-

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<sup>1</sup> Regional estimate for sub-Saharan Africa is based on 30 countries with data during 2003–2006, covering 77 per cent of the region's population.

<sup>2</sup> Regional estimate for sub-Saharan Africa is based on 28 countries with data during 2003–2006, covering 73 per cent of the region's under-five population.

treated net coverage, such as Ethiopia, Kenya and Nigeria. Again, the data presented need to be viewed within the rapidly changing context of recent and ongoing efforts to scale up insecticide treated net coverage in many countries). For example, Ethiopia has distributed more than 18 million nets since its last household survey in 2005, and Kenya has distributed more than 10 million since data were last collected in 2003 (Teklehaimanot et al., 2007). Therefore, insecticide-treated net use in these countries has likely increased significantly, but data are not yet available to document these major gains. Other countries with more recent data show much higher insecticide-treated net use rates for children under age five, including The Gambia (49 per cent in 2006), São Tomé and Príncipe (42 per cent in 2006), Guinea-Bissau (39 per cent in 2006) and Togo (38 per cent in 2006).<sup>3</sup>

Rapid gains have been made in insecticide-treated net use by children across all sub-Saharan African countries with available trend data in a short period of time and from a very low baseline. In fact, 16 of 20 countries with trend data available have at least tripled coverage since 2000. Between 2000 and 2005 the proportion of children sleeping under insecticide-treated nets based on a subset of 20 countries covering nearly half the region's under-five population (excluding Nigeria) increased from 2 per cent to 13 per cent. Despite this major progress, though, overall insecticide treated net use still falls short of global targets. While trend data for around 2000–2005 are available for these countries, large-scale distribution programs in many countries actually started much more recent than in 2000. Therefore, for most countries these large gains occurred in an even shorter timeframe than the trend analysis implies—less than three years for many countries. For example, insecticide-treated net use in Cameroon remained low at around 1 per cent between 2000 and 2004, with a sharp thirteen fold increase in coverage between 2004 and 2006, as a result of large-scale distribution efforts (WHOPES, 2005). The profile for Zambia is given in appendix V.

These high coverage rates at the national level, however, often hide important within-country disparities. For example, although boys and girls are equally likely to sleep

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<sup>3</sup> Regional estimate for sub-Saharan Africa is based on 28 countries with data during 2003–2006, covering 73 per cent of the region's under-five population.

under an insecticide treated net, children with the highest risk of malaria—those living in rural areas and in the poorest households—are much less likely. Across sub-Saharan Africa children living in urban areas are around 1.5 times as likely to be sleeping under an insecticide-treated net as those living in rural areas—and children living in the wealthiest households are three times as likely as their poorest counterparts (Appendix VI).<sup>4</sup>

Some countries, however, show little difference in the use of insecticide-treated nets by residence or household wealth. For example, 2006 data from Togo show relatively equitable coverage between rural (40 per cent) and urban (36 per cent) children as well as between children living in the poorest (41 per cent) and richest (35 per cent) households. Such coverage likely resulted from Togo's large-scale insecticide-treated net distribution, an integrated part of its child health campaign, which targeted all children throughout insecticide-treated nets (Appendix VII).

There have been reports on insecticide resistance. Insecticide resistance may render the pyrethroids ineffective for malaria control, but this is not necessarily the case with ITNs. On treated nets the pyrethroids work in three ways: first, they act as killing agent when the insect makes contact with the insecticide by landing on the net; secondly, pyrethroids have an irritating (excito-repellent) effect and the insect rests only briefly on the treated fabric and thirdly, the formulation in which the parathyroid is presented contains volatiles that cause deterrence, leading to fewer mosquitoes entering a room where an ITN is present (Lindsay *et al.* 1989; Chandre *et al.* 2000). In Kenya *A. gambiae s.s.* and *A. arabiensis* did not enter houses in lower numbers in ITN-provided bedrooms compared with houses with untreated nets (Mathenge *et al.* 2001), but the proportion of unfed and exiting mosquitoes was significantly greater in treated houses than untreated ones. Thus, ITN users are protected because fewer mosquitoes land on the net and many will leave the house.

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<sup>4</sup> The regional analysis of disparities in insecticide-treated net coverage is based on a subset of sub-Saharan African countries with data disaggregated by gender (24 countries, covering 66 per cent of the region's under five population), residence (27 countries, covering 75 per cent) and wealth (23 countries, covering 47 per cent).

Other side effects, however, are plausible. These may include changes in biting behavior expressed by outdoor biting and/or time of biting. Mosquitoes may also express a change in host preference because favored hosts can no longer be reached (they are under the ITN). Has evidence for such changes in mosquito behavior been reported? From the overview of studies that have investigated potential changes. All studies report a reduction in indoor biting in rooms where ITNs have been installed. It has to be stressed that the vectors covered by these studies concern endophilic mosquitoes, several of which prefer to bite humans. Therefore, in areas without vector control, such mosquitoes are collected in bedrooms. The excito-repellent effect of pyrethroids causes the mosquitoes to leave rooms for the outdoors, hence the observed reduction in indoor biting. Nevertheless, many mosquitoes managed to make contact with the ITN, because several studies report mass killing as expressed by a significant reduction in mosquito densities in the treated area (e.g. Cuzin-Ouattara *et al.* 1999; Maxwell *et al.* 1999). It is unlikely that the mass killing would have resulted from reduced access to blood hosts. In spite of a strong anthropophilic tendency, *A. gambiae* s.s. can readily switch to other hosts should humans not be available (Diatta *et al.* 1998) and other human-biting species are similarly inclined to feed on other hosts. When a mass killing effect was reported, this was accompanied by a reduced survival, as expected. However, because survival rates in mosquitoes are calculated from the average population age structure, those individuals that survived the effects of ITN exposure may be the select group that contributes to the next generation. In this way any resistance gene will be rapidly spread through the remaining mosquito population. Some studies report a reduction in sporozoite rate, presumably because of reduced survival. However, other studies did not see an effect on the sporozoite rate. In these cases the mosquitoes may not have entered the ITN homes and fed elsewhere, also because no effect on survival was noted. Most studies report some highly significant reductions in the EIR. This is to be expected when fewer mosquitoes bite man, and is of course the principal goal of ITN use (Diatta *et al.*, 1998).

Some effects of ITNs on the time of biting and the host choice of mosquitoes have been reported. In studies in Papua New Guinea and in Kenya a shift to outdoor biting was

observed. This was possibly also the case in a study in Tanzania (Magesa *et al.* 1991). In the Papua New Guinea and Tanzania studies shifts in host feeding and time of biting were also observed. Other hosts included pigs, dogs (Papua New Guinea) and cattle (Tanzania). Biting occurred earlier in the evening, presumably because the mosquito hosts had not yet gone to bed and were easily accessible. In the Kenya study (Mbogo *et al.* 1996) mosquitoes did not switch hosts, but they began biting earlier in the evening. The latter is the only study that reports reduced blood feeding. Because no effects on survival before and after ITN introduction were noted we must assume that the mosquitoes must have fed elsewhere. It thus appears that the overall effects of both immediate and long-term use of ITNs on mosquitoes are variable. In many cases, a reduced survival was observed as well as reduced sporozoite rates. With two exceptions, no shift to outdoor biting or non-human hosts has been recorded. In three studies mosquitoes started biting earlier in the evening. Because only few studies examined a comprehensive package of behavioral aspects related to ITN use, there is an urgent need to conduct such studies more often and in greater detail, in order to avoid long-term behavioral changes as have occurred following indoor spraying with organ chlorines (Boreham and Garrett-Jones 1973; Knols & Takken 1998).

#### *Protection afforded by untreated nets*

An attractive alternative option of using bed nets for malaria protection is the use of untreated nets, as was practiced for many centuries (Lindsay & Gibson 1988). Because the efficacy of insecticide impregnated nets was so much greater than of untreated ones (Snow *et al.* 1988), this option is rarely being considered. Its advantages are threefold no negative effects of insecticide use, the avoidance of toxic chemicals at household level and financial savings (Guyat & Snow 2002).

The behavior of mosquitoes around untreated nets has shown that considerable protection is afforded provided the nets are tucked in, maintained in good condition and sufficiently large so that the sleepers do not make contact with the net (Lindsay *et al.* 1989). Where untreated nets have been used in village trials, they resulted in a reduction of malaria morbidity compared with areas without nets, but the protection was

significantly lower compared with treated nets (Magesa *et al.* 1991). Yet, other studies report effects that are sufficiently encouraging to revisit this issue (Clarke *et al.* 2001; Hii *et al.* 1995; 2001; Guyatt and Snow 2002). In practice, most ITN users do not re-impregnate their nets unless a strongly coordinated action is put into place at the primary health care level (Clarke *et al.* 2001; Schellenberg *et al.* 2001). Therefore, the efficacy of untreated nets should be reconsidered not only from the aspect of malaria control but also from the point of sustainability. Untreated nets are clearly going to be of much longer use and easier and cheaper in use than treated ones. It is possible that behavioral changes in mosquitoes against the nets may develop, but these are unlikely to affect the protection against mosquito bites, unless a large shift in time of biting would occur. Such effects have hitherto not been clearly observed with large-scale use of ITNs and may therefore not occur with untreated nets. If children can sleep under a large enough net, the most vulnerable age groups for malaria disease would at least be well protected from mosquito bites.

In endemic areas, children under 5 years of age have benefitted from the use of nets. Community-based randomized trials in Africa have documented average reductions of 20% in all cause under-5 years mortality within 2 years of increasing ITN use from 0 to 50–70% (D'Alessandro *et al.* 1995a; Nevill *et al.* 1996; Habluetzel *et al.* 1997; Lengeler 2000). Based on this evidence, program of ITN promotion through social marketing, tax exemption and health education started in many countries during the 1990s. The Roll Back Malaria partnership has set a coverage target for Africa of 60% of children under 5 years of age sleeping under ITNs by 2005 (Roll Back Malaria , 2000a).

An imperative for Roll Back Malaria is to monitor progress towards this target, so that shortfalls in implementation can be identified and acted upon. Two indicators that are of potential value are (i) the proportion of households that have one or more nets and (ii) the proportion of children under 5 years of age who use (i.e. sleep under) a net (Roll Back Malaria 2000b). Household possession data indicate the extent to which distribution channels are enabling high coverage and may be particularly valuable at the early stages of program development and implementation. It has been established that

use of nets, however, is, of course, what affords protection and is therefore a more useful predictor of epidemiological impact. In practice, both measures will be useful for program management. If use rates are low, it is important to know whether this is due to affordability and a lack of availability, or the failure to use available nets which would suggest a need for health education. However, researchers have noted that the cost implications of collecting data for the two indicators are different (UNICEF, 2001).

Possession requires only a single question to any household member, whereas use requires additional questions on the behavior of specific, enumerated household members and therefore involves greater investment. Research has shown that use is also subject to seasonal variation, so that data collected at different times of the year in rapid surveys may not be comparable between populations. Monitoring of both indicators has gained momentum since 1998 with the inclusion of questions on malaria prevention in the nationally representative demographic and health surveys (DHS) (ORC Macro/Measure DHS) that are conducted in an increasing number of malaria endemic countries. Since 1999, DHS surveys in nine countries have provided estimates of net possession and use at household level. In addition, in 2000/2001, UNICEF conducted some 25 multiple indicator cluster surveys (MICS) on child health in malaria-endemic countries, including net use (not possession) (UNICEF, 2001).

