



**School of Postgraduate Studies**

**THE USE OF INSECTICIDE-TREATED NETS AS PART OF THE  
NATIONAL MALARIA ERADICATION PROGRAMME IN NORTH-  
WESTERN PROVINCE**

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Health**

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**Declaration**

This dissertation is the original work of **Chipo Siamulambe**. It has been done in accordance with the guidelines for **Master of Science Degree in Public Health** dissertations for the University of Lusaka. It has not been submitted elsewhere for a degree at this or another University.

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**Certification of Completion**

I, **Chipo Siamulambe**, do hereby certify that this dissertation is the product of my own work and in submitting it for my Master of Science Degree in Public Health programme, further attest that it has not been submitted in part or whole for the award of any program.

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**Certificate of Approval**

The University of Lusaka approves this dissertation of **Chipo Siamulambe** in partial fulfilment for the requirements for the award of the degree in **Master of Science Degree in Public Health**.

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**Dedication**

This study is dedicated to my loving husband Potipher Hadunka who gave me invaluable love, inspiration, assistance and encouragement throughout the study of the Master of Public Health programme and my supervisor Dr Harriet Chiyangi who supported me throughout the preparation of this dissertation.

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## **Abbreviations**

8NDP	8 <sup>th</sup> National Development Plan
CPH	Census of Population and Housing
EAs	Enumeration Areas
IRS	Indoor Residue Spraying
ITNs	Insecticide-Treated Nets
LLINs	Long-Lasting Insecticide-Treated Nets
NHRA	National Health Research Authority
NMEP	National Malaria Eradication Programme
SDGs	Sustainable Development Goals
SSA	Sub-Saharan Africa
WHO	World Health Organization
ZDHS	Zambia Demographic Health Survey
ZSA	Zambia Statistical Agency

## **Abstract**

### **Background**

In Zambia, malaria remains a major public health threat. Understanding what influences the use of mosquito nets is important to speed up malaria prevention efforts in the country. The use of Insecticide-Treated Nets (ITNs) has been proven to be effective in the prevention of malaria. ITN use is the intended health behaviour to have the greatest impact on the malaria burden, however, it is important to establish what factors affect the use of mosquito nets.

**Objective:** To assess the use of Insecticide-Treated Nets (ITNs) as part of the National Malaria Eradication Program (NMEP) in selected parts of the North-Western province.

**Methods:** This study, which was retrospective and non-experimental in nature was set in the North-Western province of Zambia, focusing on men and women aged 15-49 years. It used secondary data from the 2018 Zambia Demographic and Health Survey (ZDHS), for 960 respondents (i.e., 296 women and 664 men). Survey participants were identified through a multi-stage stratified cluster sampling design during the 2018 ZDHS survey. Further, data analysis was done at three levels, namely univariate, bivariate and multivariate analysis levels. At multivariate level, binary logistic regression was used to investigate the magnitude of the influence the various factors in the outcome variable.

**Results:** Results showed that there was no association between education level (p-value = 0.212), age of the household head (p-value = 0.547), sex of the household head (p-value = 0.206), marital status (p-value = 0.162) and residence (p-value = 0.889) and use of a mosquito net. However, a positive significant association was observed between wealth index (p-value = 0.007), spraying of a dwelling against mosquitoes in the last 12 months before the survey (p-value = 0.000), the number of mosquito nets owned (p-value = 0.000) and the number of children under a mosquito net previous night (p-value = 0.000) with use of a mosquito net.

**Conclusion:** The study concludes that a lot still needs to be done if the fight against malaria is to be won. Ownership of a mosquito net does not necessarily translate into the use as not everyone who owned mosquito nets used them. This suggests that mosquito net distribution is not sufficient and should be accompanied by vigorous sensitization and health education on the importance of mosquito net use.

## CHAPTER ONE–INTRODUCTION

### 1.1 Background

Malaria has long been identified as a global problem since time immemorial, with the vast majority living in the world's poorest countries. The disease is found throughout the tropical and subtropical regions of the world, respectively. It is a threat to more than 40% of the world's population, and out of that, there are more than 300 million acute cases each year between 1 year, of which 2.7 million people die (RBM, 2002; WHO, 2000). According to the latest World Malaria report, there were 249 million cases of malaria in 2022 compared to 244 million cases in 2021. The estimated number of malaria deaths stood at 608,000 in 2022, compared to 610,000 in 2021 (World Malaria Report 2022).

Malaria continues to be an overwhelming public health problem in Africa, especially in sub-Saharan countries. The vast majority of malaria cases (90%) are in sub-Saharan Africa (SSA), where malaria constitutes 10% of the total disease burden. Children under five and pregnant women are most at risk, with *Plasmodium falciparum* being “the main cause of severe clinical malaria and death” (TDR/WHO, 2002; RBM/WHO, 2000). Further, estimations indicate that 90% of these deaths occur among children under the age of five in SSA; malaria kills an African child every 30 seconds. Those who survive an incidence of severe malaria may suffer from a series of physical and mental disabilities, unfortunately (Chanda, 2013).

Malaria has time and again proven to be endemic throughout Zambia and continues to be a significant public health problem in many areas of the country. Efforts to control malaria, such as the use of Long-Lasting Insecticide-Treated Nets (LLINs) and prompt, effective case management, have been scaled up through coordinated efforts among result-based management partnerships (National Malaria Indicator Survey, 2015).

The global decline in malaria cases since 2000 has mainly been attributed to the use of insecticide-treated Nets (ITNs), particularly LLINs, indoor residual spraying (IRS) and improved malaria case management. An ITN is a net (usually a bed net), designed to block mosquitoes physically, that has been treated with safe, residual insecticide for the purpose of killing and repelling mosquitoes, which carry malaria. A LLIN is an ITN designed to remain effective for multiple years without retreatment (Bhatt S *et.al* 2015).

From 2004 to 2019, a major malaria control campaign based on ITNs, IRS and prompt and effective treatment with anti-malarials, prevented an estimated 1.2 billion malaria cases and 7.1

million deaths in sub-Saharan Africa. By far the most important contribution was due to ITNs, responsible for an estimated 68% of the cases averted. The scale of their deployment in SSA has been huge, with 1.9 billion ITNs supplied to the region from 2004 to 2019 (WHO, 2020).

Long-lasting insecticidal nets are the foundation of malaria control in SSA and over the past 20 years, substantial efforts have been made to expand LLIN coverage in malaria-endemic countries. From 2000 to 2015, the incidence of *Plasmodium falciparum* decreased by 40% in Africa, largely attributable to the widespread use of LLINs (Rugnao, S 2019).

The use of mosquito nets has been recognised as one of the most effective preventive measures in the national malaria eradication programme. However, despite considerable efforts to distribute mosquito nets and raise awareness, the ownership and consistent use of these nets among the population remain inconsistent. Though major achievements have been made in malaria control, the disease remains a significant cause of morbidity and mortality in Zambia, with one in five children under age of age five infected with malaria parasites and other vulnerable population groups at risk. (Ministry of Health, 2018)

Attaining universal coverage and proper use of LLINs remains challenging in SSA. In 2015, 52.5% of targeted households in Kenya had access to an LLIN, but only 47.6% of the population used the device on a regular nightly basis (WHO, 2019). Whether LLINs are effectively used to prevent malaria depends on a complex set of factors (Zhou, 2016). In a study in the western Kenyan highlands, it was shown that seasonal patterns of precipitation and vector density, along with education, were associated with LLIN use. Sleeping arrangements, such as sleeping on the floor (as opposed to a bed), and the availability of areas amenable to hanging nets have also been shown to be associated with LLIN use (Macintyre *et al.*, 2012). In the face of already known factors, it is important to have this study in Zambia, specifically in the North-Western Province, as previous studies have been limited in scope and outdated methods hence the need to use new research techniques which are constantly being developed which can result in better understanding of the factors the affect or can effect ITN use.

