Assessment of factors associated with utilization of insecticide treated bed nets among women of reproductive age: Observations from the Zambia national malaria indicator survey 2010

By

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ABSTRACT

Background: Malaria is a major public health problem and principal cause of morbidity and mortality in Zambia. We investigated key factors that may be associated with the utilisation of insecticide-treated nets (ITNs) as a malaria prevention strategy among women of reproductive age (15–49) in Zambia.

Methods: Data on the characteristics of women (n=4567), ownership and utilisation of ITNs were obtained among others from the Zambia National Malaria Indicator Survey of 2010 (ZMIS 2010). Multivariate logistic regression was used to determine predictors of ITN utilisation using Stata 11 (College Station, Texas, USA). Absence, <10% was the most important cause of non-response.

Results: Overall (n=4567), the median age was 27 (IQR 20.3). The proportion of respondents aged 15–19, was 21.1%. Those who resided in rural areas accounted for 59.3% and less than half (40%) had acquired primary level education. The proportion of the women who lived in households with at least one ITN was 69% and those who slept under an ITN on the night before the survey was 46%. Net use among those living in a household with at least one ITN was significantly higher in rural areas than urban areas (52% vs. 38%, P<0.01). The predictors of ITN use included age, having <5 children, information availability and educational level. Whereas use of ITNs was less likely in households with a higher number of children under five years (OR, 0.62; 95%CI 0.42, 0.92), a higher likelihood for use was seen in older women than in younger women (OR, 1.36; 95%CI 1.27, 1.47) who reported having heard any information on malaria (OR, 1.70; 95%CI 1.30, 2.24) and having had a higher level of education (OR, 1.58; 95%CI 1.34, 1.86). The household and eligible women response rates were 97.2% and 89.6% respectively.

Conclusion: ITN ownership did not necessarily mean utilisation in this population. Differential ITNs utilisation observed might indicate limitations in past malaria control efforts. Strategic ITNs utilisation promotional campaigns should thus consider various geographical and demographical contextual differentials such as education levels in this setting.

DEDICATIONS

My Parents, Jean Marie Vianney and Agnes Rutagwera

My Children, Lisa and Nziza Tayali

and

My Brothers and Sisters

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

AIDS	Acquired immune deficiency syndrome
ANC	Antenatal clinic
ART-LUM	Artmether-lumefantrine
CSO	Central statistical office
DHS	Demographic health survey
GDP	Gross domestic product
GIS	Geographical information system
GPS	Global positioning system
HIV	Human immunodeficiency virus
IPT	Intermittent preventive treatment
IRS	Indoor residual spraying
IUGR	Intrauterine growth retardation
MOH	Ministry of health
NBER	National bureau of economic research
NMCC	National malaria control center
PDA	Personal digital assistant
RAM	Rotarian against malaria
RBM	Roll back malaria
RDT	Rapid diagnostic test

SEA	Standard enumeration Areas
SP	Sulfadoxine-pyrimethamine
ZMIS	Zambia malaria indicator survey
WHO	World health organization

OPERATIONAL DEFINITION OF SOME KEY TERMS

Household: A person or group of persons, related or unrelated who live together in the same dwelling unit (under one household head) and share a common source of food

Insecticide treated bednets: is defined as a factory treated net that does not require any treatment, pre-treated net obtained within the past 12 months or one that has been soaked with insecticide within the past 12 months

Malaria indicator Survey: A nationally representative assessments of the coverage of the key malaria interventions in combination with the measures of malaria-related burden using malaria parasite and anaemia prevalence testing among children under age five years

Multigravidea: women who have had more than one pregnancy

Paucigravidae : women in their first or second pregnancies

Primigravidea: women in their first pregnancy

Reproductive e: women aged 15-49 years

CHAPTER ONE: INTRODUCTION

1.1 Background

1.1.1 Malaria burden

Malaria is a major public health problem in most tropical countries in Sub-Saharan Africa affecting all age groups and society classes. However, pregnant women and infants are especially vulnerable to the disease in most endemic areas in Africa, including Zambia where it remains the principal cause of morbidity and mortality in many parts of the country (MOH, 2005); Women of reproductive age group are susceptible to pregnancy and hence malaria-related complications in pregnancy (WHO,2013).

Malaria is a parasitic disease transmitted between humans through the bite of an infected female Anopheles mosquito. There are five species of *Plasmodium* parasite that can cause malaria in human namely *P. falciparum*, *P. vivax*, *P. ovale*, *P. malariae* and *Plasmodium knowlesi* (Gerald and Larry, 2000). According to WHO 2013, malaria-associated maternal illness and low birth weight is mostly the result of *Plasmodium falciparum* infection and occurs predominantly in Africa including Zambia.

Malaria contributes greatly to the suffering of mankind as well as retarding social and economic development of many countries. The impact of malaria on the nations' economies is not merely on the cost of case management but also has a negative impact on productivity due to absenteeism as well as an indirect effect on external investments and tourism into countries where malaria is endemic (Berman, 2004).

Approximately forty per cent of the world's population is at risk of malaria and the vast majority live in the world's poorest countries. The disease is found throughout the tropical and subtropical regions of the world. In 2010 they were an estimated 219 million cases of malaria illnesses and 660 000 deaths. Ninety per cent of these deaths occur among children under age five in sub-Saharan Africa (WHO, 2010).

The Zambia National Malaria Control Centre (NMCC) estimates that malaria is responsible for nearly 4.3 million clinical cases and an estimated 50,000 deaths per year; including up to 20% of all maternal mortality and 40% all infant mortality rates (MOH, 2010). Malaria's economic

impact in Zambia has not yet been quantified, but is likely substantial, with regional estimates suggesting a deficit of 1.5% GDP growth annually (RBM, 2008a). Attempts are being made to reduce incidence to a near Zero level and achieve 5 malaria free zones by 2015 (MOH, 2010).

1.1.2 Malaria in women of reproductive age

"So long as a woman has walked the earth, malaria may have stalked her" (Duffy, et al., 2001 cited in Desai, et al., 2007).According to WHO, 2013; in low-transmission settings women of reproductive age have relatively little acquired immunity to malaria. Consequently, malaria in pregnancy in these women is associated with anaemia, an increased risk of severe malaria, and may also lead to spontaneous abortion, stillbirth, low birth weight and prematurity. In high-transmission settings, the adverse effects of *P. falciparum* infection in pregnancy are most pronounced for women of reproductive age in their first pregnancy. These include maternal anaemia and placental parasitaemia which can lead to low birth weight; an important contributor to infant mortality.

In endemic areas malaria in pregnancy is a major public health problem (Gamble, et al., 2006). The effect of malaria infection during pregnancy vary by the degree of immunity that women would have acquired by the time they become pregnant (Desai, et al., 2007). Due to little or no acquired immunity to malaria in areas of low or unstable malaria, pregnant women are at increased rate of symptomatic malaria, severe malaria, anemia and undesirable birth outcomes such as miscarriage, preterm labor or stillbirth (Desai, et al., 2007).Whereas in areas of stable malaria transmission, maternal infections is usually asymptomatic, yet the mother remains at risk for severe anemia and the fetus at risk for low birth weight, prenatal death secondary to impaired growth and/or preterm birth(Desai, et al., 2007 and Steketee, et al., 2001;Shulman, et al., 1996 cited in Wylie et al., 2010).