### **2.3 Logistical Challenges and ITN Implementation**

There are numerous problems linked to the use and availability of ITNs in homes. The profile below is not exhaustive. Research has suggested that gender may influence the use of ITNs within households, as different roles dictate different sleeping patterns for men and women (Aikins et al. 1993). Additionally, several investigations in urban and peri-urban Africa suggest desire for mosquito avoidance is a strong determinant of net usage (Agyepong and Manderson 1999). This is, of course, strongly influenced by season, but is also an effect of correct understanding of the risk of transmission.

Very few publications have differentiated between possession and use, and yet this distinction is fundamental. For even though households may report they possess an ITN, if the net is not at least hung up during peak transmission seasons, its efficacy may be zero. Thus, while coverage of household ITN possession may be an important indicator for managers, it says little about the likely epidemiological impact of the program. An assessment of several national surveys suggests there is considerable disparity between ITN possession and use (Carlos 1997; Campbell, 1997; Murphy and Breman, 2001). ITN possession was shown to range between 0.1% and 28.5%, while use among children less than 5 years old ranged between 0% and 16%. This disparity between household ITN possession and individual use may include such factors as: the rationing of ITNs as a result of there being fewer nets than members or beds in a household, issue related to local understanding of transmission and mosquito avoidance behaviors.

There are outstanding issues related to ITN use at the household and individual levels include determinants of proper net deployment as well as individual adherence. The issue of how adherence varies as a function of season is also extremely important as the use of ITNs only when mosquitoes are perceived as a nuisance, or only when the weather is cool (i.e. during the rains) (Carlos, 1997), may place many individuals at risk of malaria infection outside the immediate rainy season. Answers to such questions are important and must be fed back to program planners and policy makers to achieve the greatest impact of ITN program.

## **2.4 Research Designs and Methods**

Researchers have opted to use randomized and non-randomized designs that are cross sectional in nature. The predominant methods in ITN studies are mainly household surveys. Researchers have found survey questionnaires and focus group discussions and one to one interviews to be appropriate for such studies (Appendix VIII).

It appears that DHS (ORC Macro/ Measure DHS), which are conducted on average at 5-year intervals in many malaria-endemic countries provide the most reliable data on

malaria and ITN use. Typically, a DHS consists of 4000–8000 interviews with women aged 15–49 years living in households that are sampled in a multiple-stage cluster design. When standardized questionnaires are used, they addresses, amongst others, household living conditions and assets and child health, through birth histories. By appropriate weighing between sampling units, nationally representative estimates can be obtained. Since 1998, some DHS have used specific questions on malaria prevention and treatment, including possession of nets and their use for children and pregnant women. Since 2001, most of these questions have been grouped in a malaria module, to be used in all surveys conducted in malaria-endemic countries (Netmark, 2001).

### *ITN use Surveys*

One large source of data on ITN use is the baseline surveys of net-promotion projects conducted in six African countries in 2000 under the Netmark initiative; each survey interviewed women in 1000 households spread over four or five districts (Netmark, 2001). These data were pooled over the districts with urban–rural stratification. For countries where there had been no DHS or Netmark survey, incidental surveys conducted in multiple regions or single districts were eligible.

### *Bed Net Possession*

As bed net possession and use can vary greatly among geographical areas within countries and the usefulness of net-coverage data as feedback for program planning is at district level, our research took the unit of analysis as the sub national level, and most often the provincial level. For DHS that gave us the data in this literature, we followed sub national grouping provided in published reports, which sometimes differed from provinces. Where data were not available by sub national region but included a distinction between rural and urban parts of the area, outcomes for these two groups were included separately. For the remaining surveys, national values were used. One of

the most interesting data we were able to collate is on ITN use (Ochola and Snow, 2002).

### *Difference between Possession and Use*

In order to explore the reasons for the difference between possession and in the review, we also considered smaller-scale surveys conducted at a sub-district level that looked at the difference between possession and use. Researchers seem to ask quite a number of questions. Questions were asked on – numbers of nets per household, use by household members other than children and seasonality in use; alternatively, the presence and condition of the nets were inspected visually. These surveys included evaluations during social marketing projects and the baselines and comparison arms of mosquito net intervention trials (Netmark, 2001; Ochola & Snow 2002).

## **CHAPTER THREE- METHODOLOGY**

### **3.0 Research Setting**

Katondo and Makululu townships are high density shanty townships that are situated within the 10km radius from the City Centre in Kabwe. Demographic and malariometric surveys have not been done in these areas. It is estimated that the under-five populations in these townships are 1 636 and 4 096 respectively. Both townships by ecological appearance are impoverished, predominantly semi urban in appearance. At the time of the study, no organized community based ITN activities existed. There was also no funding available locally to support population-level distribution (whether mass or targeted) of free nets. Throughout the localities, community leaders had not been previously established by the local authorities to even communicate key health messages to the local population. No baseline data existed regarding bed net coverage in the project district in the year 2011; because no organized bed net distribution existed and coverage was believed to be negligible.

### **3.1 Research Design**

A cross sectional research design was used. A cross sectional design was appealing for reasons of economy of time and cost, noting that the researcher intended to explore issues that were unknown in the setting withstanding the fact that the design severely limited the researcher's ability to address developmental issues or offer causal interpretations.

### 3.2 Target Population and Sampling

In this study, two data sources were recognized and these are:

- (i) health workers who are focal point persons of ITN distribution and these are MCH nurses and
- (ii) Heads of households.

Noting that we had two data sources, each one was sampled differently.

Sampling heads of households.

Only mothers or fathers or guardians in homes that had at least one child below five years were eligible for study. In this study, in order to draw the sample size for the quantitative data, the assumption was that there was a large population and we did not know the variability in the proportion that had under-fives therefore to determine the sample size in each township we applied the formula.

$$n = \frac{N}{1 + N(e)^2}$$

Where:

N = the population of households

n = the desired sample size

e = the precision set at 0.05

Simple random sampling without replacement was the main stay. Households were selected at random from a regularly updated housing list maintained for the two communities by political party chairpersons. A caretaker defined as the parent/guardian

who provided the daily essential needs of the child such as bathing, feeding, clothing, sending to school or to hospital when sick was the target.

#### *Inclusion Criteria*

Only households with an under five and where there was a caretaker who provided the daily essential needs of the child such as bathing, feeding, clothing, sending to school or to hospital when sick were eligible for study.

#### *Exclusion criteria*

All households without an under five were not eligible for study and non-care takers were excluded from the study.

#### *Sampling Health Workers*

Noting that health workers who are involved in ITN distribution are based at the District office, for this study, only these staffs were eligible. Recognizing that these staffs are few and cannot be randomized, expert availability sampling was the main stay.

### **3.3 Data Collection Tools**

This study employed two data collection tools and these are a survey questionnaire, and a focus group discussion.

#### *Survey questionnaire*

The ITN survey questionnaire (Appendix I) had been developed using the guidelines of developing a new research instrument by relying on Guillemin *et al.*, (1993) and Burns and Grove (1997) approaches. The development was based on theoretical knowledge in the domain of ITN and malaria. After reviewing relevant literature, key concepts that were thought to be reflective of the subject at hand were identified and used in developing the survey tool. This survey questionnaire will be pre-tested within Lusaka in Kamanga Township to control for reliability problems.

Following the guidelines and recommendation of studies like those of Nunnally (1967 and 1978 cited by Bawa 2000), the researcher will accept the lower limit for the Cronbach alpha of 0.70, although it may decrease to 0.50 in exploratory researches according to Hair *et al.* (1998:118). Nunnally (1967) as cited by Bawa argued (2000) that a Cronbach alpha value below 0.50 is unacceptable, 0.70 is a low level, 0.80 is “moderate”, and 0.90 are “high” (Bawa 2000: 80). The acceptance value set for the present study was 0.50. This selection is based on Nunnally’s guideline above and is consistent with Fagan’s (1989 who claims that reliabilities are at least adequate (alpha = 0.50), moderate (alpha = 0.70) and excellent (alpha = 0.90). All test items with scores less than 0.5 were eliminated and thereafter, the survey questionnaire was then be administered by the researcher to the caretakers in Kabwe.

#### *Focus group Discussions (FGDS)*

One FGD was conducted with DHMT staffs (eight in number) that are responsible for ITN distribution and treatment (Appendix II).

Variables to be considered in this study

#### **ACCESSIBILITY**

- Number of rooms under-fives sleep in
- Available bed space
- Duration of ITN used last rain season
- Distance to source of nets
- Cost of the net
- period of distribution of ITN
- Health staff attitudes

## **ITN AVAILABILITY**

- Ease of ITNs distribution
- availability of ITN in shops
- Constance of supply of ITNs
- Adequacy of ITNs

### **3.4 Plan for data analysis**

Quantitative data was coded and analysed using the Statistical Package for the Social Sciences (SPSS). Univariate and bivariate analyses were performed to generate frequency data. ANOVA and chi-square tests were performed to determine associations and differences of key variables.

Qualitative data was analysed using framework analysis. Framework analysis is a qualitative method that is aptly suited for qualitative research similar to grounded theory; however, framework analysis differs in that it is better adapted to research that has specific questions, a limited time frame, a pre-designed sample and a priori issues that need to be dealt with. Although framework analysis may generate theories, the prime concern in this study was to describe and interpret what was happening (Ritchie and Spencer, 1994).

The researcher listened to the tape recording over and over and only began to transcribe once he was satisfied that he had understood what was recorded in the discussions. The researcher then transcribed the discussion to create texts.

Using induction, he worked through the data to create categories or themes. Themes are used as headings in chapter four which is the results section of this study. A theme is a recurring regularity developed to link sub themes and categories later on. Sub headers (standing in for sub themes) were then defined considering that headers could have more than one descriptive organised mutually exclusive element (themes). Charting followed indexing. The researcher picked the specific pieces of data that were

indexed in the previous stage and had them arranged in charts of the themes. This means that the data had to be lifted from its original textual context and placed in charts that consisted of headings and subheadings drawn during the thematic framework, or from a priori research inquiries or in the manner that is perceived to be the best way to report the research (Ritchie and Spencer, 1994:186). The important point to remember here is that although the pieces of data are lifted from their context, the data is still clearly identified as to what case it came from.