## **1.2 Statement of the Problem**

In Zambia, malaria remains a major public health concern. Understanding what influences the ownership and use of mosquito nets is to accelerate malaria prevention efforts in the country. According to the Malaria Indicator Survey, there was a reduction in household LLINs ownership dropping from 80% in 2018 to 53% in 2021. Rural areas saw a decrease from 87% in 2018 to 55% in 2021 and urban areas saw a decrease from 72% in 2018 to 50% in 2021. Reduction in household ownership was noted in all provinces except for Copperbelt province.

Declines in ownership were greatest for the lowest wealth indexes and net use also declined among children under five years of age and pregnant women. Among children under five years of age, LINNs use dropped significantly, from 69% in 2018 to 46% in 2021. In rural areas, 46% of children slept under a net in 2021 compared to 77% in 2018. In urban areas, 45% of children slept under a net in 2021 compared to 57% in 2018 (Malaria Indicator Survey, 2021). As it has been established, it is important to understand what influences the use of LLINs to accelerate malaria prevention efforts in Zambia. Few studies, however, have been conducted to characterize and explore malaria prevention practices in the country. Studies that have been done have been of a smaller sample size as compared to this provincial one. To fill the knowledge gap and inform future malaria interventions, this study explored what factors were associated with mosquito net ownership and use in the North-western Province. Furthermore, there is limited information with regard to whether or not there is any relationship between the use of mosquito nets and the spraying of households, demographics, as well as socioeconomic factors (Chase *et al.*, 2009).

## **1.3 Justifications of the Study**

Malaria remains a pressing public health concern in Zambia, posing a significant threat to the well-being of its population, particularly among vulnerable groups such as pregnant women and children under five. In this context, investigating the utilization of ITNs becomes not only a priority but imperative. Zambia has made substantial efforts to distribute ITNs across the country, including free distribution campaigns and antenatal care programs. However, the success of these interventions is dependent upon their effective use by the population. Hence, conducting a comprehensive study on ITN usage patterns in Zambia is not only timely but essential. Such research is expected to shed light on the factors influencing ITN ownership and utilization, including socio-economic, demographic, and geographical determinants. By understanding these

details, public health authorities can tailor interventions to enhance ITN usage rates, thus contributing significantly to malaria control and ultimately reducing the burden of this devastating disease on the Zambian population. This study holds the potential to inform evidence-based policy decisions and guide future initiatives aimed at achieving malaria elimination goals in Zambia.

## **1.4 Objectives**

### **1.4.1 General Objective**

To assess the use of Insecticide-Treated Nets (ITNs) in selected parts of North-Western province with a sample of 960 that was randomly selected and hence representative of the population.

### **1.4.2 Specific Objectives**

- 1.4.2.1 To assess the prevalence of ITNs use in relation to socio-economic factors in North-Western Province.
- 1.4.2.2 To identify the proportion of ITNs use in relation to demographic factors in North-Western province.
- 1.4.2.3 To determine the proportion of dwellings that were sprayed and used ITNs in North-Western province.

## **1.5 Research Questions**

### **1.5.1 General Research Question**

How is the use of Insecticide-Treated Nets (ITNs) which are part of the National Malaria Eradication Program (NMEP) in selected parts of North-Western province?

### **1.5.2 Specific Research Questions**

- 1.5.2.1 What is the prevalence of ITNs use in relation to socio-economic factors in North-Western Province?
- 1.5.2.2 What is the proportion of ITNs use in relation to demographic factors in North-Western province?
- 1.5.2.3 What is the proportion of dwellings that were sprayed and used ITNs in North-Western province?

## **1.6 Scope of the Study**

The scope of this study, which is coupled with the rich dataset provided by the Zambia Demographic and Health Survey (ZDHS, 2018), is to comprehensively investigate the utilization and effectiveness of ITNs in Zambia. The sample was nationally representative and designed to produce national, urban and rural estimates. Zambia is divided into 10 provinces with each province subdivided into districts, each district into constituencies, and each constituency into wards.

## **CHAPTER TWO – LITERATURE REVIEW**

### **2.0 Overview**

This chapter presents a comprehensive review of the literature so as to provide a concise understanding of the research topic more clearly. This was done by reviewing a number of various studies related to the research problem done by other scholars.

### **2.1 Relationship between Usage of Mosquito Nets and Socioeconomic Factors**

#### **2.1.1 Level of Education**

Education plays a pivotal role in shaping malaria awareness and preventive behaviours. Studies have consistently shown that higher education levels are associated with improved knowledge of malaria prevention strategies and better engagement with control measures. (Boateng *et al.*, 2021). In SSA, it has been highlighted that there is a positive correlation between maternal education and child malaria prevention practices, shedding light on education's role in shaping preventive behaviors. According to Ndoen *et al.* (2017), from Indonesia, it was found that individuals with higher education levels exhibited better knowledge of malaria transmission and prevention, emphasizing education's influence on disease understanding. Furthermore, empirical evidence from diverse settings highlights the pivotal role of education in mosquito net ownership. The study conducted by Osero *et al.* (2005) in Kenya revealed a significant correlation between maternal education and bed net possession. Educated mothers were more likely to own ITNs due to their heightened awareness of malaria prevention strategies. This heightened awareness stems from their exposure to health education and information campaigns. Knowledgeable about the benefits of using ITNs, educated mothers are equipped to make informed decisions about prioritizing bed net adoption within their households. Another study by Krezanoski *et al.* (2017) in Ethiopia demonstrated that households with higher education levels were more likely to consistently use

mosquito nets. The informed understanding of the protective benefits of ITNs, acquired through education, translates into higher compliance with usage recommendations.

### **2.1.2 Wealth Index**

Socioeconomic status, encompassing income level and overall economic well-being, exerts a substantial influence on net ownership. A research by Onwujekwe *et al.* (2003) conducted in Nigeria unravels the nuanced relationship between socioeconomic status and bed net acquisition. Lower socioeconomic groups exhibited a lower willingness to pay for bed nets, indicating the presence of economic barriers. These economic constraints limit the capacity of lower-income households to allocate resources to preventive measures, thus hindering their access to effective malaria prevention tools. A study by Atieli *et al.* (2011) in Kenya demonstrated that households with higher socioeconomic status were more likely to own bed nets. This observation was attributed to the greater financial capacity of such households to invest in preventive measures. Deressa *et al.* (2014) conducted research in Ethiopia that revealed that households with higher income levels were more likely to own bed nets. The findings indicated that economic resources play a critical role in net ownership. Dada *et al.* (2020) explored the relationship between socioeconomic status and net ownership in Nigeria, underscoring that households with lower income levels faced challenges in acquiring bed nets.

## **2.2 Relationship between Demographic Factors and Usage of Mosquito Nets**

### **2.2.1 Age**

Age plays a pivotal role in shaping the ownership and usage of mosquito nets. Empirical research, such as the study by Nuwaha *et al.* (2001) in Uganda underscores age's significance. In communities with high malaria prevalence, households with young children are often more likely to possess bed nets. This can be attributed to the heightened awareness of the vulnerability of young children to malaria infection and its severe consequences. Parents and caregivers are more motivated to protect their children, resulting in increased bed net ownership within such households. Moreover, empirical findings suggest that the age of household members can influence net usage patterns. Children and the elderly, who are more susceptible to severe outcomes of malaria, are often prioritized when it comes to using mosquito nets (Alaii *et al.*, 2003).

This underscores the complex interplay between age and perceived vulnerability, driving the adoption and consistent usage of nets within households.

### **2.2.2 Sex**

Gender dynamics play a critical role in determining mosquito net usage, often reflecting cultural norms and responsibilities. Studies have shown that women often assume the responsibility of ensuring that family members, especially children, sleep under mosquito nets (Thwing *et al.*, 2011). In many societies, women are caregivers and hold the primary role in safeguarding the health of the family. As a result, they are more likely to prioritize and enforce the usage of mosquito nets, leading to higher compliance rates within households they manage. However, gender can also influence access to mosquito nets. A study by Krezanoski *et al.* (2017) done in Ethiopia found that household heads, often male, were more likely to control the distribution and utilization of nets. This power dynamic could impact who has access to nets and whether they are used consistently.