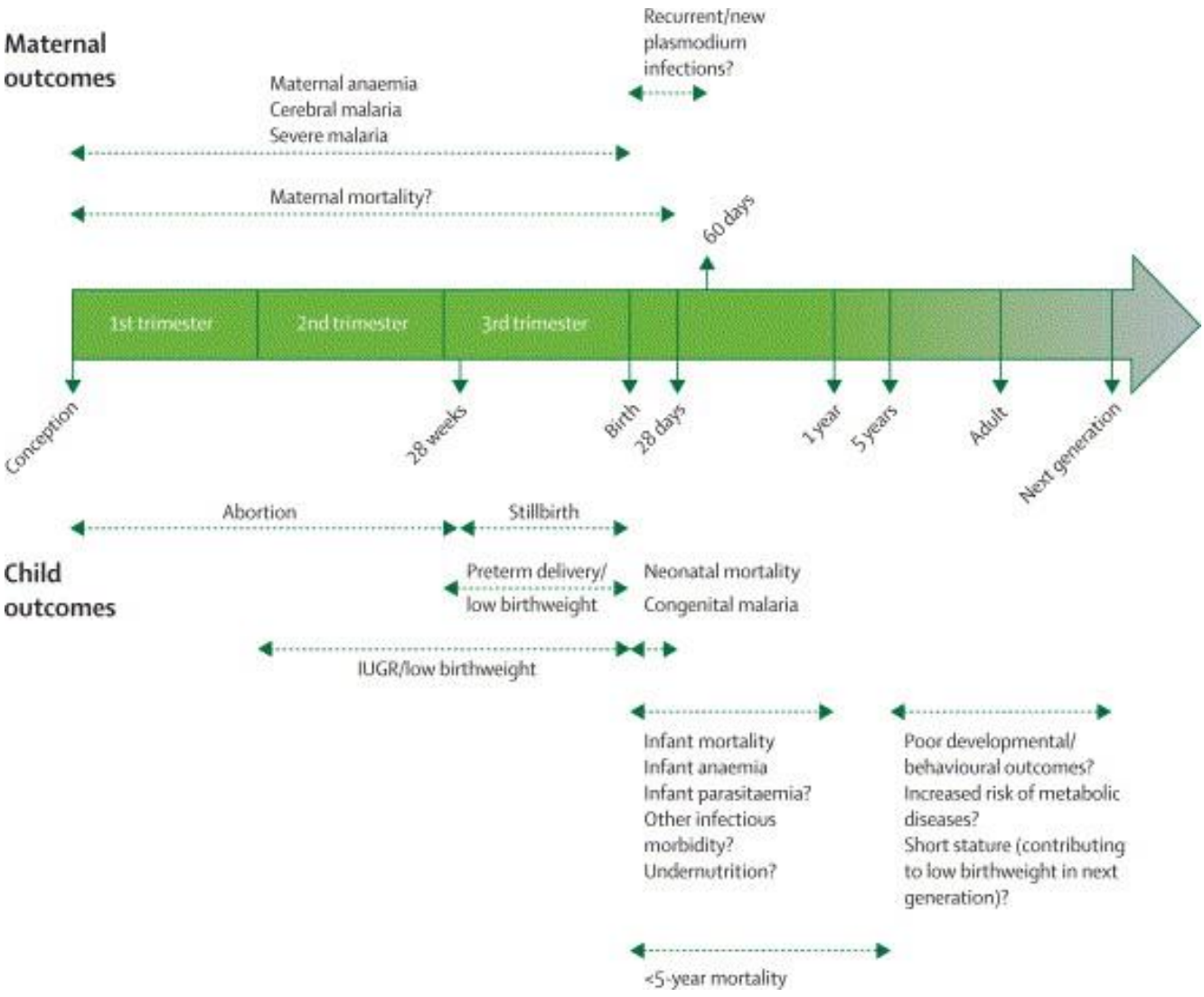
In addition to the parity-specific immunity that is acquired through consecutive pregnancies, age-associated immunity also plays an important role in controlling the infection during pregnancy in areas of high and stable transmission. (Desai, et al., 2007). Younger maternal age is an independent risk factor for malaria in pregnancy with young primigravidae and multigravidae being at greater risk of malaria and its adverse effects than older primigravidae or multigravidae, respectively (Espinoza, et al., 2005 and Walker-Abbey, et al., 2005).

1.1.3 Malaria birth outcomes

As shown in figure 1 below, malaria in pregnancy has a clearly devastating effect on the new born infant (Desai, et al., 2007). In areas of high malaria transmission in Africa, the risk of low birth weight approximately doubles if women have placental malaria (Guyatt and Snow., 2004). A review by van Geertruyden, et al. (2004) reveals placental malaria as being associated with twice the risk (odds ratio 2·19) for stillbirth; with the likelihood of the effect being stronger in paucigravidae. Also, a birth cohort study from Tanzania by Mutabingwa, et al. (2005) reported a 41% increased risk of malaria infection in infants born to mothers with placental malaria, even after adjusting for potential confounding environmental and ecological factors.

Brabin, et al. (2004) carried out a study in Malawi looking at the long term effect of malaria in children. He showed that independent of low birth weight, placental malaria is a risk factor for poor anthropometric status in infancy. Hediger, et al., 1999 cited in Desai, et al., (2007) demonstrated that the second generation may also be affected leading to incomplete catch-up growth and subsequent short stature in adolescence and adulthood and Edouard, et al., 2004; Lovel, et al., 2005 and Mohanty, et al., 2006 cited in Desai, et al., 2007 further showed that if these women become pregnant, this may in turn increase the risk of them delivering low-birth weight babies.

Figure 1 Effect of malaria in pregnancy on maternal, new born, infant, and child health



Adopted from Desai, et al., 2007

1.1.4 Malaria control and prevention strategies

Priority setting and resource allocation for disease control requires rational decisions on the geographic distribution of the populations at risk, the control interventions most appropriate to meet their health needs, and the existing levels of intervention coverage within these areas. However, this decision is hindered by the disease burden which is predominantly in low income countries coupled with a weak health information and planning systems in these countries (Murray, 2004 cited in Noor ,et al., 2010).

According to the World Health Organisation (WHO), 2010, the strategic approaches to malaria control fall into two major areas – prevention and case management. Taken together, these strategies work against both the transmission of the parasite from mosquito vector to humans (and from humans to mosquitoes) and the development of illness and severe disease in humans.

Malaria was eradicated in Europe and North America since 19th century, but this is not the case anywhere else especially in sub-Saharan Africa, despite putting up several human intervention measures. (Nyarango, et al., 2006).

Vector control can effectively be achieved through the use of insecticide treated bed-nets (ITNs) or reduction of larvae populations by larviciding and adult mosquitoes by indoor residual spraying (IRS) with insecticides (Nyarango, et al., 2006). Thus, ITNs and IRS are the cornerstones for malaria control and prevention (Ranson, et al., 2010).

Ross in 1910 invented the use of bed nets for malaria prevention, later an American and a Soviet malariologists showed that the protective effect can be enhanced through impregnating the bed nets with plant-based repellants or DDT. Pyrethroids are the only insecticides approved for treating bednetes. (Ranson,et al., 2010). Mali was the first African country to become the first site for community intervention trials with pyrethroid impregnated nets (Ranque et al 1984 cited in Marbiah ,et al., 1994).

ITNs are a key to malaria control (Lengeler, 2004) and a central component of current global malaria control initiatives (Pulford, et al., 2011). ITNs have demonstrated to reduce all-cause child mortality across a range of transmission settings in Africa (Lengeler, 2004). Systematic reviews of randomized controlled trials confirmed a significant reduction in individual risk of malaria-related morbidity and mortality associated with ITN use (Lengeler, 2004 and Gamble, et al., 2007 cited in Pulford, et al., 2011). In areas where health facilities are not easily accessible ITNs have been found to complement early malaria diagnosis and treatment (Dunn, et al., 2011).

In pregnancy , malaria control and prevention strategies include prompt identification and treatment of women with symptomatic illness, provision of intermittent preventive therapy (IPTp) with sulphadoxine-pyrimethamine (SP) (Parise, et al. 1998; Shulman, et al. 1999) and

use of ITNs among other prevention measures (Shulman, et al., 1998; ter Kuile, et al., 2003; WHO, 2010).When ITN is used by women during their first four pregnancies, maternal malaria-related anaemia was reduced (haemoglobin < 8 g ⁄ dl with parasitaemia) by 47% and parasitaemia by 38% (ter Kuile, et al., 2003). ITNs significantly reduce placental malaria in all pregnancies and reduce the incidence of low birth weight, premature birth and stillbirths ⁄ abortions in the first to fourth pregnancy (D'Alessandro, et al., 1996; ter Kuile, et al., 2003 Garner, 2006; Gamble, et al., 2006).

Since 2003, Zambia has been engaged in a large-scale, centrally coordinated national anti-malaria campaign which has become a model in sub-Saharan Africa. This campaign contributed to decreasing the death rate from malaria in Zambia by 60 per cent (National Bureau of Economic Research, 2010).

In Zambia malaria control efforts are focused around selected interventions. These include providing prompt and effective treatment with artemether-lumefantrine (ART-LUM) within 24 hours of symptom onset; and malaria prevention through the use of insecticidal nets (ITNs) by people at risk targeted primarily in rural areas; and Indoor Residual Spraying (IRS) with insecticide to control the vector mosquitoes targeted primarily in urban or peri urban areas (MOH, 2010).

Zambia is committed to control malaria at a national scale in its 2006–2011 National Malaria Strategic Plan (Steketee, et al., 2008). As of 2006, Zambia is demonstrating substantial progress toward the national targets of 80% population coverage rates for the interventions (Steketee, et al., 2008).

Figure 2: A woman and her child sleeping under an ITN

Adopted from http://www.rawcsd9750.org.au/Contact-RAWCS_D9750.php

Despite ITNs being recommended as a key malaria control strategy, several challenges have been encountered mainly in respect to their distribution, acceptance and utilization especially on a large scale implementation (Kudom and Mensah, 2010). A number of studies (Shiramaya, et al., 2009; Astaktie and Feleke, 2009; Shakira, 2012; Ankomah , et al., 2012; Pulford, 2012). They have reported coverage of ITNs, age, relative wealth, education, Household Size, distance to health facility Access to Antenatal care (ANC) services among others as factors associated with ITN ownership and utilization. In Zambia, Agah, et al (2007) noted that access, ownership and use of mosquito nets were dependent on Socio- economic status inequity.

1.1.5 The Zambia National Malaria Indicator Survey (MIS) 2010

The ZMIS 2010 represents the third and most recent nationally representative assessments of the coverage of the key malaria interventions in combination with the measures of malaria-related burden using malaria parasite and anaemia prevalence testing among children under age five years (MOH, 2010).

Malaria Indicator Surveys (MISs) were developed by the Roll Back Malaria (RBM) Monitoring and Evaluation Reference Group (MERG) with the aim to help national Ministries of Health collect key and timely information on malaria control at the national level (RBM, 2005b). The information collected during MISs is comparable with existing DHS and multiple indicator cluster surveys (MICS) protocols. Consequently, allowing comparison of data amongst the surveys and monitoring the progress of National Malaria Control Programme efforts (Jima, et al., 2010).