### **3.5 Ethical considerations**

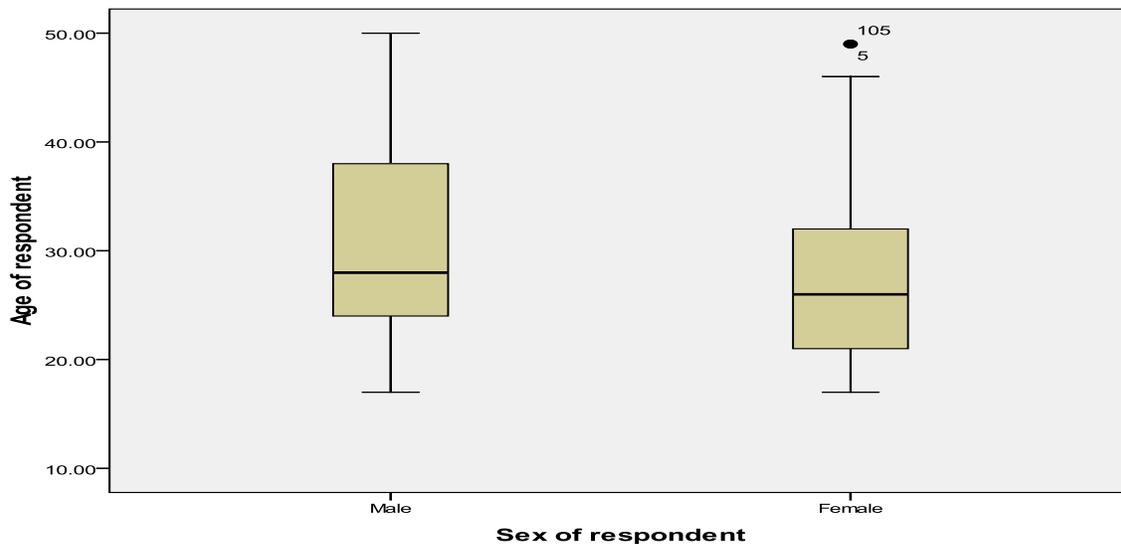
Ethical approval for this study was obtained from the University of Zambia Biomedical Research Ethics Committee. The details of ethical considerations appear in Appendix IV.

## CHAPTER FOUR- RESEARCH FINDINGS

### 4.0 Demographic Profile

The data was obtained from two townships. N= 65 (43.3%) households were from Katondo and n= 85 (56.7%) were from Makululu. There were more female members n = 95 (63.3%) of the households who were available at home during the study than male members of the household (36.7%). The oldest and youngest respondents were aged 17 and 50 years. The mean age was 28.3 (SD± 8.7). On average, male respondents were older than female respondents (figure 4.0.1).

Figure 4.0.1 Median Age Differences between male and female respondents



There were more respondents who were literate than those who were illiterate. Majority of the respondents n = 59 (39.3%) had attended junior secondary school, n = 36 (24%) primary education, n = 30 (20%) had attended senior secondary education, n = 12 (8%) had never been to school n = 12 (8%) had been to college and n = 1 had been to university. The two communities have members that fall in the lower income bracket. N = 66 (44%) earned between K 200 001 and K 500,000, n = 36 (24%) over K 800 000, n = 30 (20%) between K 500 001 and 800 000 and n = 18 (12%) less than K 200 000.

When income was related with level of education, at  $\alpha 0.05$ , the there was a significant association  $p$  was 0.00.

#### 4.1 Family Patterns and Dynamics

Before examining ITN availability and accessibility, it is important to describe the family distribution of children and the sleeping dynamics. Figure 4.1.1 below shows the profile of male children while figure 4.1.2 shows one for females.

Figure 4.1.1 Profile of Male Children

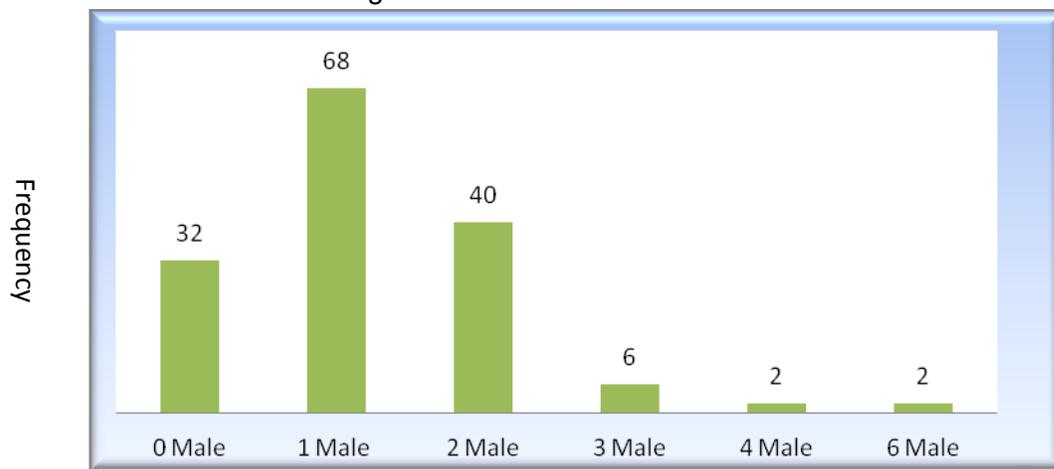
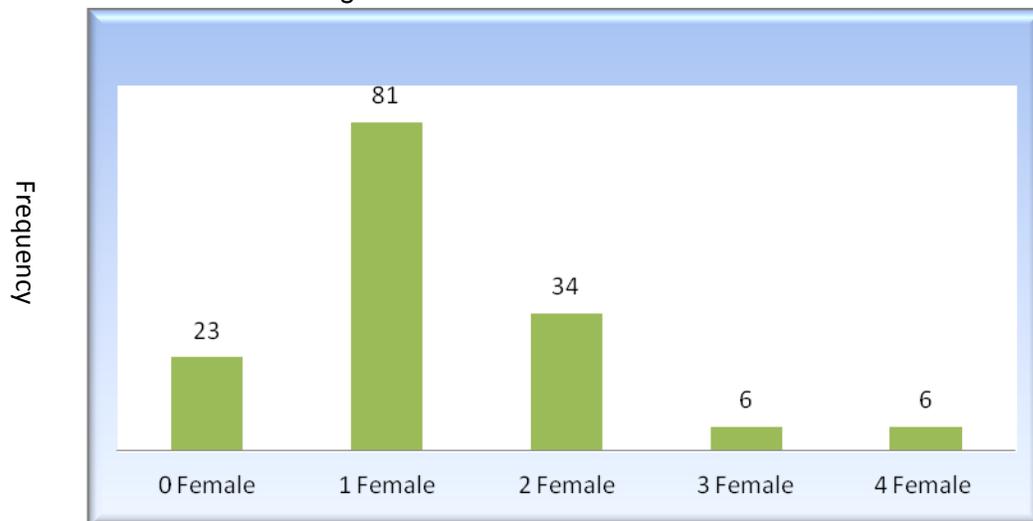


Figure 4.1.2 Profile of Female Children



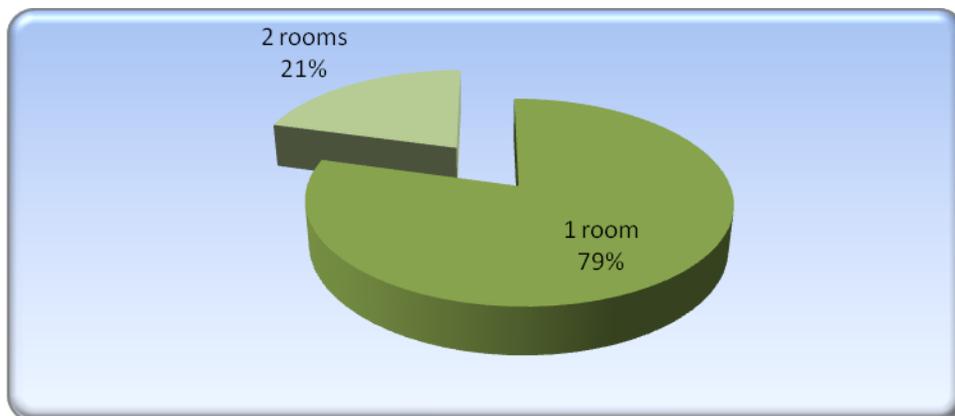
In the study sample, most households had at least one child however, there were more households that had sons or daughters than a nephew or niece or a grandchild for instance (Table 4.1.1).

Table 4.1.1 Relationship of Child to Head of Household

<i>Relationship to head of household with Child</i>								
<b>Child Characteristics</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>Total of Child per category</b>
Son	71	42	20	1	0	1	1	<b>136</b>
Daughter	67	50	7	1	2	0	0	<b>127</b>
Nephew	0	2	2	2	0	0	0	<b>6</b>
Niece	0	6	4	2	0	0	0	<b>12</b>
Grandchild (male )	8	0	2	1	1	0	0	<b>12</b>
Grandchild (female )	0	0	8	0	1	0	0	<b>9</b>
Other	0	22	14	6	3	2	3	<b>50</b>
<b>Total</b>	<b>146</b>	<b>122</b>	<b>57</b>	<b>13</b>	<b>7</b>	<b>3</b>	<b>4</b>	<b>352</b>

The children in the sample slept in either one or two rooms. Most of them (79%) slept in one room (figure 4.1.3)

Figure 4.1.3 Number of rooms under-fives slept in one or two rooms



Most of the households had one bed space however; few of them had 2 to 3 bed spaces (figure 4.1.4).

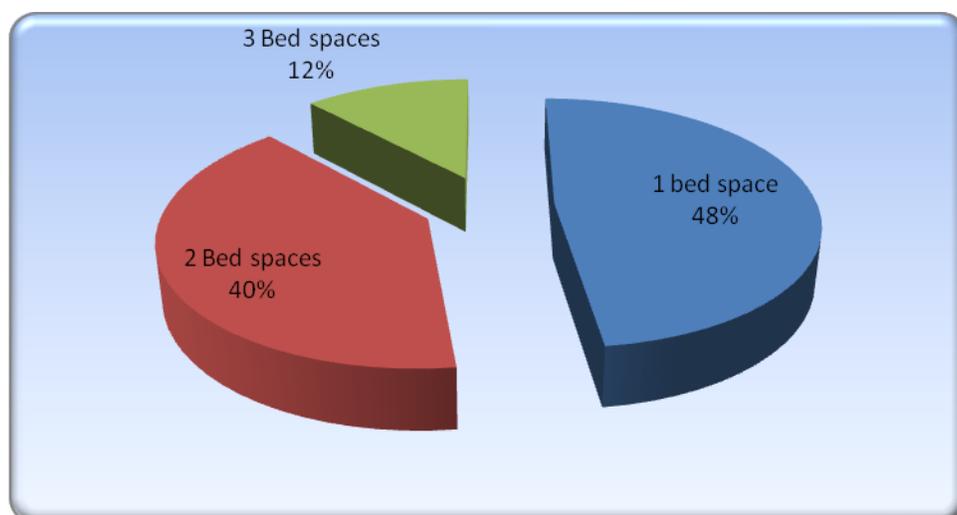


Figure 4.1.4 Number of bed spaces for under-fives

## 4.2 Level of ITN Availability

Table 4.2.1 Differential Distribution of ITNs in Households and Townships Last Rainy Season

Township		In the last rainy season did these bed spaces have each a mosquito net?		Total
		Yes	No	
Katondo	Count	44	21	65
	%within Township	67.7%	32.3%	100.0%
Makulu	Count	63	22	85
	% within Township	74.1%	25.9%	100.0%
	Total	107	43	

## 4.3 Level of ITN Accessibility and Ownership

In this study, ITNs were poorly distributed in the initial years but improved in 2011.