### **2.2.3 Marital Status**

Marital status is another demographic factor that contributes to mosquito net adoption and usage. Married couples are more likely to adopt protective behaviors like consistent net usage for themselves and their families (Deressa *et al.*, 2014). The sense of responsibility that comes with family commitment can drive couples to prioritize malaria prevention within their households. However, the influence of marital status on net usage can vary. A study by Ricotta *et al.* (2019) in SSA found that marital status alone did not consistently predict net usage; instead, the presence of children and the number of family members played a more substantial role. This highlights the importance of considering multiple factors in understanding the complex relationship between demographic characteristics and net usage. According to Kimbi *et al.* (2014), sociodemographic factors influence the ownership and utilization of nets in the Buea Health District. A related situation was reported in Nigeria by Singh & Singh (2013). The practice of acquiring ITNs from the market and ownership and utilization of ITNs were found to be associated with marital status. This can be linked to the fact that married women received financial aid from their husbands unlike single women who struggle on their own to take care of all family responsibilities. In general, better malaria prevention and control approaches have been associated with financial or

socioeconomic status of the individuals concerned as they are in most cases directly linked to the accessibility and affordability of the preventive measures (Toanga, *et al.*, 2013).

#### **2.2.4 Residence**

Evidence consistently demonstrates that rural areas, which are often characterized by higher exposure to mosquito vectors, exhibit higher rates of net utilization. The perceived threat of malaria is more pronounced in rural settings, driving individuals to prioritize preventive measures. A study conducted in Tanzania underlines this phenomenon. The research highlights that malaria predominantly affects rural regions, where agricultural activities frequently create conducive mosquito breeding sites. Consequently, the perceived risk of malaria transmission in rural areas leads to a heightened emphasis on net usage for protection (Mboera *et al.*, 2013). According to Wanzirah *et al.* (2015), a study in Uganda revealed that rural residents were more likely to use bed nets consistently in comparison to their urban counterparts, echoing the heightened emphasis on prevention in rural areas. Furthermore, Zewdie *et al.* (2017) explored net ownership and usage patterns in Ethiopia, uncovering higher net utilization rates in rural communities attributed to the perceived higher risk of malaria. While Alaii *et al.* (2003) conducted another research in Kenya, indicating that net usage was significantly higher among rural residents due to the increased exposure to malaria vectors.

Urban areas may experience lower net usage rates due to the perception of a reduced risk of exposure to malaria. The relative absence of widespread mosquito breeding sites in urban settings contributes to a perception of decreased malaria transmission risk. This perception, however, may not always align with the actual risk, as malaria can persist even in urban environments. In a study by Ruebush *et al.* (2002) in Peru, it was observed that urban residents had lower levels of bed net usage due to the prevailing perception of a diminished malaria risk in urban environments. Another study by Deribew *et al.* (2013) found that net usage rates were significantly lower in urban areas of Ethiopia, driven by the perception of reduced malaria transmission risk.

### **2.3 Hesitance for use of ITNs following indoor residual Spraying (Perceived Reduction in Mosquito Density)**

A study conducted by Strode *et al.* (2010) in South Africa established that individuals who had experienced indoor residual spraying were unlikely to use bed nets consistently. The perception of

reduced mosquito density following the indoor residue spraying was cited as a reason for decreased net usage. One of the key reasons behind the hesitancy observed in some individuals to use mosquito nets post-IRS is the perceived reduction in mosquito density. Households that have undergone IRS may believe that the insecticides applied to indoor surfaces effectively eliminate mosquitoes, leading to a decreased need for supplementary protection from bed nets. This perception might stem from a sense of reduced risk due to the perceived effectiveness of the IRS. According to Smith *et al.* (2012), net usage patterns after IRS in Zambia showed that individuals who had received IRS were less likely to consistently use nets, with many expressing confidences in the protective effects of the IRS alone. Yukich *et al.* (2010) conducted a study in Mozambique which explored factors influencing net usage post-IRS. Participants expressed high levels of trust in IRS effectiveness, leading to a reduced perceived need for net usage and resulting in a hesitancy to adopt consistent net practices. Households that have observed the tangible effects of the IRS, such as the decrease in mosquito presence, may develop a sense of confidence in the intervention's ability to provide comprehensive protection. This trust in the IRS could lead to the belief that using both IRS and mosquito nets is redundant, resulting in decreased net usage. According to Pluess *et al.* (2010), who conducted research in Tanzania, noted that some individuals who experienced IRS believed that bed nets were no longer necessary. This belief influenced their net usage behavior, contributing to the observed hesitancy.

## **2.3 Theoretical Framework**

### **2.3.1 The health belief model**

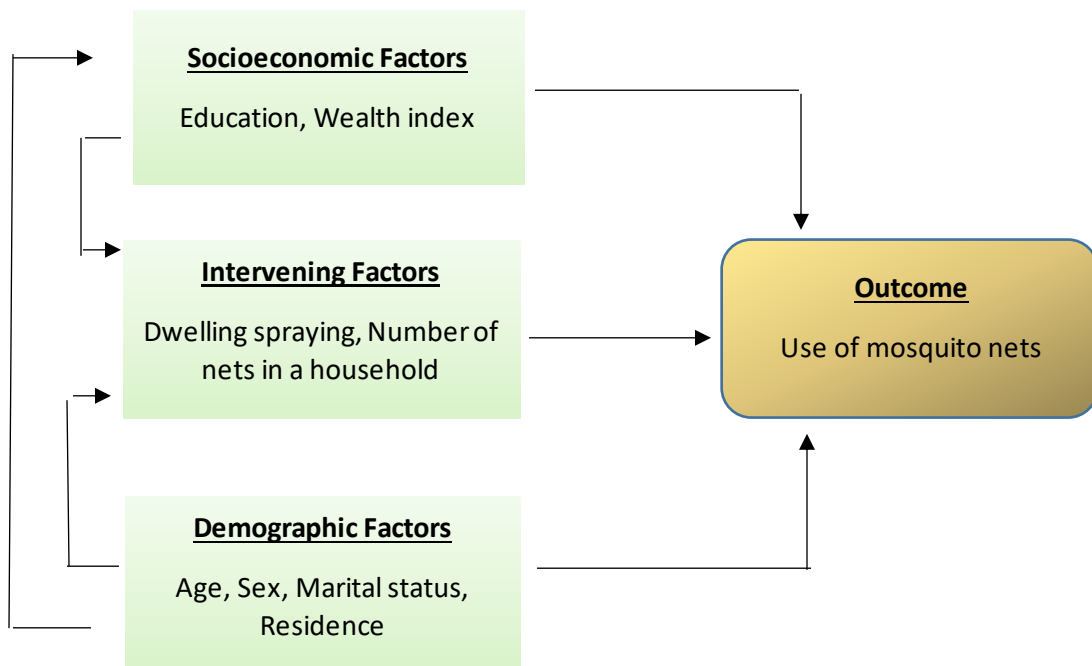
The Health Belief Model (HBM) is a behavior determinant model which was developed in the 1950's to help understand why more people did not take advantage of an immunization programme offered by the federal government (Rosenstock, Strecher and Becker, 1994). It is one of the widely utilized conceptual frameworks for understanding, explaining and predicting health behavior. The HBM is a psychological model that attempts to explain and predict health seeking behaviors by focusing on the attitudes and beliefs of individuals. It explains why people fail to engage in certain recommended desirable health behaviors.

The HBM stipulates that a person's health related behavior depends on their perception of six critical areas: the susceptibility to the illness, perceived severity of a potential illness, their

perceived benefits of taking preventive action, the barriers to taking that action, cues of action and self-efficacy. (Recapp, 2005).