1.2 Research gaps

Malaria infection during pregnancy is a major public health problem in tropical and sub-tropical regions throughout the world. The main burden of malaria infection during pregnancy is due to *P. falciparum*. In areas of Africa with stable malaria transmission, malaria infection during pregnancy is estimated to cause as many as 10,000 maternal deaths each year, 8 to 14% of all low birth weight babies, and 3-8% of all infant deaths. In Zambia malaria contributes to nearly 40% of all infant and 20% of all maternal mortality rates (MOH, 2010). Most studies on ITNs use have been on pregnant women and children under five, overlooking women of reproductive age and yet this group of women is susceptible to pregnancy and hence malaria-related complications in pregnancy. Thereby, not only increase the number of unprotected pregnant women but also might crop down to new born babies that are not protected. This is a gap in malaria control strategy.

ITNs use is one of the two primary malaria interventions during pregnancy in Zambia. According to the ZMIS 2010, the percentages of women of reproductive age sleeping under a mosquito net the night before the survey were 51.8% and 47.7% slept under ITNs; In the percentage of women reporting having slept under a mosquito net, rural women were more likely to sleep under ITN (53%) than urban women (39%). Understanding the underlying key predictors of ITN ownership and use among women of reproductive age group is essential to strengthen campaign strategies that will lead to their increased ITN use, resulting in the reduction of maternal, infant and child mortality rates among others. This is another gap in control strategy in Zambia. Thus study was set to identifying key predictors of ITN usage among other so that these gaps can be reduced.

1.3 Study Rationale

In 2005, the Roll Back Malaria Partnership (RBM) set the goal for 2010 to achieve 80% coverage of children <5 years of age and pregnant women with protective measures such as ITNs (RBM, 2005a). More recently, the Global Malaria Action Plan called for rapid scale-up to universal population coverage for all people at risk for malaria (RBM, 2008b). This has led to massive distribution of millions of free or highly subsidized ITNs in recent years to vulnerable populations in sub-Saharan Africa (Eisele, et al., 2006; Thwing, et al., 2008 and Kelly-Hope, et al., 2008). However, the impact on preventing malaria morbidity and malaria-related mortality may be minimized if ITNs are not correctly and consistently used by vulnerable populations. (Eisele, et al., 2009). Thus, this massive scale-up in ITN delivery necessitates an equivalent increase in monitoring and evaluation (M&E) efforts in order to determine the impact of ITN distributions as well as prioritize future programmes (Eng, et al. , 2010).

The Zambia ministry of Health through the National Malaria Control Programme has outlined an aggressive approach to reducing malaria and malaria – related burden through the massive scale up of malaria control interventions such as ITNs. Planning ITNs programs require a better understanding of people's perceptions of malaria and its perceived cause, preventive action, and value attached to ITNs. (Winch, et al., 1997 and Binka, 1997). This is in order to make sure that all available ITNs are used correctly and consistently all year round as it is the only way the malaria reduction impact will be felt (NetMark, 2006 cited in Astaktie and Feleke, 2009).

Since the national scale up in 2006 tremendous progress has been achieved throughout Zambia towards reaching national targets in malaria control (MOH, 2010). However, in 2009 there was evidence of an increase in malaria cases in Rwanda, Sao Tome and Principe, and Zambia countries that had previously reported reductions (WHO, 2010). The reasons for these resurgences are not known with certainty, but they highlight the fragility of progress in malaria control and the need to rigorously maintain control programmes even when cases have been reduced substantially (WHO, 2010).

Currently, Zambia has put up resources to reduce the incidence of malaria and has set a goal of achieving atleast 5 malaria free zones by 2015 as well as reduce maternal and child death in its current strategic Plan (2011 to 2015) . With this, there is need to study factors capable of influencing consistent use of ITN by vulnerable groups such as women of reproductive age group; A study group which has rarely been focused on and yet are prone to pregnancy and its related complications including maternal and child death. The outcome of this study will lead to understanding some of the factors affecting ITN use among women of the reproductive age group thereby strengthening campaign strategies that will lead to increased ITN use, resulting in the in the reduction of maternal, infant and child morbidity and mortality rates among others.

CHAPTER TWO: AIMS AND OBJECTIVES

2.1 Research Question

What are the factors associated with ownership and utilization of ITNs among women of reproductive age in Zambia?

2.2 General Objectives

To assess factors that may be associated with ownership and utilization of bed nets for malaria prevention among women of reproductive age in Zambia

2.3 Specific Objectives

1. To determine the prevalence of ITN ownership among women of reproductive age in Zambia;
2. To determine the prevalence of ITN utilization among women of reproductive age in Zambia;
3. To identify factors associated with ITN availability among women of reproductive age in Zambia;
4. To identify factors associated with ITN use among women of reproductive age in Zambia based.

A malaria proximate determinant framework was used to achieve these objectives.

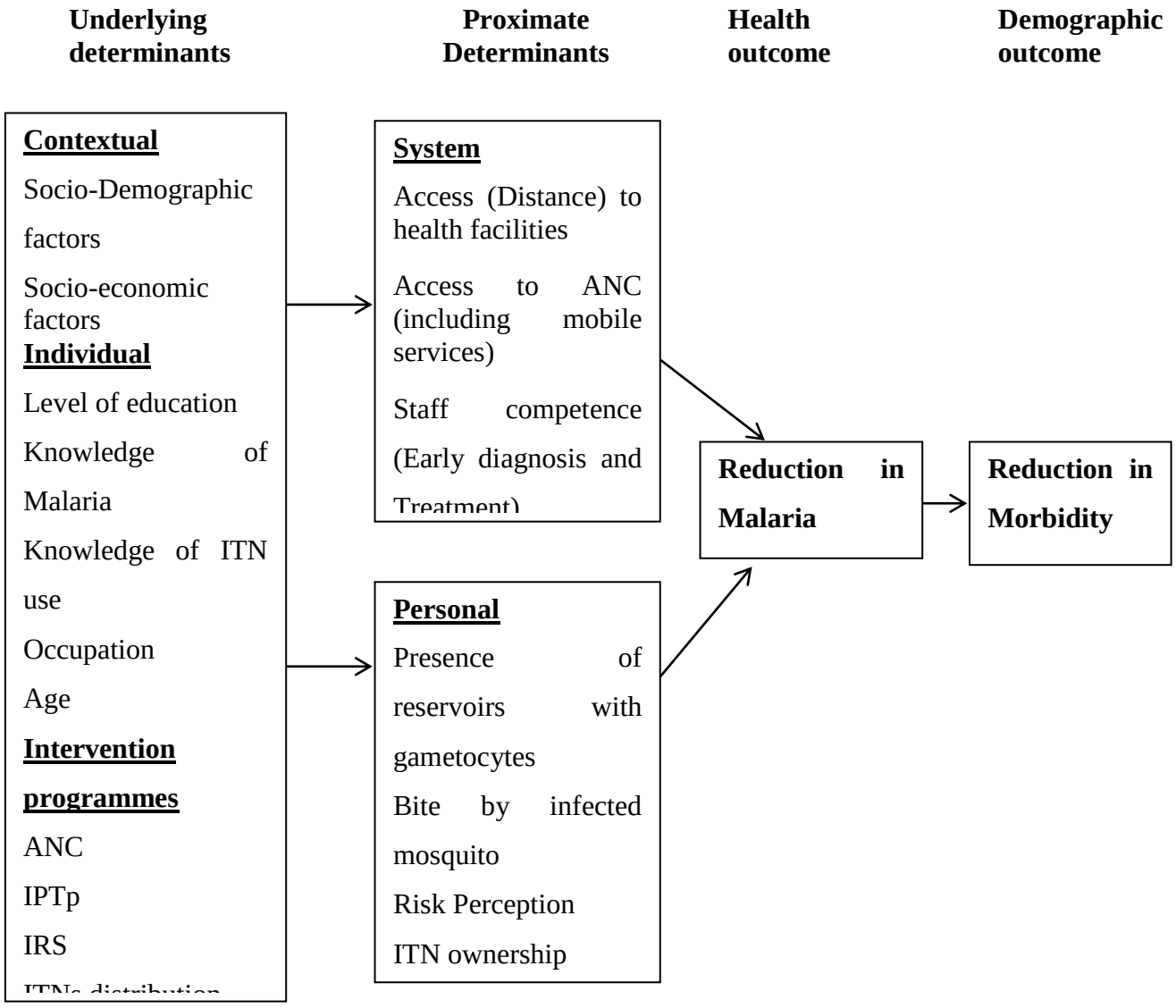
2.4 Proximate-determinants conceptual framework

This is an illustration demonstrating the relationship between all relevant systems, components and any salient factor that may affect or influence an event or program. It was initially developed and used in fertility studies, later model were developed for child survival and have also been applied to HIV studies.

In this study this model has been adapted to help us understand factors associated with ITN utilization thereby achieve the objectives.

As shown in figure 3 below utilization of ITN is determined by system factors such access to health facilities and personal factors like risk perception and ITN ownership. These are in turn influenced by socio- demographic and economic factors, level of education, Age among others.

Figure 3: Proximate-determinants conceptual framework for ITN utilization



Adapted from Boerma and Weir 2005

CHAPTER THREE: METHODOLOGY

3.1 Study design

3.1.1 The 2010 Malaria Indicator Survey (MIS)

The 2010 ZMIS was a cross-sectional household survey designed to assess coverage of key malaria interventions and malaria related burden among children under the age of five years. It was based on a nationally representative two stage cluster sample of 4500 households surveyed from 180 Standard Enumeration Areas (SEAs) randomly selected from 66 of the 72 districts from all nine provinces to provide representative national , urban and rural estimates as well as the 10 Roll Back Malaria (RBM) sentinel districts. At the first stage 180 standard enumeration areas (SEA) were randomly selected from about 17,000 SEAs the country is divided into according to Central Statistical Office (CSO). The second stage was conducted at the time of field work using Personal Digital Assistants (PDAs). All households Within a SEA were digitally listed using PDAs fitted with geo-positioning units and 25 households were random sample selected in each SEA resulting in a total of 4500 households.