Table 4.3.1 Trends of Differential Distribution of ITNs in Households

How long ago did your household obtain the nets that you used in the last rainy season?							
		2007	2008	2009	2010	2011	Total
Katondo	Count	3	3	7	8	44	65
	% within Township	4.6%	4.6%	10.8%	12.3%	67.7%	100.0%
Makulu	Count	6	3	8	13	55	85
	% within Township	7.1%	3.5%	9.4%	15.3%	64.7%	100.0%

A critical look at accessibility of insecticide treated nets in the two townships and the four seasons shows that, there were significant differences in terms of mosquito net availability and ownership in the two townships (table 4.3.2).

Table 4.3.2 One sample t test difference by township

	Test Value = 0			
	95% Confidence Interval of the Difference			
	t	df	Sig. (2-tailed)	Mean Difference
Township	38.592	149	.000	1.56667
In the last rainy season did these bed spaces have each a mosquito net?	34.732	149	.000	1.28667

This difference was not significant at all ( $p = 0.098$ ) (table 4.3.3).

Table 4.3.3 Incidence of Sleeping under the Net by Child's Position

<i>Child position</i>	<i>Frequency</i>		
	<i>Yes</i>	<i>No</i>	<i>Total</i>
Did child one sleep under the mosquito net last night?	81	65	<b>146</b>
Did child two sleep under the mosquito net last night?	51	71	<b>122</b>
Did child three sleep under the mosquito net last night?	21	36	<b>57</b>
Did child four sleep under the mosquito net last night?	5	8	<b>13</b>
Did child five sleep under the mosquito net last night?	2	5	<b>7</b>
Did child six sleep under the mosquito net last night?	0	3	<b>3</b>
Did child seven sleep under the mosquito net last night?	2	2	<b>4</b>
<b>Total</b>	<b>162</b>	<b>190</b>	<b>352</b>

Interviews with some parents showed critical factors related to ITN ownership and use. The chances of a child sleeping under the net became by the position a child occupied in the household. This position was either by age or closeness to the head of the household. The younger the child the greater the chances of sleeping under the net was. Nieces, nephews and others were unlikely to sleep under the mosquito net than were sons or daughters or grandchildren. In the two study sites, the sleeping and bed

net use dynamics were rather similar. Sleeping arrangements of children under-five years were studied taking into consideration whether they slept alone or with another family member. Children under the age of five years did not sleep alone and the bed net if it was available was shared with another family member. Children under five years slept mainly with the mother and father.

### *Sleeping arrangements*

What I have seen not only in my house, those children who are older will not sleep under the net. You just have to see which child is likely...I mean very close if there are many. If there are other children under the net it is because their mothers were using the net.

Mother of four

In my house, there are four children under five. Two are my children, two are orphaned – a niece and a grandchild. I cannot manage to sleep with all these under one net. Of course I have considered my grandchild and my son. They are very young. These other two will sleep with my mother. She does not have a net anyway. We just got one last time.

Father and cobbler of seven running an extended family

When some of the heads of households were asked about other factors surrounding the use of nets, a total of 32 respondents spontaneously mentioned financial constraints while others did not as one of the important reasons for not owning any or owning only few nets per bed space. Both men and women claimed that the availability of money is seasonal and restricted to the time when subsistence produce is sold during the dry season. This was more a factor among residents in Katondo who were predominantly subsistence and worked on farms.

In the rainy season, when mosquito density is high, we actually have no or very little cash to spend. It is during the aftermath of the rainy season that we have money. In this time, maize and groundnuts are ready for food, and we also sell some of it on the road or in the township for money. But during the rainy season, when mosquitoes are plenty, we don't have any produce to sell for money.

37 years Female Gardener widow of six

#### 4.4 Sources of ITNS among Households

ITNs which were in the households were drawn from the clinic in most instances though in fewer instances, ITNs were bought.

Table 4.4.1 Sources of the net

<i>Source of the net</i>		
<i>Was the net for free that you got from the clinic?</i>	<i>Frequency</i>	<i>Percent</i>
Yes	111	74.0
No	5	3.3
Not applicable	34	22.7
<b>Total</b>	<b>150</b>	<b>100.0</b>
<b>Was the net for free that you got from the community health worker?</b>	<b>150</b>	<b>100.0</b>
<b>Did you ever get nets from the retail shop?</b>		
Yes	6	4.0
No	9	6.0
Not at all	135	90.0
<b>Total</b>	<b>150</b>	<b>100</b>
<b>Was the net for free that you got from a relative?</b>		
Yes	13	8.7
No	137	91.3
<b>Total</b>	<b>150</b>	<b>100</b>

#### 4.5 Factors that are responsible for ITN availability and accessibility

(Table 4.5.1).Table 4.5.1. Health or Local Authority Factors

<i>Nets are easily distributed by the authorities</i>		
	Frequency	Percent
Agree	39	26.0
Somewhat agree	16	10.7
Disagree	95	63.3
<b><i>The supply from the authority is erratic</i></b>		
Agree	39	26.0
Somewhat agree	16	10.7
Disagree	95	63.3
<b><i>There is rationing of ITNs in the clinic</i></b>		
Strongly agree	3	2.0
Agree	132	88.0
Somewhat agree	12	8.0
Disagree	3	2.0

Table 4.5.2 Retail Factors

<i>The stock from the shops is erratic</i>		
	Frequency	Percent
Strongly agree	3	2.0
Agree	9	6.0
Somewhat agree	3	2.0
Disagree	129	86.0
Strongly disagree	6	4.0
<i>Nets are available in the shops</i>		
Agree	3	2.0
Somewhat agree	144	96.0
Disagree	3	2.0

#### 4.6 Problems DHMT Has Faced In Implementing the ITN Program

During FGDs, when the staff at the District Medical Office was asked about the challenges they were facing in making nets available to those who were vulnerable especially children under five years were said to be process related and logistical in nature.

For some time now, I cannot state how far, we have run out of ITNs. Our donors have not provided us on time.

Nursing manager

We do not find it very necessary to provide nets after the rainy season. This is decision of course, is not strongly influenced by season, but is also an effect of what we have and the size of our population.

Environmental health technologist

We are facing problems we are told. Costs are unexpectedly increasing. This scenario obliterated our hope of distributing according to target.

Nursing manager

Transportation of the nets from the warehouses in Lusaka is one factor. You see we have a lot of things to order drugs, sundries, and the nets. All these do not come at once. We are told they have to make priorities.... We have also experienced thefts and losses here in Kabwe.

Logistics Officer

## CHAPTER FIVE – DISCUSSION

### 5.0 Introduction

This chapter discusses the findings. The findings are initially discussed using research questions. This is followed by a contextual grounding of the findings.

### 5.1 What this Study Has Found

From The Research Questions the study has found the following:

*Regarding Research Question 1: What is the Level of ITN availability at house hold level?*

Very few households lacked insecticide treated mosquito nets for every bed space. There was a differential availability of insecticide treated nets by township with Makulu having more bed spaces with insecticide treated nets than Katondo.

*Regarding Research Question 2: What is the level of ITN accessibility at household level?*

Based on the availability of the insecticide treated nets in the last season, data shows that the distribution of the insecticide treated nets to ensure household accessibility was rather slow and very sparse. There was a differential accessibility of insecticide treated nets by township with Makulu having more insecticide treated nets than Katondo. A critical look at the mean accessibility of Insecticide treated nets in the two townships and the four seasons shows that, there were significant differences in terms of mosquito net availability in the two townships.

*Regarding Research Question 3: What are the sources of ITNS among Households*

In these two poor communities, the sources of the insecticide treated nets that were used in the households were predominantly from the clinic. (see Table ....) None of the households got the insecticide treated nets from a community health worker. An insignificant number got insecticide treated nets from a relative or a retail shop.

*Regarding Research Question 4: What Factors are responsible for ITN availability and accessibility*

Health centre factors played a role in determining the availability and accessibility of insecticide treated nets at household level. Insecticide treated nets are not easily distributed by the authorities and this affects accessibility and availability in the homes. The notable factors are as follows:

- a) The insecticide treated nets were not easily distributed by the health authorities,
- b) The supply from the authority is erratic, and
- c) That rationing of Insecticide treated nets in the clinic was common because there were fewer insecticide treated nets to go round.

In case households needed to get insecticide treated nets elsewhere apart from the local authority and clinics, there were insecticide treated nets in the shops. However, most of the heads of households that were surveyed stated that even though shops had no erratic supply of Insecticide treated nets, they faced challenges. It was difficult to procure them because the Insecticide treated nets in the shops were rather expensive.

### **5.3 Synthesis of Findings**

The current study represents the first to explore household ITN accessibility on a very small scale. Most of the studies cited are either country or regional specific and as such contextualising may not provide a better contrasting and comparative feature. However, an attempt where need arises will be made.

It was surprising to find that more than five years since the Roll Back Malaria campaign was launched, Zambia was still far below the expected 80 per cent coverage target for pregnant women and children under age five in the two townships. Meanwhile Yet ITNs cost as little as US\$ 1.7, while a year's supply of insecticide to re-treat a net costs from US\$ 0.3 to US\$ 0.6 cannot be readily available in the home and that health workers could continue to ration.

A critical examination of ITN ownership showed that the rates in the two townships fared poorly than other parts of the country where free distribution went beyond 80%. However, the rate in this study failed to exceed what has been reported across sub-Saharan Africa from the latest studies and notably: Guinea Bissau (79 per cent in 2006), Congo (76 per cent in 2005) and Niger (69 per cent) (Noor et al., 2008).

The experiences of some of the households regarding ownership and use of ITNs are similar with findings from other African countries. A few studies do address some aspects of intra-household net use, with one in the Gambia concluding that vulnerable groups were more likely than other family members to use a net (D'Alessandro, 1994) another from The Gambia finding that, by a small margin, adults used nets more than children (but defined children as under 10 years of age) and girls were more likely than boys to use the net (Aikins, 1994) and another from Burkina Faso finding that adult men were most likely to use the net (though the sample size was small at 103 households, all from 1 province) (Okrah et al., 2002). A study based on secondary analyses of the Demographic and Health Survey by Mugisha and Arinaitwe (2003) in Uganda concluded that young children were sleeping under a net only because their mothers were using the net.

## **5.4 Limitations of The study**

This was not a broad study and the researcher's discussions and conclusions are not intended to be generalizable to all sites in Kabwe or beyond Kabwe.

## **5.5 Conclusions and recommendations**

The study has made the researcher to believe that there is very little that the local authority and clinics are doing in eradicating malaria especially in the distribution of ITNs. The data support the idea that ITN distribution programmes in Kabwe could have an important role in malaria prevention in Katondo and Makululu. On the basis of the researcher's evaluation the effect of the programme appeared modest but less useful as part of a larger district malaria control strategy. To maintain high coverage, there is need to consider ITN mass distribution.

However, given this position, this study has potential recommendations on research, policy and programmatic interventions. Building on earlier research on social, cultural and economic aspects of ITNs, this investigation confirms the relevance of formative research into local knowledge and practice relating to ITN distribution, availability and ownership for the design of culturally, socially and economically appropriate and effective interventions. The researcher observes that for a successful ITN distribution campaign in the two localities to be attained, the following need to be done:

- a) Bed net promotion and distribution (or sales) should be the result of a population-level strategy.
- b) Nets that do not require regular re-application of insecticide) should be used exclusively.
- c) Commercial sales may be adequate in more prosperous regions and not in these localities. In these two localities impregnated with high combined burdens of poverty and malaria—long-lasting nets should be given to local residents without charge.