## 2.4 Conceptual Framework

A conceptual framework is a simplified diagram which shows how various factors contribute to a given problem or phenomenon. Shown below is the conceptual framework developed for this study.



**Figure 1. Conceptual framework**

As shown in the framework above, socioeconomic factors (education and wealth index) can have an influence on use of mosquito nets. However, they can also influence intervening factors (whether a dwelling is sprayed or not, the number of mosquito nets in a household) – and these intervening factors can influence whether someone uses a mosquito net or not. Additionally, the demographic factors can on one hand influence socioeconomic factors (education and wealth index) – these socioeconomic factors can influence whether someone sleeps under a mosquito net or not – on the other hand, they can also influence intervening factors (whether a dwelling is sprayed or not, the number of mosquito nets in a household) – these intervening factors can

influence whether someone uses a mosquito net or not – or the demographic factors can just influence – the usage of mosquito nets.

## **CHAPTER THREE – METHODOLOGY**

### **3.0 Overview**

This chapter presents the procedures that were used in this study. In particular, it focuses on the research setting, study approach, types of data and collection tools, sample size, data analysis, and ethical considerations among others. This methodology was important in ensuring that the study objectives were fully met.

### **3.1 Study Design**

A retrospective study design was used in this research to assess the factors that affected the ownership and usage of mosquito nets in North-Western province. Cross-sectional studies are basically snapshots of a population at a certain time, allowing conclusions to be drawn about the whole population. Its key advantages are that data could be collected at once with quick results, thus cheap, study results could be generalized to the entire population because the sample is statistically representative enough.

### **3.2 Research Setting**

This study was conducted in the North-Western province of Zambia. The cluster-based household sample was selected in the province by urban and rural residence.

### **3.3 Study Population**

The study targeted a representation of the population of women 15-49 and men aged 15-59. It is for this age range that a sample size was then established. Based on the 2010 census, the estimated population of people residing in North-Western province was 727,044.

### **3.4 Study Approach**

The research was a quantitative study. This basically involved the use of mainly statistics and numbers generated from the dataset, with the use of narratives and descriptions.

### **3.5 Types of Data and Collection Tools**

Quantitative secondary data from the Zambia Demographic and Health survey (ZDHS), conducted by the Zambia Statistical Agency (ZSA) in 2018 was used in this research. The data collection tools that were used were questionnaires. Questionnaires were used because they are fast and efficient due to the large sample size required for the study.

### **3.6 Sampling Techniques**

The ZDHS done by ZSA used a two-stage stratified sample design, with sample clusters selected during the first stage and households systematically sampled during the second stage. In the first stage, 545 clusters that were used were selected with probability proportional to size. Stratification was achieved by separating each province into urban and rural areas. In the second stage, a complete list of households served as the sampling frame in the selection of households for enumeration. An average of 25 households was selected in each cluster from a total of 133 households. The inclusion criteria were all participants with available data on necessary variables. It included women age 15-49 and men age 15-59. The study excluded all participants with missing data on any variable that was necessary to the study.

### **3.7 Sample Size**

The updated list of Enumeration Areas (EAs) for the 2010 Census of Population and Housing (CPH) provided the sampling frame for the 2018 ZDHS. Of the 13,595 households in the sample, 12,943 were occupied – of which 12,831 were successfully interviewed, yielding a response rate of 99%.

In the interviewed households, 14,189 women age 15-49 were identified as eligible for individual interviews – of which 13,683 were interviewed, yielding a response rate of 96%. A total of 13,251 men were eligible for individual interviews – of which 12,132 of these men were interviewed, producing a response rate of 92%.

But for North-Western province, which was the focus of this study, the total number of same samples respondents were as follows:

- Total: 960
- Women: 296
- Men: 664

### **3.8 Operationalization of Variables**

#### **3.8.1 Dependent Variable**

The dependent variable was; Insecticide treated net use. This variable was measured as 1-yes, and 2-No

#### **3.8.2 Independent Variables**

A number of independent variables were used in this study. These have been shown in the table below.

Table 1. Independent variables

Variables	Descriptions	Scales
Education level (hv106_01)	0=No education, 1=Primary, 2=Secondary & 3=Higher	Nominal
Wealth index (hv270)	1=Poorest, 2=Poorer, 3=Middle, 4=Richer & 5=Richest	Nominal
Age of household head (hv220)	1=15-19, 2=20-24, 3=25-29, 4=30-34, 5=35-39, 6=40-44 & 7=45+	Nominal
Sex (hv219)	1=Male & 2=Female	Nominal
Marital status (hv115_01)	0=Single, 1=Married, 3=Widowed & 4=Divorced	Nominal
Residence (hv025)	1=Urban & 2=Rural	Nominal
Has dwelling been sprayed against mosquitoes in the last 12 months (hv253)	0=No & 1=Yes	Nominal
Number of mosquito nets owned (hml1)	0, 1, 2 & 3+	Ratio
Number of children under a mosquito net previous night (hml2)	0, 1, 2, & 3	Ratio

Source: ZDHS 2018

As shown in the table above, the socioeconomic variables include education level which was captured as 0=No education, 1=Primary, 2=Secondary & 3=Higher. Wealth index was categorized as follows: 1=Poorest, 2=Poorer, 3=Middle, 4=Richer & 5=Richest.

Demographic variables included age of household head, which was captured as 1=15-19, 2=20-24, 3=25-29, 4=30-34, 5=35-39, 6=40-44 & 7=45+. Sex was captured as 1=Male & 2=Female. Additionally, marital status was captured as 0=Single, 1=Married, 3=Widowed & 4=Divorced, while residence was captured as 1=Urban & 2=Rural.

Further, the variable of whether or not a dwelling was sprayed against mosquitoes in last 12 months was captured as 0=No & 1=Yes, while the number of mosquito nets owned was captured as 0, 1, 2 & 3+ and the number of children under mosquito net previous night was captured as 0, 1, 2, & 3.

### 3.8.3 Operational Definitions of Variables

- **Level of education** – This was the highest level of education a respondent has successfully completed.
- **Wealth index** – This was the grouping of households into quintiles based on various household characteristics such as type of water source, sanitation facility, livestock ownership, materials used for floors and walls.
- **Age** – This was the exact age of a respondent as at their last birthday.
- **Sex** – This was the classification of a respondent based on their biological makeup.

- **Marital status** – This was the classification of a respondent based on whether they were in a union or not.
- **Place of residence** – This was the usual place where a respondent resides or dwells.
- **Has dwelling been sprayed against mosquitoes in last 12 months** – This was the classification of whether a household had been sprayed to protect it against mosquitoes.
- **Number of mosquito nets owned** – This was the total number of mosquito nets in a particular household.
- **Number of children under mosquito net previous night** – This was the total number of children who slept under a mosquito net on the night of the interview.

### 3.9 Data Analysis

Data analysis in this study was done at three levels, that is: univariate, bivariate and multivariate levels, respectively. It is important to note that no pre-test was done as the data used was secondary data. At univariate analysis level, percent and frequency distributions of the background variables were produced. Some of these variables included education level, age of household head, marital status, and number of children who slept under a mosquito net.

At the bivariate analysis level, cross tabulations were produced to establish the associations between the independent variables and the dependent variable. The dependent variable was measured in terms of whether a respondent in a particular household used a mosquito net on the night before the survey or not. However, the focus of analysis in this study was on those respondents who did not use a mosquito net. The level of the relationship between the different factors and the dependent variable was therefore established by computing the chi-square, at a significance of 5% and a confidence level of 95%. A p-value less than 0.05 indicated a statistically significant association. On the other hand, a p-value greater than 0.05 indicated that there was no significant relationship.

