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FACTORS ASSOCIATED WITH USE OF LONG-LASTING INSECTICIDAL NETS: A CASE OF GOROMONZI DISTRICT, MASHONALAND EAST, 2021

BY

TENDAI CHIWANGA

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Abstract

In an effort to prevent the spread of the disease, the World Health Organization (WHO) first recommended use of Long Lasting Insecticidal Treated Nets (LLINs) only to pregnant women, children, and PLWHA and later made it universally accessible to everyone at risk. In Zimbabwe, the first LLINs mass distribution campaign was conducted in 2010 and the distribution targeted one net per sleeping space. Household ownership of LLINs has increased since 2005 to 2006 in the country but the use of LLINs has remained low. The objectives of the study were to: assess the knowledge of residents on LLINs use, establish the relationship between knowledge level and LLINs use, and assess the community's attitudes and perception regarding use of LLINs. The study was carried out in Goromonzi District using an analytic cross-sectional study design. Calculation of the sample size was done using the Yamane's formula and 392 respondents were included in the study. Stratified sampling was used in the selection of households and convenient sampling for selection of study participants. On data collection, a questionnaire was administered to respondents. In addition, the researcher carried out an observation to see the state of LLINs. Logistic regression was used to establish significant factors which affect the use LLINs. The study revealed that those who attained primary level of education and below were more likely to use LLINs than those with higher level (OR 1.7; 95% CI 1.3-4.4; p=0.036). Respondents who had no problems when they use LLINs were more likely to use LLINs than those who acknowledged having problems (OR 5; CI 3.0-8.1; p<0.001). Those respondents who had LLINs with holes were less likely to use them than those with LLINs without holes (OR 0.4; CI 0.2-0.8; p=0.05). There is need for continuous sensitization of the community on the importance of using LLINs. Education should also focus on those people with higher educational level. Community health workers and local leaders must be empowered so that they can continuously monitor the use of LLINs in the community. Finally, this study recommends a mass distribution of LLIN so that the residents have new LLINs.

Key words: Community health workers; Goromonzi District; Household; Mass distribution; Sleeping spaces

Declaration Page

I, Tendai Chiwanga, hereby declare that this dissertation is my original work and has not been submitted to any University or institution of higher learning for the award of any academic qualification

Signed:  Date: 04/12/2021

Tendai Chiwanga

Supervisors:

This research has been submitted for review with our approval as University supervisors:

Name of Academic Supervisor: Dr **Caroline Mbuba**

Academic Supervisor's signature  : Date: 03/12/2021

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Dedication

I dedicate this dissertation to my beloved wife, Loice Chiwanga, my four children, brothers, sisters and relatives.

List of Acronyms and Abbreviations

WHO	World Health Organization
LLINs	Long Lasting Insecticidal Treated Nets
VHW	Village Health Workers
PLWHIV	People Living With HIV/ AIDS
MPR	Malaria Programme Review
IRS	Indoor residual spraying
ZDHS	Zimbabwe Demographic Health Survey
DHIS	District Health Information System
MOHCC	Ministry of Health and Child Care

Definition of key terms

Household: A household is defined as a group of people living within one domicile who normally share meals together.

Proper use of LLINs: Sleeping under Long Lasting Insecticidal Treated Net every night

LLINs in good state: LLINs without any hole in it.

An adult: Any household member above 18years of age.

Sleeping space: A place where one or more people sleep.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

This chapter provide an introduction to the research dissertation where a brief background to the use of LLINs is explained. A detailed description of the statement of the problem is also discussed followed the research objectives and questions. Furthermore, this chapter is also going to highlight the research assumptions, justification and finally limitations.

1.2 Background to the study

The use of Long-Lasting Insecticidal Nets has been regarded as a key weapon in the fight against the spread of malaria. Hollyman (2015) indicated that globally, about 1.2 billion people are estimated to be at risk of malaria.

In Africa, Ikeda (2017) highlighted that there has been an increase in the number of malaria cases and occurrence of outbreaks especially in the southern African region. This was attributed to the incessant rains that the southern African region is experiencing. In 2018, an estimated 405,000 people died of malaria and most of them were young children in Sub –Sahara Africa (SSA). The most vulnerable population groups include pregnant women, children under 5 years old, and PLWHA. Eckert et al (2017) further explained the burden of malaria in Africa and highlighted that most of the African countries has intense malaria transmission which accounts for 10000 deaths in pregnancies and 15% of all deaths among children less than 59 months every year.

Taking Rwanda as an example, 90% of the people are living in highly endemic zones of malaria transmission; hence they are at risk of malaria. In an effort to fight the disease, the country distributed around 6.1 million LLINs to its citizens through mass campaigns in 2010 and 2011. Rwanda was then ranked among the top African countries to reach the universal coverage of LLINs. Within the last decade, quite a number of partners intervened in the provision of resources used in malaria control efforts and this saved millions of lives and cut malaria mortality by 25% from 2010 to 2016, leading to hopes and plans for elimination and eradication of malaria (Habinamai A, 2020).

The (WHO) recommended the use of LLINs, along with indoor residual spraying (IRS) as the major vector control strategies in fight against malaria (WHO, 2011). Until 2007, the WHO had directed the distribution of LLINs only to pregnant women, children, and People Living with HIV/ AIDS (PLWHIV). However, since then, it has been recommended that LLINs should be made available to all individuals at risk in endemic areas regardless of age, sex and HIV status, hence there was universal access. According to the World health organization report of 2019, with increase in the coverage of LLINs, the infection prevalence in the endemic Africa halved between 2000 and 2015 and the clinical cases fell by 40%.

According to the Malaria Programme Review (MPR) conducted in 2016, despite high LLINs coverage and the noted decrease in the burden of malaria, it was noted that the utilization of LLINs is still low and is at 33.5% to 69% in the SSA. In Zimbabwe, malaria continues to be a significant public health threat and it constitutes the third highest cause of morbidity and mortality. MPR, (2016) revealed that

malaria constituted 30% of outpatient attendance and 12% of all hospital admissions. The review further noted that more than half of the population in Zimbabwe lives in malaria-transmission areas. Like other countries, Zimbabwe uses vector control measures such as indoor residual spraying (IRS) and distribution of long-lasting insecticide-treated nets (LLINs) to reduce malaria incidence in endemic zones.

According to Sande et al (2017), the first mass distribution of LLINs in Zimbabwe was in 20210 where distribution of LLINs was focused on districts with only low to moderate malaria transmission. The mass distribution strategy targets one net per sleeping space or sleeping pair (Zimbabwe demographic Health Survey ZDHS, 2015). Universal coverage of vector control strategies is required to achieve malaria incidences less than 1 per 1000, which are the levels considered for malaria elimination (WHO, 2011). The Ministry of Health and Child Care (MoHCC) and its partners engaged in LLINs distribution and the target is to ensure and maintain a 95% LLINs coverage rate. According to ZDHS (2015), household ownership of LLINs has increased substantially since 2005 to 2006 in the country but the use of LLINs has remained low.

Goromonzi district is also one of the districts in Mashonaland east province which is using LLINs for the prevention of malaria. The first mass distribution was conducted in 2017. Another mass distribution was conducted in 2019. Recently, 18 out of 25 wards are using LLINs in the prevention of malaria while 7 wards are under IRS. The district has achieved over 90% LLINs coverage. However, it has been noted that LLINs are being used for other purposes which are not related to malaria prevention.

1.3 Statement of the problem

The researcher made a quick survey to some of the villages and noticed that new LLINs obtained from the health facility are used for other purposes not related to malaria prevention. About 30% of the residents used the nets for protecting chicks and some put them on gardens. There were also several reports coming from the Village Health Workers complaining of misuse of nets by residents. LLINs misuse and nonuse is reportedly high, which undermines efforts to control the disease.

Although the LLINs coverage in the district is high, their use in the households is very low. For instance, the Zimbabwe demographic and health Survey (ZDHS) conducted in 2015 found out that only 9% of people who were given LLINs reportedly slept under a net the night before the survey. The primary consequence of LLINs nonuse is the increase in the burden of Malaria. The following table shows the number of malaria cases and deaths as shown in the District Health Information System (DHIS2).

Table 1 Malaria cases and deaths from 2015 to 2020

Year	Number of cases	Deaths
2015	12272	5
2016	16611	3
2017	14220	3
2018	1470	0
2019	573	0
2020	645	1

As shown in the table, although there is a decline in the number of malaria cases in the district from 2015 to 2019, the burden is still high. Economically, at individual and family level, malaria has imposed substantial costs such as travelling expenses, lost days of work and absence from school in case of school children. To the nation,

non- use or misuse of LLINs constitutes considerable wastage of scarce resources and worsening the economic situation which is already fragile.

1.4 Broad Objective

To investigate the use of LLINS for the prevention of malaria in Goromonzi District, 2021.

1.4.1 Specific Objectives

- To assess the community knowledge on malaria in Goromonzi District.
- To establish the relationship between knowledge level and the use of LLINs.
- To assess the community attitude on the use of LLINs in Goromonzi District.
- To investigate the perceived susceptibility to malaria among residents in Goromonzi District.

1.5 Research Questions

- Does the community have knowledge on Malaria?
- Is there any relationship between knowledge level and proper use of LLINs?
- What are the attitudes of the community regarding the use of LLINs?
- Does the community perceive that they are susceptible to malaria?

1.6 Assumptions

The researcher assumed that study participants answered the research questions honestly and factually.

1.7 Justification

Although studies on LLINs coverage are widespread in the world, there is no documented evidence that a study has been conducted specifically in Goromonzi

District addressing this topic. The knowledge, attitudes and practices of people differ from place to place, hence there is need to conduct the study and come up with appropriate and applicable recommendations for Goromonzi residents. Other studies on this topic were lacking in terms of sampling as they included the under 5s and people in such age groups cannot answer questions on their own, hence the researchers were using information which was not originally from the intended study participants. This study is addressed that gap by including adults who are able to give accurate information.

1.8 Limitations of the study

This study had its share of limitations; firstly the analysis was based on data from a cross sectional survey which cannot be used to infer causal relationships. Furthermore, LLIN ownership and utilization were based on self-reporting, which is subject to bias. The researcher used a closed ended questionnaire hence deprived the study participants the chance to provide an in depth explanation when answering questions.