- d) Community leaders and local health workers should be enlisted in the distribution and education of the public about ITN use in local languages, and to serve as liaisons between target populations and bed net programmes.
- e) Cost estimates for large-scale ITN distribution that the local authority and clinics has highlighted —should pay close attention to costs of adequate warehousing and transportation, both at central and at peripheral levels. There is need to prioritise the transportation and storage ITNs if the program has to be successful. There may be need to mainstream the transportation of drugs and ITNs to ensure timely and adequate delivery.
- f) The sites under study are severely impoverished and just like others have concluded that poverty is a formidable barrier to bed net purchase at personal and institutional level (Santos, 1999; Howard et al. 2003). Given that donors are willing to make nets available, it is recommended that the local authority and clinics employ large-scale targeted (or mass) distribution and/or retreatment of bed nets, without charge than the current strategy of distributing at antenatal clinics. This can be an efficient and effective technique for achieving high levels of coverage in these two localities. There is evidence of such approaches elsewhere. Successful programmes have been piloted in Ghana, Kenya and Vietnam, among other sites (Kachur et al. 1999; Guyatt et al.2002; Guyatt and Ochola 2003; Hungle et al. 2002; Grabowsky et al. 2005).
- g) The researcher is proposing that future research be operational in nature. This is because the approach presented in this thesis has documented how surveys, interviews, field observations and focus group discussions can be incorporated into a community strategy using basic principles of operations research. The short discussions highlighted the problems people at the grassroots and the people who serve them have. Operations research would facilitate the integration of public health perspectives and community perspectives into a coherent promotional strategy. Such an approach becomes particularly important if ITNs are to be introduced to large populations.

## References

- Agyepong, IA & Manderson, L ( 1994 ) The diagnosis and management of fever at household level in the Greater Accra Region, Ghana. *Acta Tropica* 58, 319-330.
- Aikins MK, Pickering H, Alonso PL, D'Alessandro U, Lindsay SW, Todd J, and Greenwood BM, (1993). A malaria control trial using insecticide-treated bed nets and targeted chemoprophylaxis in a rural area of The Gambia, West Africa. 4. Perceptions of the causes of malaria and of its treatment and prevention in the study area. *Trans R Soc Trop Med Hyg* 87 (Suppl 2): 25–30.
- Aikins, MK, Pickering, H, Alonso, PL, D'Alessandro, U, Lindsay, SW, Todd, J, Greenwood, BM ( 1993 ) A malaria control trial using insecticide-treated bed nets and targeted chemoprophylaxis in a rural area of The Gambia, West Africa. *Transactions of the Royal Society for Tropical Medicine and Hygiene* 87 (Suppl. 2), 25-23.
- Alaii JA, Hawley WA, Kolczak MS et al. (2003) Factors effecting use of permethrin-treated bed nets during a randomized controlled trial in Western Kenya. *American Journal of Tropical Medicine and Hygiene* 68, 149–160.
- Antimalarial Treatment in Infants. *Clinical Infectious Diseases* 45(1): 26–28.
- Boreham PFL & Garrett-Jones C (1973) Prevalence of mixed blood meals and double feeding in a malaria vector (*Anopheles sacharovi* Favre). *Bulletin of the World Health Organization* 48, 605- 614.
- Bull World Health Organ* (2006) 84:120-126.
- Burkot TR, Garner P, Paru R et al. (1990) Effects of untreated bed nets on the transmission of *Plasmodium falciparum*, *P. vivax* and *Wuchereria bancrofti* in Papua New Guinea. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 84, 773- 779.
- Campbell C.C., *FEMS Immunology and Medical Microbiology* 18 325-331 328.
- Carlos,C.C. (1997) *FEMS Immunology and Medical Microbiology* 18.325-331.
- Centers for Disease Control and Prevention (1993) *Controlling Malaria in Africa: Progress and Priorities*. CDC, Atlanta,GA.

- Chandre F, Darriet F, Duchon S et al. (2000) Modifications of parathyroid effects associated with kdr mutation in *Anopheles gambiae*. *Medical and Veterinary Entomology* 14, 81- 88.
- Clarke SE, Bogh C, Brown RC, Pinder M, Walraven GE & Lindsay SW (2001) Do untreated bed nets protect against malaria? *Transactions of the Royal Society for Tropical Medicine and Hygiene* 95, 457- 462.
- Cook GC. (1992) Malaria: an underdiagnosed and often neglected medical emergency. *Aust N Z J Med*;22:69-80.
- Crawley, J. J. Hill, J. Yartey, and others. (2007). From Evidence to Action? Challenges to Policy Change and Programme Delivery for Malaria in Pregnancy. *The Lancet Infectious Diseases* 7(2): 145–55.
- Curtis C, Maxwell C, Lemnge M, Kilama WL, Steketee RW, Hawley W, Bergevin Y, Campbell CC, Sachs J, Teklehaimanot A, Ochola S, Guyatt H, Snow RW (2003) Scaling-up coverage with insecticide-treated nets against malaria in Africa: who should pay? *Lancet Infect Dis*, 3:304-307.
- Cuzin-Ouattara N, Van den Broek AHA & Habluetzel A (1999) Wide-scale installation of insecticide-treated curtains confers high levels of protection against malaria transmission in a hyper endemic area of Burkina Faso. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 93, 473-479.
- D'Alessandro U, Olaleye BO, McGuire W et al. (1995a) Mortality and morbidity from malaria in Gambian children after introduction of an impregnated bednet programme [see comments]. *Lancet* 345, 479–483.
- D'Alessandro U (2001): Insecticide-treated bed nets to prevent malaria. The challenge lies in implementation. *BMJ* 2001, 322:249-250.
- Diallo DA, Cousens SN, Cuzin-Ouattara N, Nebié I, Ilboudo-Sanogo E, Esposito F: Child mortality in a West African population protected with insecticide-treated curtains for a period of up to 6 years. *Bull World Health Organ* 2004, 82:85-91.
- Diatta M, Spiegel A, Lochouarn L & Fontenille D (1998) Similar feeding preferences of *Anopheles gambiae* and *An. arabiensis* in Senegal. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 9, 270- 272.
- Earthscan Monasch, R. et al. (2004) Child coverage with nets and malaria treatment from population-based surveys in African countries: a baseline for monitoring progress in Roll Back Malaria. *Am. J. Trop. Med. Hyg.* 71 (Suppl. 2), 232–238.
- GFATM (The Global Fund to Fight AIDS, Tuberculosis and Malaria). 2007. *Partners in Impact: Results Report*. Geneva.

- Goodman C, Coleman P, Mills A (1999) Cost-effectiveness of malaria control in sub-Saharan Africa. *Lancet* 1999, 354:378-385.
- Grabowsky M, Farrell N, Hawley W et al. 2005b. Ghana and Zambia: Achieving equity in the distribution of insecticide-treated bed nets through links with measles vaccination campaigns. HNP Discussion Paper: Reaching the Poor Program Paper No. 10. Washington, DC: The World Bank.
- Guillet P, Alnwick D, Cham MK, Neira M, Zaim M, Heymann D (2001): Long-lasting treated nets: a breakthrough in malaria prevention.
- Guyatt H, and Ochola S. (2003). Use of bed nets given free to pregnant women in Kenya. *The Lancet* 362: 1549–50.
- Guyatt H, Gotink M, Ochola S, Snow R. 2002. Free bed nets to pregnant women through antenatal clinics in Kenya: a cheap, simple and equitable approach to delivery. *Tropical Medicine and International Health* 7: 409–20.
- Guyatt HL & Snow RW (2002) The cost of not treating bed nets. *Trends in Parasitology* 18, 12-16.
- Habluetzel A, Diallo DA, Esposito F et al. (1997) Do insecticide treated curtains reduce all-cause child mortality in Burkina Faso? *Tropical Medicine and International Health* 2, 855–862.
- Hamel MJ, Odhacha A, Roberts JM&Deming MS (2001) Malaria control in Bungoma district, Kenya: a survey of home treatment of children with fever, bednet use and attendance at antenatal clinics. *Bulletin of the World Health Organization* 79, 1014–1023.
- Hatch, E., and Lazaraton, A.(1991). *The research manual: Design and statistics for applied linguistics*. Boston, MA: Newbury House.
- Hay, S., C. Guerra, A. Tatem, and others. (2004). The Global Distribution and Population at Risk of Malaria: Past, Present, and Future. *The Lancet Infectious Diseases* 4(6): 327–36.
- Helen L. Guyatt, Sarah K. Corlett, Timothy P. Robinson, Sam A. Ochola and Robert W. Snow (2001). *Tropical Medicine and International Health* 7 (4) 298–303.
- Hii J, Birley MH, Kanai L, Foligeli A & Wagner J ( 1995) Comparative effects of permethrin-impregnated bed nets and DDT house spraying on survival rates

- and oviposition interval of *Anopheles farauti*, 1 (Diptera: Culicidae) in Solomon Islands. *Annals of Tropical Medicine and Parasitology* 89, 521- 529.
- Hii JLK, Smith T, Vounatsou P et al. (2001) Area effects of bednet use in a malaria-endemic area in Papua New Guinea. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 95, 7-13.
- HIV/AIDS Infection and Disease. Part 1: Determinants Operating at Individual and Household Level. *The Lancet Infectious Diseases*, 4(5): 271–72.
- Holding PA et al. (1999) Cognitive sequelae of severe malaria with impaired consciousness. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 93(5):529-34.
- Howard N, Chandramohan D, and Freeman T (2003). Socio-economic factors associated with the purchasing of insecticide-treated nets in Afghanistan and their implications for social marketing. *Tropical Medicine and International Health* 8: 1043–50.
- Hung le Q, de Vries P, Giao P et al. (2002). Control of malaria: a successful experience from Viet Nam. *Bulletin of the World Health Organization* 80: 660–66.
- Jane Okrah, Corneille Traore´, Augustin Pale´, Johannes Sommerfeld and Olaf Mu ller (2002)*Tropical Medicine and International Health*. 7 (3) 240–248.
- Kachur S, Phillips-Howard P, Odhacha A (1999). Maintenance and sustained use of insecticide-treated bednets and curtains three years after a controlled trial in western Kenya. *Tropical Medicine and International Health* 4: 728–35.
- Kampala City Council (2002) Mosquito Net Coverage. Baseline Assessment in 5 Parishes of Kampala. Kampala City Council, Kampala.
- Klein RE, Weller SC, Zeissig R, Richards FO, Ruebush TK II: (1995), Knowledge, beliefs and practices in relation to malaria transmission and vector control in Guatemala. *Am J Trop Med Hyg* 52:383-388.
- Lengeler C & Snow RW (1996) From efficacy to effectiveness: insecticide-treated bed nets in Africa. *Bulletin of the World Health Organization* 74, 325- 332.
- Lengeler C (2000) Insecticide treated bed nets and curtains for malaria control (Cochrane Review). *Cochrane Database System Rev Issue 2: CD 000363*.
- Lengeler C (2004) Insecticide-treated nets for malaria control: real gains. *Bull World Health Organ*. 82:84.