Furthermore at multivariate analysis level, binary logistic regression was used to determine the factors that influence the usage of mosquito nets in North-Western province described by the logistic function below:

$$\text{Logistic}(y) = \beta_0 + \beta_1x_1 + \beta_2x_2 \dots \dots \beta_nX_n$$

Where

- Y denoted the binary dependent variable.
- $\beta$  denoted the intercept

- X denoted the independent variables

The intercept in the model was the value of Y when the value of all the independent variables was zero. The coefficients described the effect of independent variables on the dependent variable. The coefficients were interpreted as follows:

- Positive regression coefficient will mean that the independent variable X increases the probability of the dependent variable Y.
- Negative regression coefficient will mean that the independent variable X decreases the probability of that dependent variable Y.
- Big regression coefficient will mean that the explanatory variable strongly influences the chance of the outcome.
- Near zero or zero regression coefficient would mean that the explanatory factor had little or no influence on the probability of that outcome.

It is also cardinal to note that STATA v.14 software was used to carry out all the statistical data analysis. In order to do so, a do file was created to enable the compilation of all commands that were later executed in STATA. For data cleaning, non-response and don't know responses were dropped so as to remain with the observations of interest. Other softwares that were used included Microsoft Excel which was used to generate graphs, tables and graphs, while Microsoft Word was used to write the report.

### **3.10 Ethical Considerations**

This study was to be conducted in compliance with the research protocol and standard ethical guidelines in Zambia. In line with this, approval was obtained from the University of Lusaka, National Health Research Authority (NHRA).

### **3.11 Limitations**

Among the main limitations faced when carrying out this study were the following:

- a) It was difficult to do more detailed descriptive analysis as most of the secondary data used was quantitative in nature.
- b) The objectives set for the 2018 ZDHS were a limiting factor in that they dictated what could be studied as these objectives were not set by the researcher – hence limited what this study could have focused on.
- c) The study could not investigate cause-effect relationships between variables due to the fact that the data was not longitudinal but cross-sectional.

## CHAPTER FOUR – DATA PRESENTATION

### 4.0 Overview

This section presents various findings that were generated from the various analyses which were done. First, some background characteristics of the respondents are presented, and then the rest of the findings are presented as per study objectives.

### 4.1 Background Characteristics

A number of background characteristics were considered in this study. Hence, shown in Table 2 are the frequency and percent distributions of the respondents for the various characteristics.

Table 2. Background characteristics (N=960)

Variables	Frequency	Percent
<b>Education level</b>		
No education	104	10.8
Primary	338	40.4
Secondary	332	34.6
Tertiary	136	14.2
<b>Wealth index</b>		
Poorest	293	30.5
Poorer	246	25.6
Middle	163	17.0
Richer	112	11.7
Richest	146	15.2
<b>Age of household head</b>		
15-19	5	0.5
20-24	73	7.6
25-29	130	13.5
30-34	134	14.0
35-39	141	14.7
40-44	111	11.6
45+	366	38.1
<b>Sex of household head</b>		
Male	664	69.2
Female	296	30.8
<b>Marital status</b>		
Single	83	8.7
Married	619	64.5
Widowed	105	10.9
Divorced	153	15.9
<b>Residence</b>		
Urban	286	29.8
Rural	674	70.7
Totals	960	100.0

For education level, the results show that most of the respondents had primary level of education (40.4%, n=338), while the least number of the respondents had no education (10.8%, n=104). For

wealth index, the results show that most of the respondents came from the poorest households (30.5%, n=293), followed by those who came from poorer households (25.6%, n=246), while the least number of respondents came from richer households (11.7%, n=112). Additionally, the results for the age of the household head show that most of them were aged 45+ years (38.1%, n=366), followed by those who were aged 35-39 years (14.7%, n=111), while the least number of respondents were aged 15-19 years (0.5%, n=5).

Table 2 also shows that in terms of sex of the household head, 39.2% (n=664) were males, while 30.8% (n=296) were females. In terms of marital status, the results show that most of the respondents were married (64.5%, n=619), while the least number of respondents were single (8.7%, n=83). Lastly, the results for residence show that 29.8% (n=286) of the respondents came were in urban areas, while 70.7% (n=674) were in rural areas.

Other interesting findings in this study related to the number of mosquito nets owned by various households and the number of children who slept under one the previous night.

### Number of mosquito nets owned

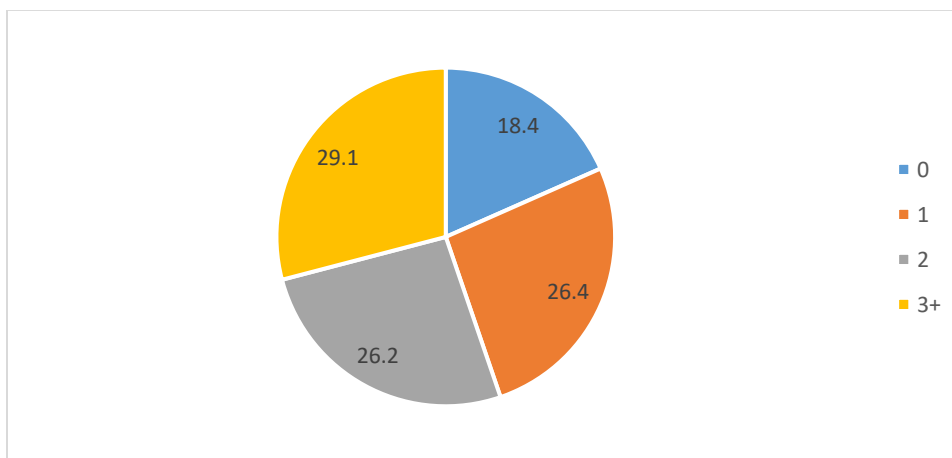


Figure 2. Percent distribution of the number of mosquito nets owned (N=960)

Results in Figure 2 above hence show that most of the households owned 3+ mosquito nets (29.1%, n=279), while the least number of households owned no mosquito nets (18.4%, n=177).

## Children under a mosquito net the previous night

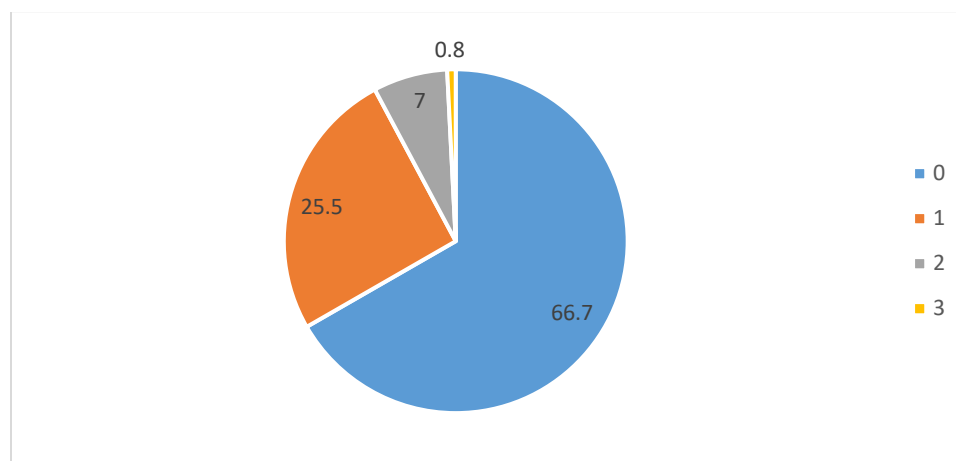


Figure 3. Percent distribution of the number of children under a mosquito net previous night (N=960)

For Figure 3 above, the results show that most of the respondents said that no children slept under each mosquito net the previous night (66.7%, n=640), while the least number of the respondents said that 3 children under each mosquito net the previous night (0.8%, n=8).

### 4.2 Relationship between Usage of Mosquito Nets and Socioeconomic Factors

Table 3 below shows results for the association between the usage of mosquito nets and various socioeconomic factors.