The Survey was carried out during April and May 2010 by 15 field teams using two standardized questionnaires, the household and the women questionnaires, pre-programmed onto hand held computers (Personal Digital Assistants (PDAs) to facilitate data entry, extraction and Analysis. All data were entered in an ACCESS database.

Some of the questions in the household questionnaires included socio demographic factors such age, region, tribe and education, source of ITNs, ITNs and household possession (used to calculate relative wealth), ITN use of nets among all household members. The utilization of ITN was measured by considering those who slept under an ITN a night before the survey as being utilizers of nets.

The women questionnaires included among others background characteristics (e.g., education level, asset-based wealth index), Reproductive and birth history, pregnancy status, General malaria and ITN use knowledge and IPT for pregnant women.

3.1.2 ITN utilization survey

This Research was a secondary data analysis of some of the variables from the 2010 Malaria indicator survey. The outcome variable for this study was ITN utilization and all women in the reproductive age group (15-49 years) who answered the question on utilization and residence were eligible for this study. Since the sample size of the primary dataset was determined using 95% CI, 80% power with design effect of 2.00 and 20% adjustment for non-response and all women in the reproductive age group in the primary data set were considered for this study, hence, this study had enough power sufficient to show a true Zambia national picture of the factors associated with ITN availability and use among women of reproductive age.

A total of 4,567 women of reproductive age group were considered in this study. The women data was obtained from women questionnaires which included the characteristics of women, the source of ITNs, ownership and utilization of Insecticide Treated Nets, knowledge about malaria and of the use of insecticide treated mosquitoe nets. Whereas the household survey data was used to determine the wealth index for measuring the socio-economic status. The operational variable frame work is shown in table 1 below.

Note *that all insecticide treated nets, whether long lasting insecticide treated nets or retreated nets are referred to in this paper as ITNs. Non treated nets were not included in the definition of use also the term woman is used in to define woman of reproductive age.*

Table 1: Operational variable framework

Variable		**Indicator**	**Scale of measurement**
Dependent variable			
Utilization of bednet		Sleeping under ITN	Slept under an ITN a night before the survey.
Independent variables			
Ownership of bednet		Availability of ITN	Have atleast 1 ITN/number of ITNs in the household
Socio economic status		Wealth index	Household assets- based Quintiles as: lowest, second, Middle , fourth and highest
Socio-demographic:	Age	Age	Age Last birthday (in years)
	Household size	Household size	Number of individuals in the household
	Tribe	Tribe/ethnicity	Bemba
			Tonga
			North-western
			Barotse
			Nyanja
			Mambwe
			Tumbuka
			Other
	Type of residence	Residence	Urban
			Rural
	Level of	Education received	No education

Variable		Indicator	Scale of measurement
	education		Primary
			Secondary
			Higher
	Children under five years	Presence of Under 5 years old children in the house	Number of Under 5 years old children
		Under-five children sleeping under ITN	Number of under 5 children who slept under ITN a night before the survey
Knowledge of malaria		Cause of malaria.	mention of mosquito bite as a cause = 1 any other= 0
		Information on Malaria Received at home	Yes = 1 No = 0
		Malaria information received from a health worker at home	Health Care worker/Community Health Worker = 1 Any other = 0
Knowledge of use of Insecticide treated mosquito nets		Use ITN	Mention of ITN as a protective measure = 1 Any other=0
IPT		IPT received	Number of times SP/Fansidar taken
Access to antenatal care		ANC visits	Mention of receiving Antenatal care from a health profession during pregnancy=1

Variable	Indicator	Scale of measurement
		Any other = 0
Source of ITN	Number of Household ITNs	% of Household ITNs obtained at the Health facility

Definitions of Operational variables

*Utilization of bednet***:** was defined as sleeping under the ITN a night before the survey.

Ownership of bednet: was defined as having one or more ITN in the household including number of nets in the household.

Socio economic status: referred to a wealth index measure of household assets. A wealth index was calculated as a weighted sum of household assets. The wealth index was divided into quintiles (lowest, second, middle, fourth and highest) corresponding to poorest, very poor, poor, less poor and least poor groups of the population.

Socio-demographic variables: These included the urban/rural residence, age of the respondent (age last birthday in years), the number of children less than five years in the household, the number of children less than five years in the household who slept under ITN a night before the survey, tribe of the respondent and educational level of the respondent (no education, primary, secondary and higher), household size.

IPT: was defined as having taken at least two treatment doses of an effective antimalarial drug during routine antenatal care visits starting from the second trimester and a month apart. In Zambia, SP (Fansidar) is currently the drug used for IPT.

Knowledge of malaria: This study only considered whether the respondent mentioned mosquito bite as a cause of malaria as knowledge of malaria is nearly universal (Agha et al.,2007).

*Knowledge of use of Insecticide treated mosquito nets***:** This study only considered whether the respondent mentioned ITN as a protective measure for malaria.

Access to antenatal care: was defined as the respondent receiving antenatal care from a health profession during pregnancy. Those who have received scored 1 where as those who had not scored 0.

Source of ITN: This study considered the place where ITNs were obtained from. Whether the source was from a Government/clinic facility, CHWs or from any other agent**.**

3.1.3 Inclusion criteria

- All women aged 15-49 consenting to participate in the survey at household level and responded to the ITN utilization question.

3.1.4 Exclusion criteria

- Women less than 15 and above 49 years
- All Women aged 15-49 who did not agree to take part in the survey
- All Women aged 15-49 who did not respond to ITN utilization question

3.1.5 Data Management

Data was stored in Excel and MS Access and later loaded in STATA version 11 (Stata Corporation, College Station, TX) for analysis.

3.2 Data analysis

Data was analysed using STATA version 11 (Stata Corporation, College Station, TX). Univariate and bivariate analysis were first performed to describe the socio-demographic characteristics of the study participants. Thereafter, Cross tabulations were performed to show the relationship between ITN use and socio-demographic variables as well as that of ITN ownership with other exposure variables.

Multivariate analyses were then carried out to identify key predictors of ITN utilization taking into account potential confounders and other important interactions. A forward stepwise logistic regression was used to confirm the predictors of ITN ownership and use after adjusting for other variables. Variables that were significantly associated with ownership at bivariate level as well as some of those associated at univariate level (suspected risk factors) were entered in logistic model A (Factors associated with ITN ownership) to determine predictors of ITN ownership using the stepwise forward likelihood ratio. This was repeated with variables significant with utilization and entered in model B (Factors associated with ITN utilization).

The distribution of age as a continuous variable conformed to normality as assessed by probability plots. The Likelihood Ratio Test (LRT) was used to identify interactions as well as ascertain which variables that could either be included or excluded from the model.

In the multivariate model, the outcome variable was utilization of ITNs. Results were presented as odds ratios with confidence intervals effects. The P value used as significant was 0.05 and the confidence Interval at 95%.

The Mantel Haenszel Odds Ratio (MH-ORs) Chi- square statistics and the P-value were used to ascertain statistical significance of the confounding effect. Any variable that was identified as an independent risk factor of ITN utilization and had a different odds ratio (after adjusting for another covariate) from the crude odds ratio was considered to be a confounder.

Residence was used as the denominator to determine to the total number of respondents/ sample size (4567). The data set was checked for missing values prio analysis using the code book command "summarize". During analysis observations with missing values were excluded to ensure that likelihood tests were performed on the same number of observations.

3.3 Ethical considerations

The University of Zambia Biomedical and Research Ethics Committee (UNZABREC) approved the study .Permission for the use of 2010 ZMIS was granted by the Ministry of Health which approved and provided ethical clearance for the initial survey where participation was based on informed oral or written consent. Respondents were counselled and informed that the malaria testing was for both service and research purposes, thus those found to be infected were to be provided standard care.

CHAPTER FOUR : RESULTS

4.1 Background characteristics

Overall (n=4,567), the median age was 27 (IQR20.3), and 21.1% of the respondents were aged 15–19, 59.3% lived in rural areas and less than half (40%) had acquired primary level education (see Table 1). In addition, 27.8% were found to be in the highest wealth index quintile. Of all the women who owned ITNs, over two-thirds (65.6%) reported obtaining them from government clinics and hospitals, 10% from community health workers/agents and about 25% from other sources such as retail shops, pharmacies, and neighbourhood health committees. Access to antenatal care during the last pregnancy was reported in 60% of the women.