- Lengeler, C. (2004) Insecticide-treated bed nets and curtains for preventing malaria. *Cochrane Database Syst Rev.* 2, CD000363 Phillips-Howard, P. et al. (2003) Efficacy of permethrin-treated bed nets in the prevention of mortality in young children in an area of high perennial malaria transmission. *Am. J. Trop. Med. Hyg.* 68 (Suppl. 4), 23–29.
- Lindblade KA, Eisele TP, Gimnig JE, Alaii JA, Odhiambo F, ter Kuile FO, Hawley WA, Wannemuehler KA, Philipps-Howard PA, Rosen DH, Nahlen BL, Terlouw DJ, Adazu K, Vulule JM, Slutsker L: Sustainability of reductions in malaria transmission and infant mortality in Western Kenya with use of insecticide-treated bed nets. *J Am Med Assoc* 2004, 291:2571-2580.
- Lindsay SW, Adiamah JH, Miller JE & Armstrong JRM (1991) Pyrethroid-treated bednet effects on mosquitoes of the *Anopheles gambiae* complex in the Gambia. *Medical and Veterinary Entomology* 5, 477-483 an old idea, new angle. *Parasitology Today* 4, 270-272.
- Lindsay SW, Alonso PL, Armstrong Schellenberg JRM et al. (1993) A malaria control trial using insecticide-treated bed nets and targeted chemoprophylaxis in a rural area of the Gambia, West Africa. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 87 (Suppl. 2), 45-51.
- Lindsay SW, Gibson ME: (1988) Bed nets Revisited – Old Idea, New Angle. *Parasitol Today*, 4:270-272.
- Lindsay SW, Shenton FC, Snow RW & Greenwood BM (1989) Responses of *Anopheles gambiae* complex mosquitoes to the use of untreated bed nets in the Gambia. *Medical and Veterinary Entomology* 3, 253-262.
- Magesa SM, Wilkes TJ, Mnzava AEP et al. (1991) Trial of parathyroid impregnated bed nets in an area of Tanzania holoendemic for malaria vector population. Part 2. Effects on the malaria vector population. *Acta Tropica* 49, 97- 108.
- Malenga, G., A, Palmer, S. Staedke, and others. 2005. Antimalarial Treatment with Artemisinin Combination Therapy in Africa. *British Medical Journal* 331: 706–07.
- Mallet J (1989) The evolution of insecticide resistance: have the insects won? *Ecology and Evolution* 4, 336- 340.
- Mathenge EM, Gimnig JE, Kolczak M, Ombok M, Irungu LW & Hawley WA (2001) Effect of permethrin-impregnated nets on exiting behavior, blood feeding success, and time of feeding of malaria mosquitoes (Diptera: Culicidae) in western Kenya. *Journal of Medical Entomology* 38, 531- 536.

- Maxwell CA, Myamba J, Njunwa KJ, Greenwood BM & Curtis CF (1999) Comparison of bed nets impregnated with different pyrethroids for their impact on mosquitoes and on re-infection with malaria after clearance of pre-existing infections with chlorproguanil-dapsone. *Transactions of the Royal Society for Tropical Medicine and Hygiene* 93, 4-11.
- Maxwell, C.A. et al. (2002) Effect on malaria morbidity of communitywide use in Tanzania of insecticide treated nets for 3–4 years. *Trop. Med. Int. Health* 7, 1003–1008.
- Mbogo CNM, Baya NM, Ofulla AVO, Githure JI & Snow RW (1996) The impact of permethrin-impregnated bed nets on malaria vectors of the Kenyan coast. *Medical and Veterinary Entomology* 10, 251- 259.
- Miller, J.M., E.L. Korenromp, B.L. Nahlen, and others. (2007). Estimating the Number of Insecticide-Treated Nets Required by African Households to Reach Continent-Wide Malaria Coverage Targets. *Journal of the American Medical Association* 297(20): 2241–50.
- Mugisha F, and Arinaitwe J, (2003). Sleeping arrangements and mosquito net use among under-fives: results from the Uganda Demographic and Health Survey. *Malaria J* 2: 40. <http://www.malariajournal.com/content/2/1/40>.
- Müller O, Ido K, Traoré C (2002) : Evaluation of a prototype long-lasting insecticide-treated mosquito net under field conditions in rural Burkina Faso. *Trans R Soc Trop Med Hyg.*96:483-484.
- Müller O, Traoré C, Kouyaté B, Yé Y, Frey C, Coulibaly B, Becher H: Effects of insecticide-treated bed nets during early infancy in an African area of intense malaria transmission: a randomized controlled trial. *Bull World Health Organ* 2006, 84:120-126.
- Murphy SC, Breman JG. (2001) Gaps in the childhood malaria burden in Africa: cerebral malaria, neurological sequelae, anemia, respiratory distress, hypoglycemia, and complications of pregnancy. *American Journal of Tropical Medicine and Hygiene.* 64(1-2 Suppl):57-67.
- Nabarro DN, Tayler EM (1998) The 'Roll Back Malaria' Campaign. *Science* 280:2067-2068.
- Netmark (2001) Netmark baseline survey on insecticide-treated materials (ITMs): cross-national summary of findings. Netmark, a regional partnership for sustainable malaria prevention. <http://www.netmarkafrica.org/research/quantitative/rossCountryQuan2001.pdf>.

- Nevill CG, Some ES, Mung'ala VO et al. (1996) Insecticide-treated bed nets reduce mortality and severe morbidity from malaria among children on the Kenyan coast. *Tropical Medicine and International Health* 1, 139–146.
- Noor et al., (2008) [www.thelancet.com](http://www.thelancet.com) Published online November 18, 2008 DOI:10.1016/S0140-6736(08)61596-2.
- Nunnally, J. (1978). *Psychometric theory*. New York: McGraw-Hill.
- Ochola SA& Snow RW (2002) Analysis of Community-based Baseline Survey of Roll Back Malaria Indicators in Four Sentinel Districts. Division of Malaria Control, Ministry of Health, Kenya.
- Okrah J, Traoré C, Palé A, Sommerfeld J, and Müller O, (2002). Community factors associated with malaria prevention by mosquito nets: an exploratory study in rural Burkina Faso. *Trop Med Int Health* 7: 240–248.
- Olliaro P, Cattani J, Wirth D. (1996) Malaria, the submerged disease. *JAMA* 275:45-8.
- Poser CM, Bruyn GW (1999) The General History of Malaria. In *An illustrated history of malaria*. Edited by: Poser CM, Bruyn GW. New York: Parthenon Publishing Group;;121-125.
- Priscilla W.Gikandi, Abdisalan M. Noor, Carol W. Gitonga<sup>1</sup>, Antony A. Ajanga and Robert W. Snow (2008) *Tropical Medicine and International Health*.13 (2) .208–217.
- PSI (Population Services International). 2006. “Mosquito Net Coverage of Vulnerable Groups Reaches 50% in Kenya.” Nairobi. [[www.psi.org/malaria/pubs/Kenya-ITN-program.pdf](http://www.psi.org/malaria/pubs/Kenya-ITN-program.pdf)].
- RBM (1999) The Global Partnership to Roll Back Malaria. Initial period covered July 1998:December 2001 (preparatory phase: July 1998a December 1999). Proposed strategy and work plan. Draft 3.1b/12 . World Health Organization, Geneva.
- Ritchie, J., Spencer, L., (1994). Qualitative data analysis for applied policy research. In: Bryman, A., Burgess, R.G. (Eds.), *Analysing Qualitative Data*. Routledge, London.
- Rodríguez AD, Penilla RP, Henry-Rodríguez M, Hemingway J, Betanzos AF, Hernández-Avila JE (2003) Knowledge and beliefs about malaria transmission and practices for vector control in Southern Mexico. *Salud Pública de México* 45:110-116.

- Roll Back Malaria (2000) The African summit on Roll Back Malaria. World Health Organization, Abuja. WHO/CDS/RBM/ 2000.17.
- Santos J. 1999. [Low adherence and high cost as factors in the failure of the use of insecticide-impregnated mosquito bed nets in the control of malaria in the Brazilian Amazon]. *Revista da Sociedade Brasileira da Medicina Tropical* 32: 333–41.
- Schellenberg D et al. (2001) Intermittent treatment for malaria and anaemia control at time of routine vaccinations in Tanzanian infants: a randomised, placebocontrolled trial. *Lancet*. 357(9267):1471-7.
- Schellenberg JRMA, Abdulla S, Nathan R et al. (2001) Effect of large-scale social marketing of insecticide-treated nets on child survival in rural Tanzania. *Lancet* 357, 1241-1247.
- Snow RW (1999) Estimating mortality, morbidity and disability due to malaria among Africa's non-pregnant population. *Bulletin of the World Health Organization*. 77(8):624-40.
- Snow RW, Rowan KM, Lindsay SW & Greenwood BM (1988) A trial of bed nets (nets) as a malaria control strategy in a rural area of The Gambia, West Africa. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 82, 212-215.
- Tanser FC, Sharp BL & le Sueur D (2003) Malaria seasonality and the potential impact of climate change in Africa. *Tropical Medicine and International Health* 3, 139–146.
- Tayles N (1996): Anemia, genetic diseases, and malaria in Southeast Asia. *Am J Phys Anthropol*. 101:11-27.
- Teklehaimanot, A., J.D. (2007) Sachs, and C. Curtis. . Malaria Control Needs Mass Distribution of Insecticidal Bednets. *The Lancet* 369(9580): 2143–46.
- Traoré C (2003): Epidemiology of malaria in a holoendemic area of rural Burkina Faso. In PhD Thesis. Ruprecht-Karls-University Heidelberg, Department for Tropical Hygiene and Public Health.
- UNICEF (2001) Multiple Indicator Cluster Surveys (MICS-2)/ End of Decade Assessment. <http://www.childinfo.org/MICS2/>.
- US Census Bureau Roll Back Malaria 2005 World Malaria Report.
- Van Bortel W, Barutwanayo M, Delacollette C & Coosemans M (1996) Motivation à l'acquisition et à l'utilisation des moustiquaires imprégnées dans une zone à

paludisme stable au Burundi. *Tropical Medicine and International Health* 1, 71–80.

Vundule C, Mharakurwa S (1996) Knowledge, practices and perceptions about malaria in rural communities of Zimbabwe: relevance to malaria control. *Bull World Health Organ* . 74:55-60.

Warrel DA. (1993) Leishmaniasis, malaria, schistosomiasis in Saudi Arabia. *Saudi Med J*;14:203-8.

WHO (2005a). *Malaria Control Today: Current WHO Recommendations*. Working Document, Geneva.

WHO (2005b). *WHO Technical Consultation on Verbal Autopsy Tools*. Geneva. [[www.who.int/healthinfo/statistics/mort\\_verbalautopsy.pdf](http://www.who.int/healthinfo/statistics/mort_verbalautopsy.pdf)].

WHO (2005c). *World Health Report 2005: Make Every Mother and Child Count*. Geneva.

WHO (World Health Organization) and UNICEF (United Nations Children's Fund). 2003. *Africa Malaria Report 2003*. Geneva.