Table 3. The relationship between usage of mosquito nets and socioeconomic factors (N=960)

Variables	Used a Mosquito Net		P-Value
	No	Yes	
<b>Education level</b>			
No education	46.2 (48)	53.9 (56)	0.212
Primary	39.2 (152)	60.8 (236)	
Secondary	44.3 (147)	55.7 (185)	
Tertiary	36.0 (49)	63.9 (87)	
<b>Wealth index</b>			
Poorest	39.9 (117)	60.1 (176)	0.007
Poorer	37.4 (92)	62.6 (154)	
Middle	54.0 (88)	46.0 (75)	
Richer	41.1 (46)	58.9 (66)	
Richest	36.3 (53)	63.7 (93)	

The results show that there was no association between the education level of a respondent and whether they used a mosquito net or not, as seen from the p-value of 0.212, which was greater than 0.05. However, the results show that most of the respondents who did not use a mosquito net had no education (46.2%), while the least number of respondents who did not use a mosquito net had tertiary level of education (36.0%).

For the wealth index, the results show that there was a significant association between this factor and whether a respondent used a mosquito net or not, as seen from the p-value of 0.007, which was less than 0.05. The results further show that most of the respondents who did not use mosquito nets came from middle households (54.1%), while the least number of the respondents who did not use them came from the richest households (36.3%).

### 4.3 Relationship between Demographic Factors and Usage of Mosquito Nets

Shown in Table 4 below are results for the association between various demographic factors and the usage of mosquito nets.

Table 4. The relationship between demographic factors and usage of mosquito nets (N=960)

Variables	Used a Mosquito Net		P-Value
	No	Yes	
<b>Age of household head</b>			
15-19	20.0 (1)	80.0 (4)	0.547
20-24	48.0 (35)	52.1 (38)	
25-29	46.2 (60)	53.9 (70)	
30-34	40.3 (54)	59.7 (80)	
35-39	42.6 (60)	57.5 (81)	
40-44	36.9 (41)	63.1 (70)	
45+	39.6 (145)	60.4 (221)	
<b>Sex of household head</b>			
Male	39.9 (265)	60.1 (399)	0.206
Female	44.3 (131)	55.7 (165)	
<b>Marital status</b>			
Single	47.0 (39)	53.0 (44)	0.162
Married	38.9 (241)	61.1 (378)	
Widowed	41.0 (43)	59.1 (62)	
Divorced	47.7 (73)	52.3 (80)	
<b>Residence</b>			
Urban	40.9 (117)	59.1 (169)	0.889
Rural	41.4 (279)	58.6 (395)	

The results showed that there was no association between the age of the household head and whether a respondent used a mosquito net or not, as seen from the p-value of 0.547, which was greater than 0.05. However, the results show that most of the respondents who did not use a mosquito net were aged 20-24 years (48.0%), while the least number of respondents who did not use a mosquito net were aged 15-19 years (20%).

The table also shows that there was no association between the sex of the household head and whether a respondent used a mosquito net or not, as seen from the p-value of 0.206, which was

greater than 0.05. Further, the results show that more females did not use a mosquito net compared to their male counterparts (44.3% vs. 39.9%).

In terms of marital status, the results show that there was no association between marital status and whether a respondent used a mosquito net or not, as seen from the p-value of 0.162, which was greater than 0.05. The results also show that most of the respondents who did not use a mosquito net were single and divorced (47.0%), respectively, while the least number of respondents who did not use a mosquito net were married (38.9%).

Lastly, Table 4 shows that there was not association between residence and whether a respondent used a mosquito net or not, as seen from the p-value of 0.889, which was greater than 0.05. However, the results show that more rural residents did not use a mosquito net compared to their urban resident counterparts (41.4% vs. 40.9%).

#### 4.4 People Who Have their Houses Sprayed for Mosquitoes Become Hesitant to Use Mosquito Nets

Table 5 below shows results for the association between various factors, namely, whether a dwelling has been sprayed, the number of mosquito nets owned and the number of children who slept under a mosquito net previous night & mosquito net usage.

Table 5. The relationship between dwelling spraying, the number of mosquito nets owned and the number of children who slept under a mosquito net previous night & mosquito net usage (N=930)

Variables	Used a Mosquito Net		P-Value
	No	Yes	
Has dwelling been sprayed against mosquitoes in last 12 months			
No	45.7 (270)	54.3 (321)	0.000
Yes	34.7 (126)	65.9 (243)	
Number of mosquito nets owned			
0	100.0 (177)	0.0 (0)	0.000
1	31.2 (79)	68.8 (174)	
2	26.3 (66)	73.7 (185)	
3+	26.5 (74)	73.5 (205)	
Number of children under mosquito net previous night			
0	55.8 (357)	44.2 (283)	0.000
1	13.5 (33)	86.5 (212)	
2	7.5 (5)	92.5 (62)	
3	12.5 (1)	87.5 (7)	

The results show that there was a significant association between whether a dwelling was sprayed against mosquitoes in the last 12 months preceding the survey and mosquito net usage, as seen from the p-value of 0.000, which was less than 0.05. However, the results show that more of the

respondents who did not have their dwellings sprayed did not use a mosquito net, compared to those who had their dwellings sprayed (45.7% vs 34.7%).

Table 5 also shows that there was a significant association between the number of mosquito nets owned and the usage of mosquito nets, as seen from the p-value of 0.000, which was less than 0.05. The results further show that most of the respondents who did not use a mosquito net had no mosquito nets (100%), while the least number of respondents who did not use a mosquito net owned 3+ mosquito nets (12.5%).

Lastly, Table 5 shows that there was a significant association between the number of children and those who slept under a mosquito net previous night, as seen from the p-value of 0.000, which was less than 0.05. The results also show that most of the respondents who did not use a mosquito net had no children under a mosquito net previous night (55.8%), while the least number of respondents who did not use a mosquito had 2 children under a mosquito net previous night (7.5%).

#### 4.5 Factors that Influence the Usage of Mosquito Nets

Table 6 below shows binary logistic regression results, namely, odds ratios, p-values and confidence intervals for how the various explanatory factors influence the outcome variable (i.e., the dependent variable called usage of mosquito nets).

Table 6. Factors that influence the levels of mosquito net usage (N=960)

Variables	Odd Ratio	P-Value	CI at 95%
<b>Education level</b>			
No education*	1		
Primary	1.151	0.647	0.631-2.099
Secondary	1.139	0.719	0.560-2.316
Tertiary	1.047	0.923	0.408-2.685
<b>Wealth index</b>			
Poorest*	1		
Poorer	0.696	0.128	0.436-1.109
Middle	0.451	0.006	0.255-0.799
Richer	0.943	0.882	0.437-2.035
Richest	0.876	0.771	0.359-2.138
<b>Age of household head</b>			
15-19*	1		
20-24	1.115	0.933	0.087-14.312
25-29	0.548	0.635	0.046-6.573
30-34	0.684	0.765	0.057-8.269
35-39	0.551	0.638	0.046-6.572
40-44	0.709	0.787	0.059-8.548
45+	1.131	0.922	0.096-13.257
<b>Sex of household head</b>			
Male*	1		

Female	0.910	0.746	0.515-1.609
<b>Marital status</b>			
Single*	1		
Married	0.681	0.313	0.323-1.435
Widowed	0.782	0.600	0.311-1.964
Divorced	0.798	0.584	0.357-1.787
<b>Residence</b>			
Urban*	1		
Rural	0.815	0.418	0.496-1.337
<b>Has dwelling been sprayed against mosquitoes in last 12 months</b>			
No*	1		
Yes	1.427	0.050	1.000-2.034
<b>Number of mosquito nets owned</b>			
0*	1		
1	1.040	0.864	0.659-1.640
2	1.162	0.506	0.747-1.808
3+	1.000	—	—
<b>Number of children under mosquito net previous night</b>			
0*	1		
1	4.815	0.000	3.068-7.558
2	10.536	0.000	4.020-27.615
3	5.411	0.124	0.628-46.610
_cons	2.853	0.448	0.189-42.923

NOTE: \* denotes the reference category; CI denotes confidence interval.