Table 2: Socio-demographic characteristics of the respondents

Characteristic (N)	Categories	Number (%)
Age of the woman (4 497)	15–19 years	952 (21.17)
	20–24 years	879 (19.55)
	25–29 years	890 (19.79)
	30–34 years	669 (14.88)
	35–39 years	477 (10.61)
	40–44 years	342 (7.61)
	45–49 years	288 (6.40)
Type of residence (4 567)	Rural	2 710 (59.34)
	Urban	1 857 (40. 66)
Level of education (4 497)	No formal education	890 (19.79)
	Primary	1 885 (41.92)
	Secondary or higher	1 722 (38.29)
Wealth index (4 567)	Lowest quintile	857 (18.77)
	Second quintile	624 (13.66)
	Middle quintile	832 (18.22)
	Fourth quintile	984 (21.55)
	Highest quintile	1 270 (27.81)
Household (4 567)	1–6 persons	3 075 (67.33)
	7–13 persons	1 350 (29.56)
	More than 13 persons	142 (3.11)
Source of ITN (2 279)	Government clinic/hospital	1 496 (65.64)
	Community health worker/agent (centre)	216 (9.48)
	Other	567 (24.88)
Access to antenatal care (2 878)	Yes	2 809 (97.60)
	No	69 (2.40)

4.2 Distribution of ITN ownership and utilization

Across all ages over two-thirds of the women (68.9%) owned ITNs and less than half of the women (45.9%) had slept under an ITN the night before the survey as shown in figure 4a below. More women in rural areas owned (74%) and utilized (52%) ITN as presented in figure 4b below.

Figure 4a: Percentage of ITN ownership and Utilization across all age groups

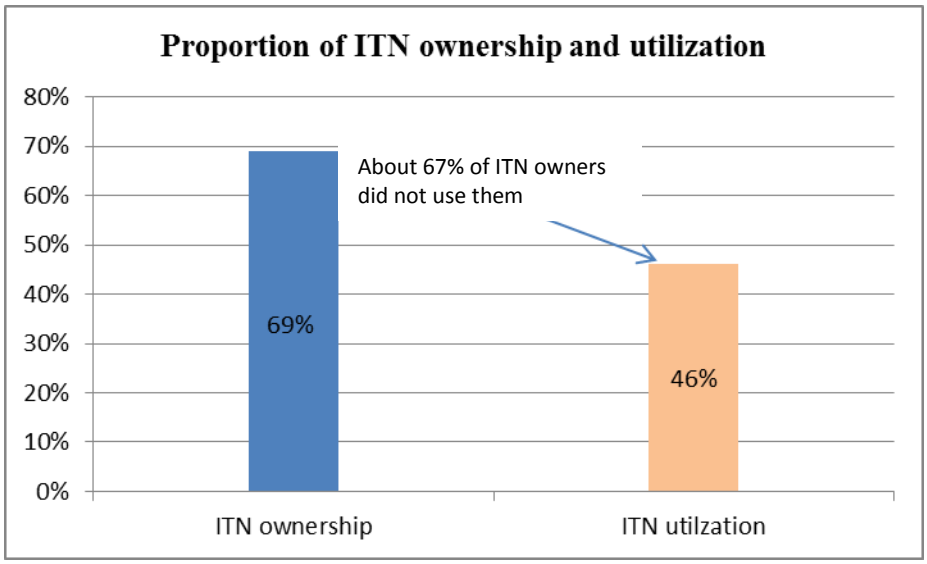
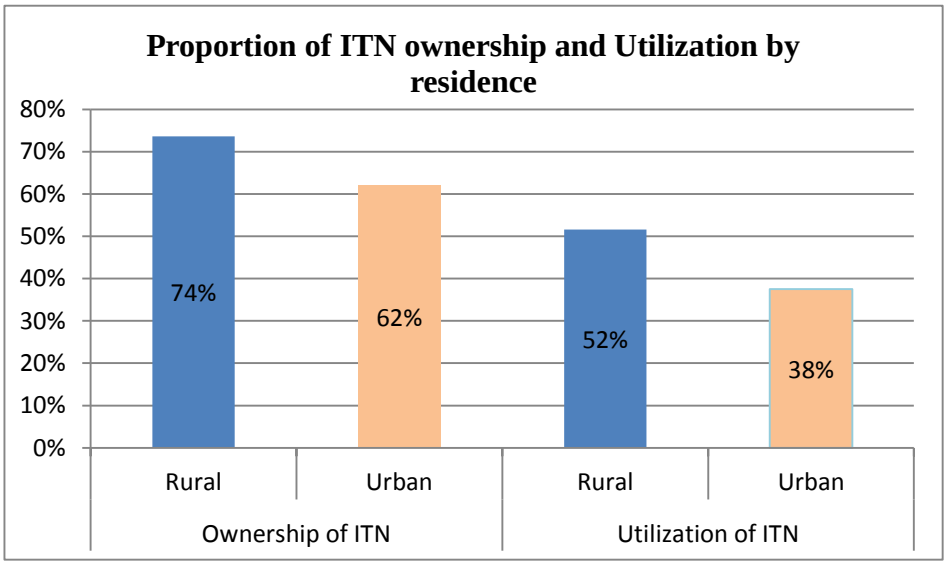


Figure 4b: Proportion of ITN ownership and Utilization by residence


Proportion of ITN ownership and Utilization by residence
80%
70%
60%
50%
40%
30%
20%
10%
0%
74%
62%
52%
38%
Rural
Urban
Rural
Urban
Ownership of ITN
Utilization of ITN

The crude association between ITN utilization and socio demographic characteristics is shown in table 2 below. 67% of the owners of ITNs slept under an ITN a night before the survey. A crude association between ITN ownership and ITN utilization was observed with p-value (Pr<0.001)

Age of the woman: About 70% of women in each age group were found to own an ITN. ITN use was observed to be higher in women aged 25 to 29 and 30 to 34 higher (52.36% and 51.42%) respectively than any other age groups; with the 15 to 19 ages having the least use (32.88%). A crude association between a woman's age group and ITN utilization was observed with p-value (Pr<0.001) whereas no crude association was seen with ITN ownership (Pr =0.755).

Type of residence: 74% of the women in rural areas owned ITN where as 62 % of those living in urban areas owned nets. More women in rural area (52%) slept under ITN. A crude association between the type of residence and both ownership and utilization of ITN was observed with p-value (Pr<0.001)

Tribe: The results showed more ITN ownership in the Bemba women (63%). The Barotse and north western women reported highest ITN use 151 (57.85%) and 211 (57.18%) respectively. A crude association between a woman's tribe and ITN utilization was observed with p-value (Pr<0.001)

*Level of Education***:** ITN ownership was reported to be higher in women who attained secondary school or higher (71%). These were followed by those with primary education (69%) and least in women with no formal education (66%). ITN use was seen to be less in those with no formal education (39%) and highest with those who attained primary (51%). No crude association between level of education and ITN ownership (P=0.072) where as a crude association was observed with ITN utilization observed with p-value (Pr<0.001).

Wealth index: 70% of ITN were found to be available in the second to fifth wealth index quintile with 63% possession in the lowest quintile. High ITN use was reported in women in the second quintile (51%) and least in women in the highest quintile (41%) A crude association

between wealth index and ITN ownership and utilization was observed with p-value (Pr= 0.002 and <0.001 respectively).

Household size: ITN ownership was found to be higher in household with 13 or more persons (80 %) and least in families with 1 to 6 persons. Highest ITN use was reported higher in households with 1 to 6 persons and least in households with 13 and above persons. A crude association between the woman's household size and ITN ownership and utilization was observed with p-value (Pr<0.001 and =0.024 respectively)

Number of children of less than 5 years in the house with women of Reproductive age: More ITN possession was found in women who reported to have a maximum of 2 under 5 year old children (73%) and 71 % possession with those with 3 or more Under 5 year old. High use of ITN (50.48%) was observed in women who reported to have a maximum of 2 under 5 year old children. No crude association was observed between the number of children of less than 5 years in the house with women of Reproductive age of number and ITN ownership (P= 0. 600). However, Crude association was observed with ITN utilization (P=0.047).

Number of children under 5 who slept under ITN a night before the Survey: all (100%) of the household which had atleast 1 under 5 year old child who slept under an ITN a night before the survey owned a bednet. High use of ITN (94%) was observed in women with a minimum of 3 children under the age of 5 who slept under nets and least (7%) in those without an under 5 year old child in the house. A crude association between the presence of the under 5 years children who slept under ITN and women ITN ownership and utilization was observed both with p-values (pr<0.001).

Source of ITN: 95% of ITN were reported to have been obtained either from Government clinic/hospital or other sources like retail shops, pharmacies, neighbourhood Health Committee etc. Highest use was noted in those obtained from government clinics/hospital (93%) and least in those from Community health workers/agents (87%). A crude association between the Source of ITN and both ownership and utilization of ITN was observed with p-value (Pr<0.001 and =0.016 respectively).