WHO 2007. *Insecticide-treated Nets: A WHO Position Statement*. Geneva.

WHOPES (World Health Organization Pesticide Evaluation Scheme). 2005, *Guidelines for Laboratory and Field Testing of Long-Lasting Insecticidal Nets*. WHO/CDS/WHOPES/GCDPP/2005.11. World Health Organization, Geneva.

Zucker, J.R. and Campbell, C.C. (1995) Antimalarial chemo-therapy: a relentless challenge. *Curr. Opin. Infect. Dis.* 8, 455-460.

# APPENDICES

**Appendix I – Survey Questionnaire**

THE UNIVERSITY OF ZAMBIA

SCHOOL OF MEDICINE

DEPARTMENT OF COMMUNITY MEDICINE

STRUCTURED QUESTIONNAIRE FOR INTERVIEW SCHEDULE

**TOPIC: Household ITN accessibility and availability in Kabwe's Two Highly Densely Populated Townships**

DATE.....  
NO.....

SERIAL

**INSTRUCTIONS FOR THE INTERVIEWER**

1. Introduce yourself to the respondents and explain the reason for the interview.
2. Do not write the names of respondents on the interview schedule.
3. Tick the most appropriate response to the question in the space provided.
4. Request the respondents to sign consent before you start the interview.
5. All the information provided by respondents should be kept in strict confidence.
6. The respondent should be free to ask questions during the interviews.
7. Respondents should not be forced to be interviewed.
8. Thank the respondents at the end of the interview.

Hello:

You are invited to participate in our survey to understand what the situation on malaria and the use on the mosquito net is like in your home concerning those children who are under five years. In this survey, you and other people will be asked to complete this survey questionnaire. It will take approximately 5 minutes to complete the questionnaire.

Your participation in this study is completely voluntary. There are no foreseeable risks associated with this project. However, if you feel uncomfortable answering any questions, you can withdraw from the survey at any point. It is very important for me to learn your opinions, as this survey represents our consultancy project for my MPH at The University of Zambia.

Your survey responses will be strictly confidential and data from this research will be reported only in the aggregate. Your information will be coded and will remain confidential. If you have questions at any time about the survey or the procedures, you may contact The Biomedical Research committee at The University of Zambia at the email address specified below.

If you are unsure of any of the answers, please do not worry too much or look any of them up... Just go with your instinct!

Thank you very much for your time and support.

Kalulu

**SECTION A: DEMOGRAPHIC DATA**

**FOR OFFICIAL USE ONLY**

PLACE NAME .....

Makululu                       Katondo

HOUSEHOLD NUMBER

1. Age of respondent

2. Age interval

3. Sex of respondent

4. Income of household (Husband and wife if both are engaged in income generating activities)

Income range

Less than K 200 000	<input type="checkbox"/>
2001 to 500 000	<input type="checkbox"/>
5001 to 800 000	<input type="checkbox"/>
Over 800 000	<input type="checkbox"/>

5. Educational level

Never been to school	Primary	Junior secondary	Senior secondary	College	University
<input type="checkbox"/>					

6. Now we would like some information about the people who usually live in your household or who are below five and are staying with you now.

Number of males	<input type="text"/>
Number of females	<input type="text"/>

7. Relationship to head of household (adult person found on the survey date) you (tick any possible combinations)

	Son	Daughter	Nephew	Niece	Grandchild (male )	Grandchild (female )	Others
Child one							
Child two							
Child three							
Child four							
Child five							
Child six							
Child seven							

8. Are there any other people who may not be members of your family, such as domestic servants, lodgers or friends who usually live here?  Yes  No

**SECTION B: ITN ACCESSIBILITY IN THE TWO TOWNSHIPS**

ITN program like on the ground in the two townships

9. In how many rooms do the under fives sleep?
10. How many bed spaces are there in your house for the under fives?
11. In the last rainy season did these bed spaces have each a mosquito net? Yes  No
12. How long ago did your household obtain the mosquito nets that you used in the last rainy season?
15. Where did you get the net?

From the clinic	
From the community health worker	
From the retail shop	
From a relative	

16. Was the net for free that you got from

	Yes	No	Not applicable
From the clinic?			
From the community health worker?			
From the retail shop?			
From a relative?			

17. When you got the net, was it already factory-treated with an insecticide to kill or repel mosquitoes?  
 Yes  No

18. If it was not, was it ever soaked or dipped in a liquid to repel mosquitoes or bugs any time there after?

Yes

No

19. How long ago (in months) was the soaking or dipping?

### SECTION C: ITN DISTRIBUTION LOGISTICAL PROBLEMS

Logistical problems

What can you say about ITNs?

	Strongly Agree	Agree	Somewhat agree	Disagree	Strongly disagree
Nets are easily distributed by the authorities					
Nets are easily readily available in the shops					
Nets are cheap					
The supply from the authority is erratic					
There is rationing of ITNs in the clinic as a result of there being fewer nets than members or beds in a household					
The stock from the shops is erratic					

## **Appendix II - Schema of In-depth Interview Questions with DHMT Program and Operations Manager**

### **Theme I: ITN Program at household level**

1. It is three years since the Malaria rollback program was implemented in Kabwe, have you done any household malaria and ITN survey?
2. What can you say about the distribution and sources of ITNs in the two townships?
3. What is the level of ITN availability per household?

### **Theme II: Implementation Problems of ITN Programs**

2. What problems have you faced in implementing the ITN program in the two townships?
3. If there are any problems what is being done to address the situation?

### Summary

Let's summarize some of the key points from our discussion. Is there anything else?

Do you have any questions?

*Thank you for taking the time to talk to us!!*

## **Appendix III - Schema of In-depth Interview Questions with Selected Families**

### **Theme I: ITN Program at household level**

1. It is three years since the Malaria rollback program was implemented in Kabwe, do you have nets in your home?
2. What can you say about the nets and sleeping patterns?
3. What is the problem that you experience the most with ITN ?

### Summary

Let's summarize some of the key points from our discussion. Is there anything else?

Do you have any questions?

*Thank you for taking the time to talk to us!!*

**Appendix III- GHANT CHART (2010) January - February (2012)**

No.	Activity	Responsible	2010												2012			
			J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	
1.	Literature review	researcher																
2.	Proposal development	Researcher																
3.	Presentation to dept. and graduate studies	Researcher																
4.	Approval by research ethics committee	Researcher																
5.	Data collection	Researcher																
6.	Data analysis	Researcher																
7.	Report writing	Researcher																
8.	Submission of draft report	Researcher																
9.	Submission of final report	Researcher																
10.	Dissemination of results	Researcher																

## **Appendix IV - INFORMED CONSENT**

### **Ethical Consent Form**

#### **INTRODUCTION**

I am Kalulu Christopher Mwiimbu; a student of masters in public health from university of Zambia kindly requesting for your participation in the research study stated above. Before you decide whether or not to participate in this study, I would like to explain to you the purpose of the study, any risks or benefits and what is expected of you. Your participation in this study is entirely voluntary. If you decline to participate, no sanctions or privileges will be taken away from you (Miley et al., 2007). If you agree to participate, you will be asked to sign the consent in the presence of someone. Agreement to participate will not result in any immediate benefits.

#### **Purpose of study**

To explore implementation challenges related to indoor residual household spraying. The study will assist to obtain information on problems service providers experience in implementing indoor residual spraying. The study will help health care managers and policy makers to come up with strategic decisions that can improve ITN intervention in malaria control.

#### **Procedure**

This study involves a face to face interview with the staff that will ask you questions using a semi-structured questionnaire. After you have signed the consent form, I will ask you questions on implementation of ITN and your responses will be recorded on the questionnaire. The interviews may be recorded if you would be willing. You will also be given a chance to make suggestions on how ITN implementation can be improved to attain desired results. The interview will take about 30 minutes.

#### *Risks and discomforts*

There are no risks or harm involved in this study though part of your time will be utilised to answer some questions. However, the researcher will endeavour to minimise any immediate and subsequent potential discomforts as a result of participating in this research. If you decide to take part in the study, you will be asked if the researcher could ask you some of the questions on ITN program, particularly about your experiences and observations. Your name will not be on any tape or paper or report if you agree to have the interview recorded and after the interview is typed, the tape will be kept under lock and will be destroyed three years after the study. However, if you feel uncomfortable or decide to decline to take part or stop everything, you have to do so voluntarily. The researcher who would be responsible for the study is not a member of any health management or regulatory board and that your participation will not have any harm in any way.

*Benefits:*

Noting the many steps the ministry of health and local government are taking to reduce malaria infection, the study will make considerable contribution in public health by enhancing strategic planning. There is however no guaranteed direct benefits to you immediately on account of this research, but education will be given on how ITN program can be effectively be implemented.

*Confidentiality:*

Your research records and any information you will give will be confidential to the extent permitted by law. You will be identified by a number and personal information will not be released without your written permission except when required by law. The ministry of health, the University of Zambia Research ethics Committee or the School of Medicine may review your records again but this will be done with confidentiality.

*Informed Consent form*

The purpose of this study has been explained to me and I understand the purpose, the benefits, risks and discomforts and confidentiality of the study. I further understand that:

If I agree to take part in this study, I can withdraw any time without any sanctions and that taking part is purely voluntary.

I.....agree to take part in this study.

Signed ..... Date ..... (Participant)

Witness's name ..... sign .....

## Appendix V: BUDGET

ITEM	QUANTITY	UNIT COST	TOTAL COST
<b>1. Stationary</b>			
(a) A4 paper	5 reams	K35,000	K175,000
(c) Pens	10	K1,500	K15,000
(d) Pencils	10	K1000	K10,000
(e) Rubbers	5	K1000	K5,000
(f) Tipex	4	K10,000	K40,000
(g) Files	5	K5000	K25,000
(h) CDs	2	K10,000 x 2	K20,000
(i) Flash disk	1	K300,000	K300,000
(j) Stapler	1	K40,000	K40,000
(k) Staples	1	K10,000	K10,000
z(l) Scientific calculator	1	K80,000	K80,000
(m) Flip charts	2	K40,000	K80,000
(n) Markers	6	K3,000	K18,000
(o) Tape recorder	1	K120,000	K120,000
(p) Tapes	5	K3000	K15,000
(q) Bags	2	K70,000 X 2	K140,000
(r) Note books	3	K8,000 x 3	K24,000
<b>Subtotal</b>			<b>K1,117,000</b>
ITEM	QUANTITY	UNIT COST	TOTAL COST
<b>2 Services</b>			
(a) Statistical consultant	1	K750,000	K750,000
(b) Printing dissertation	1 x 100 pages	100 x K2000/pg	K200,000
(c) printing questionnaire	1 x 12 pages	12 x K2000/pg	K24,000
Photocopying dissertation	4 x 100 pages	400 x K300/ pg	K120,000
(d) Photocopying questionnaire	130 x 12 pages	1560 x K300/ pg	K468,000
(e) Data analysis	1	K1,000,000	K1,000,000
(f) Binding dissertation for examiners	5	5 x K15,000	K75,000
(spiral)	5	5 x K250,000	K1,250,000
(h) Binding final dissertation	1	K250,000	K250,000
(i) Payments ethics committee			
<b>Subtotal</b>			<b>K4,137,000</b>

ITEM	QUANTITY	UNIT COST	TOTAL COST
<b>3. Field work</b>			
<b>(a) lunch allowance</b>			
(i) Principal researcher	1	K50,000 x 60days	K3,000,000
(ii) Research assistants	2 x 30,000	K60, 000 x 60 days.	K3.600,000
<b>b)Transport allowance- site locally</b>			
i) Research assistants	2 x 30,000	K60,000 x 60 days	K3.600,000
ii) Principle researcher	1 x 30,000	K30,000 x 60 days	K1.800,000
<b>c) Transport - Lusaka to Kabwe</b>			
i) Principal researcher	1	K150,000 x 8 trips	K1.200,000
<b>d) Snacks for participants</b>			
i) long life Milk	1 x 4000	K4000 x 129	K516,000
ii) Pie	1 x 6000	K6000 x 129	K774,000
<b>Subtotal</b>			<b>K14,490,000</b>
<b>Total</b>			<b>K19,744,000</b>
<b>Contingency 10%</b>			<b>K1,974,400</b>
<b>GRAND TOTAL</b>			<b>K21,718,400</b>

## **BUDGET JUSTIFICATION**

A total of K21, 718, 400 (twenty-one million, seven hundred and eighteen thousand, four hundred kwacha) is required for stationary, services, and field work expenses in order to carry out this research successfully.