The results in Table 6 show that the respondents with primary level education were 15% more likely to not sleep under a mosquito net when compared to those with no education. The respondents with secondary level education were 14% more likely to not sleep under a mosquito net, while the respondents with tertiary level education were 5% more likely to not sleep under a mosquito net when compared to those with no education, respectively. However, all the education levels were not significantly associated to the no education level category (p-values = 0.647, 0.719 & 0.923).

For wealth index, the results show that the respondents from poorer households were 30% less likely to not sleep under a mosquito net, when compared to those from the poorest households. The respondents from middle households were 55% less likely to not sleep under a mosquito net, when compared to those from the poorest households. Further, the respondents from richer households were 6% less likely to not sleep under a mosquito net, when compared to those from the poorest households. The results also show that the respondents from the richest households were 13% less likely to not sleep under a mosquito net, when compared to those from the poorest

households. However, only the middle wealth index was significantly associated to the poorest one (p-value = 0.006).

Thirdly, Table 6 shows that the respondents from households with household heads aged 20-24 years were 12% more likely to not sleep under a mosquito net, when compared to those aged 15-19 years, while those from households with household heads aged 25-29 years were 46% less likely to not sleep under a mosquito net, when compared to those aged 15-19 years. Additionally, the respondents from households with household heads aged 30-34 years were 32% less likely to not sleep under a mosquito net, when compared to those aged 15-19 years. The results also show that the respondents from households with household heads aged 35-39 years were 45% less likely to not sleep under a mosquito net, when compared to those aged 15-19 years, while those from households with household heads aged 40-44 years were 29% less likely to sleep under a mosquito net, when compared to those aged 15-19 years, though the respondents from households with household heads aged 45+ years were 13% more likely to not sleep under a mosquito net, when compared to those aged 15-19 years. Significance results show that all the age categories were not significantly associated to those aged 15-19 years (p-values = 0.933, 0.635, 0.765, 0.638, 0.787 & 0.922).

Table 6 further shows that the respondents from households with female household heads were 9% less likely to not sleep under a mosquito net, when compared to their male counterparts, and there was not significant association between being female and male (p-value = 0.746).

In terms of marital status, the results show that the married respondents were 32% less likely to not sleep under a mosquito net, when compared to those who were single. Those who were widowed were 22% less likely to not sleep under a mosquito net, when compared to those who were single, while those who were divorced were 21% less likely to not sleep under a mosquito net, when compared to those who were single. Further, all the marital status categories were not significantly associated to the single marital status category (p-values = 0.313, 0.600 & 0.584).

Table 6 also shows that the respondents who were residing in rural areas were 19% less likely to not sleep under a mosquito net, when compared to those who were residing in urban areas. Significance results show that there was no association between residing in rural areas and residing in urban areas (p-value = 0.418).

Additionally, results in Table 6 show that respondents who had their dwelling sprayed were 42% more likely to not sleep under a mosquito net, when compared to those who did not have their

dwelling sprayed. Significance results further show that there was an association between having a dwelling sprayed and not having it sprayed (p-value = 0.050).

Also in Table 6 are results which show that having respondents who owned one mosquito net were 4% more likely to not sleep under a mosquito net, when compared to those who did not own any. The respondents who owned two mosquito nets were 16% more likely to not sleep under a mosquito net, while those who owned 3+ mosquito nets were 0% likely to not sleep under a mosquito net, when compared to those who did not own any, respectively. Further, the results show that owning one or two mosquito nets were not significantly associated to owning no mosquito nets, respectively (p-values = 0.864 & 0.506).

Lastly, the results show that the respondents who said that one child slept under a mosquito net previous night were 382% more likely to not sleep under a mosquito net, when compared to those who said that no children slept under mosquito net previous night. Further, the results show that the respondents who said that two children slept under a mosquito net previous night were 954% more likely to not sleep under a mosquito net, while those who said that three children slept under a mosquito net previous night were 441% more likely to not sleep under a mosquito net, when compared to those who said that no children slept under mosquito net previous night, respectively. Significance results show that having one child sleep under a mosquito net was very significantly associated with having no child sleep under a mosquito net (p-value = 0.000).

## **CHAPTER FIVE – DISCUSSION, CONCLUSION & RECOMMENDATIONS**

### **5.0 Overview**

This section presents a discussion and conclusion of the key results of this study, and some salient recommendations in relation to what can be done in order to address the issue of low usage of mosquito nets as a way of curbing malaria.

### **5.1 Discussion**

#### **5.1.1 Relationship between Usage of Mosquito Nets and Socioeconomic Factors**

Two factors were considered under socioeconomic factors, namely education level and wealth index. The findings of this study revealed that there was no significant association between education level and the use of a mosquito net. However, the results also showed that the more a respondent increased their level of education, the more likely they were to use a mosquito net – and the biggest increase in the use of mosquito nets was seen when a respondent moved from having no education to having the primary level of education. What these results show is that access to the right education is essential in increasing the use of mosquito nets.

These results are similar to the findings of a study by Boateng *et al.*, 2021, it was found that higher education levels are associated with improved knowledge of malaria prevention strategies and better engagement with control measures. Another study by Ndoen *et al.* (2017) found that individuals with higher education levels exhibited better knowledge of malaria transmission and prevention, emphasizing education's influence on disease understanding. What this implies is that investments in the education of a population is important when it comes to increasing the use of mosquito nets. However, this education must not only be the ordinary grades 1 to 12 but other types of informal education which may include sensitizations, peer education, cultural dances and other public performances which provide information about malaria transmission, prevention and treatment.

The study further established that the wealth index had a significant association with the use of mosquito nets. Overall, the results showed that an improvement in the wealth index led to an increase in the use of mosquito nets among the respondents. This indicates that a better standard of living for an individual is important if they are to use more mosquito nets.

The results are similar to what has been found in a study where it was shown that lower socioeconomic groups tend to exhibit a lower willingness to pay for bed nets, which may be due to lacking financial means to buy. A study by Deressa *et al.* (2014) showed that households with higher income levels were more likely to own bed nets. What these findings hence go on to show is that the financial capacity of a household have a huge bearing in as far as that household being able to put in place or have access to ways of preventing transmission of malaria such as owning mosquito nets is concerned. Where someone has the financial means to own a mosquito net, capable of investing in preventive measures and medication, then the prevalence of malaria is likely to be reduced.

### **5.1.2 Relationship between Demographic Factors and Usage of Mosquito Nets**

Under demographic factors, four factors were considered, namely: age of the household head, sex of the household head, marital status and residence. The findings demonstrated that there was no association between the age of the household head and the use of a mosquito net. However, with an increase in a respondent's age, there was an increase in the use of mosquito nets. The biggest increase in the use of mosquito nets was from age 15-19 to 20-24 years and from age 40-44 to 45+ years respectively. What these results show is that as someone grows in age, they tend to be more responsible and ensuring that they safeguard their health takes centre stage.

Further results showed that there was no association between the sex of the household head and the use of a mosquito net. Males were more likely to use a mosquito net compared to females. This could have been due to the fact that some cultural norms considered males to be more important in a household, hence likely to receive special treatment – possibly even them being the first option when it came to who used one between males and females.

The findings concerning marital status showed that there was no association between this factor and the use of a mosquito net. Furthermore, the results indicated that generally, when someone changed their marital status (upwards), they were more likely to use a mosquito net. The biggest increase in the use of mosquito nets was seen when a person moved from being single to being married, and the lowest use of mosquito nets was seen among the divorced. In addition, moving from singlehood to marriage came with the presence of children as having children encouraged the parents to use mosquito nets to protect them from getting malaria. It is important to also note

that, the divorced were the least likely to use mosquito nets possibly because they were not likely to have pressure that came with having children who may need protection from malaria.