Access to antenatal care: Women who reported to have had access to Antenatal Care (ANC) also reported high net ownership (71%) while those without ANC access had 64% ITN ownership. More than half of Women who had Access to ANC (53.93%) were noted to have ITN use compared to those without access (47%).No crude association was observed with Access to ANC and both ITN ownership and utilization with p- value (0.212 and 0.085 respectively)

Table 3: Crude association between socio demographic factors and both ITN ownership and utilization

Characteristic(n)	Categories	%	ITN utilization	
			%(n_a)	p-value
Ownership of bed net (4 567)	No	31.09	0 (1420)	Pr<0.001
	Yes	68.91	66.6(3147)	
Age of the woman (4 497)	15–19 years	21.17	32.88(952)	
	20–24 years	19.55	47.21(879)	
	25–29 years	19.79	52.36(890)	Pr<0.001
	30–34 years	14.88	51.42(669)	
	35–39 years	10.61	48.85(477)	
	40–44 years	7.61	50.00(342)	
	45–49 years	6.40	46.88(288)	
Type of residence (4 567)	Rural	59.34	51.62(2710)	Pr<0.001
	Urban	40. 66	37.53(1857)	
Level of Education (4 497)	No formal education	19.79	39.33(890)	Pr<0.001
	Primary	41.92	50.88(1885)	
	Secondary or higher	38.29	44.60(1722)	
Wealth index (4 567)	Lowest	18.77	44.92(857)	Pr<0.001
	Second	13.66	50.48(624)	
	Middle	18.22	48.44(832)	
	Fourth	21.55	48.48(984)	
	Highest	27.81	40.63(1270)	
Household size (4 567)	1–6 persons	67.33	46.96(3075)	Pr=0.024
	7–13 persons	29.56	44.44(1350)	
	More than 13 persons	3.11	36.62(142)	
Number of children of under 5 years in the house with women of reproductive age (3 248)	Maximum of 2 children	90.39	50.48(2936)	Pr=0.047
	3 and more children	39.78	44.55(312)	
Number of children under 5 who slept under ITN a night before the survey (3 248)	None	44.49	7.20(1445)	Pr<0.001
	1 child	36.24	81.14(1177)	
	2 children	17.18	89.25(558)	
	3 and more children	2.09	93.44(68)	
Source of ITN (2 279)	Government clinic/hospital	65.64	92.65(1496)	
	Community health worker/agent (centre)	9.48	87.04(216)	Pr=0.016
	Other	24.88	91.01(567)	
Access to antenatal care (2 878)	Yes	97.60	53.93(2809)	Pr=0.085
	No	2.40	46.07(69)	

Note: n – Sample size represents the respondent for respect variable
n_a – Represent raw totals

4.3 Predictors of ITN ownership and utilization

Bivariate analysis

Table 4 below shows the association between ITN ownership /Use and risk factors. There was no crude association observed between pregnancy statuses at the time of the survey, types of residence, access to ANC and knowledge of the cause of malaria with both ITN ownership and Utilization. In all variables the P value was found to be >0.05 and 95%CI included 1.

Both ITN ownership and Utilization were associated with source of ITN, IPT doses received, household size, level of education, any woman in the house head malaria information, number of children under five years in the house who slept under ITN, wealth index, CHW help hang ITN as well as receiving information on malaria at home.

Source of ITN: Women who obtained nets from community health workers were less likely to own a bednet by almost half compared to those who obtained them from government clinic/hospital (OR=0.43, 95% CI: 0.27,0.70). Their use of bednet was also likely to be high by half as compared to those who obtained them from government clinic/hospital (OR= 0.53, 95% CI: 0.34, 0.83). Whereas, those obtaining net from other sources were 0.80 less likely to use ITN (95% CI: 0.57, 1.14) than the ones whose source of ITN was the government clinic/hospital.

IPT received: The use of ITN was almost the same in women who received incomplete dosages of IPT with those who did not receive any dose (OR= 1.22 (95% CI: 0.99, 1.50). Nevertheless, women who received complete dose of IPT were 1.7 more like to own ITN (95% CI: 1.37, 2.11) and 1.62 more likely to use ITN (OR= 1.62; 95% CI: 1.32, 1.99) than those who did not receive any dose.

Household size: The women with more than 13 persons were twice more likely to own net (OR= 2.11; 95% CI: 1.39, 3.22) than those with less than 5 persons. However, their use rate was 0.65 times less likely those with less than 5 persons (OR= 0.65; 95% CI: 0.46, 0.93). On the other hand, the utilization of bed net between women with 6 to 13 persons and those with less than 5 persons was likely to be the same (OR=0.90; 95% CI: 0.80, 1.03).

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Level of education: Women who attained secondary school or higher were 1.22 times more likely to own ITN (95 % CI: 1.03-1.45) than those with no formal education. On the other hand, ownership of those with primary education was likely to be the same as those with no formal education (OR= 1.11; 95% CI: 0.94, 1.32).

The results also indicated that women who attained primary education were 1.60 times more likely to sleep under ITN compared to those with no formal education (OR =1.60; 95%CI: 1.36, 1.88) whereas, women who attained secondary or higher were 1.24 times more likely to use bednet compared with those without formal education (95%CI: 1.05, 1.47)

Any woman in the house heard any information on malaria: According to the results Women who did not hear information on Malaria were less likely to own ITN (OR=0.76; 95% CI: 0.66, 0.87) as well as sleep under bednet compared to those who heard information on Malaria (OR= 0.70; 95% CI: 0.61, 0.80).

Wealth index: The higher the wealth index quintile the more likelihood of owning an ITN as compared to those in the lowest quintile. The women in the second wealth index quintile were 1.25 times more likely to sleep under net than those in the lowest quintile (OR= 1.25; 95% CI: 1.02, 1.54). The results showed that the middle, fourth and highest quintile women had no significance difference on usage of ITN (95%C1 included 1); Implying bednet usage in women in these quintiles were likely to be the same with those women in the lowest quintile.

CHW help hang ITN: The women who were assisted to hang nets by Community Health Workers (CHW) were about 3 times more likely to own ITN (OR= 3.33; 95% CI : 1.85, 5.97) compared to those CHW did not help to hand bednet. These women were also more than twice likely to sleep under ITN compared to those who had no help from CHWs (OR =2.50; 95%CI: 1.65, 3.79).

Receiving information on malaria at home: The results showed a women who did not receive information on Malaria at home were 0.76 times less likely to own a bednet and 0.69 times less

likely to sleep under ITN compared to those who received the information (OR= 0.76; 95%CI: 0.65-0.87; OR= 0.69; 95%CI: 0.60, 0.80 respectively).

From the results, only 3 variables were associated with utilization of bednets and not ownership. These include Number of children of less than 5 years in the house with women of reproductive age, age of the woman, knowledge of use of ITN.

Number of children of less than 5 years in the house with women of reproductive age: There is no significant difference in ITN ownership between women with 3 or more number of children under 5 years and those with 2 or less number below the age of 5(OR =0.93; 95%CI: 0.72, 1.21). However, the use of net was likely to be almost the same in women, regardless of the number of children less than 5 years present in the house (OR= 0.79; 95% CI: 0.62, 1.00).

Age of the woman: The age of the woman was not significantly associated with ITN ownership but with ITN utilization across all age group (OR above 1 in all) with the reference group of 15-19 of age. All age groups were about twice more likely to sleep under net compared to 15-19 age group, with the age groups 25-29 and 30-34 being more likely to use net than any other group (OR=2.24 ; 95%CI 1.85,2.72 and 2.16 ;95%CI: 1.76, 2.66 respectively).

Knowledge of ITN use: The results points out a significant difference in the use of ITN between women who had knowledge on the use of ITN as a protective measure against Malaria and those without knowledge. (OR =1.29; 95% CI: 1.10, 1.51). Women who know that ITN are used as a protective measure against Malaria are more likely to sleep under it than those who do not know. Nevertheless, the likelihood of the two categories owning ITN was the same (OR =1.16; 95%CI: 0.98-1.39).

Table 4 : Bivariate analysis of ITN ownership/ use and independent variables

	Ownership of ITN		Utilization of ITN	
Characteristics (n)	**OR**	**95% C.I**	**OR**	**95% C. I**
Pregnancy status (3926)				
Yes	1.00		1.00	
No	1.12	0.89-1.42	1.08	0.87-1.35
Unsure	0.96	0.28-3.25	1.6	0.50-5.14
Source of ITN (2279)				
Government Clinic/Hospital	1.00		1.00	
Community health worker/agent	0.43	0.27-0.70	0.53	0.34-0.83
Other	1.18	0.75-1.85	0.8	0.57-1.14
IPT doses received (2878)				
No IPT received (0)	1.00		1.00	
Incomplete IPT received (1 to 2)	1.39	1.11-1.74	1.22	0.99-1.50
Complete IPT received (≥3)	1.7	1.37-2.11	1.62	1.32-1.99
Household size (4567)				
Normal family size (< 5 persons)	1.00		1.00	
Moderate family size (6 - 13 persons)	1.53	1.32-1.77	0.90	0.80-1.03
High family size (>13 persons)	2.11	1.39-3.22	0.65	0.46-0.93
Level of education (4497)				
No formal education	1.00		1.00	
Primary	1.11	0.94-1.32	1.60	1.36-1.88
Secondary or higher	1.22	1.03-1.45	1.24	1.05-1.47
Type of residence (4567)				
Rural	1.00		1.00	
Urban	0.95	0.84-1.08	0.89	0.79-1.01
No. of children of less than 5 years in the house (3,248)				
Maximum of 2 children	1.00		1.00	
3 and above children	0.93	0.72-1.21	0.79	0.62-1.00

Table 4 continued : Bivariate analysis of ITN ownership/ use and independent variables

	Ownership of ITN		utilization of ITN	
Characteristics (n)	**OR**	**95% C.I**	**OR**	**95% C. I**
Any woman in the house heard any information on malaria (4,003)				
Yes	1.00		1.00	
No	0.76	0.66-0.87	0.70	0.61-0.80
Age of the woman (4,497)				
15-19 years	1.00		1.00	
20-24 years	1.07	0.88-1.30	1.83	1.51-2.21
25-29 years	1.11	0.91-1.35	2.24	1.85-2.72
30-34 years	1.14	0.92-1.42	2.16	1.76-2.66
35-39 years	1.09	0.86-1.38	1.95	1.55-2.45
40-44 years	1.10	0.84-1.44	2.04	1.58-2.63
45-49 years	0.92	0.69-1.21	1.80	1.38-2.36
Wealth index (4,567)				
Lowest quintile	1.00		1.00	
Second quintile	1.32	1.06-1.65	1.25	1.02-1.54
middle quintile	1.35	1.10-1.65	1.15	0.95-1.40
fourth quintile	1.49	1.22-1.82	1.15	0.96-1.39
highest quintile	1.3	1.08-1.56	0.84	0.70-1.00
CHW help hang ITN (3,941)				
No	1.00		1.00	
Yes	3.33	1.85- 5.97	2.50	1.65-3.79
Knowledge of use of ITN (4,003)				
No	1.00		1.00	
Yes	1.16	0.98-1.37	1.29	1.10-1.51
Receiving information on Malaria at home (2,767)				
Yes	1.00		1.00	
No	0.76	0.65-0.87	0.69	0.60-0.80

Multivariate analysis

The results showing the Predictors of ITN ownership (Model A) and of ITN utilization (Model B) have been shown in table 5 below.