In addition, the study was conducted during the COVID 19 pandemic and some residents denied the researcher entry in to enter their houses. The data collectors asked heads of households on who slept under a LLIN the previous night. Therefore, recall bias and desirability were possible limitations. There were also limitations in terms of physical accessibility as some of the areas are mountainous; hence some of the study participants were not reachable due to poor road network. Apart from physical access, the researcher also faced financial limitations since he was funding the study.

CHAPTER2: REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter explores the views of other authors in as far as LLIN use is concerned. Various studies have been conducted in different settings and some findings concur while others contradict. The researcher is going to highlight the results of other studies with reference to the use of LLINs, ownership, attitudes and perceptions of people and the knowledge of respondents with regards to LLINs use. Literature review is of paramount importance as it forms the base of the study and it also enables the researcher to identify the gaps in the previous studies and come up with ways on how to fill those gaps.

2.2 The concept of LLINs

Many researchers conducted by various scholars put much concentration of the use of LLINs rather than exploring the factors that influence the use of the net. Exploring the factors helps to address factors behind the use and misuse of LLINs. According to WHO (2016), LLINs have been proven to be very effective in the prevention of malaria because they act as a barrier and they also kill the vector. LLINs and IRS have been used jointly in many countries around the globe in an effort to eradicate malaria. Although LLINs are one of the key interventions against malaria, many countries are still lacking in terms coverage and ownership and efforts are being made by the WHO to ensure a wider and universal coverage, Savigny (2011) highlighted that many programs have been launched in Africa in countries like Zimbabwe , Uganda , Ethiopia , Kenya and Botswana just to mention a few and the program is aimed at eradicating malaria and improving LLINs coverage. Mugwagwa

et al (2015) highlighted that most countries still have a problem of malaria, for example Honde Valley area in Zimbabwe. Efforts have been made to identify how nets are being used in these areas but no research was made to establish the factors that affect the use of LLINs.

2.3 Efficacy of LLINs

LLINs have been proven through various researches that they are effective in preventing malaria. They act as a barrier and they also have the ability to kill mosquitoes with the chemical they are treated with. This will result in the reduction of the vector population. The reduction in the vector population will subsequently result in the protection of other people who don't use LLINs (MOHCW, 2011).The use of LLINs is much cheaper as compared to other malaria control methods. The other advantage is that LLINs have other benefits besides the killing of mosquitoes. This includes protection from other insects and also protection from reptiles like snakes and scorpions. WHO (2008), further highlighted that LLINs kill head lice and bedbugs.

However, some people may argue that the use of LLINs depends on the attitudes, behaviours and perceptions of the user but on IRS, once the chemical is deposited on the wall, it remains effective and do not continuously depend on the individual behaviour for it to be effective. Some also prefer IRS since mosquitoes can change their biting times. Overly, both IRS and the use of LLINs are equally important and they should complement each other. Malaria may lead to the emergency of other several diseases which could have been prevented through the use of LLINs and other malaria prevention methods. Hartman et al, (2010) states that malaria causes

maternal anaemia, miscarriages, intrauterine demise, premature delivery, still birth, low birth weight and neonatal death.

Mugwagwa et al (2015) carried out a study in Mutasa district after there was a malaria outbreak and the study found out that those who slept under LLINs were less likely to contract malaria than those who do not use LLINs. The use of IRS as a vector control strategy was found to have disadvantages in that mosquitoes can develop resistance to chemicals, and on humans the parasite may also develop resistance to the drug used for treating malaria then the only protective measure against the disease is the use of LLINs. This then gives credit to LLINs because the barrier effect is always there when they are efficiently used. On the other hand, it should be pointed that LLINs on their own are not sufficient in the prevention of malaria but should be complimented with other methods. For instance, a person is only protected during the time when he or she is sleeping under the LLINs but is vulnerable to mosquito bites once he gets outside the net (Omolade et al 2016).

2.4 Conceptual Frame work

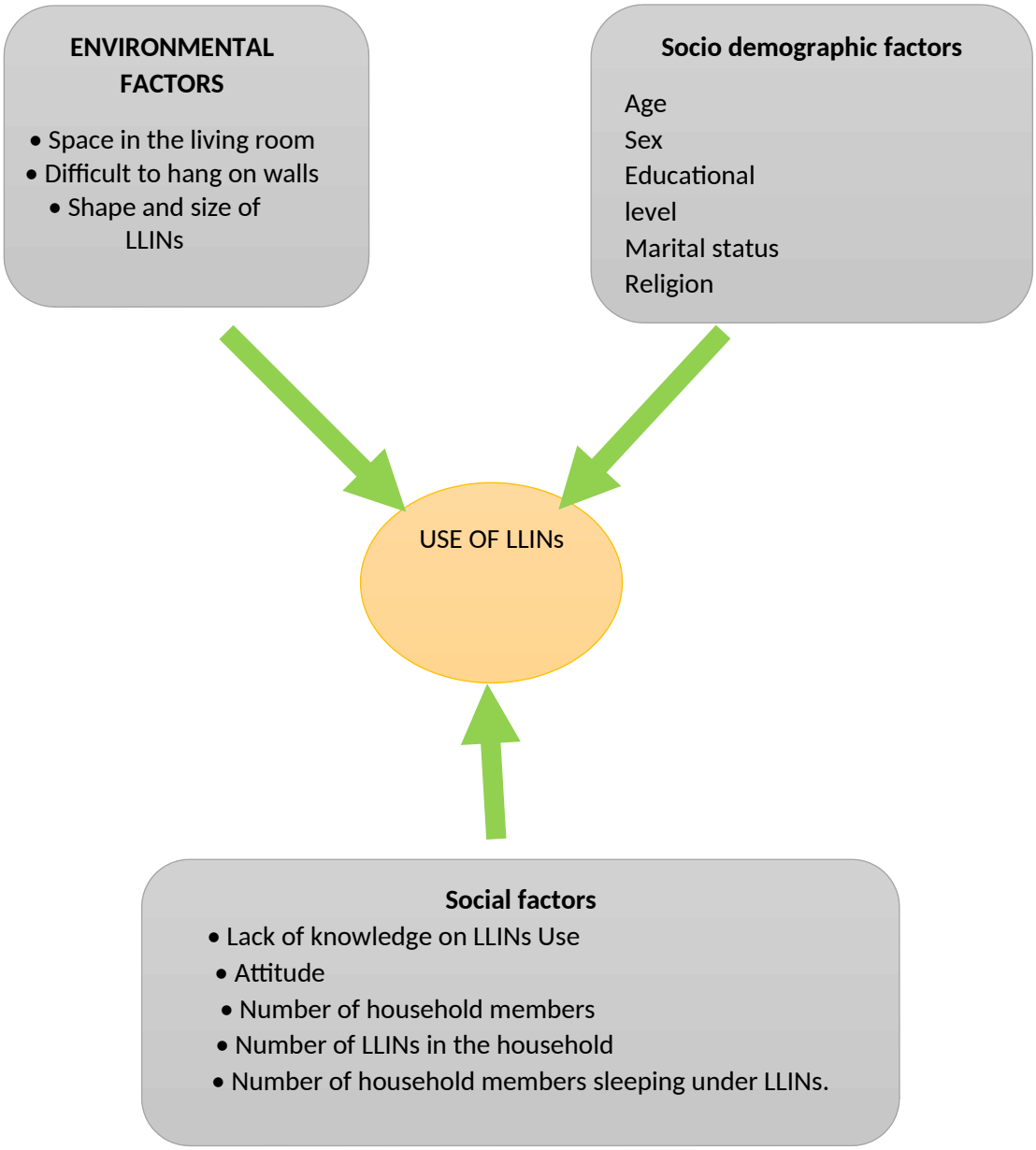

Figure 1 Conceptual framework

The conceptual framework shown in figure 1 above shows that there are different factors that affect the use of LLINs.

The factors which affect the use of LLINs vary from place to place due to various reasons. Some highlight that climate change has an impact on the use of LLINs. According to Graves et al (2011) in a study conducted in Ethiopia, there was a decline in net use among households owning nets between two representative

household surveys conducted approximately one year apart, and this did not appear to be associated with differences in sampling or any climatic or seasonal differences between the survey years (Graves et al, 2011). Most of the surveys revealed that net use is declining despite the increase in net ownership and also net use is on the decline despite the fact that LLINs offer a protection from malaria. LLIN use is found to be declining when logically there is supposed to be an increase in net use. One may say the issues to do with climate change within an area can not affect the use of LLINs.

A study conducted by Omolade et al (2016) in Nigeria, on the attitudes of pregnant and non-pregnant women on the use of LLINs discovered that among the one hundred and eight of the pregnant women who possess LLIN, 44% of them use them while sixty (56%) were not using them. Among the fifty women who were not pregnant, 16(46%) use the net while the other 54% were not using LLINs. Interpreting findings of this study, it can be deduced that the use of LLINs is still very low although ownership has improved. Therefore there is need to educate the community and overcome the barriers of LLINs use.

Findings of Omolade et al (2016) in Nigeria contradict with those of Graves et al (2011) in which the author found out that ownership of LLINs are a prerequisite for net use. Net use and net ownership are two parallel things, one may argue saying, for a person to use a net he or she must own a net. However it does not necessarily mean that if a person possesses a net uses a net. There is need to understand the factors that influence net use so as to improve the rate of net utilisation among households and individuals.

The methods that are being used to distribute the LLINs like the 'Push' system does not respect the recipient's feelings towards the LLINs and this eventually may lead to having low LLINs utilization within those who have received the LLINs. Among many people who have received LLINs, some are abusing nets and some are not willing to use them. Many people who received LLINs did not sleep under them, resold them, reduced their efficacy through inappropriate washing practices, or failed to replace them when they became damaged or torn.

Other researchers have considered net use as associated with the number of nets within a household and the number of people in the same household (net density). There are very few other studies that examined net use in relation to household net density while adjusting for other factors (Graves et al, 2011), net density per household also contributes to net use in the sense that increased net density was associated with decreased likelihood of a net being used, which is logical by virtue that, if there are more nets in a household than available sleeping spaces, the less the chance of each one being used. Therefore, one may say the reason why nets are being misused can be due to the fact that the households could have received more nets than they required.