Lastly, the results for residence showed that there was no association between where a respondent lived and the use of a mosquito net. However, they also showed that there was no difference in terms of mosquito net usage between those who lived in urban or rural areas. This shows that more people had seen the importance of using a mosquito net, irrespective of where they came from. It could also be that sensitization interventions about the dangers of malaria were bringing about a mindset and behavior change among more people.

Unlike this study, other studies have found different results. A study by Mboera *et al.* (2013), found that malaria predominantly affected rural regions, where agricultural activities frequently created conducive mosquito breeding sites. Consequently, the perceived risk of malaria transmission in rural areas led to a heightened emphasis on net usage for protection. It is worth noting hence that the differences in the above results with what this study found could be attributed to improvements in the levels of sensitization about malaria prevention in both urban and rural areas.

### **5.1.3 People Who Have their Houses Sprayed for Mosquitoes Become Hesitant to Use Mosquito Nets Afterwards**

The study established that having a dwelling sprayed did not result in hesitancy to use a mosquito net as respondents who had their households sprayed were also more likely to use mosquito nets. This indicates that those who had their dwelling sprayed may have wanted to further protect themselves from malaria, or they could have received more sensitization from those who sprayed their houses on the importance of not only having a dwelling sprayed, but also the importance of using a mosquito net. It was interesting to note that unlike what the literature review had anticipated, the opposite was the case.

The results in relation to how many mosquito nets were owned by the respondents showed that the more mosquito nets were owned, the higher the chances were that the owned mosquito nets would be used, compared to when few were owned. It is clear that the only way someone could use a mosquito net – was if they owned one making it easier for them to consistently and correctly use them. Ownership of two or more mosquito nets was very important if their usage was to be increased.

Lastly, the results also showed that households which had more children living under the same roof had higher chances of using mosquito nets. The highest use was seen when the number of children who slept under a mosquito net moved from one to two. These results may indicate that once the children started using mosquito net they slowly got used to using one and would be more likely to remind their parents to put them under one – or the parents would see the need to consistently use one to help ensure that their children were protected from malaria. It could also be due to the fact that once a certain habit such as using a mosquito was formed in the parents' routines, it became difficult to change that habit, hence more consistent use of a mosquito net.

### **5.1.3 Factors that Influence the Usage of Mosquito Nets**

Respondents with a primary level of education were at the highest risk of not using mosquito nets as compared to those with a secondary level or tertiary level of education. The implication is that for more people to be encouraged to use mosquito nets, education would be emphasized for those with a primary level of education.

Wealth index results showed that respondents from richer households were at the lowest risk of not using a mosquito net, in comparison to those from the richest, poorer and middle households. If more people were to be encouraged to use mosquito nets, efforts must be directed towards those who came from richer households. It is possible that they may have possessed the mosquito nets, but took it for granted that they might not get malaria.

Furthermore, results indicated that respondents from households with household heads aged 25-29 years were at the highest risk of not using a mosquito nets compared to respondents from households where the household head was in the other age groups. What this shows is that if more is to be achieved in terms of increasing the use of mosquito nets, focus must be directed to households with household heads age between 25-29 years.

Sex of the household head findings showed that respondents from households where the household head was female were less likely to not use a mosquito net compared to males. Hence, this meant that if the use of mosquito nets was to be increased, focus must be directed towards encouraging more females to use them. This less use among females may be tied to the prevalence of certain retrogressive cultural traditions, norms and mindsets which favored males compared to females, who were considered as second-class.

Other results established that the divorced were at the lowest risk of not using a mosquito compared to the widowed and married. An increase in mosquito nets use can be achieved by applying more effort towards encouraging the divorced to realize the importance of using a mosquito net, followed by those who are were widowed.

In Addition, respondents residing in rural areas were less likely not to sleep under a mosquito net, as compared to those residing in urban areas indicating more effort to be directed towards those in urban areas.

The results concerning whether a dwelling was sprayed or not show that respondents who had their dwelling sprayed were more likely to not sleep under a mosquito net, compared to those who did not have their dwelling sprayed possibly due to the fact that those who had their household sprayed also wanted to further protect themselves by also ensuring that they use a mosquito net.

Ownership of a mosquito net findings showed that people who owned two mosquito nets were at the highest risk of not using a net compared to those who owned one and 3+.

Last but not least, households where two children slept under a mosquito net were at the highest risk of not using a mosquito net compared to those in which three children slept under one. To foster an increase in net usage, emphasis must be directed towards ensuring those with two children who slept under a mosquito net the previous night used more of the mosquito nets.

## **5.2 Conclusion**

According to the study findings, a lot still needs to be done in the promotion of malaria control. Ownership of a mosquito net does not necessarily translate into the use as not everyone who owned mosquito nets uses them. This implies that mosquito net distribution is not enough, it should be accompanied by vigorous sensitization and health education on the importance of mosquito net use. An improved standard of living also has a vital role to play in malaria eradication as the study established that those with a higher standard of living were more likely to use nets as opposed to those who had lower standards of living.

## **5.3 Recommendations**

The study recommends that:

- The distribution of mosquito nets must be accompanied by interventions and sensitizations that will promote their use.

- Factors that have an effect and influence on the use of mosquito nets should be appropriately addressed for instance education access to the right education results in the usage of mosquito nets.
- Behavioral change interventions should be implemented to encourage health practices such as mosquito net use.
- The study showed that men were more likely to use a mosquito net as compared to women. It is therefore important educate more women on malaria prevention strategies as well as mosquito net use in their households and communities.

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## Appendices

### Appendix I – Budget

Description	Estimate
Stationery (e.g., pens, ream of paper, etc.)	K500
Logistics (e.g., transport)	K300
Bundles for internet usage (i.e., during proposal and report phase)	K500
Printing of proposal	K400
Printing of report	K600
Totals	K2,300

### Appendix II – Work Plan

TASK/ACTIVITY	Activity Durations			
	Month 1	Month 2	Month 3	Month 4
Preparation of research proposal and study tools				
Approval from the University				
Approval from NHRA				
Data analysis				
Thesis writing				

## Appendix III: University of Lusaka research ethics approval



### **SCHOOL OF MEDICINE AND HEALTH SCIENCES LEOPARDS HILL CAMPUS**

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### **SCHOOL OF MEDICINE AND HEALTH SCIENCES RESEARCH ETHICS COMMITTEE**

Ref no: FWA00033228-02711/23

Date: 10<sup>th</sup> November 2023

**STUDENT NAME: SIAMULAMBE CHIPO; STUDENT NUMBER: MPH22113363**

**OWNERSHIP AND USE OF MOSQUITO NETS AS PART OF THE NATIONAL  
MALARIA ERADICATION PROGRAMME**

The above research was submitted to the research ethics committee for review. The study has no major ethical problems and is approved subject to the following:

1. The study cannot be changed without express permission of the UNILUS research ethics committee.
2. Approval from the necessary authority should be sought.

Congratulations and the committee wishes you success in your work.



Prof Kasonde Bowa  
MSc(Glasgow),M.Med(UNZA),FRCS(Glasgow),FACS,FCS,DPH(LSTMH),MPH(UCL)  
Chairman- UNILUS REC  
Professor of Urology and Consultant Urologist  
Executive Dean  
University of Lusaka and University Teaching Hospital  
School of Medicine and Health Sciences.

Appendix IV: Clearance from NHRA



**NATIONAL HEALTH RESEARCH AUTHORITY**  
**The Health Research Act**  
**(Act No. 2 of 2013)**

**CERTIFICATE OF REGISTRATION**

THIS IS TO CERTIFY THAT

**Chipo Siamulambe**

has been registered as a Health Researcher

Dated this 7th December 2023

Registration number NHRAR-R-1148/08/12/2023



A handwritten signature in black ink, appearing to be "V. Chalwe", written over a horizontal line.

A/DIRECTOR AND CHIEF  
EXECUTIVE OFFICER  
PROF. VICTOR CHALWE