ITN Ownership:-The variables that were found to have a positive statistically significant association of ITN ownership included women receiving information on malaria at home (AOR=1.30; 95% C.I 1.11-1.50), having received complete doses of IPT (AOR=2.26; 95% C.I 1.16- 4.39) and the relative wealth *(A*OR= 1.06; 95% C.I 1.02-1.11). The source of ITN was also a relative risk factor for ownership; Those who receive net from NHC/CHW were negatively associated with ITN ownership in comparison with those who receive from Government clinic or hospitals (AOR=0.51; 95% C.I 0.31- 0.84).

ITN Utilization:-Six (6) factors were found to be key predictors of ITN use; these were relative wealth, number of children less than 5 years in the house, the number of children of less than five years sleeping under ITN, age of the woman, women in the house having heard any information on malaria and the level of education.

The Odds of net utilization was less among women of second relative wealth status as compared to those of lowest status (AOR= 0.96; 95% C.I. 0.92, 1.00). The number of children under-five in the house was associated with utilization of nets in that the Odds of utilizing nets reduced with family size of three children or more (AOR= 0.62; 95% CI 0.42-0.92). In addition, the number of under-five children who slept under ITN was our best proxy to utilization .this variable was also found to be a confounder of the effects of House Hold Size (HHZ) and Education on utilization of nets with P values less than 0.001.

Women in the age group of 20 to 24 were 1.36 more likely to use ITN as compared to those in the age group of 15 to 19 (OR=1.36; 95% C.I. 1.27-1.47) and this was closely associated with having information on malaria in that the presence of any woman in the house having heard any information on Malaria was found to be 1.70 more likely to have women utilizing ITN as compared to those who had none (OR= 1.70 95% C.I. 1.30-2.24). This was also associated with education level (P<0.001). Further analysis showed that women with primary education

were 58% more likely to sleep under an ITN as compared to those with no education (OR=1.58; 95% C.I 1.34-1.86).

Table 5 Logistic regression predicting models of ITN ownership (Model A) and of ITN utilization (Model B)

MODEL A: PREDICTORS OF ITN OWNERSHIP			MODEL B: PREDICTORS OF ITN UTLIZATION			
Predictor (n)	**Category**	**Adjusted OR (95%CI)**	**Predictor (n)**	**Category**	**Adjusted OR (95%CI)**	**LRT p-value**
Wealth index (4 567)	Lowest	1.00	**Wealth Index (4 567)**	Lowest	1.00	
	Second class	1.06 (1.02 - 1.11)		Second Class	0.96 (0.92 - 1.00)	
Source of ITN(2 279)	Government clinics/hospitals	1.00	**No. of children < 5 years living in the house (3 248)**	Maximum of 2	1.00	
	NHC/CHW	0.51 (0.31 - 0.84)		3 or more	0.62 (0.42 - 0.92)	
Received information on Malaria at home (2 767)	No	1.00	**No. of children < 5 years in the house who slept under ITN (3 248)**	None	1.00	
	Yes	1.30(1.11 - 1.50)		One Child	66 (50.9 - 86.0)	
IPT doses received (2 878)	No dose	1.00		2 or more	142.8 (100.8 - 202.2)	
	complete dose	2.26 (1.16 - 4.39)	**Age of the woman (4 497)**	15 to 19	1.00	
				20 to 24	1.36 (1.27 - 1.47)	
			Receiving information on Malaria at home (2 767)	No	1.00	
				Yes	1.70 (1.30 - 2.24)	
			IPT doses received (2 878)	No dose	1.00	
				Complete dose	0.99 (0.60 - 1.62)	
			Level of Education (4 497)	No education	1.00	
				primary	1.58 (1.34 - 1.86)	<0.001
				At least secondary	1.30 (1.09 - 1.54)	
			Household size (4 567)	Normal	1.00	
				Moderate	0.92 (0.81 - 1.05)	0.05

The interaction of selected risk factors and utilization of nets stratified by Number of under 5 Children who slept under ITN a night before the survey was shown in table 5. The number of Under 5 years sleeping under ITNs a night before the survey modified the associations between utilization and wealth index, age as well as household size. In all cases the p-value for test of homogeneity of odds less than 0.001.

Table 6: Association between selected risk factors and utilization of nets stratified by Number of under 5 Children who slept under ITN a night before the survey

CHARACTERISTICS (n)	CATEGORIES	0DDS RATIO			p-value for the test of homogeneity of odds
		No child	One child	Two children	
Wealth Index (4567)	Lowest class	1.00	1.00	1.00	<0.001
	Second class	1.32	0.76	0.73	
Access to antenatal care(2 878)	No	1.00	1.00	1.00	0.8
	Yes	1.95	1.15	0	
Age of the woman (4,497)	15-19	1.00	1.00	1.00	0.001
	20-24	1.38	1.32	1.18	
Source of ITN (2279)	Government	1.00	1.00	1.00	0.34
	Neighbourhood HC & CHW	0.78	Too few	Too few	
	Others	1.34	0.71	0.21	
Pregnant status (2878)	Yes	1.00	1.00	1.00	0.65
	No	0.75	1.08	1.15	
	Unsure	Too few	Too few	Too few	
IPT doses received (2878)	None	1.00	1.00	1.00	0.615
	Incomplete	0.48	0.74	1.24	
	Complete	0.86	0.96	1.79	
Household size (4,567)	1 to 3	1.00	1.00	1.00	<0.001
	4 to 6	1.92	0.15	0	
	7 to 9	2.54	0.07	0	
	10 and above	2.16	0.07	0	
No. of children < 5 years living in the house (3248)	Maximum of 2	1.00	1.00	1.00	0.59
	3 and above	0.37	0.39	0.57	
Receiving information on malaria at home (2,767)	No	1.00	1.00	1.00	0.08
	Yes	1.48	1.79	2.49	
Type of residence (4567)	Urban	1.00	1.00	1.00	0.375
	Rural	1.11	0.73	0.84	

CHAPTER FIVE: DISCUSSION

The findings illustrated the prevalence of 68.9% ITN ownership and 45.6% ITN utilization among women of reproductive age (15- 49 years). Implying that 67% of those who owned ITNs slept under it a night before the survey. This demonstrated a greater than 30% ITN non-utilization gap. This still falls far short of expected ITN utilization levels (80% in vulnerable groups) which might however be an important factor, probably explaining why the burden of malaria still remains a challenge in this population. The reasons for these observations were beyond the scope of this study but the observations reflect the existence of an array and interplay of various factors which might be associated with ITN utilization. The factors may be driven by differential socio-economic determinants given that more highly educated and wealthier groups in this population had higher utilization levels which were also associated with higher 'malaria preventive information' acquisition .

Given that there was limited information regarding factors affecting the utilization of ITNs among women of reproductive age, a potential consideration was to use pregnant women as a reasonable population proxy. In an effort to examine this assertion, preliminary analysis showed differential ITN utilization patterns between these groups which could be explained by the fact that pregnant women are a selected group with higher access to selected malaria preventive information including ITNs. This selection makes this group to be potentially different from women in the general information. The key determinants for utilization nonetheless included, number of under-five children living in the household, educational level of mothers and their economic status.

The study limitations could have possibly been due to non-participatory at household level or by eligible women in the primary data. However with the response rates of 97.2% and 89.6% respectively and all women in the reproductive age group with information on residence were considered for this study, this limitation could not have adversely affected this study.

This is a study based on the information collected in the 2010 ZMIS. It is therefore limited to the information available in the said survey. ITN utilization was measured as Sleeping under an ITN a night before the survey. We are aware that this approach is prone to recall bias. Nonetheless, it is also reasonable to assume that the magnitude of such measurement bias is

reduced to a minimal, compared to requiring the participant to remember what happened over a longer period of time. This measure does not allow a distinction to be made among individuals who never or rarely use a mosquito net, individuals who inconsistently use a mosquito net and individuals who usually use a mosquito net, but for whatever reason did not do so the night prior to survey (Pulford; et al, 2011). Thus, the inability to identify the membership of these respective groupings, and their respective reasons for non-use was beyond this study and it is recommended to carry out such a study as this could confound informed and targeted intervention. Notwithstanding the potential presence of these biases, we are convinced however that these biases may not have been important in defining the findings of this study.