In a study by MOHCW (2011), it was noted that, there was evidence of the abuse of LLINs through making fowl runs, wedding dresses and fishing nets in some communities around Zimbabwe. This can be due to the fact that those who abused LLINs had excess LLINs within their households. To understand the reason why they used LLINs in that manner, there is need to understand the factors that influence the use of LLINs. Lack of adequate LLINs at a house hold can negatively impacts on the use of LLINs. A study conducted by Eng et al (2010) in Sierra Leone revealed a low

net use due to the fact that there were no adequate LLINs available in the household and for this reason; the nets available in the house were being used by someone else.

Contrary, the findings of Graves et al (2011) where people were found with LLINs in excess and they were not using them. It can be concluded that in some cases net use can be affected by the number of nets and the number of people in a household who are intended to use the nets. More than required nets may result in other nets not being used and too many people than the available nets may result in other people not using the net hence influencing the use of nets.

Apart from net density, there are other factors that influence LLINs use and according Graves et al (2011), there is the aspect of net condition like the existence of holes, cleanliness, smell and the perceived effectiveness of insecticide. Non-use of LLINs has been attributed to malaria outbreaks.

According to a study conducted by Mugwagwa et al (2015), there was an outbreak of malaria in Honde valley. Despite the fact that nets were found to be the only protective measure against malaria during the Honde valley outbreak of 2014, the use of LLINs was below expectations and this could be due to some factors like smell and net condition or other effects that may come along with the nets. Therefore the net condition and the other effects of the net like smell and perceived effectiveness of insecticide on the net may also affect the use of nets.

A study was carried out by Eng et al (2010) with the aim of assessing LLINs use and non us in Niger, Madagascar and Sierra Leone. During the study, a question was asked to determine the reasons why the person did not sleep under the net. From the

responses , it was found that in Madagascar, 75.2% of the respondents said that the LLINs which they were supposed to use was being used by someone else, some were saying they were not enough LLINs (breakdown: 27.5% said someone else was using the net, 42.2% said there were not enough nets available, 5.5% gave both reasons).

The same study was also done in Sierra Leone and the same results were obtained. Eng et al (2010) found out that the major reason for not sleeping under the net the previous night was inadequacy of LLINs at a household. On the other hand, the situation in some households but in the same setting was different in that 5.1-5.9% of all children lived in households that owned the LLINs but did not use them.

2.5 Religion and the use of LLINs

Religion plays a major role in influencing the treatment seeking behavior of people and the use of LLINs to prevent the spread of malaria. The impact of religion on the use of LLINs is quite significant in many countries around the world. Taking Madagascar as a case study, a research conducted by Njatosoa et al (2021) showed a strong link between religion and the use of LLINs.

In some religions in the highlands and eastern regions of Madagascar, the use of LLINs represents death. The people of *Moramanga* in the highlands and *Morondava* in the West coast install the bodies of the deceased under a mosquito net during the 3 days of the funeral rites to avoid contact between and body and the flies. They put the nets to avoid flies from getting in contact with the body so that the corpse will not go bad quickly. LLINs are mainly used for this purpose. This painful event then negatively impact on the use of LLINs.

Sleeping under LLINs sparks fears of the anguish of dying. The type of LLINs they use in such events are white LLINs, therefore white mosquito nets are associated with death and not the prevention of the spread of malaria. As a result, many people in these areas expressed an aversion to nets of this colour. People feel that when one sleep under a mosquito net, he or she looks like a corpse hence no one likes to use the net. There is therefore need to educate the community on the importance of using LLINs and this will help in removing that misconception and thereby improve the uptake of LLINs.

Njatosoa et al (2021) further noted that while some areas associate the use of LLINs with death, in some areas of the country the use of LLINs is a common practice. In areas like (*Antsohihy, Mananjary, Farafangana, Sambava*); they use LLINs not for the purpose of malaria prevention but they use LLINs because they were used by their ancestors. In earlier times, mosquito nets were reserved for adults and were perceived as a high class commodity, a sign of wealth and therefore appreciated by the community.

The main reason for using the net was the comfort that the net provide during sleep and they also prevent nuisances caused by insects and preserving the couple's privacy. The other reason why people use nets in areas like *Mananjary* and *Farafangana*, is that they use LLINs as one of the gifts in the occasion of weddings or birth days thus it is part of the family tradition. Before the circulation of information about malaria, such nets were sewn and used for the prestige they conferred upon to the new couples on the wedding day. At the birth of a child, the net was required to protect the child from insect bites.

This habit has been maintained through the present day, making marriage or childbirth key moments in the mosquito net use. Participants typically date their first use of nets to the time of their marriage. Even after the introduction of free LLIN distribution, the tradition of providing nets to newlyweds has continued, but the traditional bed net has been replaced by the LLIN. Today, free net distributions have democratized access to nets: wealth level no longer affects whether people have a net or not.

Contrary, Njatosoa et al (2021) noted that in the coastal areas of Madagascar LLIN use is generally very low simply because the area is very hot especially from October to November. In summer time, people usually sleep late at around 9 o'clock because that is the time when it would be cooler. Sociability practices such as parties with friends and family discussions extend this time of exposure to mosquitoes to an undefined length. However, during this time of year, mosquitoes are present in high densities. Thus, even people who protect themselves during sleep are still subject to mosquito bites because they are exposed longer before going to bed.

2.6 Risk perception and the use of LLINs

According to Kimbi et al, pregnant women who perceive malaria as a serious disease were found to be more likely to seek treatment at ANC as compared to those with a lower risk perception. This implies that there was an increased uptake of IPT among those with a higher perception of malaria. The same will also applied on the ownership and use of LLINs (Kimbi et al). A cross-sectional study conducted in Nigeria revealed that the social norms influenced pregnant women's perceived seriousness of malaria. This negatively impacted on their behaviour at ANC clinic as some of them preferred the use of traditional medicines rather than the use of LLINs in preventing malaria (Diala, Pennas, Marin, & Belay, 2013).

Another study conducted in Uganda by Mbonye, Mohamud, & Bagonza (2016) showed that one of the reasons for not using LLINs was that pregnant women were not sick and so they did not see the benefit of using LLINs and the use of other preventive measure such as the use of SP for IPTp.

The low risk perception indicated that there was lack of awareness of asymptomatic malaria and this subsequently resulted in low usage of LLINs among pregnant women. Contrary, a study conducted by Boene et al (2016) in Southern Mozambique showed that the majority of pregnant women used LLINs and SP for IPTp. Furthermore, they perceived malaria as dangerous although most of them showed lack of knowledge on the dangers of malaria on the foetus. Pregnant women reported that their first preferred malaria prevention method was LLINs (62.6%) followed by IPTp (12.5%), and indoor residual spray (IRS) was the third choice. The few women who did not use LLINs as a malaria preventive measure pointed out difficulty in hanging the LLINs as a hindering factor.

2.7 Community knowledge on malaria

General awareness of malaria is high in most parts of the world. A study by Soleimani-Ahmadi et al (2014) conducted in Iraq showed that the community was knowledgeable about malaria. Nearly 89% of the respondents in the study knew at least one symptom of malaria and 86.8% considered malaria as an important disease. The majority of respondents (77.8%) believed that malaria is transmitted through mosquito bite and 60.8% acknowledged that use of LLINs is the main protective measure against mosquito bites.

The study revealed that about 44.8% of the people washed their LLINs once in six months and this demonstrated that people have knowledge on the maintenance of their LLINs. However, the community showed a lack of knowledge on how to dry their bed nets after washing as 92% of them mentioned that they dried their bed nets on direct sunlight. It was also noted that LLINs usage was very low because only 18.5% of the respondents acknowledged sleeping under the Bed net the night before the survey. The use rate is lower than the targeted coverage of 80% which is recommended by the WHO.

The findings of a study conducted by Lyer, Skelton, Wildt & Meza 2019 in the Peruvian Amazon concur with those of Soleimani-Ahmadi et al, 2014 in that in Peru, all participants showed that they have knowledge on the signs and symptoms of malaria and they know that it is transmitted through mosquito bites. However, the study revealed that there were some misconceptions about the disease as two of the participants thought that drinking boiled water is a preventive measure against malaria.

A study conducted in Kenya by Watanabe et al (2014) contradict with the findings of Soleimani-Ahmadi et al, 2014 and Lyer et al, 2019 in that 84 % of the respondents in the Kenyan study acknowledged sleeping under the net the previous night and this demonstrated that usage of LLINs is very high among the residents. Furthermore, the participants also demonstrated a better knowledge of malaria preventive measures.

Habimana et al in the study conducted in Rwanda found out that respondents had high knowledge as they showed that they knew the importance of sleeping under LLINs. Most of the respondents in that study (99.2%) knew that using LLINs helps

fight against the spread of malaria. LLIN ownership was 84.1% and usage was 87.6% meaning that most of the people were using the LLINs that they were given.

A similar study was also conducted by Habimana et al in the southern Rwanda and the knowledge of people pertaining the use of LLINs was measured. The researcher used three levels of measuring the knowledge level of respondents: low scored 0 to 3, moderate scored 4 to 6 and high knowledge scored 6 to 8. The study had revealed that all respondents showed that they knew the importance of LLINs as they score the 6 to 8 range which demonstrates that the use of LLINs helps to prevent bite from mosquitoes. To further demonstrate their knowledge, 98.4% of the study participants also agreed that sleeping under LLIN can prevent malaria transmission to the pregnant women. In addition, 31.8% demonstrated that LLINs were treated with insecticides which will expire in four to five years.

2.8 Association between knowledge level and utilization of LLINs

In a study conducted in Ethiopia in Shewa town by Abate, Degarege & Erko (2013), a significant association between level of education and net ownership by households was reported. Higher level of education affirmatively influences the knowledge of linking sleeping under net with malaria prevention.

Another study to determine the association between the knowledge level and net ownership and use was conducted in Thailand by Kitidamrongsuk et al (2016). The study compared the knowledge level between Women of Child Bearing Age in rural areas and those living in urban areas. Most urban women have access to diverse sources of information on malaria and the use of LLINs through mass media and other means of public health communications.

In addition, they had more access to education as compared to rural women. This study found out that rural women owned and utilized LLINs more than urban women although urban women had higher educational status and exposure to communication materials. From the findings of this study, there may be other factors which affect LLINs ownership and utilization other than awareness, knowledge and educational status.

It was however noted that the health education talks conducted by health workers in the community together with trainings had attributed to the high knowledge of the respondents in the area. Social media and mass media had also contributed significantly to the dissemination of knowledge.