**Stationary, other services and field work expenses** are needed. Printing services is needed for printing of dissertation and questionnaire. Photocopying services is required for the questionnaires, draft dissertations for examiners and final dissertation copies for distribution. Also bags are needed for carrying questionnaires, calculators will be used during data analysis, and tape recorder will be used during interviews. Flash disks required for data storage and CDs for backup. Other accessories like pencils, books, pens etc will be used during routine collection of data.

### **Field work**

The researcher needs two research assistants to assist during data collection. The researcher and research assistants needed lunch allowance and transport allowance to facilitate movements from one place to another while in the field. Principal researcher also needs transport allowance outside Kabwe, thus from Lusaka to Kabwe which is the research site during data collection. **Contingency** of 10% of the total budget is required to cover extra costs or inflation of prices.

## APPENDIX VI: LETTER TO THE DISTRICT DIRECTOR OF HEALTH

The University of Zambia  
School of Medicine,  
Department of Community medicine  
Box 50110,  
Lusaka.  
30/01/09.

The District Director of Health  
Kabwe District Health office  
Box 80735  
Kabwe

Dear sir/ madam,

**Re: Application for permission to collect data on Insecticide Treated Net program in Kabwe Urban District.**

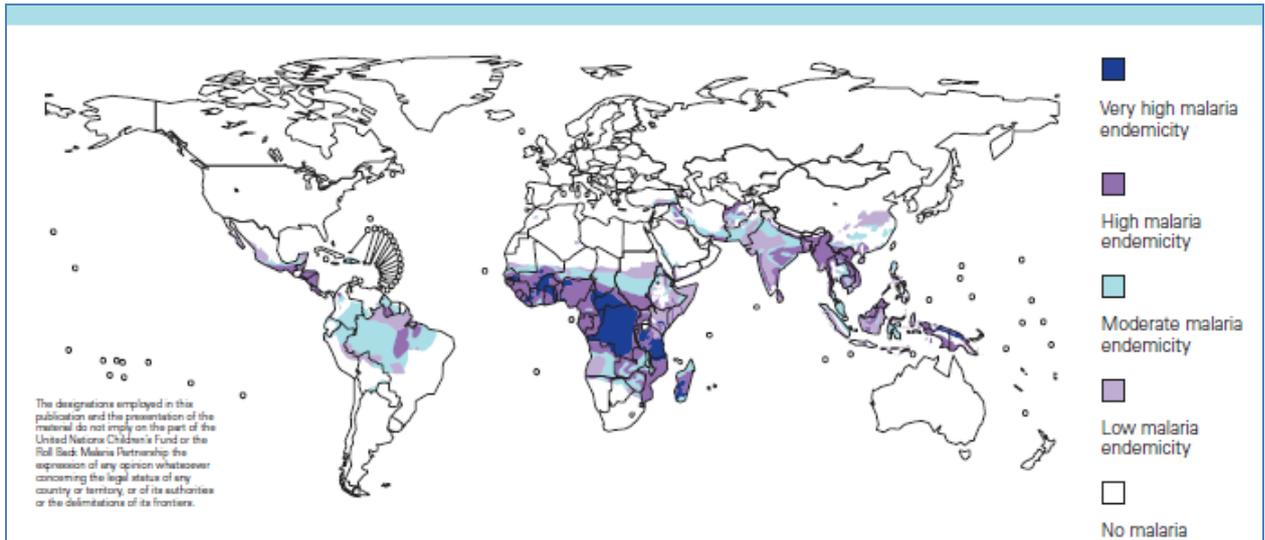
I refer to the above subject matter and would wish to apply for the same. I am a master of public health student at the above mentioned institution. In partial fulfillment of this program, I am expected to carry out a research study. My research topic is “**Household ITN accessibility and availability in Kabwe’s Two Highly Densely Populated Townships**”

The study will involve interviewing program officers and spray operators. Data will be collected from 18<sup>th</sup> – 19<sup>th</sup> August, 2009.

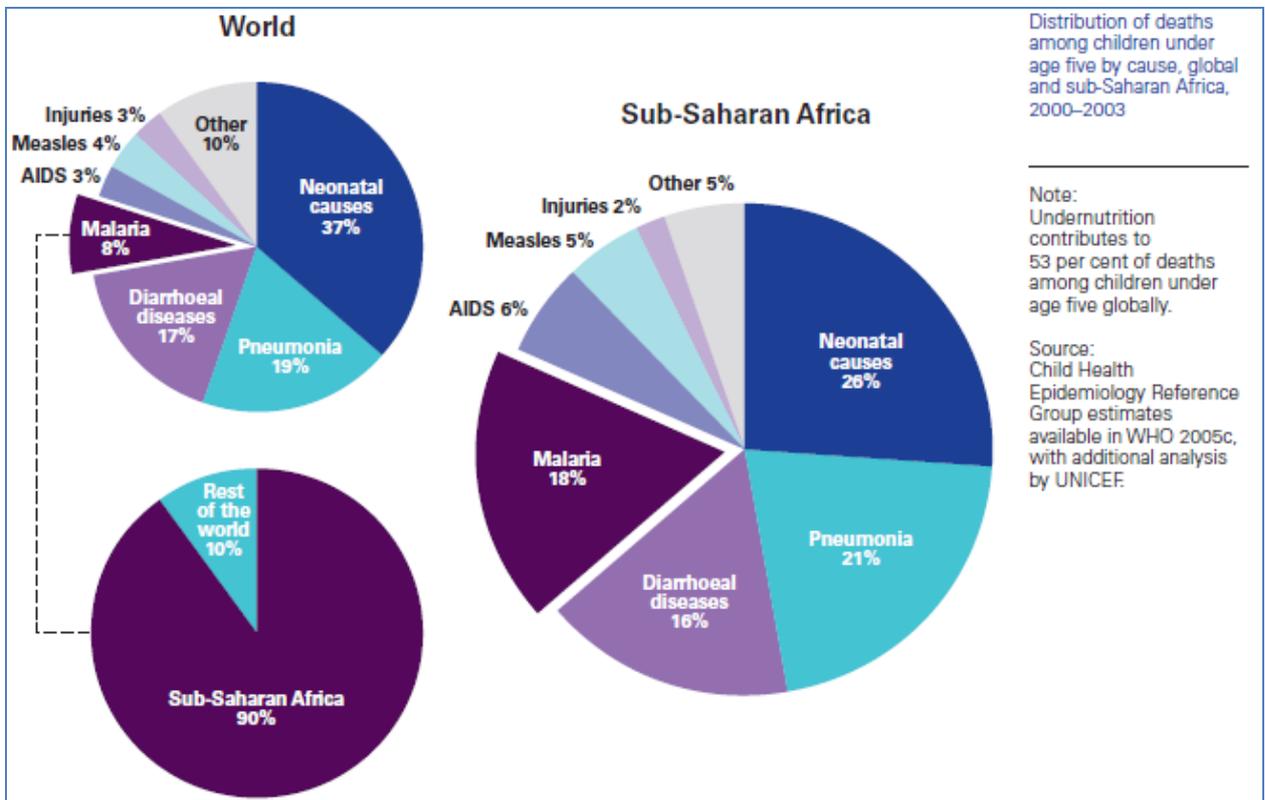
Your earliest consideration will be highly appreciated.

Yours faithfully,

Kalulu Christopher Mwiimbu



**Annex I Global malaria distribution and endemicity, 2003 (UNICEF, 2007)**



**Annex II. African Children Suffer the Greatest Malaria Burden**

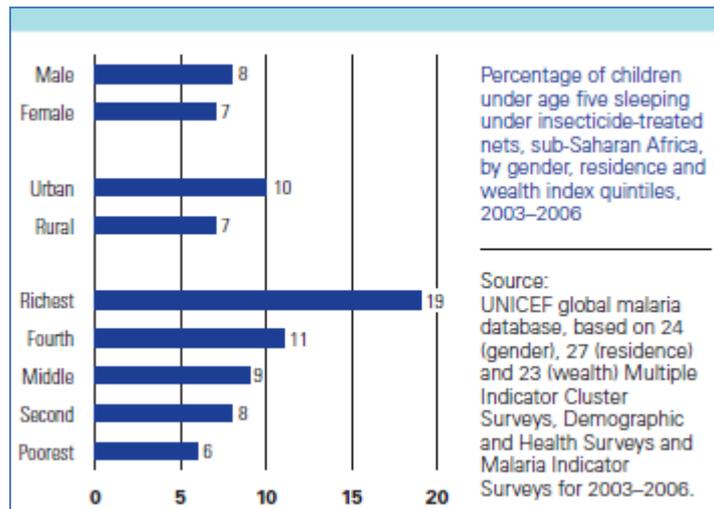


**Annex III Distribution of malaria and drug-resistant Plasmodium falciparum**

**From Zucker and Campbell (1995)**

<b>Indicator</b>	<b>2000</b>	<b>2001-2002</b>	<b>2004</b>	<b>2006</b>
% of households with at least one mosquito net of any type	-	27	-	50
Household availability of at least one insecticide-treated net	-	14	27	44
% of children under five years of age sleeping under any type of mosquito net	6	16	-	27
% of children under five years of age sleeping under an insecticide-treated mosquito net (ITN)	1	7	7	23
% of pregnant women aged 15-49 years sleeping under an ITN	-	8	12	24
% children under five years of age with fever receiving any anti-malarial medicines	-	52	-	58
% children under five years of age with fever receiving any anti-malarial medicines promptly (within 24 hours)	-	37	-	37
Children with fever receiving any anti-malarial medicines	58	52	-	58
% of women who received IPT (treatment with at least 2 doses of SP/Fansidar) during pregnancy	-	-	54	61

**Annex IV Survey-Based Progress Tracking**



**Annex V- African children living in rural areas and poorest households use of insecticide-treated nets**