In this population, both ITN ownership and utilization were higher in rural areas as compared to those in urban areas. This observation has also been documented in other studies (Astatkie and Feleke ., 2009; Shakira ., 2012). Despite the utilization being higher in rural, it was not an important factor if examined outside the influence of education and economic status as has also been reported elsewhere (Astatkie and Feleke ., 2009; Shakira ., 2012). As a result of this observation other authors argue that this is reasonable because it is not geographical residence that matters, but the type of residence that is associated with ITN use bringing a concept of perceived risk as an underlying determinant (Ankomah , et al., 2012). In this study information on the type of residence was, however, not available. The higher utilization could have been due to the fact that most rural areas are a target for programmes that adopt a push strategy in ITN mass distribution using neighborhood health committees (NHCs) and community health workers (CHWs) who are more active in rural areas. This further supports the 'perceived risk' concept as a driver for both distribution and use and not residence *per se*.

This idea of perceived risk might be associated to ITN use (defined as sleeping under the net the previous night) among under-five children. In this view, finding that the higher the number of under-five children living in the house the higher the proportion of women who slept under an ITN was not surprising as the concept of individual perceived risk produced a multiplier effect. Reported sleeping under the net the previous night was thus an important predictor of utilization driven by *'availability-based-use'* phenomenon. Information on these dynamics in literature is scant, thus there is a need to explore further the core determinants for utilisation in

the population subgroups as well as in what contexts utilisation should occur and for what reason. Our findings suggest that the other possible explanation for these utilisation differentials is that women with three or more under-five year old children probably received these nets free during the antenatal visit in each pregnancy as per Zambian policy. Furthermore, mothers often tend to sleep with at least one of the younger or youngest of the children. These factors could have led to an increase of ITN utilisation in women and children. However, the utilization might also be driven by socio-economic parameters of which educational level is critical.

Similarly, other studies revealed that education, relative wealth and the age of the woman also influence ITN utilization (Astatkie and Feleke., 2009; Shakira ., 2012; Ankomah; et al, 2012). These studies showed that women with at least primary education had a positive influence on the utilisation of ITN in comparison with those with no education and in lower wealth status. The explanation for this finding could be that educated women are able to understand messages on malaria-related topics, especially when it comes to the importance of malaria prevention using ITNs. Such women are likely to own and use an ITN. It is worth noting that some authors (Ankomah , et al., 2012) did not find education to be of significant influence on ITN utilisation at both bivariate and multivariate levels. This finding points to the need for additional rigorous determinant research models that also will examine the influence of intention as a factor. The 'education as a social vaccine' concept has been hypothesised in many different study domains including HIV infection and nutritional studies [United nation population fund., 2008]. As in our study, the link between education and income was documented in these studies. This is a plausible observation because women with a reasonable income are possibly able to buy an ITN even when it is not distributed freely.

In agreement with some other studies, we found that older women are more likely to use ITNs than 15–19 year olds who are not just younger and inexperienced but may not have reached their educational and other socio-economic potential to make significant efforts critical in malaria prevention for themselves and their children (Shakira ., 2012). In other words, the older women are likely to have had at least secondary education and have experienced an

active child-bearing period thereby increasing their level of understanding of the importance of malaria prevention.

The number of Under 5 years sleeping under ITNs a night before the survey had an important interaction effect, modifying the effect of various variables on the utilization of ITN in either direction thereby under-estimating or over-estimating the true effect of these variables. Efforts to find other studies on this variable proved to be futile and we would like to recommend this area to be considered in future qualitative or quantitative studies.

6.0 CHAPTER SIX: CONCLUSION AND RECOMMENDATION

6.1 Conclusion

ITN ownership does not necessarily translate into utilization. Factors associated with ITN ownership among women of reproductive age group included the source of ITN, receiving malaria information at home and the number of IPT doses received. Whereas, the key determinants of ITN utilization among these women included the number of under-five children living in the household, education level of women as well as their economic status.

The wide gap between ITN ownership and utilisation might reflect the influence of differential structural and social structures critical in malaria prevention at community level. It may also suggest past limitations in existing prevention and control efforts in the distribution of ITNs. Furthermore, this gap might be associated with limitations in net distribution in situations where this distribution is not accompanied by appropriate health promotion messages. If this observation is true, it may signal a need to reform the values and ethos of programmes on the promotion of ITN usage with a possibility of re-directing these efforts towards all women in the reproductive age group. We conclude that in order to increase the use of nets, it is not just enough to hand out ITNs – but that the relevant role players should also take into account the age of the woman, her level of education, the presence of children under five years who sleep under ITNs. Furthermore, appropriate health education should be provided on malaria in homes where these women are found. In doing so, considerations on exploiting integrated home-based outreach programmes could be system and structural responses worth strengthening by incorporating ITN distribution for malaria prevention.

6.2 Recommendation

This study demonstrated a wide gap between ITN ownership and Utilization among women of reproductive age group (15-49 years). Therefore, the suggested recommendations arising from this study for the national malaria control efforts are as follows:

- To reassess the behavioural change communication (BCC) intervention the national malaria control programme has been using for ITN ownership and utilization. This should include behavioural change messages that aim at improving knowledge about

the efficacy of consistent ITN utilization. The Ministries of health, education and community development mother and child health should liaise in developing and disseminating information on ITN use and benefits in the language that the audience best understand.

- Further research studies are required to guide malarial control efforts. These include:
- A qualitative study to identify respective reasons for non-use of ITN among individuals who never or rarely use a mosquito net, individuals who inconsistently use a mosquito net and individuals who usually use a mosquito net, but for whatever reason do not do so at times. This is important as these respective groupings could confound informed and targeted intervention
- A qualitative or quantitative study to explore the relationship between the number of Children under the age of five sleeping under ITNs in a household and that of women in the same household sleeping under a net.
- Policy makers to consider inclusion of a policy which utilizes a Community based approach to increase ITN usage. That is involving community leaders to spear head the monitoring of correct use of ITNs.
- To strengthen the system and structural responses by integrated home based outreach programs. ITN distribution and BCC messages on malaria prevention can be incorporated with other outreach programmes.

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APPENDIX I: ETHICAL CLEARANCE LETTER

THE UNIVERSITY OF ZAMBIA
BIOMEDICAL RESEARCH ETHICS COMMITTEE

Telephone: 260-1-256067
Telegrams: UNZA, LUSAKA
Telex: UNZALU ZA 44370
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Assurance No. FWA00000338
IRB00001131 of IORG0000774

Ridgeway Campus
P.O. Box 50110
Lusaka, Zambia

12th October, 2012.

Your Ref: 007-04-12.

Ms Marie-Reine Rutagwera,
School of Medicine,
Department of Community Medicine,
Lusaka.

Dear Ms Rutagwera,

RE: RE-SUBMITTED RESEARCH PROPOSAL: **"ASSESSMENT OF FACTORS ASSOCIATED WITH UTILIZATION OF INSECTICIDE TREATED BED NETS AMONG WOMEN OF REPRODUCTIVE AGE: OBSERVATIONS FROM THE ZAMBIA NATIONAL MALARIA INDICATOR SURVEY 2010"**

The above mentioned research proposal was re-submitted to the Biomedical Research Ethics Committee with recommended changes on 14th September, 2012. The proposal is approved.

CONDITIONS:

- This approval is based strictly on your submitted proposal. Should there be need for you to modify or change the study design or methodology, you will need to seek clearance from the Research Ethics Committee.
- If you have need for further clarification please consult this office. Please note that it is mandatory that you submit a detailed progress report of your study to this Committee every six months and a final copy of your report at the end of the study.
- Any serious adverse events must be reported at once to this Committee.
- Please note that when your approval expires you may need to request for renewal. The request should be accompanied by a Progress Report (Progress Report Forms can be obtained from the Secretariat).
- **Ensure that a final copy of the results is submitted to this Committee.**

Yours sincerely,

Dr. J.C Munthali
CHAIRPERSON

Date of approval: 12 October, 2012 **Date of expiry:** 11 October, 2013

APPENDIX II : MINISTRY OF HEALTH APPROVAL LETTER

All Correspondence should be addressed to the
Permanent Secretary
Telephone: +260 1 253040/5
Fax: +260 1 253344

In reply please quote:
NMCC/RSCH/10/8/5

Ref.....

REPUBLIC OF ZAMBIA
MINISTRY OF HEALTH

NDEKE HOUSE
P. O. BOX 30205
LUSAKA

3rd June 2011

Dr. R.N Likwa
MPH Coordinator
University of Zambia
PO Box 50110
LUSAKA

Dear Dr Likwa,

REQUEST FOR PERMISSION FOR MPH STUDENT TO CONDUCT THE RESEARCH STUDY – RUTAGWERA MARIE-REINE INGABIRE

The Ministry of Health is in receipt of your request on behalf of Ms Rutagwera Marie-Reine Ingabire (MPH student) for authority to conduct the following study: **"An Assessment of the use of Insecticide Treated Bed nets among women of reproductive age in Zambia"**. We acknowledge that in order to conduct this study access to the Zambia Malaria Indicator Survey (MIS) database for 2010 is required. I wish to inform you that following submission of your request to my Ministry and our review of the same, my Ministry has granted your student authority to carry out the study and access the MIS database on condition that the final report is shared with the Ministry of Health, through the National Malaria Control Center. The MIS 2010 database may be obtained from the National Malaria Control Center.

I consider this research topic to be of policy relevance in malaria control in Zambia.

Yours sincerely,

Dr. P. Mwaba
Permanent Secretary
MINISTRY OF HEALTH

PM/skc