2.9 Community attitude on LLINs

A study undertaken in India to assess the community perception regarding use of LLINs, their acceptability and collateral benefits showed that LLINs were of much importance to the community in bringing down malaria incidence. Most of the respondents (98.3%) highlighted that LLINs were of much importance not only in the prevention of mosquito bites alone but also assisted in reducing malaria incidence. As a result, 93.2% of the respondents demonstrated their willingness to use LLINs if available at an affordable price. All the respondents were satisfied about the performance of the LLINs in reducing the mosquito nuisance, safety of use and collateral benefits and they acknowledged that LLINs are safe, socially acceptable and should be promoted for vector control to reduce the disease burden in their area (Stood, Mittal, Kapoor&Razvan 2010).

A similar study conducted in Ethiopia by Tomass et al (2016) agree with the finding from a study by Sood et al, 2010 in which eighty-nine percent of the respondents believed LLINs prevented malaria by way of killing or acting as a physical barrier against mosquitoes. Moreover, this study revealed a better understanding of the importance of LLINs in the prevention of malaria. This was evidenced by 96.2 % of the respondents who believed that sleeping under LLINs prevented malaria. All participants preferred LLINs to traditional nets although some participants indicated that LLINs offered less privacy than the traditional net.

Knowledge, perception and practice related to malaria nearly 90% (441) of the respondents perceived malaria as the top health problem in the study area. Out of the total 507 households in this survey, 441 (87.3%) associated mosquito bites with malaria infection. There was a very high understanding of the importance of bed nets, 99.2 and 97.6% of the respondents knew the importance of LLIN for prevention of mosquito bites and malaria respectively.

In some studies conducted, some communities believed in traditional methods that clearing of vegetation and drainage of water logged areas are the major vector control strategies. The use of LLINs is regarded as of no importance and a lot the people have no knowledge in the use of LLINs. Among those who were knowledgeable about LLINs, they view prolonged use of LLINs as safe; hence they did not use LLINs for a longer period. Some studies on the acceptance of LLINs revealed various factors such as cultural, demographic, ethnicity, accessibility, gender relations and seasonality of malaria influence the use of LLINs.

In Kenya, a study was carried out where there was an assessment of the community's reaction about permethrine-treated nets. Although malaria was considered a disease of public health importance, LLINs were believed to be partially beneficial due to the people's perception that malaria had multiple causes, in addition to that, there was fear that the chemicals used to treat LLINs were associated can also cause sterility.

According to the Health belief Model developed by Becker (1974), perceptions on the use of LLINs and other malaria preventive interventions have been conceptualized and the two main factors that influence the likelihood that a person will adopt a recommended preventive action. First, a person must feel susceptible and threatened by the disease, with perceived serious consequences. Secondly, the person must believe that the benefits of practicing prevention outweigh the perceived barriers to the prevention action. Therefore, four constructs can be derived from this model and these are perceived susceptibility, perceived severity, perceived benefits and perceived barriers

2.10 Summary of the factors affecting the use of LLINs

According to various studies conducted in countries like Ghana, Burkina Faso, Pakistan and other countries in various parts of the world, the major reasons for not using LLINs include: difficulty in hanging the nets, not enough space in the house to hang the net and poor sleeping conditions and positions, negative perceptions on the use of nets as some people perceive that mosquitoes can still bite through the net, some people just don't like sleeping under the net, some people believe they are resistant to malaria hence they see it not necessary to use LLINs. Most of the people say sleeping under the net is uncomfortable and cause heat hence they do not want to

sleep under the nets. Different people highlight a variety of problems; some say LLINs can cause suffocation especially to children. A qualitative study conducted in Uganda by Lam et al, (2014) revealed that nonuse of LLINs was basically due to poor sleeping habits, for instance children slept anyhow throwing hands and feet left and right, hindrance to sexual relationships and alcoholism. Offensive habits of men like alcoholism affect proper and consistent use of LLINs. In terms of educational level, a study conducted in Kenya by Hill, (2016) noted that that the number of mosquito nets, relative wealth, number of household occupants and the educational level of the household head had no effect on the regular use of LLINs. However, excessive heat was often cited as the reason for irregular use of LLINs. In the same study, other important reasons for non-adherence were disruption of sleeping arrangements, lack of motivation and technical problems like room to hang the net also affects consistency in utilization of the net. The same study further unearthed that people did not use the LLINs as they were afraid of the itchness they thought is from the chemicals used in the treatment of LLINs. Another review on community acceptance of bed nets has shown that various factors influence the use of bed nets and the factors are: cultural, behavioral and demographic factors, ethnicity, accessibility, gender relations and seasonality of malaria.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter describe in detail the methodological choice and the research design of this study. In addition, the chapter set the procedures to collect and analyse data. The chapter finally discuss the ethical considerations to be followed so as to preserve the rights of study participants.

3.2 Research Design

The study used an analytic cross-sectional study design to assess independent and dependent variables. The independent variables include socio demographic factors which are: age, sex, and marital status, educational status of the head of household, family size, occupation and religion. In addition, the LLINs characteristic was also considered under independent variables. Apart from interviewing respondents, the further carried out an observation on the state of LLINs and also to observe if LLINs were properly hanged. The dependent variable was the use of LLINs in which respondents were asked whether they slept under a net the previous night.

3.2.1 Study Setting

The study was carried out in Goromonzi district which is one of the 9 districts in Mashonaland East Province. Goromonzi District borders Mashonaland West province in its northern side, Murehwa District in the eastern side and Seke district in the southern part and Harare. The district has 25 wards of which 18 of them are under LLINs and 7 are under IRS.

3.3 Population and sampling

The study participants consisted of the head of the household or any member who was above 18 years who resided in Goromonzi District. Adults were more preferred as the study population because they provide more reliable information on LLIN use and were likely to be found at home most of the time.

3.3.1 Inclusion criteria

Adults who were 18 years and above and resided in Goromonzi District were included in this study.

3.3.2 Exclusion criteria

The study excluded children who were under the age of 18 as most of them are not heads of household. Visitors, non-consenting participants and people who were very sick were excluded.

3.3.3 Sample size

The sample size was calculated using the Yamane formula

Yamane's formula

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

n= Sample size

N= Population Size (18750)

e= Level of precision or Sampling error- ± 5%

n= 392

3.4 Sampling Procedure

Simple random sampling- Among the 18 wards under LLINs, 1 ward was randomly selected for the study.

Stratified sampling-Within the selected ward, a village was considered as a stratum from which 10 households were randomly selected. Ten households were selected from each village in the ward until the researcher obtains the required number of participants.

Purposive sampling-The researcher purposively selected an adult member of the household for the interview.

3.5 Data collection instruments

A structured closed-ended questionnaire was used to collect data. The questionnaire was developed in English and translated to Shona, the language that most of the residents in the area understood. The questionnaire included questions about the respondent's socio-demographic characteristics, knowledge and perception about malaria and use of LLINs. In addition, there was also an observation checklist included variables such as the number of LLINs found in the house, number of sleeping spaces, number of LLINs hanged and the condition of the net.

3.6 Pretesting of Instruments

Pretesting was done in Makumbe community in Goromonzi District before the commencement of the study. This was done to test the validity and reliability of the instrument. Questions which were ambiguous and not clear were rephrased.

3.7 Data collection Procedure

Data collection took place in Mawanga ward which was randomly selected. A questionnaire was administered to adults who were residents of Goromonzi District. In addition, observations were made to see the state of LLINs and how they are being used. Data collection was done by 6 Environmental Health Technicians (EHT) who were trained on how to use the questionnaire. The questionnaire was written in English and Shona because most of the residents speak these languages. Pretesting of the questionnaire was done prior to the commencement of the study. After that, it was administered to the research participants. During data collection, EHTs reported challenges they were facing to the researcher. The researcher made sure that data collection progressed as planned and provided the resources needed.

3.8 Data management

After data collection, the researcher cross checked the questionnaires to see if there were sections which were not completed. Responses written in the questionnaire were then entered in the epi info 7. After entering the data, data cleaning was done by checking if the frequencies were tallying. Bivariate and multivariate logistics regression was used to describe the factors which affect the use of LLINs.

3.9 Data Analysis

Epi info 7 was used to analyse data. Bivariate and multivariate logistic regression analysis was used to assess the effect of independent variables on the dependent variable. The Odds ratio was used to determine the association between independent variables and dependent variables.

3.10 Ethical considerations

Ethical clearance for the research was granted by the Africa University Research Ethical Committee and the DMO for Goromonzi District. The study participants were then informed of the study and the participants signed a written consent form. Only the researcher had access to the information obtained from the study and this was done to ensure confidentiality. The collected data was used strictly for the research purpose and the data was pass-word protected. Participants were given an individual identification number, so there was no personal identifiable information linked to the data.

CHAPTER 4: DATA PRESENTATION, ANALYSIS & INTERPRETATION

4.1 Introduction

This chapter presents the findings of 392 respondents. The study aimed at investing LLINs use and associated factors in Goromonzi District. The findings presented include the demographic data, knowledge and practices on the use of LLINs, problems faced by respondents when they use LLINs and the attitudes towards the use of LLINs. The variables examined in this chapter formed a base under which data was analyzed. Bivariate and multivariate logistics regression analyses were used to establish the association between the independent variable and the independent variables. Graphs and pie charts were used in the presentation of the findings.

4.2 Socio-Demographic characteristics

The study had 392 participants and the socio demographic characteristics are described in table 1.

Table 2 Socio-demographic distribution (n=392)

Variable	Use LLINs Freq (%)	Do not use LLINS Freq (%)
Gender		
Male	132 (47.7)	55 (52.2)
Female	145 (52.4)	60 (47.8)
Age		
18-25	25 (9.0)	24 (20.9)
26-35	36 (13.0)	13 (11.3)
36-45	83 (30.0)	22 (19.1)
46-55	84 (30.3)	32 (27.8)
56 and above	49 (17.7)	24 (20.9)
Educational level		
Tertiary	74 (26.7)	44 (38.3)
Never went to school	31 (11.2)	6 (5.2)
Primary	94 (33.9)	32 (27.8)
Secondary	78 (28.2)	33 (28.7)
Profession		
Casual labor	5 (1.8)	0
Farmer	28 (10.1)	13 (11.3)
Housewife	19 (6.9)	6 (5.2)
Jobless	40 (14.4)	23 (20.0)
Public servant	61 (22.0)	23(20.0)
Self employed	78 (28.2)	26 (22.6)
Student	20 (7.2)	16 (13.9)
Trader/ Vendor	26 (9.4)	8 (7.0)
Marital status		
Divorced	30 (10.8)	12 (10.4)
Married	145 (52.4)	52 (45.2)
Single	82 (29.6)	39 (33.9)
Widowed	20(7.2)	12 (10.4)
Religion		
African Traditional Religion	60 (21.7)	26 (22.6)
Pentecostal	90 (32.5)	40 (34.8)
Protestant	79 (28.5)	25 (21.7)
Roman Catholic	48 (17.3)	24 (20.9)

4.2.1 Gender

Of the 392 respondents, 187(47.7%) were males while 205(52.3%) were females. When asked whether they slept under a LLIN the previous night, it was found out that among the males, 132 (70.6%) slept under LLINs while on women, 145(70.7%) of them slept under LLINs.

4.2.2 Age

Majority of the respondents 221 (56.38%) were 36 -55 years. LLINs usage increased with age from the age of 18-55 but decreased in the age group of 56 and above. This was evidenced by 51%, 73% and 79% of the respondents who acknowledged sleeping under LLIN the previous night among the age group of 18-25, 26-35, and 36-55 respectively. However, the proportion of respondents who use LLINs started declining with increasing age.

4.2.3 Educational level

Most of the respondents had primary level education 126 (32.14%). Those who never went to school had the least number of participants. Comparing LLIN usage among different levels of education, participants who never went to school had largest proportion (83.8%) of people who slept under LLIN the previous night.

4.2.4 Profession

Of the 392 respondents, most of them 114 (29%) were self-employed. The remaining 79% consisted of people who are public servants, farmers, some were jobless, students, vendors and mid wives.

4.2.4 Marital status

Majority of recipients were single (50.3%). Married people had a larger proportion of respondents (73.6%) who use LLINs as compared to divorced, single and widowed which had 71.4%, 67.8% and 62.5% respectively.

4.2.5 Profession

The findings showed that the majority 104 (26.5%) were self-employed. Casual workers (100%) and public servants (82.2%) have the highest proportion of people who use LLINs and students had the lowest proportion (51.3%).

4.2.6 Religion

Of the respondents, 78.3% were Christians who belong to different type of religions while 21.9% belonged to African traditional religion. Among the Christians, the majority (33.2%) were Pentecostal, 26.5% were protestant, and 18.5% were Roman Catholic. Christians constituted the highest proportion of people who used LLINs (70.9%) as compared to the African traditional religion with (69.8%).

4.2.7 Number of household members

Of the household visited, most of them 210 (53.6%) consisted of 3 members, 124 (31.4%) had 4 and above, 40(10.2%) had 2 members and the least 18 (4.6%) had only 1 member.

4.2.8 Number of people who sleep under LLIN

Of the 392 respondents interviewed, most of the households 137(44%) acknowledged that all members sleep under LLINs while 118 (30.1%) said that none of the members slept under LLINs.

4.3 Knowledge and practice of respondents on the use of LLINs

An assessment was made on the knowledge and practices of respondents with regards to the use of LLINs and the results were presented in the following table.

Table 3 People's knowledge on malaria transmission and prevention

Factor	**Frequency**	**Percentage (%)**
Knew how malaria is transmitted		
Yes	356	90.8
No	36	9.2
Knew how malaria is prevented		
Yes	364	92.9
No	28	7.1
Knew how LLINs prevent malaria		
Yes	229	58.4
No	163	41.6

4.3.1 Malaria transmission

Among the respondents interviewed, 356 (90.8 %) knew how malaria is acquired.

4.3.2 Malaria prevention

The majority of the respondents 92.9 knew how malaria is prevented. Most of them 229 (58.4 %) mentioned the use of LLINs as a measure to prevent the spread of malaria.

4.3.3 Ways in which LLINs prevent malaria

The greatest number of respondents 309 (78.8%) correctly stated that LLINs act as physical barriers, 54(13.8%) said LLINs kills mosquitoes and 23(5.9%) said LLINs irritate mosquitoes. Only 6 (1.5%) didn't know how LLINs prevented malaria.

4.3.4 How frequently should one use LLINs?

The respondents showed that they are knowledgeable on how frequent one should use LLINs as 201(51.3%) of them stated that LLINs should be used every night. However, 128 (32.7%) of the respondents mentioned that LLINs must be used when mosquitoes are seen in the house and a further 63 (16.1%) said LLINs should be used seasonally.

4.3.5 Participants' use of LLINs

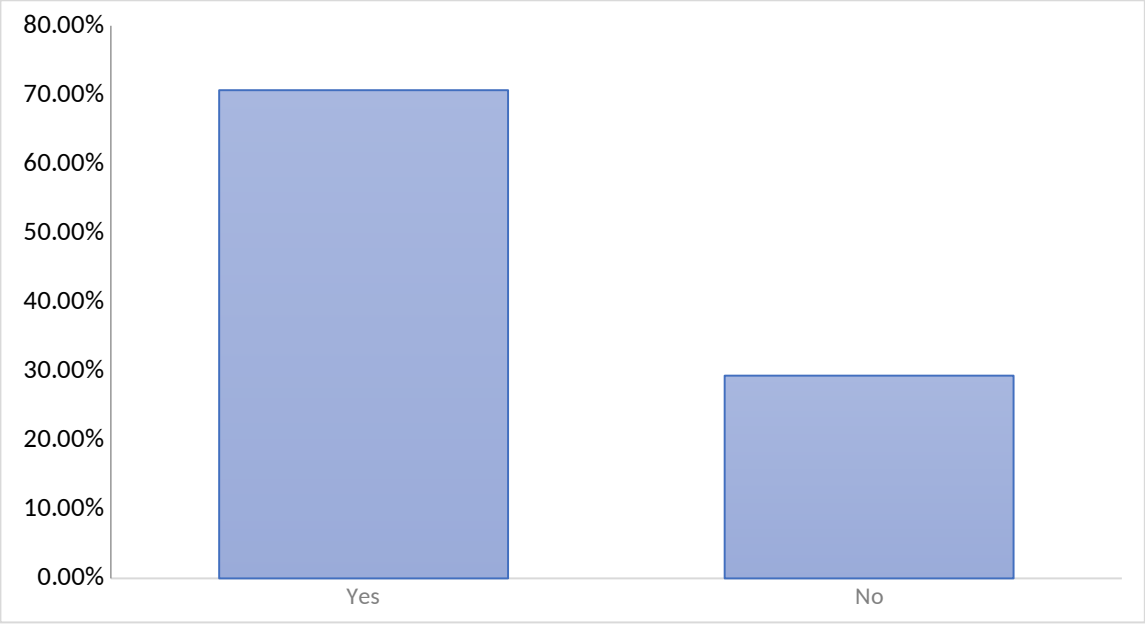

Figure 2 Participants' use of LLINs

As shown in the graph above, the majority 70.7% of the people acknowledged that they sleep under LLINs while 29.3% said they did not. Of the respondents, 45.1% used LLINs when mosquitoes were seen in the house and a further 12.6% used

LLINs seasonally. On the other hand, 42.2% acknowledged that they used LLINs every night.

Table 4 Does sleeping under LLINs cause any problem?

Sleeping under LLINs cause problems	**Frequency**	**Percentage (%)**	**Cumulative percentage (%)**
Yes	197	50.3	50.3
No	195	49.7	100
Total	392	100	100

Of the respondents interviewed, 50.3% acknowledged having problems when they used LLINs while 49.8% said they do not have any problems. The researcher went on to explore the problems that the people faced when they used LLINs and among the 197 respondents who said they have problems; the responses were as follows:

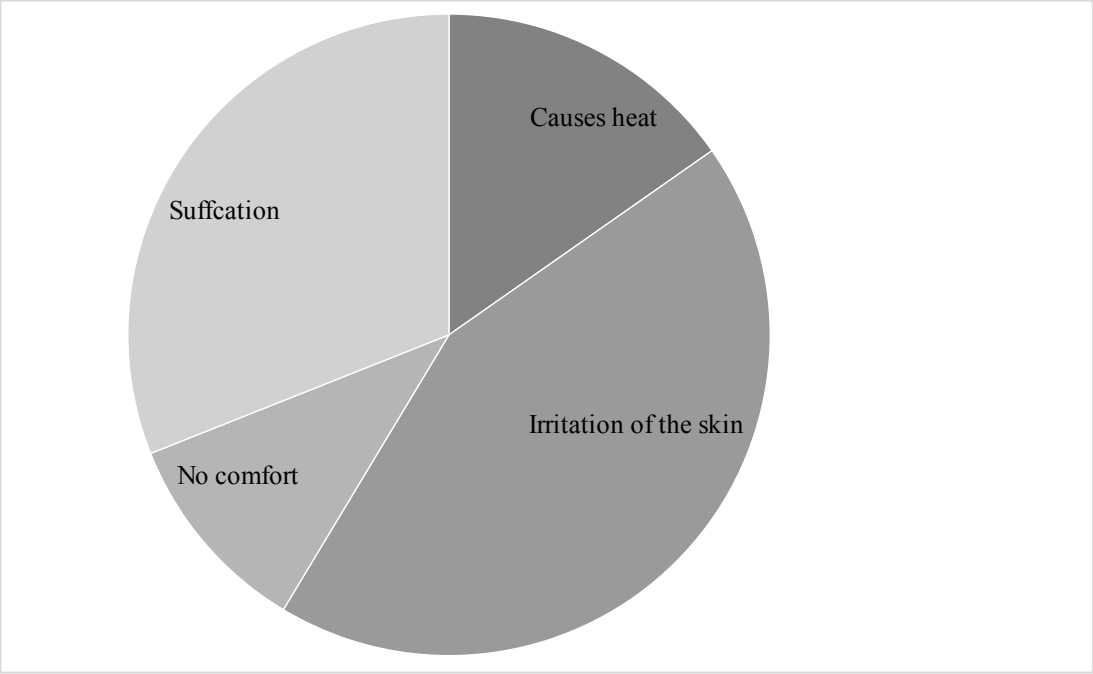

Figure 3 Problems faced when using LLINs

As shown in the figure above, skin irritation and suffocation are the major problems faced by people when they use LLINs. Other problems such as heat and lack of comfort are also experienced by a smaller proportion of respondents.

4.3.7 The state of LLINs

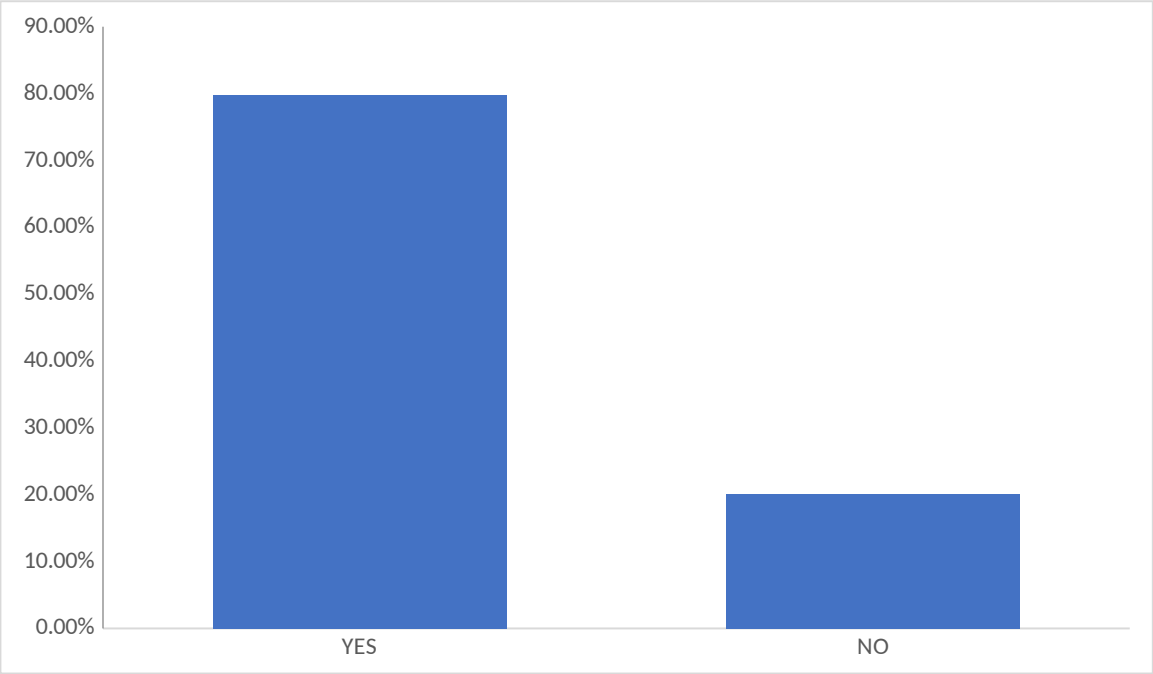

Figure 4 State of LLINs

The study involved observing the state of LLINs that the residents are using, whether they have holes or not. As shown in the graph, 79 (20.2%) of LLINs had holes while 313(79.9%) were in good state. People may be willing to use LLINs even if they use the LLINs regularly; mosquitoes still find their way through the holes. This could have an impact in the increase of malaria in the district.

4.4 Bivariate analysis of the factors associated with the use of LLINs

Table 5 Bivariate analysis of factors associated with use of LLINs

Variable	LLIN users	Non LLIN users	OR	95% CL	p- value
Gender					
Male	132	55	0.9	0.6-1.5	0.975
Female	145	60			
Age					
18-55	228	91	1.2	0.7-2.1	0.461
56 and above	49	24			
Education					
Primary and below	125	38	2.5	1.6-3.9	0.001
Secondary and above	152	77			
Occupation					
Employed	139	49	1.4	0.9-2.1	0.171
Not employed	138	66			
Religion					
Christians	217	26	12.4	7.3-20	0.001
Non-Christians	60	89			
Has adequate knowledge on malaria transmission					
Yes	257	99	2.2	1.1-4.4	0.026
No	20	16			
Has knowledge on how often LLINs should be used					
Yes	145	56	1.2	0.8-1.8	0.510
No	132	59			
Experience problem when he or she use LLINs					
Yes	170	87	0.5	0.3-0.8	0.007
No	107	28			
Number of LLINs seen in the house					
1-2	85	52	0.5	0.3-0.8	0.060
3 and above	192	63			
Type of LLINs seen					
Treated	28	17	1.5	0.8-2.9	0.186
Not treated	249	98			
Sleeping spaces with LLINs					
0-2	151	83	0.5	0.3-0.7	0.001
3 and above	126	32			
Has hanged the LLIN properly					
Yes	138	41	1.8	1.1-2.8	0.010
No	139	74			
Existence of holes in the LLIN					
Yes	65	14	0.5	0.2-0.8	0.011
No	14	101			
Risk perception					
High	142	41	1.9	1.2-3.0	0.005

Low	135	74

The following variables were found to be statistically significant: educational level, religion, knowledge on malaria prevention, whether respondents had problems when they use LLINs, number of LLINs found in the house, type of LLINs, sleeping spaces found with LLINs, whether LLINs are properly hanged and finally risk perception.

Table 6 Unconditional logistics regression of factors affecting the use of LLINs

Term	**Odds Ratio**	**95% C.I.**	**P-Value**
Educational level (Primary and below/Secondary and above)	1.7	1.3-4.4	0.004
Does sleeping under LLINs cause any problems (No/Yes)	5.0	3.0-8.1	≤0.001
Is there any hole in the mosquito net (Yes/No)	0.4	0.2-0.8	0.005

As shown in the table above, educational level, whether using LLINs cause any problem and whether the LLINs have any hole or not were found to be significant factors which affected the use of LLINs.

4.4.1 Educational level

Those who attained primary level and below were 1.68 times more likely to use LLINs compared to those with secondary level and above (p= 0.04).

4.4.2 Problems faced by respondents when they use LLINs

The respondents who had problems when they slept under LLIN were 5 times more likely to use LLINs than those who acknowledged having problem ($p< 0.001$)

4.4.3 Existence of holes on the LLIN.

Those who had LLINs with holes were less likely to use LLINs than those with LLINs without holes ($p=0.05$)

CHAPTER 5: DISCUSSION, CONCLUSION & RECOMMENDATIONS

5.1 DISCUSSION

This study sought to identify the factors associated with use of LLINs among the residents of Goromonzi District. The use of LLINs was defined as when the study participant acknowledged sleeping under the net the night preceding the study. In this study, the use of LLINs was at 70.7% and this was higher than what was observed in the demographic surveys conducted in Zimbabwe and Ghana where LLINs utilization was 9% and 59% respectively. The higher LLINs usage was attributed to the fact that by the time the study was carried out (August, September and October); it was a time when there were a lot of mosquitoes hence people were likely to sleep under the net.

5.2 Socio- Demographic factors and LLINS use

5.2.1 Gender and LLINs use

This research revealed that males were less likely to use LLINs than women (p=0.97). This difference can be attributed to the fact that men usually sleep outdoors because of their profession. Some of the people in the area have professions which makes them sleep outdoors. For instance, guards and miners.

5.2.2 Age and LLINs use

This study found out that the use of LLINs decreased with increase in age. The findings concur with those of a similar study conducted in Ghana by Konlan et al (2019) in which participants who were 18-55 years were1.2 times more likely to use LLINs as compared to those aged 56 and above. The more likelihood of using LLINs among the 18-55 age groups was attributed to the fact that people in this age range

were more educated and knew how malaria is transmitted. Their risk perception was higher compared to those aged 56 and above hence they are more likely to use nets.

In another study conducted by Fokam, EB., Kindzeka, Ngimuh, L & Wanji (2017) revealed that family heads those aged 21-40 years owned at least one LLIN than those aged between 41 and 60 years of age.

A study conducted in Nigeria by Obafemi et al concur with the findings of this study and those of Konlan et al as it also showed that younger women (aged < 30 years) were less likely to utilize LLINs compared to older women.

However, Njatosoa et al in the study conducted in Madagascar contradict with the findings of this study and the findings of Obafemi et al and Konlan et al. The author first related the sleeping space arrangement in a household and age family member. In the study, it was noted that parents sleep together with children under the age of 5 and the other children who are older sleep elsewhere without a LLIN or a bed. This then exposes children above the age of five to mosquito bites and they will be at a higher risk of getting malaria.

Iwashita et al, 2010 highlighted that a family consist of an average of 5.2 people who possess 1.9 LLINs and children under the age of 14 constitute half of the population. The researcher noted that many older children sleep without a net because they sleep in a living room and they usually sleep without a bed where the place is difficult to hang a net. It was found in this study that the most suitable place to hang a LLIN is in the bedroom or a place where there is a bed. It was found that it is difficult to use LLINs when one is sleeping in other rooms such as kitchen and dining because the LLINs are hanged temporarily. In the morning, the room is used for its intended purpose and it becomes tiresome to remove and hang the LLINs every day.

5.2.3 Occupation and LLINs use

Most of the study participants (26.5%) were self-employed. They work as carpenters, welders and builders. Those employed in the public sector are usually accommodated at their area of work places so very few of them were found during the study. Casual workers and public workers had a greater proportion of people who used LLINs with 100% and 82.2% respectively. A bivariate analysis conducted showed that those people who are employed are 1.4 times more likely to use LLINs than those who are not and the factor was not statistically significant. This can be attributed to the fact that most of the employed people are more knowledgeable on the importance of using nets hence they are more likely to use them.

5.2.4 Marital status and LLINs use

The majority of respondents were single and they constituted 50.3 %. This was attributed to the fact that schools and universities were closed due to the COVID 19 pandemic hence there were a lot of young people found in homes during the study. In terms of using LLINs married people had a larger proportion of respondents (73.6%) who used LLINs compared to divorced, single and widowed which had 71.4%, 67.8% and 62.5% respectively. This study concurs with the findings of Konlan et al in which married caregivers were found to be 5.5 times more likely to use LLINs than those who are single although the factor was not statistically significant.

The finding that married people are more likely to use LLINs than those who are single was also found by Njatosoa et al (2021) in Madagascar. In Madagascar, they had a custom of including LLINs in the wedding. And this has led to an association between LLINs use and marital status. The use of LLINs in Madagascar symbolises that one is married hence there is higher number of married people who use LLINs as

compared to those who are not married. The use of LLINs is a tradition to most of the people and they believe that when one get married he or she must have a net.

However, the results of a study conducted by Fokam E. et al, 2017 contradict with the findings of this study in that the author noted that the utilization of LLINs was 2.5 times more likely in households with female heads.

5.3 Problems caused when one use LLINs

This study found out that 50.3% of the respondents acknowledged having problems when they use LLINs. The problems highlighted included skin irritation, heat, breathlessness and suffocation. While some people may have genuine problems, in some people these problems can be attributed to negative attitudes towards the use of LLINs

A study conducted in Rwanda also concurs with the findings of this study in that it the respondents highlighted similar problems like heat, feeling uncomfortable when one use LLINs, skin rash and itchiness and some said the experience shortness of breath. Babalola et al, 2019 also concur with the findings of the one conducted in Rwanda and pointed out that other sources of LLINs utilization gap found among WCBA in Nigeria are the problems which the women highlighted and these includes: health and discomfort, feeling of breathlessness or choking while sleeping under LLIN, perception that mosquitoes still bite while sleeping under the LLIN and that most rooms have low mosquito density. To avert these limitations, attention should be made on behavioural change communication to drive the closure of LLINs utilization gap.

5.4 Knowledge of malaria transmission and prevention

Majority of the respondents knew how one gets malaria. This was evidenced by 90.8% who mentioned mosquito bites. The high percentage could positively influence LLINs use since people would know how the disease is transmitted. These findings concur with those of a study conducted in Iraq where majority of respondents (77.8%) believed that malaria is transmitted through mosquito bite and 60.8% of them acknowledged that the use of LLINs is the main protective measure against mosquito bites (Soleiman-Ahmadi et al, 2014).

5.5 Association between Knowledge level and the use of LLINs

There was a significant association between the knowledge level and the use of LLINs. Those who attained education from primary level and below were 2.5 times more likely to use LLINs than those who had attained secondary level and above. The findings of this study concur with a study carried out in in Ethiopia in Shewa town which showed a significant association between level of education and net utilization (Abate et al, 2013).

5.6 Conclusion

This study found out that demographic factors play a major role in the use of LLINs. Apart from demographic data, other factors seen to have an influence in the use of LLINs included the problems associated with use of LLINs and the state of LLINs. Nets causing heat, suffocation, itching and discomfort were reported as problems that resulted into incorrect and inconsistent use of LLINs. Although some people were knowledgeable on malaria transmission, they still did not use LLINs.

5.7 Recommendations

1. There should be continuous sensitization of the community to regularly and properly use LLINs. During mass and continuous distribution health workers should make people aware that nets should be hanged properly high and drawn, spread well around the sleeping area in order to reduce suffocation, discomfort and heat.

2. People should be educated on how to hang LLINs in different. For example, most people prefer a conical net so they must be taught on how to hang it in a round shape when given a rectangular net.

3. Education on the use of LLINs should also be given to those with higher educational level since they had a larger proportion of people who did not use LLINs. This class of people also include health workers who are the hardest to reach when it comes to accepting the services they deliver, other people include teachers, policemen and other cadre of public workers.

4. A mass distribution of LLINs should be done so that the community have new LLINs

5. Community health workers must be empowered so that they can continuously monitor the use of LLINs in the community

5.8 Suggestion for further research

This research sought to find the factors associated with use of LLINs. Further research works should be complemented by qualitative study to investigate reasons of non-use and possible misuse of LLINs.

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APPENDIXES

APPROVAL NUMBER AUREC2116/21

ANNEX I: Study questionnaire (English version)

Questionnaire No……. Household No……

Place a code e.g. A1.1 in the box alongside each item according to the responses given by the respondent

A. Socio-demographic data

No.	Question	Response category	Code
A1	Sex of the respondent	A1.1 Male A1.2 Female	
A2	Age of the respondent	A2.1 18-25 A2.2 26-35 A2.3 36-45 A2.4 46-55 A2.5 56 and above	
A3	Educational level	A3.1 Never went to school A3.2 Primary A3.3 Secondary A3.4 College/ Tertiary	
A4	Occupation	A4.1 Farmer A4.2 Public servant A4.3 Self employed A4.4 Casual labour A4.5 Trader A4.6 Student A4.7 Housewife A4.8 Jobless A4.9 If other, (Specify)……	
A5	Marital status	A5.1 Married A5.2 Single A5.3 Widowed A5.4 Divorced	
A6	What is your Religion?	A6.1 Roman Catholic A6.2 Protestant A6.3 Pentecostal A6.2 African Traditional Religion	
A6	Total number of Household members	A6.1 1 A6.2 2-5 A6.3 6 and above	
A7	How many of the members sleep under LLIN?	A7.1 1 A7.2 2 A7.3 3-5 A7.4 All A7.5 None	

B. Knowledge and practice of respondents on the use of LLINs.

No.	Question	Response	Code
B1	How does one get malaria	B1.1 Mosquito bite B1.2 Drinking un boiled water B1.3 Bad season B1.4 Others, (Specify)…….	
B2	In your opinion what can people do prevent malaria	B2.1 Use net B2.2 Use repellents B2.3 IRS B2.4 Wear long cloths B2.5 Fill pits B2.6 Burn Cow dung B2.7 Others___	
B3	How does LLINs prevent malaria transmission?	B3.1Physical barriers B3.2 Kills mosquitoes B3.3 Irritate mosquitoes B3.4 Not known	
B4	How frequent should one use LLINs	B4.1 Every night B4.2 Seasonally B4.3 When mosquitoes are seen in the house B4.4 If Other, (Specify)	
B5	Do you sleep under LLIN	B5.1 Yes B5.2 No	
B6	If Yes to B5 above, how frequent do you sleep under LLIN	B6.1 Every night B6.2 Seasonally B6.3 When mosquito nets are seen in the house B6.4 If other, (Specify)	
B7	How do you use LLINs	B7.1 Hang and draw B7.2 Use as a blanket B7.3 Use a curtain in doors, windows and ventilators B7.4 If Others, (Specify)	
B8	Does sleeping under LLINs cause any problem?	B8.1 Yes B8.2 No	
B9	If Yes to B8 above, what is the major problem?	B9.1 No comfort B9.2 Causes heat B9.3 Suffocation B9.4 Irritation of the skin	
B10	If NO to B5 above why? *(More than one response is possible)*	B10.1 Lack of enough space to hang the net B10.2 Uncomfortable to sleep in B10.3 No mosquito net in the	

		house B10.4 Difficulty in hanging B10.5 Nets are treated so they have side effects B10.6 Don't want B10.7 Forget B10.8 No reason B10.9 If other, (Specify) …….

C. Observed state of LLINs in the household

No	Area to be observed	Observation	Code
C1	Number of mosquito nets seen in the house.	C1.1 One C1.2 Two C1.3 Three and above	
C2	The type of mosquito net that a household owned	C2.1 Re-treatable C2.2 Permanently treated C2.3 Not treated	
C3	Number sleeping spaces observed with Nets	C3.1 One C3.2 Two C3.3 Three and above C3.4 None	
C4	Is the bed net hanged properly over the sleeping space	C4.1 Yes C4.2 No	
C5	Is there any hole in the mosquito net	C5.1 Yes C5.2 No	

D. Perceived susceptibility

		Very low	**low**	**high**	**Very High**	**Not Sure**
D1	My chances of getting malaria					
D2	The chances of my young child getting malaria are					
D3	Chances of my wife getting malaria when pregnant are					
D4	There is a good chance that I will get malaria					

ANNEX II: Study questionnaire (Shona version)

APPROVAL NUMBER AUREC2116/21

Questionnaire No……. Household No……

A. Nhoroondo yemunhu

No.	Mubvunzo	Mhinduro	Mucherechedzo
A1	Masikirwo	A1.1 Murume A1.2 Mukadzi	
A2	Makore	A2.1 18-25 A2.2 26-35 A2.3 36-45 A2.4 46-55 A2.5 56 and above	
A3	Makadzidza kusvikapapi?	A3.1 Handina kubvira ndaenda kuchikoro A3.2 Primary A3.3 Secondary A3.4 College/ Tertiary	
A4	Munoita basarei?	A4.1 Murimi A4.2Mushandi vehurumende A4.3 Kuzvishandira A4.4 Mabasa emaoko A4.5 Mutengesi A4.6 Mwana vechikoro A4.7 Kuita Mabasa epamba A4.8 Handishandi A4.9 Rimwewo basa……	
A5	Makaroorwa ere?	A5.1 Ndakaroorwa A5.2 Handina kuroorwa A5.3 Ndakafirwa A5.4 Ndakarambwa	
A6	Chitendero	A6.1 Roma A6.2 Savadha A6.3 Kereke dzemweya A6.2 Chivanhu	
A6	Munogara murivangani?	A6.1 1 A6.2 2-5 A6.3 6 and above	
A7	Vangani vanorara vakafuga mosquito net?	A7.1 1 A7.2 2 A7.3 3-5 A7.4 Tose A7.5 Hapana	

B. Ruzivo maererano nemashandisirwo e mosquito net.

No.	Mubvunzo	Mhinduro	Mucherechedzo
B1	Malaria inoparararirasei?	B1.1 Kurumwa neumhutu B1.2 Kuinwa mvura isina kufashaidzwa B1.3 Mwakavakaipa B1.4 Zvimwewo…….	
B2	Sekufuga kwenyu malaria Inga dziirirwa sei?	B2.1 kushandisa mosquito net B2.2 Kuzora ma repellents B2.3 Kufirita dzimba B2.4 Kupfeka hembe refu B2.5 Kuvhara makomba B2.6 Kupisa ndove B2.7 Zvimwewo___	
B3	Mosquito net inoshanda sei pakudzivirira malaria?	B3.1Inoita kuti mosquito isapinde B3.2 Inouraya mosquitoe B3.3 Inodzinga mosquitoes B3.4 Handizive	
B4	Mosquito net inoshandiswa kangani	B4.1 Mazuvaose B4.2 Nguvainowanda mosquito B4.3 Kana mosquito yaakuonekwa mumba B4.4 Zvimwewo)	
B5	Munoshandisa mosquito net here?	B5.1 Hongu B5.2 Kwete	
B7	Munoshandisasei mosquito net?	B7.1 Kuisungirira B7.2 Kuifuga segumbeze B7.3 Semaketeni B7.4 Zvimwewo	
B8	Mune dambudziko ere pakushandisa mosquitonet?	B8.1 Hongu B8.2 Kwete	
B9	Dambudziko racho nderei?	B9.1 Handinyatsonzwe zvakanaka B9.2 Rinopisa B9.3 Ndinozarirwa B9.4 Kuskwinyiwa	
B10	Kana risiri dambudziko riripamusoro zvimwe ndezvipi. *Munogona kusarudza mhinduro dzakawanda*	B10.1 Hapana pekusungira B10.2 Rinobhowa B10.3 Handina mosquito net B10.4 Rinonetsa kusungira B10.5 Mushonga vacho unokuvadza B10.6 Handing ode B10.7 Ndinokanganwa	

		kuishandisa B10.8 Hapana chikonzero B10.Zvimwewo……..

C. Zvakaonekwa maererano nezvakaita ma mosquito nets mudzimba

No	Zvakatariswa	Zvakaonekwa	Mucherechedzo
C1	Uwandu hwema mosquitonet akaonekwa	C1.1 Rimwechete C1.2 Maviri C1.3 Matatu kana kudarika	
C2	Mhando ye mosquito net yakaonekwa	C2.1 Inoda mushonga nguva nenguva C2.2 Yakaiswa mushonga kamwechete C2.3 Hainamushonga	
C3	Nzvimbo dzekurara dzakaonekwa	C3.1 Imwechete C3.2 Mbiri C3.3 Nhatu kana kudarika C3.4 Hapana	
C4	Mosquito net yakasungirwa zvakanakaere	C4.1 Hongu C4.2 Kwete	
C5	Mosquito net inepayaka booka here	C5.1 Hongu C5.2 Kwete	

D. Njodzi yekubatira malaria

		Yakanyanya kudzikira	Yakadzikira	Yakakura	Yakanyanya yakukurisa	Handizive
D1	Mukanavekubatira malaria					
D2	Mukana wevana vangu kubatira malaria					
D3	Mukana wemudzimai vangu kubatira malaria					
D4	Mukana vangu kubatira malaria					

ANNEX III: Informed consent form (English version)

APPROVAL NUMBER AUREC2116/21

Use of Long-lasting Insecticidal Nets and its associated factors: a case of Goromonzi District, Mashonaland East, 2021

My name is Tendai Chiwanga. I am a post-graduate student studying towards Master of Public Health at Africa University, Zimbabwe. The aim of this study is to improve long-lasting insecticidal nets usage in Goromonzi District. You were selected for the study because you are a resident of this area where there is a problem of Malaria. Besides you, there are 391 people who will be involved in this study.

Improvement in the use of LLINs will subsequently result in the reduced burden of malaria in the district. As one of the selected respondents, your views are of paramount importance and will help go a long way in exploring the reasons for non-use or misuse of LLINs and come up with ways to redress the problem.

Procedures and duration

If you agree to participate in this study, you will be given a questionnaire to answer. It is expected that this will take about 20 minutes. After answering the questionnaire, the researcher will enter your room to see if the nets are hanged and this will only be done upon your approval.

Risks and discomforts

Some people may not feel comfortable for the researcher to enter into their house. To mitigate this, the researcher will first seek consent from the head of the household and he will enter the house only if allowed.

Benefits and/or compensation

The study will help in improving net use in the area and this will subsequently lead to reduction in the burden of malaria

Confidentiality

Any information obtained in this study will not be disclosed without the permission of the study participants. Names and any other identification will not be asked for in the questionnaires.

Voluntary participation

Participation in this study is voluntary. Your decision not to participate in this study will not affect your future relationship with the organization. You are free to withdraw your consent and there will be no penalty for that.

Authorisation

Please sign in the spaces provided below to indicate that you have read and understood the information provided above and have agreed to participate.

---------- ----------

Name of Research Participant (please print) Date

Signature of Research Participant or legally authorised representative

If you have any questions concerning this study or consent form beyond those answered by the researcher including questions about the research, your rights as a research participant, or if you feel that you have been treated unfairly and would like to talk to someone other than the researcher, please feel free to contact the Africa

University Research Ethics Committee on telephone (020) 60075 or 60026 extension 1156 email aurec@africau.edu

ANNEX IV: Informed consent form (Shona version)

APPROVAL NUMBER AUREC2116/21

Tsvakurudzo yezvikonzero zvinokanganisa kushandiswa zvakanaka kwema mosquito nets muGoromonzi District, Mashonaland East, 2021

Zita rangu ndinonzi Tendai Chiwanga. Ndirikuita Master of Public Health pa Africa University muno mu Zimbabwe. Chinangwa chetsvakurudzo iyi ndechekuvandudza mashandisirwo anoita mamosquitoneti muno mu Goromonzi. Imi masarudzwa kupinda mutsvakurudzo iyi nekuti murimugari vemuno muGoromonzi, nzvimbo ine dambudziko remalaria. Kune vamwe vanhu 391 vachapindawo zvakare mutsvakurudzo iyi.

Kuvedzera kwekushandiswa kwema mosquito neti kuchaita kuti dambudziko remalaria ridzikiremuno mu Goromonzi. Maonero enyu akakosha pakuti anobatsira kuburitsa pachena zvikonzero zvinoitakuti ma mosquito neti asa shandiswe pakudzivirira malaria, zvozobatsira zvakare pakutsvaka nzira dzekuvedzera mashandisirwo ema mosquito neti.

Maitirwo anenge achiitwa tsvakurudzo iyi

Muchapiwa gwaro rinengerine mibvunzo yamuchapindura. Zvinogona kutora maminetsi makumi maviri kupindura mibvunzo iyi. Shure kwaizvozvo, muchakumbirwa nemuongorori kuti apinde mumba menyu kuti aone kuti mosquito neti yakasungirwa here. Izvi zvinoitwa shure kwekunge matendera.

Zvingangokanganisa

Zvinozivikana kuti vamwe vanhu vanogona kunzwakusasununguka kupindirwa mumba, asi muongorori anongopinda mumba chete kana atenderwa nemuridzi vemba.

Zvinobatsira patsvakurudzo iyi

Vachapinda mutsvakurudzo iyi vachava neruzivo pamusoro pekudzivirirwa kwe malaria uyezve mashandisirwo ema mosquito neti.

Kuchengetedzwa kwemhinduro

Zvichawanikwa patsvakurudzo iyi hazviudzwe mumwe munhu kunze kwekuti imi matendera. Patsvakurudzo iyi hapana pamuchabvunzwa zita renyu kana mimwe mibvunzo inoita kuti muzivikane.

Hapana kumanikidzwa

Hapana anomanikidzwa kupindura mibvunzo. Hapana mhosva yamunopiwa kana mukasapindura mibvunzo iyi.

Kubvuma

Sainai pazasi kana mabvuma kupinda mutsvakurudzo iyi

---------- ----------

Zita Zuvarechibvumirano

Siginecha yekubvuma

Kana muine mibvunzo maererano netsvakurudzo iyi kana chibvumirano ichi, ikodzero yenyu kana kuti kana muchinzwa kuti kodzero dzenyu dzatyorwa, sunungukai kufona ku Africa University Research Ethics Committee panhamba dzinoti (020) 60075 or 60026 extension 1156 email aurec@africau.edu

ANNEX V: Analysis plan

Objective	**Type of Variables**	**Appropriate statistical test**
To assess community knowledge on malaria	Categorical	Multivariate logistic regression
Establish relationship between knowledge level and the use of LLINs	Categorical	Bivariate logistic regression
To assess community attitude on the use of LLINs	Categorical	Multivariate logistic regression
To investigate perceived susceptibility to malaria among residents	Categorical	Multivariate logistic regression

ANNEX VI: Approval letter from the district

Telephone: 263-772 194 212-4

MINISTRY OF HEALTH & C.C.
MAKUMBE DISTRICT HOSPITAL
P.O. BOX CY 660
CAUSEWAY
ZIMBABWE

22/04/2021

T. CHIWANGA

MAKUMBE HOSPITAL
BOX CY 660
CAUSEWAY.

RE: AUTHORIZATION TO CONDUCT A STUDY ON FACTORS ASSOCIATED WITH USE OF LONG-LASTING INSECTICIDAL NETS IN GOROMONZI DISTRICT.

This letter serves as a notification that authority has been granted for you to conduct a study on the factors associated with use of Long-Lasting insecticidal Nets (LLINs) in Goromonzi District.

Yours sincerely

MINISTRY OF HEALTH & CHILD CARE
MAKUMBE DISTRICT HOSPITAL
DISTRICT MEDICAL OFFICER
2021 -11- -4
P.O. BOX CY 660, CAUSEWAY
ZIMBABWE

DR S. KARIM – DISTRTICT MEDICAL OFFICER- GOROMONZI DISTRICT.

ANNEX VII: Approval letter from AUREC

AFRICA UNIVERSITY
A United Methodist-Related Institution
Investing in Africa's future

AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC)

P.O. Box 1320 Mutare, Zimbabwe, Off Nyanga Road, Old Mutare-Tel (+263-20) 60075/60026/61611 Fax: (+263 20) 61785 website: www.africau.edu

Ref: AU2116/21

11 June, 2021

Tendai Chiwanga
C/O CHANS
Africa University
Box 1320
Mutare

RE: FACTORS ASSOCIATED WITH USE OF LONG-LASTING INSECTICIDAL NETS: A CASE OF GOROMONZI DISTRICT, MASHONALAND EAST, 2021

Thank you for the above titled proposal that you submitted to the Africa University Research Ethics Committee for review. Please be advised that AUREC has reviewed and approved your application to conduct the above research.

The approval is based on the following.

a) Research proposal
b) Data collection instruments
c) Informed consent guide

- **APPROVAL NUMBER** AUREC 2116/21
  This number should be used on all correspondences, consent forms, and appropriate documents.
- **AUREC MEETING DATE** NA
- **APPROVAL DATE** June 11, 2021
- **EXPIRATION DATE** June 11, 2022
- **TYPE OF MEETING** Expedited
  After the expiration date this research may only continue upon renewal. For purposes of renewal, a progress report on a standard AUREC form should be submitted a month before expiration date.
- **SERIOUS ADVERSE EVENTS** All serious problems having to do with subject safety must be reported to AUREC within 3 working days on standard AUREC form.
- **MODIFICATIONS** Prior AUREC approval is required before implementing any changes in the proposal (including changes in the consent documents)
- **TERMINATION OF STUDY** Upon termination of the study a report has to be submitted to AUREC.

AFRICA UNIVERSITY
RESEARCH ETHICS COMMITTEE (AUREC)
APPROVED
P.O. BOX 1320, MUTARE, ZIMBABWE

Yours Faithfully

MARY CHINZOU – A/AUREC ADMINISTRATORFOR CHAIRPERSON, AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE