POST GRADUATE PROGRAMS DIRECTORATE

INSECTICIDES TREATED BED NET UTILIZATION AND ASSOCIATED FACTORS AMONG UNDER-FIVE CHILDREN IN FEDIS DISTRICT OF EAST HARARGHE ZONE, EASTERN ETHIOPIA

MPH THESIS

AYATULAHI YUSUF ALI (BSc)

DECEMBER 2025

HARAMAYA UNIVERSITY, ETHIOPIA

Insecticides Treated Bed Net Utilization and Associated Factors among Under-Five Children in Fedis District Of East Hararghe Zone, Eastern Ethiopia

A Thesis Submitted to the School of Public Health,

Post Graduate Programs Directorate

HARAMAYA UNIVERSITY

In Partial Fulfillment of the Requirements for the Degree of

MASTER OF PUBLIC HEALTH IN GENERAL PUBLIC HEALTH

Ayatulahi Yusuf Ali (BSc)

Major Advisor: Roba Argaw (PhD, Assistant Professor)

Co-Advisor: Melake Damena (MPH, Assistant Professor)

September 2025

Haramaya University, Ethiopia

APPROVAL SHEET

HARAMAYA UNIVERSITY

POSTGRADUATE PROGRAMS DIRECTORATE

I hereby certify that I have read and evaluated this Thesis entitled “Insecticides Treated Bed Net Utilization and Associated Factors among Under-Five Children in Fedis District of East Hararghe Zone, Eastern Ethiopia” prepared under my guidance by Mr. Ayatulahi Yusuf Ali. I recommend that it be submitted as fulfilling the thesis requirement.

Mr. Roba Argaw (PhD, Assistant Professor) _____ ___ /__/___

Major Advisor Signature Date

Mr. Melake Damena (PhD. Assistant Professor) _____ ____ /___ /___

Co-Advisor Signature Date

As a member of the Board of Examiners of the MPH Thesis Open Defense Examination, I certify that I have read and evaluated the Thesis prepared by Mr. Ayatulahi Yusuf Ali and examined the candidate. I recommended that the thesis be accepted as fulfilling the Thesis requirements for the degree of Master of Public Health in General Public Health

_____ _____ ____ /____ /____

Chairperson Signature Date

_____ _____ ____ /____ /____

Internal Examiner Signature Date

_____ _____ ____ /____ /____

External Examiner Signature Date

Final approval and acceptance of the Thesis is contingent upon the submission of its final copy to the Council of Graduate Studies (CGS) through the candidate’s department

or school graduate committee (DGC or SGC).

STATEMENT OF THE AUTHOR

By my signature below, I declare and affirm that this Thesis is my own work. I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis, and compilation of this Thesis. Any scholarly matter that is included in the Thesis has been given recognition through citation.

This Thesis is submitted in partial fulfillment of the requirements for MPH Degree at Haramaya University. The Thesis is deposited in the Haramaya University Library and is made available for borrowers under the rule of Library. I solemnly declare this Thesis has not been submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

Brief quotation from this Thesis may be made without special permission provided that accurate and complete acknowledgment of the source is made. Requests for permission for extended quotations from or reproduction of this Thesis in whole or in part may be granted by the Head of School or Department when in his judgment the proposed use of the material is in the interest of scholarship. In all other instances, permission must be obtained from the author of the Thesis.

Name: Mr. Ayatulahi Yusuf Ali

Signature: _____

Date: ____ /___ /_____

School/Department: Public Health/General Public Health

BIOGRAPHICAL SKETCH

Name is Ayatulahi Yusuf, I was born on April 16,1982 EC. In Burka Gamachu kebele, Goro Muti district east Hararghe zone, Oromia regional state, eastern Ethiopia. I was attended Bubisa primary school for primary education and joined chelenko higher and preparatory school on September,1998 EC. Then I joined Jimma University in 2002 E.C.

Educational Qualification; BSC degree in Biomedical Engineering science, in 2006 EC, and I am a candidate for graduation for 2nd degree, master degree in General Public health (MPH in GPH). Institution where I learned is BSC in Biomedical Engineering from Jimma University Institute of Technology.

Regarding employment history; I had done in different area within my more than 10 years' work experience. As Expert in Haramaya Primary Hospital for about two years (2007-2008) E.C. and East Hararghe Zonal Health Department for eight years (209-2017) EC.

. Now I am living in kebele 17 Jenila district, Harar city, Harari region state, eastern Ethiopia. My Address for Mobile phone 0917233678, line phone 025 6665719/ 0256660231

ACKNOWLEDGEMENTS

I would like to thank Haramaya University, Colleges of Health and Medical Sciences, School of Public Health and Postgraduate Programs Directorate for providing opportunity to conduct the study. My deepest gratitude goes to my advisors, Dr. Roba Argaw and Mr. Melake Damena for their valuable comments, professional contributions and technical supports throughout the study. My appreciatiation goes to Fedis District Health Office and their public health facilities for providing the background information of the study setting. I would like acknowledge the study participants, data collectors, supervisors and involved other individuals for their dedicated contributions, significant supports and valuable cooperation. Last but not the least; I would like to thank my colleagues for vital comments and technical inputs throughout the study.

ABBREVIATIONS AND ACRONYMS

ACT: Artemisinin Combination Therapy
AOR: Adjusted Odds Ratio
BCC: Behavioral Change Communication
CI: Confidence Interval
CSA: Centre for Statistical Agency
EDHS: Ethiopian Demographic Heath Surveys
FMOH: Federal Ministry of Health
HH: House Hold
IEC: Information Education Communication
IHRERC: Institutional Health Research Ethics Review Committee
IRS: Indoor Residual Spray
ITNs: Insecticide Treated Nets
KAP: Knowledge, Attitude and Practice
LLIN: Long Lasting Insecticide Treated Net
LMIC: Low- and Middle-Income Countries
MBN: Mosquito Barrier Net
MIS: Malaria Indicator Survey
RBM: Roll Back Malaria
HEW: Health Extension Worker
RDT: Rapid Diagnostic Test
SSA: Sub-Saharan Africa
WHO: World Health Organization

TABLE OF CONTENTS

61

LIST OF TABLES

LIST OF FIGURES

-

ABSTRACT

Background: Malaria continues to be a significant public health challenge in Sub-Saharan Africa, including Ethiopia. Despite the proven effectiveness of long-lasting insecticidal nets (LLINs) to prevent malaria, data on their utilization among under-five children in Fedis District, Eastern Ethiopia, remain scarce.

Objectives: To assess utilization of insecticides treated bed nets and associated factors among under-five children in Fedis District in eastern Ethiopia, from January 1-31, 2025

Method: A community-based cross-sectional study was conducted among 626 randomly selected under-five children in Fedis District, East Hararghe Zone, Ethiopia. Data were collected through face-to-face interviews using a pretested structured questionnaire. The data were entered into EpiData version 3.1 and analyzed with Stata MP 17. Descriptive

statistics were used to summarize participants 'characteristics and LLIN utilization. Bivariable and multivariable logistic regression analyses were performed to identify factors associated with LLIN utilization. Statistical significance was declared at $p < 0.05$, and adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported to identify predictor variables.

Results: The utilization of LLIN among under-five children in Fedis District was 33%, (95% CI: 29.2%–36.9%). Respondents age (35–49 years) (AOR = 2.92(1.07, 7.99), marital status (married) (AOR = 3.524, 95% CI: 1.016–12.223), formal education (AOR = 1.98, 95% CI: 1.15–3.41), and participants occupation—being a farmer (AOR = 25.86, 95% CI: 7.23–92.50) or a housewife (AOR = 24.31, 95% CI: 5.85–101.02)—were significantly associated with LLIN utilization. In addition, belonging to the rich wealth index (AOR = 2.863, 95% CI: 1.45–5.66), owning two or more LLINs (AOR = 4.56, 95% CI: 2.46–8.45), having LLINs without holes (AOR = 4.34, 95% CI: 1.79–10.51), perceiving good benefits of LLINs (AOR = 3.04, 95% CI: 1.50–6.15), perceiving low barriers to their use (AOR = 2.87, 95% CI: 1.70–4.83), and receiving good social support (AOR = 10.46, 95% CI: 5.70–19.18) were also positively and significantly associated with LLIN utilization.

Conclusions: The findings of the current study revealed that utilization of LLIN among under-five children in Fedis District was low, highlighting the need for substantial efforts to improve coverage and reduce malaria-related morbidity and mortality among children and mothers. LLIN use among mothers is influenced by sociodemographic, household wealth, and perception-related factors. Targeted interventions addressing education, household wealth, access to intact LLINs, and social support could enhance utilization and strengthen malaria prevention in the community.

Key-terms: Insecticides treated bed net, Utilization, Under-five children, Mothers, Ethiopia

1. INTRODUCTION

1.1. Background

Malaria is a complex and deadly disease that puts approximately 3.3 billion people at risk in 109 countries and territories around the world (WHO,2014, 2022). As different studies show, in 2000, there were between 350 and 500 million cases of malaria and at least one million deaths worldwide, of which most of them occur in African children (Tokponnon et al., 2014; USAID, 2017; WHO, 2022). According to a WHO report in 2022, 25 million pregnant women are at risk for malaria each year, and malaria accounts for over 10,000 maternal and 200,000 neonatal deaths per year (WHO, 2014, 2022).

In Africa, 30 million women living in malaria endemic areas become pregnant each year. For these women, malaria is a threat both to themselves and to their babies, with up to 200,000 newborn deaths each year due to malaria in pregnancy (Teklemariam et al., 2015; USAID, 2017). The WHO strives to increase access to bed net for lactating women in all areas with moderate to high malaria transmission in Africa, as part of maternal and child health service package ((WHO, 2014; Bugssa & Tedla, 2020; WHO, 2022).

Long-lasting insecticidal nets (LLINs) have proved to be an important tool for malaria control and other vector-borne diseases. Studies in malaria endemic countries have shown the usefulness of LLINs in reducing man-vector contact from malaria. It has been shown to reduce all-cause child mortality by 20%, decrease clinical cases of malaria by 50%, and severe malaria by 45% ((FMOH, 2017; USAID, 2017; Bugssa et al., 2020; MOH-Ethiopia., 2021). It has three main functions; first, when mosquitoes are in contact with net, it has knockdown effect, disabling or killing mosquitoes, has a repellent effect and reduces contact between the person sleeping under ITN and mosquitoes by acting as a physical barrier. LLINs also have an effect on other insects like head lice, sandflies, ticks and other household pests (Gobena et al., 2012; Negash et al., 2012; Woyessa et al., 2014; Bugssa et al., 2020; Okafor & Ogbonnaya, 2020).

The LLINs, indoor residual spray (IRS), and Artemisinin-based combination therapy (ACT) are the components of current malaria control campaigns (Bugssa et al., 2020; WHO, 2022). Current malaria control strategies in Ethiopia IRS and LLINs while others include effective case management and rapid diagnostic tests (RDTs) (EPHI, 2016; FMOH, 2017; USAID, 2017; Bugssa et al., 2020; MOH-Ethiopia., 2021).

A cornerstone for malaria disease prevention in Ethiopia is the use of LLINs. The key strategy used by the country is a rolling periodic free distribution of LLINs to all

population groups living in endemic, high and moderate malaria risk areas of Ethiopia. Currently, Ethiopia aims to achieve universal coverage by distributing one LLIN per two persons (sleeping space) through mass, free campaigns at the community level, through the health extension workers and/ or health facilities. Ethiopia has distributed about 60 million LLINs since 2021 (EPHI, 2016; Mariam & Girsha, 2016; Tsegaye Berkessa et al., 2016; Bugssa et al., 2020).

The indicators of ITN includes proportions of at risk population slept under ITN the previous night; proportion of population with access to LLIN within household; proportion of households with at least one LLIN for every two people; proportion of households with at least one LLIN; proportion of existing LLINs used the previous night; and proportion of targeted risk group with LLIN (EPHI, 2016; USAID, 2017; MOH-Ethiopia., 2021; WHO, 2022).

There are two types of malaria preventing nets. Insecticide treated net (ITN) and long-lasting insecticide treated nets (LLINs). ITNs are ordinary mosquito nets treated with insecticide provide much more effective protection than the ordinary plain nets by repelling and killing the mosquitoes. However, these nets need to be re-impregnated after six month (twice a year) and LLIN have insecticide incorporated in their fiber so that insecticide is not removed by as many as 20 washes. The efficacy of ITN is retained up to 3- 5 years (FMOH, 2011; EPHI, 2016; FMOH, 2017; Bugssa et al., 2020).

LLIN: It is a net treated with insecticide by the manufacturer and does not need to be retreated until after 20 washes or four years of use and all mosquito bed nets in Ethiopia are LLINs (Woyessa et al., 2014; Teklemariam et al., 2015; Mariam et al., 2016; Tsegaye Berkessa et al., 2016; Watiro & Awoke, 2016)

Current internationally recognized standard for malaria protection from mosquito bites is LLINs and in this study both used interchangeable. The use of LLINs is a cost-effective intervention to reduce maternal death and maternal anemia where malaria imposes an important disease burden (WHO, 2014; Tsegaye Berkessa et al., 2016; USAID, 2017; MOH-Ethiopia., 2021; WHO, 2022). Several countries, including Ethiopia have worked towards malaria elimination using a combination of both insecticides treated nets (ITN) and indoor residual spraying (IRS) (Astatkie & Feleke, 2009; FMOH, 2011; Zewdneh Tomass et al., 2011; Gobena et al., 2012; FMOH, 2017; USAID, 2017; Bugssa et al., 2020; MOH-Ethiopia., 2021).

1.2. Statements of the Problem

World Health Organization (WHO) estimates that 207 million cases of malaria occurred globally in 2012 and 627,000 deaths and estimated 90% of all malaria deaths occur in Africa (WHO, 2013, 2014). Plasmodium falciparum causes most of the deaths in SSA and Malaria is a major public health problem in Ethiopia; contributes 20% of under-five deaths, estimated to cause 5-10 million clinical malaria cases each year and 12% of outpatient visit and 10% of health facility admissions (Okafor et al., 2020; WHO, 2022). About half of the world's population is at risk of malaria and 97 countries are affected by malaria (Tsegaye Berkessa et al., 2016; Watiro et al., 2016; USAID, 2017; WHO, 2022). The most commonly used methods to prevent mosquito bites are sleeping under an LLIN and spraying the inside walls of a house with IRS. Use of LLINs has been shown to reduce malaria incidence rates by 50% in a range of settings, and to reduce malaria mortality rates by 55% in children aged underfive years in SSA (Okafor et al., 2020; WHO, 2022). Although LLIN utilization shows substantial increase since 2000, they fall short of universal (100%) coverage of this preventive measure. The continent-wide estimates of those sleeping under an LLIN obscure variations in progress among and within countries (USAID, 2017; WHO, 2022).

Apart from coverage, issues regarding the utilization of LLIN are very crucial. This is because the LLIN that are available at a household level left unused or even if they are used, vulnerable members of the household may not be given priority or LLIN use is an intermittent (FMOH, 2017; USAID, 2017; Bugssa et al., 2020; MOH-Ethiopia., 2021). Despite massively expanded ITN distribution in malaria endemic SSA countries since 2005, there is limited information on community based actual use of nets owned, area specific reasons for non-use, and the impact of the variations in use on malaria vector densities and transmission in either Kenyan highlands or other countries where malaria is seasonal and unstable (Atieli et al., 2011; Zhou et al., 2014).

The ITN use is one of the main malaria control strategies in Ethiopia to reach national target to achieve malaria elimination within specific geographical area with low malaria transmission and achieve zero malaria death in Ethiopia and FMOH did a

continuous mass-distribution of ITNs from 2005-2018, targeting to distribute two LLINs per household in malaria` endemic areas (Gobena et al., 2012; Woyessa et al., 2014; Araya et al., 2015; Teklemariam et al., 2015; Mariam et al., 2016; Watiro et al., 2016; Bugssa et al., 2020; MOH-Ethiopia., 2021).

Increase in bed net access does not necessarily translate to equal rise in utilization because, the success of ITN use risk factors such as educational background, residence, age, gender, color of nets, and willingness of people to use nets and inconvenience to hang the nets (EPHI, 2016; MOH-Ethiopia., 2021). Despite decades of sustained control efforts, malaria still remains as the major cause of morbidity, death and socioeconomic problems in Ethiopia (FMOH, 2011; Biadgilign et al., 2012; EPHI, 2016). The use of LLINs is one of the main malaria control strategies in Ethiopia to reach the national targets to achieve malaria elimination within specific geographical areas with historically low malaria transmission and achieve zero malaria death in the remaining malaria's areas of the country by 2020 (FMOH, 2017; USAID, 2017; Bugssa et al., 2020; MOH-Ethiopia., 2021).

Between 2005 and 2023, over 100 million LLINs were distributed in mass campaigns by FMOH nationwide (Deressa et al., 2011; FMOH, 2011; Negash et al., 2012; EPHI, 2016; FMOH, 2017; USAID, 2017; MOH-Ethiopia., 2021). However, despite high LLIN ownership, there is still a gap between the coverage and proper utilization ITNs which is one of the most promising malaria preventive measure in the country is also limited due to lack of sustainable distribution and issues related to replacement of nets, and poor knowledge of the community with regard to the link between mosquitoes and malaria. In Ethiopia, MIS showed the gaps in the scale-up of LLIN interventions, clearly indicating needs for better targeting and a comprehensive SBCC approach to maximize use of LLINs. Oromia region had the lowest achievement in ITN ownership (45.6% in 2007 and 44.3% in 2011) compared to other regions (Deressa et al., 2011; FMOH, 2011; Negash et al., 2012; EPHI, 2016; FMOH, 2017; USAID, 2017; MOH-Ethiopia., 2021). Moreover, a wide gap exists between coverage and use of LLINs. Beside, lack of knowledge among priority groups sleep under LLIN and inappropriate usage hamper effective utilization of LLINs in Ethiopia (Astatkie et al., 2009; Deressa et al., 2011; Tomass et al., 2011; Zewdneh Tomass et al., 2011; Alemu et al., 2012; Biadgilign et al., 2012; Gobena et al., 2012; Berie et al., 2013; Araya et al., 2015; Mariam et al., 2016). Furthermore, malaria remains a leading cause of morbidity and mortality among children under five in Fedis district, where Data on the utilization of insecticide treated bed net (ITNs) is critically low. Despite the proven effectiveness of ITN in preventing

malaria there is lack of evidence-based information on the level of utilization of LLIN among underfive children in Fedis District in rural eastern Ethiopia. Therefore, this study will assess utilization of LLIN and associated factors among under-five children in Fedis district in eastern Ethiopia.

1.3. Significances of the Study

The findings of the study could help for interventions by Fedis District Health Office and the health facilities with their health workforces, as well as acting partners, non-governmental organizations and stakeholders working on prevention and control of malaria in the District. In addition, the findings could use as the baseline information for the future researchers, program planners, acting implementers, policy-makers and program evaluators intervening on the above-mentioned gaps. Besides, the study results could add evidences to the existing scientific literatures on utilization and factors associated with insecticides treated bednets. Moreover, the findings could also help as the background information for future at local, regional and national levels focused on utilization of insecticides treated bednets and associated factors among under-five children in Fedis district in eastern Ethiopia and similar settings.

1.4. Objectives of the Study

1.4.1. General objective

To assess utilization of insecticide treated bed net and associated factors among under-five children in Fedis District in Eastern Ethiopia, from January 1-31, 2025.

1.4.2. Specific objectives

√ To assess the utilization of insecticides treated bed net among under-five children in Fedis district of East Hararghe Zone, Eastern Ethiopia

√ To identify factors associated with utilization of insecticides treated bed net among

under-five in Fedis District of East Hararghe Zone, Eastern Ethiopia

2. LITERATURE REVIEW

2.1. Utilization of Insecticides Treated Bednet

Nationally representative malaria indicator survey done in Ethiopia among 5,083 houses hold 65.6% own at least one ITN. In ITN owning household, 53.2% of all people had slept under on ITN the prior night from this 65.7% of pregnant women (Bennett et al., 2012; EPHI, 2016). A large scale and survey, a community based cross sectional study on use of ITNs has been shown in multiple settings across SSA to reduce clinical episodes of malaria and all-cause of child mortality (Bennett et al., 2012; Negash et al., 2012; Teklemariam et al., 2015). Study done in Sierra Leone 6 months after mass LLIN distribution campaign including 4,620 in 2010 revealed that 87.6% of households own at least one ITN of those possessing one ITN, 95.7% hanged at least one ITN the night preceding the survey (Bennett et al., 2012).

A community based cross sectional study conducted in Raya, Tigray in 2013 revealed that of 649 under five children, 445(68.6%) of them were utilizing LLINs. The proportion of pregnant women slept under LLIN in early morning survey was 71.64 % and 69% respectively (Araya et al., 2015). A cross-sectional study conducted in Kersa, Eastern Ethiopia showed that, of the total 2867 households, 65.5% (1879) had at least one LLIN, but 33.5% (630) of LLINs owned households had used at least one LLIN the night before the survey(Gobena et al., 2012).

A study done in Chewaka, Southwest Ethiopia revealed that 334 (80 %) of the households used at least one ITNs. The night before the day of the survey, 77.4 % (418) of all children under five and 75 % (54) of all women slept under LLIN(Tsegaye Berkessa et al., 2016).

A cross sectional study in Afar showed that the proportion of children under 5 years of age who slept under LLIN during the night preceding the survey was 728(82.0%) and 676 (76.1%) of households for reported and observed, respectively. Prevalence of pregnant women who slept under treated nets was 79.1% and 70.0% for reported and

observed (Negash et al., 2012). Another study in Harar showed 57.9% of participants having ≥1 ITN of whom 73.3% reported utilization and 57.9% of respondents demonstrated proper hanging (Teklemariam et al., 2015).

The study done in Ghana on ITN use among Under five showed that the proportion of child who slept under ITN the previous night was 34% (Zhou et al., 2014). Study done in Burkina Faso, self-reported compliance was 98% during dry and rainy season (Tokponnon et al., 2014).

The assessment on the proper hanging of bed nets was found to be very low. The study done in rural Burkina Faso had shown that the proportion of ITN found to be tacked correctly under mat/mattress during direct observation was 10% and 34% during the dry and rainy season surveys, respectively (Tokponnon et al., 2014).

In Ethiopia, EDHS report showed that only 10% of peoples at high risk of malaria (altitude at 1500m) own ITN, just 1% of pregnant women slept under ITN the night before the survey(EPHI, 2016). The other study conducted in Ethiopia had shown that only 6% of pregnant women and children aged under 5 years) had slept under net prior night (EPHI, 2016).

Although the distribution of ITNs is improving through time, it was seen that nearly half of bed nets were not in use. It was further seen that self-report utilization of ITNs tends to be over reported compared to direct observation. Insecticide treated nets scaling up have shown progress, but the situation of utilization among lactating women in Africa are not well known. Hence, the periodic assessment of the progress (with coverage and utilization among vulnerable groups) towards achievement of the targets was highly recommended in the National strategic plan and WHO Malaria report (WHO, 2013, 2014; Bugssa et al., 2020; WHO, 2022). A cross sectional study done in Ethiopia Gida Ayana district show that 43.1% of the pregnant women identify slept under LLIN night prior of study (Woyessa et al., 2014; Watiro et al., 2016).

2.2. Factors Associated with Utilization of Insecticides Treated Bednet

2.2.1. Sociodemographic factors

A research done in Cameron showed that ITN use prevalence was 69.7%. A total of 83.4%, 13.8% and 3.4% used ITNs throughout the year and the use of ITN associated with being from an urban area (P = 0.01) (Mboera et al., 2013). A cross sectional survey in Kenya revealed that important factors affecting the use of ITNs include: a household education level of at least primary school level, significantly high numbers of nuisance mosquitoes, and low indoor temperatures (Atieli et al., 2011; Zhou et al., 2014).

A cross-sectional study conducted in Ethiopia that presence of at least one women in family was not significantly associated (Deressa et al., 2011; Mariam et al., 2016). According to the study in Harari Region those farmer were more likely to utilize ITNs than other occupation (AOR: 2.262(1.002, 5.108) (Teklemariam et al., 2015). Another cross-setional study done Itang, Gambella showed that family size and age of household head associated with using ITNs were found to be barriers to the use of ITNs(Watiro et al., 2016). A cross-setional study conducted in different parts of Ethiopia showed that Households heads engaged as a farmer (AOR=0.137; 95% CI: 0.04–0.50) and homemaker (AOR 0.26; 95% CI: 0.08–0.82) were less likely to use ITN than those of others (Biadgilign et al., 2012; Gobena et al., 2012; Teklemariam et al., 2015).

A study done in Bahirdar showed knowledge about malaria risks and ITNs importance (AOR= 2.3; 95% CI 1.23- 4.40), formal education (AOR= 2.39; 95% CI 1.40- 4.08) and better income associated with ITN use (AOR= 1.83; 95%CI 1.05- 3.20)(Berie et al., 2013). Another study conducted in Adama district, Oromia Region showed that those households who are literate (AOR= 2.05, 95% CI=1.53-7.09), governmental employees (AOR=2.52, 95% CI=1.1-6.53), roof corrugated iron sheet (AOR=1.90, 95% CI=1.79, 4.60) were almost two times more likely to slept under LLIN in the last night prior to interview (Mariam et al., 2016).

A study conducted in Raya district, Ethiopia showed that, number of ITN in households [AOR (95% CI)= 0.09(0.26-0.281)], household's marital status [AOR (95% CI)=0.43(0.186-0.997)] and occupation of the household head [AOR (95% CI) = 0.297 (0.113-0.781)] were the predicators for LLIN utilization (Araya et al., 2015). A study done in Southwest Ethiopia showed that factors associated with use of ITN was sex and age, number of ITNs freely supplied presence of children under five (Tsegaye Berkessa et al., 2016).

A cross sectional study done in west Nigeria in 2012 reported the association between education and knowledge of ITN shows 48.9% of mothers had poor awareness on ITN use (Oresanya et al., 2008; Okafor et al., 2020). However, in the study done between education and women who use ITN showed that there was no association (Oresanya et al., 2008; Okafor et al., 2020). A cross-setional study done in Adama, Ethiopia shows that ITN use associated being aged 18-24 years were three times higher compared to others (Mariam et al., 2016).

2.2.2. Healthcare and environmental factors

A cross sectional survey in Kenya revealed that important factors affecting the use of

ITNs is significantly associated with high numbers of nuisance mosquitoes, and low indoor temperatures (Atieli et al., 2011; Zhou et al., 2014). A study conducted in Ethiopia showed that number of ITNs in the household (AOR= 2.93, 95%CI = 2.21–3.90), number of ITNs per household (AOR = 4.23, 95% CI= 2.93–6.12) and no problem while using ITNs (AOR=1.94, 95% CI=1.03–3.63) increased the chance of ITN use (Deressa et al., 2011; Mariam et al., 2016).

Another study conducted in Adama district, Oromia Region showed that those households having roof corrugated iron sheet (AOR=1.90, 95% CI=1.79, 4.60) were almost two times more likely to slept under LLIN in the last night prior to interview (Mariam et al., 2016). A cross sectional study done in Southwest Ethiopia showed that ITN use associated with number of ITNs freely supplied presence of children in family (Tsegaye Berkessa et al., 2016).

2.2.3. Knowledge, Attitude and Perception related factors

A study conducted in Ethiopia showed that knowledge about ITNs (AOR=1.52, 95% CI = 1.02– 2.27) was increased the chance of ITN use (Deressa et al., 2011; Mariam et al., 2016). According to the study in Harari Region the household who have knowledge about ITNs use were less likely to utilize ITNs (AOR: 0.373(0.151, 0.918)(Teklemariam et al., 2015). Another study done Itang, Gambella showed that HH awareness of malaria prevention was associated with ITN utilization (Watiro et al., 2016). A study conducted in Gursum district, eastern Ethiopia showed that households who had knowledge about ITN in the last 6 months were three times more likely to have use ITNs (AOR 3.25; 95% CI 1.5–7.10) (Biadgilign et al., 2012; Gobena et al., 2012; Teklemariam et al., 2015). A study done in Bahirdar showed knowledge about malaria risks and ITNs importance (AOR= 2.3; 95% CI 1.23- 4.40) (Berie et al., 2013). A study done in Southwest Ethiopia showed that factors associated with use of ITN was associated with knowledge of malaria transmission (AOR = 3.44, 95 % CI: 1.80, 6.59) (Tsegaye Berkessa et al., 2016).

A cross sectional study done in west Nigeria in 2012 reported the association between education and knowledge of ITN shows 48.9% of mothers had poor awareness on ITN use (Oresanya et al., 2008; Okafor et al., 2020). However, in the study done between education and women who use ITN showed that there was no association (Oresanya et al., 2008; Okafor et al., 2020).

A cross-sectional study done in Africa showed that ITNs utilization by pregnant women are very low and have identified various social, behavioral and economic barriers to ITNs use. These include a lack of information about the benefit of ITNs, poor access to market for ITNs, cultural preferences and low income (Negash et al., 2012; Teklemariam et al., 2015).

The study done in Uganda on knowledge, attitude and practice related to malaria and insecticide treated nets had shown that majority (71.5%) of the respondents know that children five years or under are at greater risk of malaria, but only 9.9% reported that pregnant women are also at risk. Only 24.6% of respondents cited the use of mosquito nets as best prevention method and 17% did not know how to prevent malaria at all. Although nets were viewed positively, nearly 11 halves (42.8%) nets found in the households during the survey were not in use. The common reasons for failure to use the bed net were perceived to be expensive, not hanged, no bedroom, too small, a cause of heat and lack of enough air when slept under it (Mbonye et al., 2006).

The study done in Nigeria showed socioeconomic factors influence ITN utilization. Religious practices did not affect the use of the net. Some of the factors that negatively impacted the use of bed nets include lack of space, the belief that bed nets reduce airflow, increased heat when sleeping under the bed net, breathing difficulties, skin reaction to the chemical in the nets, and the inconvenience of the net up every day (Oresanya et al., 2008; Okafor et al., 2020).

The study was done in Nigeria which is different sociocultural and belief to Ethiopia, which assessed malaria knowledge among pregnant women in Tanzania and Democratic Republic of Congo respectively, showed education had association with utilization of ITN (Hanson et al., 2008; Oresanya et al., 2008; Pettifor et al., 2008; Mboera et al., 2013; Okafor et al., 2020).

A study done in Nigeria on utilization of ITN found the rate of utilization to be 47% of women, compared to over 60% in the general population and this study show common factors that affect use of ITN are lack of awareness, cultural beliefs, low educational levels and ignorance. Study done in Nigeria on ITN utilization and associated factors among women showed that 48.9% of participants had poor awareness about ITN (Oresanya et al., 2008; Okafor et al., 2020). Another study conducted in Adama, Ethiopia shows that knowledge of ITN use as a priority tool for malaria prevention that associated with some socio-demographic factors, those aged 18-24 years were three times more knowledgeable than others (Mariam et al., 2016).

Study done on Insecticide-treated net utilization and associated factors among pregnant women and under-five children in East Belessa District, Northwest Ethiopia: using the Health Belief model ware the Perceived susceptibility was 373(51.5%) of the participants had low perceived susceptibility with the mean ± (SD) score of perceived susceptibility of 25.29 (± 3.79) ,Perceived severity was 348(51.9%) of the respondents had high perceived severity of malaria with the mean (± SD) perceived severity score of 25.78 (± 3.7459) ,Perceived benefit was 341(47.1%) of the participants had low perceived benefits of ITN with the mean (± SD) perceived benefit score of 26.69 (± 3.4215),Perceived barrier was 398 (55%) of the respondents had low level of perception of the barrier of ITN with the mean (± SD) perceived barrier score of 11.5 (± 5.2942) ,Self-efficacy was 398(45%) of the participants had high confidence of ITN utilization with the mean (± SD) self-efficacy score of 24.99 (± 3.7781). (Yirsaw et al., 2021).

2.3. Conceptual Framework

This conceptual framework shows multiple factors determine utilization of LLITN.

Figure 1: Conceptual framework for utilization of insecticide treated bednet and associated factors among children in Fedis District, Eastern Ethiopia (adapted from different literatures)

3. MATERIALS AND METHODS

3.1. Study Area and Period

This study was conducted in Fedis District of East Hararghe Zone in eastern Ethiopia. Fedis district is found in East Hararghe Zone of Oromia Region in rural eastern Ethiopia. The district is located at 549 KM East of Addis Ababa, Capital of Ethiopia. The district is bordered in West, North, East and South direction by Girawa, Harari Region, Babile and Midega Tola districts, respectively. Administratively, the district has a total of 21 kebeles (2 urban and 19 rural) and all of the kebeles are malaria endemic areas and ITNs were distributed to all kebeles. Based on the 2007 national population census projection, the district has estimated total populations of 113108 (55858 Females and 57250 Males) with 23565 households and 18585 under-five children. In 2023, the district has a total of government 5 health centers, 21 health posts and 26 private health facilities with a total of 1804 health workers offering the routine primary health services for the general public (FDHO, 2023).This study will be conducted from January 1-31, 2025.

3.2. Study Design

A community-based cross-sectional study design was employed.

3.3. Population

3.3.1. Source population

All households of children under five years in 21 kebeles of Fedis District in Ethiopia

3.3.2. Study population

House hold with Children under five years in randomly selected kebeles of the Fedis District in Ethiopia

3.4. Inclusion and Exclusion Criteria

3.4.1. Inclusion criteria

All House hold of under five children who lived at least 6 months in the Fedis district.

3.4.2. Exclusion criteria

Critically sick participants who unable to respond or unavailable at their home after three repeated visits during an interview.

3.5. Sample Size Determination

The sample size for this study was determined using a single population proportion

formula for first specific objective which assess the ITN utilization and two population's proportion formula used to calculate EPI-Info version 7.2 for second specific objective which assess the factors associated with ITN utilization. The larger sample size will be considered as a minimum required sample size for this study. Accordingly, as there was no clear previous study conducted on ITN utilization in the study area and we assumed it to be 50% to have the largest sample size for the prevalence of ITN use and then, computed the sample size with the following assumptions: 95% confidence level, significance level of 5%, margin of error 0.05, design effect of 1.5, 10% non-response.

A single population proportion formula:

$n_o = (Z_{1-\alpha/2})^2 * P*(1-P)/d^2$

Where: n_o = Minimum sample size

Where: $Z_{1-\alpha/2}$,95%.CI =1.96

P= Proportion ITN utilization (P=50%)

d^2 =the marginal error 5%;

Thus, $n_o = (Z_{1-\alpha/2})^2 * P*(1-P)/$, $n_o = (1.96)^2 *(0.50)(1-0.50)/(0.05)^2$ =569 by adding 10% non-response rate (57), the final sample size will be=626 study subjects for first specific objective.

Sample size for second specific objective was computed by Epi-Info version 7.2 using two population proportions formula considering few proximate factors associated with utilization of LLIN with the following assumptions: 95% confidence level, 80% power of the study, significance level of 5%, equal 1:1 ratio unexposed to exposed and 10% non-response (Table1).

Table 1: Sample size estimation for factors associated with utilization of insecticide treated bednet among under-five children in Fedis District, Eastern Ethiopia

Associated Factors	Proportion of outcome among unexposed (P2)	AOR (95% CI)	Sample size with 10% non-response rate	References
Wealth Index (Rich)	43.5	1.70(1.22, 2.14)	528	Gathitu, 2014
Access to media (yes)	63.6	2.30(1.06, 1.54)	282	
Higher education (yes)	80.9	2.10(1.15, 3.45)	579	Seidu, 2017

Numbers of ITNs (≥4)	50.3	2.22(1.21, 4.09)	253	Seidu, 2017

Finally, after comparing computed sample sizes for each specific objective and the largest sample size is considered and used as a minimum required sample size of the study. Therefore, 626 will be used and considered as a minimum required sample size for this study.

3.6. Sampling Procedures and Sampling Technique

Two-stage stratified sampling technique was used to select the study participants. First, the district will be stratified to urban and rural kebeles and then, 30% of rural kebeles (six kebeles) and 30% of urban kebeles (one kebele) was randomly selected using lottery method. Then, the study population was allocated proportionally to each selected kebele based on their total number of households of children under five years old (list of recorded Households of under five children from Health post data). Finally, a separate sampling frame was prepared for each kebele by (list of Households with under five children divided by sample of each kebele) kth for Urban=2 and for rural=1and eligible household will be recruited using a systematic random sampling technique. (Figure 2)

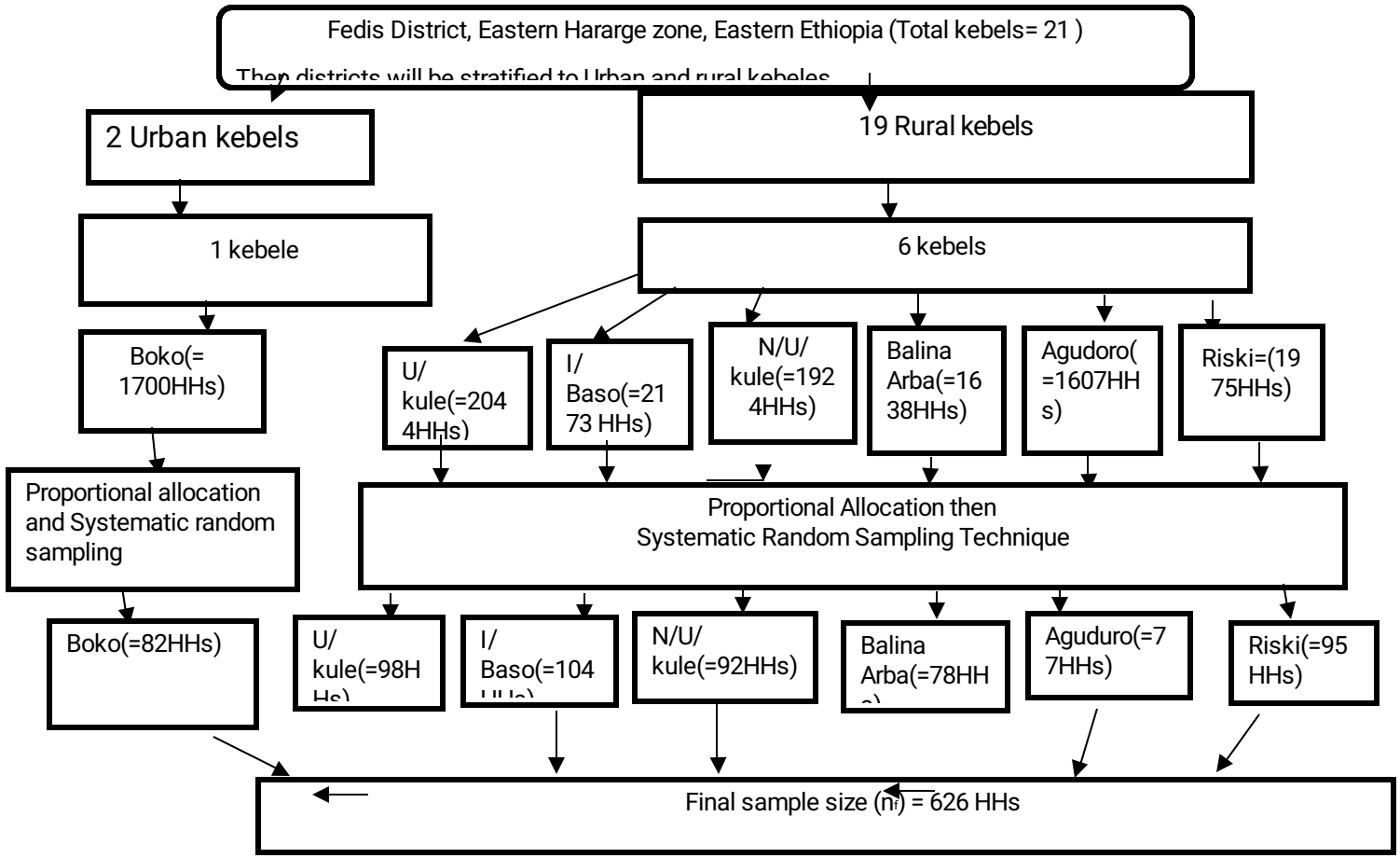

Figure 2: Sampling scheme of sampling procedure for utilization insecticides treated bed net and associated factors Among under-five children in Fedis district, Eastern Ethiopia

3.7. Data Collection Method

3.7.1. Data collection instruments

Data were collected using pretested structured questionnaire adapted from different literatures (Mbonye et al., 2006; Hanson et al., 2008; Oresanya et al., 2008; Pettifor et al., 2008; Tomass et al., 2011; Zewdneh Tomass et al., 2011; Gobena et al., 2012; Negash et al., 2012; Mboera et al., 2013; Kimbi et al., 2014; Tokponnon et al., 2014; Woyessa et al., 2014; Zhou et al., 2014; Teklemariam et al., 2015; Mariam et al., 2016; Tsegaye Berkessa et al., 2016; Watiro et al., 2016; Okafor et al., 2020;Yirsaw et al.,2021) with slight modification to meet the study objective . The questionnaire was prepared in English and translated to Afan Oromo and back translated to English again to ensure its consistency. The instrument contains socio-demographic related factors, environmental and healthcare related factors, knowledge, attitude and perceptions towards malaria and LLIN, and utilization of LLIN.

3.7.2. Data collectors and supervisors

Six BSc degree nurses were selected and trained (by principal investigator) for two days on how to collect the data and two epidemiologists was recruited and trained for two days to supervise the overall data collection.

3.7.3. Data collection procedure

Data collectors administered questionnaires-based, face-to-face interview from mothers/ caregivers through house-to-house survey using pretested structured questionnaire that translated into local language (Afaan Oromo). On daily bases, the principal investigator made field supervision and required rectifications were provided during the process. The objective of the survey was explained at the beginning of both questionnaires, and the detailed contact address of the investigator was disclosed in case of any queries from the study participants.

3.8. Study Variables

3.8.1. Dependent variable

Utilization of LLIN (Yes/No)

3.8.2. Independent variables

Socio-demographic related factors: Residence area, respondents' age, sex (of child), religion, ethnicity, current marital status, highest education level, main occupation, family size, number of under-five children and wealth index.

Knowledge, Attitude and Perception/behavior related factors: Knowledge about malaria

and ITN, attitude toward ITN, perceived self-efficacy to ITN use, perceived benefit of using ITN, perceived barrier of using ITN, perceived severity of malaria, perceived susceptibility to malaria and not use ITN, social support to use ITN, number of ITN owned and condition of ITN.

Environment and healthcare factors: House condition, availability of HEWs and visit by HEWs.

3.9. Operational Definitions

LLITN utilization: Participant who responded" yes" when their children slept under an ITN in the previous night of the data collection day/interview.

LLITN condition: Participant who had ITN with no hole was considered good" those had ITN with one hole that fits torch battery size as" fair" those had ITN with 1-4 that fits torch a battery size as "poor" and unsafe if it has five or more holes that fit a torch battery size (Tomass et al., 2011; Woyessa et al., 2014; Teklemariam et al., 2015; Mariam et al., 2016; Watiro et al., 2016).

Knowledge about malaria: Participant who scored the mean and above from composite index score computed from five knowledge questions to be dichotomized as '1' (when answered correctly) and '0' (when answered a wrongly) (asking cause, mode of transmission, sign and symptoms and prevention of malaria) was considered to has a good knowledge about malaria and poor unless otherwise (Tomass et al., 2011; Woyessa et al., 2014; Teklemariam et al., 2015; Mariam et al., 2016; Watiro et al., 2016).

Knowledge about ITN: Participant who scored the mean and above from composite index score computed from five knowledge questions to be dichotomized as '1' (when answered a correct response) and '0' (when answered a wrong response) was considered to has good knowledge about using ITN and poor otherwise (Tomass et al., 2011; Woyessa et al., 2014; Teklemariam et al., 2015; Mariam et al., 2016; Watiro et al., 2016).

Attitude toward ITN: Participant who scored the mean and above from a composite index score computed from four three-point Likert scale attitude questions toward malaria/ using ITN will be considered to has a positive attitude and negative attitude otherwise (Tomass et al., 2011; Woyessa et al., 2014; Teklemariam et al., 2015; Mariam et al., 2016; Watiro et al., 2016).

Perceived susceptibility of malaria: Participant who scored the mean and above from a composite index score computed from four three-point Likert scale perceived susceptibility questions on malaria (ranging from disagree to agree) was considered to has a high perceived susceptibility and low perceived susceptibility otherwise (Tomass et

al., 2011; Woyessa et al., 2014; Teklemariam et al., 2015; Mariam et al., 2016; Watiro et al., 2016).

Perceived severity of malaria: Mothers who scored the mean and above from a composite index score computed from six three-point Likert scale perceived severity questions on malaria (ranging from disagree to agree), was considered to has a high perceived severity and low perceived severity otherwise (Teklemariam et al., 2015; Mariam et al., 2016; Watiro et al., 2016).

Perceived benefit of using ITN: Participant who scored the mean and above from a composite index score computed from seven three-point Likert scale perceived benefit questions on using ITN (ranging from disagree to agree), was considered to has a high perceived benefit and low perceived benefit unless otherwise (Teklemariam et al., 2015; Mariam et al., 2016; Watiro et al., 2016).

Perceived barriers to use ITN: Participant who scored the mean and above from a composite index score computed from 10 three-point Likert scale perceived barriers questions to use ITN (ranging from disagree to agree) was considered to has a high perceived barriers and low perceived barriers otherwise (Teklemariam et al., 2015; Mariam et al., 2016; Watiro et al., 2016;Yirsaw et al.,2021).

Perceived self-efficacy to use ITN: Participant who scored the mean and above from a composite index score computed from four three-point Likert scale perceived self-efficacy questions on ITN use (ranging from disagree to agree) was considered to has a high perceived self-efficacy and low perceived self-efficacy unless otherwise (Tomass et al., 2011; Woyessa et al., 2014; Teklemariam et al., 2015; Mariam et al., 2016; Watiro et al., 2016;Yirsaw et al.,2021).

Social support to use ITN: Participant who scored the mean and above from a composite index score done from 08 dichotomous questions to use ITN, considered to has a high social support and low social support otherwise (Teklemariam et al., 2015; Mariam et al., 2016; Watiro et al., 2016).

3.10. Data Quality Control

The questionnaire was initially prepared in English language and then, translated to local language Afan Oromo and back to English by two translators to check its consistency. Questionnaire was pretested on 5% of the sample size in a separate kebele (non-selected kebele) of the district two weeks before the actual data collection started and amendment was made. Internal consistencies reliability analysis of items was checked using Cronbach's alpha (minimum requirement of alpha≥0.7) for each composite index

scores before any data analysis. Training was given for two days for data collectors and supervisors by principal investigator on how to administer the questionnaire explain objective of the study and ethical issues. The filled questioners were checked for completeness on data collection site and cross-checked by the principal investigator.

3.11. Data Processing and Analysis

First, the completeness of the data was checked. Data were entered into EpiData version 3.1 and analyzed using StataMP 17. Data were recoded and composite index scores were computed after verifying internal consistency of items used in composite index score by reliability analysis using Cronbach alpha. Descriptive statistics (frequency and percentage, mean, media, range and IQR) were computed to describe the participants. Wealth index score was computed using Principal Component Analysis (PCA) using a varimax rotation method and perception construct was computed using PCA/factor analyses using a varimax rotation technique. Multicollinearity tests was checked using Variance Inflation Factor (VIF) for all independent variables before assessing the statistical associations between covariates and outcome variable. Bivariate and multivariate logistic regression analyses were used to identify factors associated with utilization of LLIN among mothers/caregivers of under five children. Independent variables with P-value<0.25 in the bivariable analysis was considered for multivariable analyses model. Multivariable logistic regression analysis was conducted to control confounders and identify factors significantly associated with utilization of LLIN among mothers with under five children. Adjusted odds Ratio (AOR) with 95% CI was used to report the association and significance will be declared at P-value<0.05. The model fitness was tested by or Hosmer and Lemeshow goodness of fit test at P-value> 0.05.

3.12. Ethical Consideration

The study was carried out after obtaining ethical clearance and approval will be obtained from Institutional Health Research Ethical Review Committee (IHRERC) of the Haramaya University. Official letter was written to Fedis District Health Office to obtain an official permission. Informed, Voluntary, written and Signed Consent obtained from the study participants and confirmed by signature after explain the purpose of the study. Confidentiality and privacy were kept during data collection. The study participant's personal identifier information was not be written on the questionnaire during data collection.

3.13. Information Dissemination

The results of the study will be disseminated to governmental/non-governmental

organizations to provide information on utilization of LLIN and associated factors among mothers/caregivers with under-five children in Fedis district in eastern Ethiopia. The findings of the study will be submitted to Haramaya University and the copies of the report will be given to East Hararghe Zone and Fedis District Health Offices with their public health facilities via seminar/workshop. Last but not the least, efforts will made to present the findings on national and international scientific conferences and manuscript will submitted to peer-reviewed journal for peer-reviewed publication

4. RESULTS

4.1. Characteristics of Participants

4.1.1. Socio-demographic characteristics

A total of 624 out of 626 respondents-child pairs were participated in the study, yielding response rate of 99.7%. The majority, 535(85.7%) of the participants were rural residents. Two-third, 414(66.3 %) of the participants were in the age group of 25-34 years old and the mean (±SD) age of respondents of the children was 30.64±5.58 years. Almost all (94.6%) participants were currently married and more than one-third (40.4%) of the infants' mothers/caregiver had no formal education and exactly one-third of the participants were poor (33.0%) (Table 2).

Table 2: Sociodemographic characteristics of participants in Fedis District of East Hararghe Zone, Eastern Ethiopia, 2025

Characteristics (n=624)	Options	Frequency	Percent
Residence area	Urban	89	14.3
	Rural	535	85.7
Age of respondents (in years)	15-24	56	9.0
	25-34	414	66.3
	≥34	154	24.7
Sex of child	Female	380	60.9
	Male	244	39.1
Marital status	Married	590	94.6
	Divorced	23	3.7
	Widowed/separated	11	1.8
Educational level	Not read and/or write	252	40.4
	Read and write only	145	23.2
	Primary education	148	23.7
	Secondary education	54	8.7
	Higher education	25	4.0
Occupation	Government employee	41	6.6
	Farmer	455	72.9
	Merchant	62	9.9

	Housewife	65	10.4
	Student	1	0.2
Religion	Muslim	578	92.6
	Orthodox	30	4.8
	Protestant	12	1.9
	Catholic	4	0.6
Ethnicity	Oromo	568	91.0
	Amhara	43	6.9
	Gurage	13	2.1
Family size	>5	414	66.3
	≤5	210	33.7
Under-five children	≥2	281	39.1
	<2	343	60.9
Wealth index	Poor	206	33.0
	Medium	207	33.2
	Rich	211	33.8

4.1.2. Environmental and healthcare factors

The majority 465(74.5%) of participants had pest infestation in their home and all 624 (100%) of the participants had HEWs in their residing kebele, have received advice on ITN from health workers and had health center/hospital within 10-kilometer radius of their living house. The majorities, 613(98.2%) and 614(98.4%) of the participants had knowledge about malaria and LLIN bed net, respectively (Table 3).

Table 3: Environmental and healthcare characteristics of participants in Fedis District of East Hararghe Zone, Eastern Ethiopia, 2025

Characteristics (n=624)	Options	Frequency	Percent
Housing condition	Pest infection	465	74.5
	Leakage	26	4.2
	Structural break	133	21.3
HEW is available in your kebele	Yes	624	100.0
	No	0	0.0
Have you received advice from HEW	Yes	624	100.0
	No	0	0.0
Availability of health facility/HC/ hospital within 10 km radius	Yes	624	100.0
	No	0	0.0
Knowledge status about malaria	Good	613	98.2
	Poor	11	1.8
Knowledge status about LLIN bednet	Good	614	98.4
	Poor	10	1.6
Hanging of LLIN on the bed	Yes	204	32.7
	No	420	67.3
Number of LLIN bednet in the family	≥2	403	64.6
	<2	221	35.4
Number of holes on the LLIN bednet	0	547	87.7
	≥1	77	12.3

Maternal utilization of LLIN	Yes	205	32.9
	No	419	67.1

4.1.3. Attitude and perception of participants

The majority 456(73.1%) of participants had positive/good attitude toward LLIN bed net and nearly half 302(48.4%) and nearly two-third, 410(65.7%) of the participants had good perceived susceptibility and good perceived severity toward LLIN bed net if not used, respectively. Nearly two-third (66.5%) and more than half (53.0%) of the participants had good perceived benefit and good perceived social support toward LLIN bed net utilization (Table 4).

Table 4: Attitude and perception of participants in Fedis District of East Hararghe Zone, Eastern Ethiopia, 2025

Characteristics (n=624)	Options	Frequency	Percent
Attitude toward LLIN bed net	Good/Positive	456	73.1
	Poor/Negative	168	26.9
Perceived susceptibility	Good	302	48.4
	Poor	322	51.6
Perceived severity	Good	410	65.7
	Poor	214	34.3
Perceived benefit	Good	415	66.5
	Poor	209	33.5
Perceived barrier	Low	225	36.1
	High	399	63.9
Perceived self-efficacy	Good	424	67.9
	Poor	200	32.1
Perceived social support	Good	331	53.0
	Poor	293	47.0

4.2. Utilization of LLIN Among Children

Utilization of LLIN among under-five children was 206(33.0%) (95% CI: 29.2%, 36. 9%) in the study area (Figure 3).

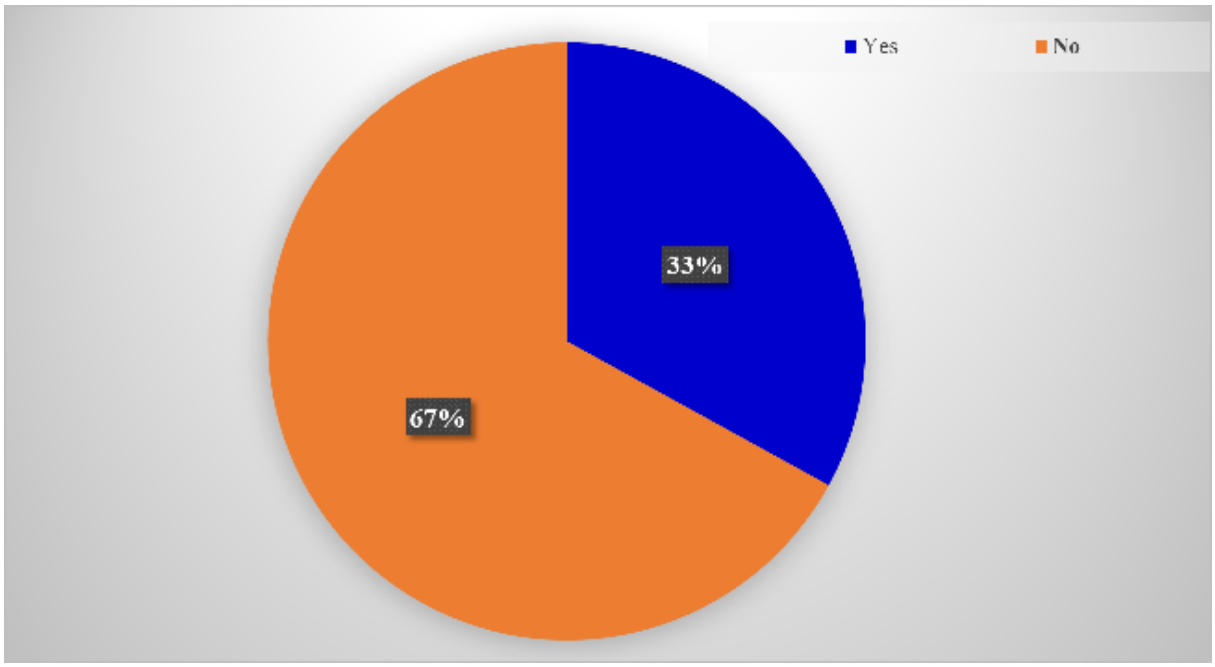

Figure 3: Utilization of LLIN among under-five children in Fedis District, Eastern Ethiopia, 2025 (n=624)

4.4. Factors Associated with LLIN Utilization

In the bivariable analysis, maternal age, religion and occupation, sex of children, wealth index, number of LLIN, number of hole on LLIN, attitude, perceived severity, perceived benefit, perceived barrier and perceived social support were associated with utilization of LLIN among under-five children at P-value ≤0.001 and maternal perceived susceptibility and perceived self-efficacy were associated with utilization of LLIN among under-five children at P-value≤0.01 while respondents current marital status was associated with utilization of LLIN among under-five children at P-value<0.05 (Table 5).

Table 5: Bivariable logistic regression analysis of factors influencing LLIN utilization among under-five children in Fedis District, Eastern Ethiopia, 2025

Variables (n=624)	Options	Utilization of LLIN		COR (95% CI)
		Yes (%)	No (%)	
Residence area	Urban	32(36.0)	57(64.0)	1.17(0.73, 1.86)
	Rural	174(32.5)	361(67.5)	1
Age of respondents (in years)	18-24	13(23.2)	43(76.8)	1
	25-34	104(25.1)	310(74.9)	1.52(0.68, 3.43)
	≥34	89(57.8)	65(42.8)	4.53(2.25, 9.10)***
Sex of child	Male	103(42.2)	141(57.8)	1.97(1.40,2.76)***
	Female	103(27.1)	277(72.9)	1
Religion	Muslim	198(34.6)	374(65.4)	2.91(1.33,6.31)***
	Christian	8(15.4)	44(84.6)	1
Current marital status	Married	201(34.1)	389(65.9)	3.00(1.14,7.86)*
	Unmarried	5(14.7)	29(85.3)	1
Participants education	No formal education	121(30.5)	276(69.5)	1
	Formal education	85(37.4)	142(62.6)	1.98(1.15, 3.41)*
Participants occupation	Farmer	173(38.0)	282(62.0)	15.34(5.55,42.41)***
	Housewife	29(44.6)	36(55.4)	20.14(6.62,61.27)***
	Other	4(3.8)	100(96.2)	1
Family size	<5	78(37.1)	132(62.9)	1.32(0.93, 1.87)
	≥5	128(30.9)	286(69.1)	1
Under-five children	<2	122(35.6)	221(64.4)	1.30(0.92, 1.82)
	≥2	84(29.9)	197(70.1)	1
Wealth Index	Poor	39(18.9)	167(81.1)	1
	Medium	81(39.1)	126(60.9)	2.75(1.76,4.30)***
	Rich	86(40.8)	125(59.2)	2.95(1.89,4.59)***
Knowledge on	Good	204(33.3)	409(66.7	2.24(0.48,10.48)

malaria			)	
	Poor	2(18.2)	9(81.8)	1
Knowledge about ITN	Good	202(33.1)	411(66.9)	1.15(0.30, 4.50)
	Poor	3(30.0)	7(70.0)	1
Number of LLIN	≥2	170(42.2)	233(57.8)	3.75(2.49, 5.64)***
	<2	36(16.3)	185(83.7)	1
Number of LLIN hole	0	194(35.5)	353(64.5)	2.98(1.57, 5.65)***
	≥1	12(15.6)	65(84.4)	1
Attitude	Good/+ve	187(41.0)	269(59.0)	5.45(3.27, 9.10)***
	Poor/-ve	19(11.3)	49(88.7)	1
Perceived susceptibility	Good	118(39.1)	184(60.9)	1.71(1.22, 2.39)**
	Poor	88(27.3)	234(72.7)	1
Perceived severity	Good	179(43.7)	231(56.3)	5.37(3.43, 8.40)***
	Poor	27(12.6)	187(87.4)	1
Perceived benefit	Good	188(45.3)	227(54.7)	8.79(5.22, 14.79)***
	Poor	18(8.6)	191(91.4)	1
Perceived barrier	Low	106(47.1)	119(52.9)	2.63(1.88, 3.77)***
	High	100(25.1)	299(74.9)	1
Perceived self-efficacy	Good	154(36.3)	270(63.7)	1.62(1.12, 2.36)**
	Poor	52(26.0)	148(74.0)	1
Perceived social support	Good	162(55.3)	131(47.7)	8.07(5.45, 11.94)***
	Poor	44(13.3)	287(86.7)	1

Note: COR=Crude Odds Ratio; LLIN= Long Lasting Insecticide Treated Net, * p < 0.05, ** p < 0.01, *** p < 0.001;

In multivariable analysis, the odds of utilization of LLITN was three times [AOR=2.92(1.07, 7.99))] higher among under-five children whose respondents aged at least 34 years old compared to those children whose respondents was in the age group of 18-24 years old. The odds of utilization of LLITN was 3.53 times [AOR=3.52(1.02,

12.22)] higher among under-five children whose respondents were currently married compared to whose respondents were currently unmarried. The odds of utilization of LLIN was two times [AOR=1.98(1.15, 3.41)] higher among under-five children whose respondents had formal education compared to those whose respondents had no formal education.

Being farmer and housewife by occupation associated with higher odds of utilization of LLIN, [AOR=25.86(7.23, 92.50)] and [AOR=24.31 (5.85, 101.02)], among children aged under-five and statistically significant. The odds of utilization of LLIN was three times [AOR=2.86(1.45, 5.66))] higher among under-five children of rich family/household compared those from poor family/household. The odds of utilization of LLIN was 4.56 times [AOR=4.56(2.46, 8.45)] and 4.336 times [AOR=4.34(1.79, 10.51)] higher among under-five children whose family/household had at least two LLIN and who had intact LLIN (their bed net had no any hole) compared to their counterparts. Good perceived benefit [AOR=3.04 (1.50, 6.15)], low perceived barrier [AOR=2.87(1.70, 4.83)] and good perceived social support [AOR=10.46(5.701,19.18)] associated with higher odds of LLIN utilization among children aged under-five and statistically significant (Table 6).

Table 6: Predictor variables influencing LLIN utilization among under-five children in Fedis District, Eastern Ethiopia, 2025

Variables (n=624)	Options	Utilization of LLIN		AOR (95% CI)
		Yes (%)	No (%)	
Age of respondents	18-24	13(23.2)	43(76.8)	1
	25-34	104(25.1)	310(74.9)	1.19(0.46, 3.08)
	≥34	89(57.8)	65(42.2)	2.92(1.07, 7.99)*
Current marital status	Married	201(34.1)	389(65.9)	3.52(1.02, 12.22)*
	Unmarried	5(14.7)	29(85.3)	1
Maternal education	Formal education	85(37.4)	142(62.6)	1.98(1.145, 3.41)*
	No formal education	121(30.5)	276(69.5)	1
Maternal occupation	Farmer	173(38.0)	282(62.0)	25.86(7.23, 92.50)***
	Housewife	29(44.6)	36(55.4)	24.31(5.85,101.02)***
	Other	4(3.8)	100(96.2)	1
Wealth Index	Poor	39(18.9)	167(81.1)	1
	Medium	81(39.1)	126(60.9)	1.18(0.64, 2.16)
	Rich	86(40.8)	125(59.2)	2.86(1.45, 5.66)**
Number of LLIN	≥2	170(42.2)	233(57.8)	4.56(2.46, 8.45)***
	<2	36(16.3)	185(83.7)	1
Number of LLIN hole	0	194(35.5)	353(64.5)	4.34(1.79, 10.51)***
	≥1	12(15.6)	65(84.4)	1
Perceived benefit	Good	188(45.3)	227(54.7)	3.04(1.50, 6.15)***

	Poor	18(8.6)	191(91.4)	1
Perceived barrier	Low	106(47.1)	119(52.9)	2.87(1.70, 4.83)***
	High	100(25.1)	299(74.9)	1
Perceived social support	Good	162(55.3)	131(44.7)	10.46(5.70,19.18)***
	Poor	44(13.3)	287(86.7)	1

Note: AOR=Adjusted Odds Ratio; LLIN= Long Lasting Insecticide Treated Net, * p < 0.05, ** p < 0.01, *** p < 0.001;

5. DISCUSSION

This study aimed to determine the household ITN utilization for under-5 children the previous night in Fedis District, East Hararghe Zone, Eastern Ethiopia. Utilization of LLIN among under-five children in Fedis District was 33%, which is comparable to findings from Ghana (34%) (Zhou et al., 2014) and Kersa, Eastern Ethiopia (33.5%) (Gobena et al., 2012). However, it is lower than reports from Senegal (58.7%) (Bennett et al., 2012), Raya, Tigray (68.6%) (Araya et al., 2015), Chewaka, Southwest Ethiopia, where 77.4% of children under five and 75% of women slept under LLINs (Tsegaye Berkessa et al., 2016), and Afar, with 82.0% reported and 76.1% observed utilization (Negash et al., 2012). These differences may be due to variations in study settings, socio-economic status, access to LLINs, health education coverage, seasonal differences in malaria transmission, or differences in the availability and distribution of nets.

In the current study, being a farmer was strongly associated with higher LLIN utilization. This is consistent with findings from Harari National Regional State, Ethiopia, where farmers were more than twice as likely to use ITNs [AOR = 2.26; 95% CI: 1.002–5.108] (Teklemariam et al., 2015). However, it contrasts with results from Gursum District, Eastern Ethiopia, where farmers were less likely to use ITNs [AOR = 0.137; 95% CI: 0.04–0.50] (Biadgilign et al., 2012; Gobena et al., 2012; Teklemariam et al., 2015). The study also found that being a housewife was positively associated with ITN utilization, which differs from findings in Kersa, Eastern Ethiopia, where housewives were less likely to use ITNs [AOR = 0.26; 95% CI: 0.08–0.82] (Biadgilign et al., 2012; Gobena et al., 2012; Teklemariam et al., 2015). These discrepancies may be explained by differences in malaria endemicity, ITN distribution and access, household decision-making roles, and the extent of health education interventions across regions.

The present study further revealed that increasing age was positively associated with LLIN utilization. This finding is consistent with evidence from Itang, Gambella, where older individuals (≥50 years) were significantly more likely to use ITNs [AOR = 4.14; 95% CI: 1.52–11.27] (Watiro et al., 2016). A possible explanation is that older individuals may have greater awareness of malaria risks, acquired through personal and family experiences, and therefore are more likely to prioritize preventive practices such as regular ITN use

In this study, the odds of LLIN utilization were nearly twice as high among participants with under-five children who had attended formal education. This finding is consistent with studies conducted in Bahir Dar, Ethiopia (Berie et al., 2013), and in Adama District,

Oromia Region (Mariam et al., 2016). The study also revealed that mothers from wealthier households were about three times more likely to utilize LLINs, which agrees with findings from Bahir Dar, Ethiopia (Berie et al., 2013). In addition, the odds of LLIN utilization were more than four times higher among respondents from households that owned at least two LLINs in good condition (without holes). This result is in line with evidence from Raya District, Ethiopia, where the number and condition of ITNs in a household were positively associated with utilization (Araya et al., 2015). These findings suggest that participants education, household wealth, and net availability play a critical role in promoting consistent LLIN use, as they influence awareness, affordability, and accessibility of preventive measures against malaria.

In addition, married participants with under-five children were more than three times more likely to use ITNs in the current study. However, this finding is inconsistent with results from Raya District, Ethiopia, where married women were less likely to utilize LLINs [AOR = 0.43; 95% CI: 0.186–0.997] (Araya et al., 2015). The discrepancy may be related to contextual differences in household decision-making, cultural roles, or variations in malaria risk perception across settings.

This study also showed that 98% of respondents had good knowledge about LLIN use, which is considerably higher than findings from Western Nigeria, where only 51% of mothers demonstrated good knowledge on ITN utilization (Oresanya et al., 2008; Okafor et al., 2020). The higher awareness observed in the current study may reflect improvements in malaria education, health communication strategies, and the intensity of ITN promotion campaigns in the Ethiopian context. However, despite this high level of knowledge, the actual practice of ITN utilization remains insufficient. This gap suggests that current awareness-raising mechanisms may not be effectively translated into consistent behavioral change, highlighting the need for more practical, action-oriented education approaches, strengthened community engagement, and closer supervision to improve utilization rates.

In this study, respondents who perceived high benefits of LLINs were more likely to utilize them compared to their counterparts. Similarly, those who perceived fewer barriers to net use and those who received strong social support had significantly higher odds of LLIN utilization. This suggests that enhancing positive perceptions of LLIN benefits, reducing barriers to their use, and strengthening community and family support are critical strategies for improving consistent utilization.

Overall, LLIN utilization among under-five children in Fedis District was remained low

(33%), influenced by participants occupation, age, education, household wealth, net availability, and marital status. Despite high knowledge (98%) of LLIN use, actual utilization remained low, highlighting a gap between awareness and practice. Strengthening practical health education, improving net access, and enhancing community engagement are crucial to promote consistent use.

PRACTICAL IMPLICATION OF THE STUDY

- Targeted Health Education: Educating mothers, especially those with no formal education, on the importance and correct use of LLINs can improve utilization and malaria prevention.
- Improving LLIN Access and Distribution: Ensuring that households have enough LLINs, and that nets are in good condition without holes, is crucial to increase usage.
- Socioeconomic Interventions: Supporting low-income households through subsidies, incentives, or distribution campaigns can enhance LLIN ownership and use.
- Strengthening Social and Community Support: Leveraging community health workers, women's groups, and local leaders can encourage proper LLIN use and maintain adherence.
- Focus on High-Risk Groups: Interventions should target participants who are with under five children or engaged in occupations like farming, as these groups showed lower utilization rates.
- Behavior Change Communication: Addressing perceptions—highlighting benefits of LLINs and reducing perceived barriers—can positively influence consistent use.
- Monitoring and Evaluation: Regular follow-up and observation can help identify households with low LLIN use and provide timely support.
- Integrated Community Health Approach: Combining LLIN promotion with other child and maternal health interventions (immunization, nutrition programs) can maximize community health benefits.
- Policy Implications: Findings can inform local and national malaria control programs to design context-specific strategies that increase LLIN coverage and reduce malaria-related morbidity and mortality.

6. CONCLUSIONS AND RECCOMENDATIONS

6.1. Conclusion

The findings of this study showed that the utilization of LLINs among under-five children in Fedis District remains low, highlighting critical gaps in malaria prevention. Maternal sociodemographic factors, household wealth, access to intact LLINs, perceptions of their benefits and barriers, and social support play key roles in determining use. Interventions that enhance education, ensure availability of functional LLINs, and strengthen community support are essential to increase utilization and reduce malaria-related morbidity and mortality among children.

6.2. Recommendations

In light of the study findings, the following recommendations are presented to relevant stakeholders to support coordinated interventions aimed at reducing malaria-related morbidity and mortality among children under five

To Fedis District Health Office

- √ Actively encourage and monitor under-five children to use available LLINs consistently.
- √ Promote the use of LLINs by all family members, emphasizing nightly use to reduce malaria transmission.
- √ Coordinate with health extension workers to provide ongoing education and follow-up in households with low LLIN use.

To Researchers

- √ Conduct further studies using alternative designs to identify determinants of LLIN utilization and barriers among utilizers and non-utilizers.
- √ Investigate the effectiveness of interventions targeting behavior change and improved LLIN use.

To NGOs

- √ Focus on increasing community knowledge about malaria transmission and prevention.
- √ Give special attention to low-income households and households headed by employed individuals to improve LLIN utilization.
- √ Support community-based interventions and demonstrations to encourage proper LLIN use.

To Households

- √ Ensure all family members sleep under LLINs every night, especially children under five.
- √ Maintain LLINs in good condition, avoiding holes and ensuring proper installation.

7. REFERENCES

Alemu A., Muluye D., Mihret M., Adugna M. and Gebeyaw, M. (2012). Ten year trend analysis of malaria prevalence in Kola Diba, North Gondar, Northwest Ethiopia. Parasites & vectors, 5, 1-6.

Araya GD., Reda H. L. and Tesema, A. G. (2015). Utilization of long lasting insecticidal nets among household in malarious areas of Raya Alamata District, Tigray, Ethiopia. Sci J Public Health, 3(2), 216-221.

Astatkie, A. and Feleke, A. (2009). Utilization of insecticide treated nets in Arbaminch Town and the malarious villages of Arbaminch Zuria District, Southern Ethiopia. Ethiopian Journal of Health Development, 23(3).

Atieli H. E., Zhou G., Afrane, Y., Lee, M.-C., Mwanzo I., Githeko A K., et al. (2011). Insecticide-treated net (ITN) ownership, usage, and malaria transmission in the highlands of western Kenya. Parasites & vectors, 4, 1-10.

Bennett A., Smith S J., Yambasu S., Jambai A., Alemu, W., Kabano, A., et al. (2012). Household possession and use of insecticide-treated mosquito nets in Sierra Leone 6 months after a national mass-distribution campaign. PloS one, 7(5), e37927.

Berie Y., Alemu K., Belay, A. and Gizaw, Z. (2013). Factors affecting utilization of Insecticide treated nets among people living with HIV/AIDs in Bahir Dar city, northwest Ethiopia. Science Journal of Clinical Medicine, 2(6), 147-152.

Biadgilign S., Reda A. and Kedir H. (2012). Determinants of Ownership and Utilization of Insecticide-Treated Bed Nets for Malaria Control in Eastern Ethiopia. Journal of tropical medicine, 2012(1), 235015.

Bugssa, G. and Tedla, K. (2020). Feasibility of Malaria Elimination in Ethiopia. Ethiop J Health Sci, 30(4), 607-614. doi:10.4314/ejhs.v30i4.16

Deressa W., Fentie G., Girma S. and Reithinger, R. (2011). Ownership and use of insecticide-treated nets in Oromia and Amhara Regional States of Ethiopia two years after a nationwide campaign. Tropical Medicine & International Health, 16(12), 1552-1561.

EPHI. (2016). Ethiopian Public Health Institute: Ethiopia National Malaria Indicator Survey 2015. In FMoH (Ed.). Addis Ababa: Federal Minstry of Health.

FMOH. (Federal Ministry of Health). (2011). Federal Minstry of Health-Ethiopia. NATIONAL STRATEGIC PLAN FOR MALARIA PREVENTION CONTROL AND ELIMINATION 2011-2015. In World Health Organization (Ed.). Addis Ababa: FMoH.

FMOH (Federal Ministry of Health). (2017). Federal Minstry of Health-Ethiopian National Malaria Guidelines, Fourth edition Addis Ababa: FMoH.

Gobena T., Berhane Y. and Worku, A. (2012). Low long-lasting insecticide nets (LLINs) use among household members for protection against mosquito bite in kersa, Eastern Ethiopia. BMC Public Health, 12, 1-9.

Hanson K., Nathan R., Marchant T., Mponda H., Jones C., Bruce J., et al. (2008). Vouchers for scaling up insecticide-treated nets in Tanzania: methods for monitoring and evaluation of a national health system intervention. BMC Public Health, 8, 1-10.

Kimbi HK., Nkesa SB., Ndamukong-Nyanga., Sumbele, I. U. N., Atashili J. and Atanga MBS. (2014). Socio-demographic factors influencing the ownership and utilization of insecticide-treated bed nets among malaria vulnerable groups in the Buea Health District, Cameroon. BMC Research Notes, 7, 1-8.

Mariam, A. G. and Girsha, W. D. (2016). Assessment of long-lasting insecticidal net utilization and its associated factors among households in Adama district, Oromia Region, Ethiopia. Science Journal of Public Health, 13(2), 476-481.

Mboera, L. E., Mazigo, H. D., Rumisha, S. F. and Kramer, R. A. (2013). Towards malaria elimination and its implication for vector control, disease management and livelihoods in Tanzania. MalariaWorld Journal, 4.

MbonyeAK., Neema S. and Magnussen P. (2006). Preventing malaria in pregnancy: a study of perceptions and policy implications in Mukono district, Uganda. Health policy and planning, 21(1), 17-26.

FMOH (Federal Ministry of Health). (2021). Minstry of Healh-Ethiopia National Malaria Elimination Program (NMEP). Addis Ababa: MoH.

Negash K., Haileselassie B., Tasew A., Ahmed Y. and Getachew, M. (2012). Ownership and utilization of long-lasting insecticide-treated bed nets in Afar, northeast Ethiopia: a cross-sectional study. The Pan African Medical Journal, 13(Suppl 1).

Okafor CJ. and Ogbonnaya NP. (2020). Knowledge, accessibility, and utilization of insecticide treated nets among pregnant women in a selected hospital in South-Eastern Nigeria. Eur J Midwifery, 4, 48. doi:10.18332/ejm/130591

Oresanya OB., Hoshen M. and Sofola OT.(2008).Utilization of insecticide-treated nets by under-five children in Nigeria: assessing progress towards the Abuja targets. Malaria journal,7, 1-15.

Pettifor, A., Taylor, E., Nku, D., Duvall, S., Tabala, M., Meshnick, S., et al. (2008). Bed net ownership, use and perceptions among women seeking antenatal care in Kinshasa, Democratic Republic of the Congo (DRC): opportunities for improved maternal and child health. BMC Public Health, 8, 1-10.

Teklemariam, Z., Awoke, A., Dessie, Y. and Weldegebreal, F. (2015). Ownership and utilization of insecticide-treated nets (ITNs) for malaria control in Harari National Regional State, Eastern Ethiopia. Pan African Medical Journal, 21(1).

Tokponnon, F. T., Sissinto, Y., Ogouyémi, A., Sovi, A., Gnanguenon, V., Adéothy, A. A., et al. (2014). Assessment of long-lasting insecticidal net coverage, use and physical integrity one year after universal distribution campaign in Plateau department in South-East Benin. J Public Health Epidemiol, 6, 76-84.

Tomass, Z., Dejene, T. and Kidane, D. (2011). Knowledge, attitude and practice (KAP) about insecticide treated net (ITN) usage against malaria in Kolla Tembien district, Tigray, Ethiopia. Momona Ethiopian Journal of Science, 3(2).

Tsegaye Berkessa, T. B., Oljira, D. and Tesfa, B. (2016). Insecticide treated nets use and its determinants among settlers of southwest Ethiopia.

USAID (United States of America Aid). (2017). President's Malaria Initiative: Ethiopia - Malaria Operational Plan FY 2017. In U. CDC, DOS, USAID (Ed.). US: USAID.

Watiro, A. H. and Awoke, W. (2016). Insecticide-treated net ownership and utilization and factors that influence their use in Itang, Gambella region, Ethiopia: cross-sectional study. Risk management and healthcare policy, 101-112.

WHO (World Health Organization). (2013). A Global strategy for malaria control. World Health Organization. Geneva: WHO.

WHO (World Health Organization). (2014). Achieving universal coverage with long-lasting insecticidal nets in malaria control . World Health Organization. In Global Malaria Programme (Ed.). Geneva WHO.

WHO (World Health Organization). (2022). World Health Organization World malaria report. Geneva: WHO.

Woyessa, A., Deressa, W., Ali, A. and Lindtjørn, B. (2014). Ownership and use of long-lasting insecticidal nets for malaria prevention in Butajira area, south-central Ethiopia: complex samples data analysis. BMC Public Health, 14, 1-10.

Zewdneh Tomass, Z. T., Tadesse Dejene, T. D. and Dawit Kidane, D. K. (2011). Knowledge, attitude and practice (KAP) about insecticide treated net (ITN) usage against malaria in Kolla Tembien district, Tigray, Ethiopia.

Zhou, Ototo,Atieli, H. E., Githeko, A. K. and Yan, G. (2014). Evaluation of universal coverage of insecticide-treated nets in western Kenya: field surveys. Malaria journal, 13, 1-8.

Yirsaw AN, Gebremariam RB, Getnet WA, Mihret MS. (2021) Insecticide-treated net utilization and associated factors among pregnant women and under-five children in

East Belessa District, Northwest Ethiopia: using the Health Belief model. Malar J, Mar 4;20(1):

8. ANNEXES

8.1. Information Sheet and Informed Voluntary Consent Form for District Health Office

Introduction:

My name is Ayatulahi Yusuf. I am principal Investigator of the study to be conducted in this Fedis district. I kindly request you to give me your attention to explain the study and your district being selected as the study setting.

The study title: Insecticide treated bednet Utilization and associated factors among underfive children in Fedis District of East Hararghe Zone, eastern Ethiopia
Purpose/aim of the study: The findings of this study can be paramount importance for district health office to plan the program interventions used to prevent and control malaria and, the productivity. Besides, the aim of this study is to write thesis as partial requirement for fulfillment of my master degree of public health in General Public Health.

Procedure and duration: Data collectors will be interviewing the participants using a questionnaire to provide them with pertinent data that is helpful for the study. There are certain questions to answer where the data collectors will fill the questionnaire through interviewing the participants at their home. All the question and interview will take about 30-45 minutes, so I kindly request you to give me a permission to conduct this study.

Risks and benefits: The risk of being participating in this study is very minimal, but only taking few minutes from participants time. There would not be any direct payment for participating in this study. But the findings from this study reveal important information for health planner and actors.

Confidentiality: The information the participants will provide us will be confidential. There will be no information that will identify them in particular. The findings of the study will be general for the study community and will not reflect anything particular of individual person or health office. The questionnaire will be coded to exclude showing names. No references will be made in oral or written reports that could link the participants to the research.

Rights: Participation for this study is fully voluntary. you have the right to declare to

participate or not in this study. If you decide to participate, you have the right to withdraw from the study at any time, this will not able you or your organization for any loss of benefits which you otherwise are entitled. you do not have to answer any question that you do not want to answer.

Contact address: If there, are any questions or enquires at any time on the study or the study procedures, please contact principal investigator, Ayatulahi Yusuf Ali: Phone: +251917233678; email: ayatulahyusuf@gmail.com or Institutional Health Research Ethic Review Committee (IHRERC) at office phone 0254662011 or P.O.BOX 235, Haramaya University Harar, Ethiopia.

Declaration of Informed Voluntary Consent

I have read the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, the rights of participating and the contact address for any queries. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that the district health office has the righty to stop the study from being conducted if misdeeds and unethical procedures are observed during the data collection process in the study area. Thus, I declare my voluntary consent on behalf of Fedis District Health Office to allow the study to be conduct in the district with my signature.

Name and signature of Head of District Health Office----------date --------

Name and signature of the principal Investigator----------date --------

8.2. Information Sheet and Informed Voluntary Consent Form for Participants>=18 years

My name is ----------. I am working, as a data collector for the study will be conducted by Ayatulahi Yusuf Ali who studying for his Master degree of Public Health in General Public Health at Haramaya University, College of Health and Medical Sciences. I kindly request you to give me your attention to explain the study and you selected as the

study participant.

The study title: Insecticide treated bednet utilization and associated factors among underfive children in Fedis District of East Hararghe Zone, eastern Ethiopia

Purpose/aim of the study: The study findings have paramount importance for you and district health office and facilities to plan the program interventions used to prevent and control malaria and, the productivity. Besides, the aim of this study is to write thesis as partial requirement for fulfillment of his master degree of public health in General Public Health for principal investigator.
Procedure and duration: I will be interviewing you using a questionnaire to provide me with pertinent data that is helpful for the study. There are certain questions about 89 to answer where I will fill the questionnaire by interviewing you. The interview will take about 30-45 minutes, so I kindly request you to spare me this time for the interview.

Risks and benefits: The risk of participating in this study is very minimal, but only taking few minutes from your time. There would not be any direct payment for participating in this study. But the findings from this study may reveal important information for the local health planners.

Confidentiality: The information you will provide us will be confidential. There will be no information that will identify you in particular. The findings of the study will be general for the study community and will not reflect anything particular of individual person. The questionnaire will be coded to exclude showing names. No references will be made in oral or written reports that could link study participants to the research.

Rights: Participation for this study is fully voluntary. You have the right to declare to participate or not in this study. If you decided to participate, you have the right to withdraw from the study at any time and this will not label you for any loss of benefits which you otherwise are entitled. You do not have to answer any question that you do not want to answer.

Contact address: If there, are any questions at any time on the study or the study procedures, please contact me principal investigator; Ayatulahi Yusuf Ali: cell phone: +251917233678 and email: ayatulahyusuf@gmail.com or Institutional Health Research Ethic Review Committee (IHRERC) at office phone 0254662011 or P.O.BOX 235, Haramaya University Harar, Ethiopia.

Declaration of Informed Voluntary Consent:

I have read/ read to me the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, the rights of participating and the contact address for any queries. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that I have the right to withdraw from the study at any time or not to answer any question that I do not want. Therefore, I declare my voluntary consent to participate in this study with my signature.

Name and signature of Study Participant----------date----------

Name and signature of data collector----------date----------

8.3 Information Sheet and Voluntary Consent form for Parents/Guardians of Participants <18 Years Old.

My name is ----------. I am working, as a data collector for the study will be conducted by Ayatulahi Yusuf Ali who studying for his Master degree of Public Health In General Public Health at Haramaya University, College of Health and Medical Sciences. I kindly request you to give me your attention to explain the study and you selected as the study participant.

The study title: Insecticide treated bednet utilization and associated factors among underfive children in Fedis District of East Hararghe Zone, eastern Ethiopia

Purpose/aim of the study: The study findings have paramount importance for you and district health office and facilities to plan the program interventions used to prevent and control malaria and, the productivity. Besides, the aim of this study is to write thesis as partial requirement for fulfillment of his master degree of public health in General Public Health for principal investigator.

Procedure and duration: I will be interviewing you using a questionnaire to provide me with pertinent data that is helpful for the study. There are certain questions about 89 to

answer where I will fill the questionnaire by interviewing you. The interview will take about 30-45 minutes, so I kindly request you to spare me this time for the interview.

Risks and benefits: The risk of participating in this study is very minimal, but only taking few minutes from your time. There would not be any direct payment for participating in this study. But the findings from this study may reveal important information for the local health planners.

Confidentiality: The information you will provide us will be confidential. There will be no information that will identify you in particular. The findings of the study will be general for the study community and will not reflect anything particular of individual person. The questionnaire will be coded to exclude showing names. No references will be made in oral or written reports that could link study participants to the research.

Rights: Participation for this study is fully voluntary. You have the right to declare to participate or not in this study. If you decided to participate, you have the right to withdraw from the study at any time and this will not label you for any loss of benefits which you otherwise are entitled. You do not have to answer any question that you do not want to answer.

Contact address: If there, are any questions at any time on the study or the study procedures, please contact me principal investigator; Ayatulahi Yusuf Ali: cell phone: +251917233678 and email: ayatulahyusuf@gmail.com or Institutional Health Research Ethic Review Committee (IHRERC) at office phone 0254662011 or P.O.BOX 235, Haramaya University Harar, Ethiopia.

Declaration of Informed Voluntary Consent:

I have read/ read to me the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, the rights of participating and the contact address for any queries. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that I have the right to withdraw from the study at any time or not to answer any question that I do not want. Therefore, I declare my voluntary consent to participate in this study with my signature.

Name of Study Participant----------date----------

Name and signature of Study Parents/Guardians----------date----------

Name and signature of data collector----------date----------

8.4 Information Sheet and Voluntary Consent of Participants >=18 Years old (Afan Oromo Version)

UNKAA IBSITUU HAALA QORANNOO FI HAYYAMA HIRMAATTOTAA MIRKANEESSU.

Ani Maqaan kiyya _____kan jadhamu yoo tahu; kaniin asitti argameefiis ragaa qorannoo sassaabuu fi; Qorannoo kan gaggeessu obbo Ayaatullaah Yuusuf ;Ulaagaa barumsa sadarkaa Maastaraa Yuniversitii Haraomaayaa koollejii Fayyaatti barachaa jiru guutuuf naannoo keessan kanatti ragaa jiru irratti; ragaa sasaabuufi. Kanaafuu; qalbii fi yaada qorannoo kana irrati akka hirmaataniif filatamuu keessan irrati qabdan akka naaf laataniin kabajaan isin gaafadha.

1. Matadureen Qorannichaa:

Haaala ittifayyadama Saaphana busaa akasumas; sababoota ittifayyadama irratti dhiibbaa uumuu Malan qorachuun adda baasuudha baadiyyaa Fadis irratti; baha Itiyophiyaa.

2. Barbaachisummaa/ kaayoon Qorannichaa/ purpose and aim of the study:

Bu'aan qorannoo kanaa hedduu yoo tahu; sadarkaa duraati waajjirrii fayyaa fadis ragaa aragamu; karoora hojii dhimma kanaaf barbaachisu baafachuuf galtee tahuun gargaara. Irra caalamayaan garuu bar'uu qorannoo qorataan kuni barumsa Maastraa Fayyaa Hawaasaa waliigalaatiin (GMPH) barachaa jiruuf ulaagaa guutachuuf maxansuuf fayada.

3. Haala adeemsaa fi yeroo fudhatu / procedures, and period:

Gaafannoo mataa keessaaniin guutamuun isinff raabasa. Gaafanoon gaafiilee lalaaftuu hanga 89 tokko qabdi. Hirmaatooni hayamamoo taatan hundi gaafiilee dhihaatan dubiftanii deebisaa waan sitti fakaate bilisa taatanii itti martu. Waan ifa hin tahini fi Kan hin dubifamne soda malee na gaafattu. Galmi ijoon isaa ragaa dhugaa qorannoo kanaaf oolu argachuun dhugaa jiru hubachuun adda baasuu qofa. Kana irraa ka'uun hojjattootni fi gaggeessoni keessan rakkoo isin qabadaniif furmaata barabaaduu ni dandahu. Waliigala daqiiqaa 30-45 isiniiraa fudhachuu danadaha. Sa'aa hojii nuuf laatan kanaaf galatoomaa janna. Kafaltiin kallatiin aragatan jiraachuu baatuus; bu'aan rakkoo keessan furuu keessati qabu ol'aanaadha. Kanaafuu qalbii guutuun akka hirmaatan niin abdadha.

4. Miidhaa fi Bu'aa / risk and benefit:

Miidhaan kana irratti hirmaachuun mudatu haalaan xiqqaadha. Kuniis sa'aa hojii keessanii nuuwaliin turuu qofa. Akuma olitti eerame kafaltiin bu'aan ammati aragamullen hin jiru. Garuu bu'aa qoranichaatirraa bu'aa guddaatu aragama. Kuniis ragaa qabatamaa argamu irra dhaabachuun gageessoni keessan karoora furmaata rakkoolee busaa ittisuufuuf isaan mudatu baafachuuf gargaara. Miilanumaan isiniis rakkoon keessan isiniraa furama.

5. Ofitti amantummaa /Confidentiality:

Ofittiamantummaa guutuu qabaachuu qabdu. Ragaan isin kennitan kamuu iccitiin eegamaadha. Odeefannoo fi bu'aan argamu kamuu qorannoo qofaaf oola. Ragaan dhunfaa hin jiru. Gaafannoon kamuu lakoofsa/koodiin guutama malee maqaan kessan

hin bareefamu.

6. Mirga / Rights:

Hirmaannaan Qorannoo kanaa fedhinnaa qofaani, hirmaachuu fi Kan isiniti hin tolle taanaan yeroo feetanitti keessaa bahuufiis mirga guutuu qabdu.gaafii isinitti hin tolle agartaniis dhiisuuf mirga guutuu qabdu. Tahuus bu'aan qorannichaa waan murteessaa taheef amantaan fudhadheera.

7. Teessoo nama qunnamuu barbaaddanii / Contact address:

Dhimma Qoranichaas tahee adeemsa qoranichaa kamuu irrati gaaffii yookaanis yaada yoo qabaatan; Qorataa kan tahe; obbo: Ayaatullaah Yuusuf lakkoofsa bilbilaa; Mobil 0917233678 and 025 6665719 yookaaniis e-mailii "ayatulahyusuf@gmail.com". Akkasumas; Koree Naamusa qorannoo universitichaa / Institutional Health Research Ethics Review Committee (IHRERC) bilbila 0254662011 or P.O.Box 235, Harar, Ethiopia] taheen qunamuu fii yaada ibsadhaa.

8. Goolabbii waliigaltee fedhinnaan hirmaachuu / Declaration of informed voluntary consent:

Ani odeefannoo dhihaate hunda dubbiseera, ergaa guutuu, kaayoo, adeemsa, naamusa, mirga hirmaatotaa, bu'aa fii miidhaa qorannicha isaatiis sirriti hubadheera. Kanaafuu qorannicha irratti fedha kiyya guutuun hirmaachuu kiyya mallattoo kiyyaaniin mirkaneessa.

Maqaa fi Mallattoo hirmaataa: _____Mallattoo_____Guyyaa _____
Maqaa fi Mallattoo raga sassaabaa:_____Mallattoo_____ Guyyaa _____

8.5 Information Sheet and Voluntary Consent of Parents/Guardians of Participants<18 Years old (Afan Oromo Version)

UUNKAA IBSITUU HAALA QORANNOO FII HAYYAMA HIRMAATTOTAA MIRKANEESSU.

Ani Maqaan kiyya _____kan jadhamu yoo tahu; kaniin asitti argameefiis ragaa qorannoo sassaabuufi; Qorannoo kan gaggeessu obbo Ayaatullaah Yuusuf; ulaagaa Barumsa sadarkaa Maastaraa Yuniversitii Haraomaayaa koollejii Fayyaatti barachaa jiru guutuuf naannoo keessan kanatti ragaa jiru irratti; ragaa sassaabuufi. Kanaafuu; qalbii fi yaada qorannoo kana irratti akka hirmaataniif filatamuu keessan irrati qabdan akka naaf laataniin kabajaan isin gaafadha.

1. Matadureen Qorannichaa:

Haaala ittifayyadama Saaphana busaa akasumas; sababoota ittifayyadama irratti dhiibbaa uumuu Malan qorachuun adda baasuudha baadiyyaa Fadis irratti; baha Itiyophiyaa.

2. Barbaachisummaa/ kaayyoon Qorannichaa/ purpose and aim of the study:

Bu'aan qorannoo kanaa hedduu yoo tahu; sadarkaa duraati waajjirrii fayyaa fadis ragaa aragamu; karoora hojii dhimma kanaaf barbaachisu baafachuuf galtee tahuun gargaara. Irra caalamayaan garuu bar'uu qorannoo qorataan kuni barumsa Maastraa Fayyaa Hawaasaa waliigalaatiin (GMPH) barachaa jiruuf ulaagaa guutachuuf maxansuuf fayada.

3. Haala adeemsaa fi yeroo fudhatu / procedures, and period:

Gaafannoo mataa keessaaniin waa'ee daa'ima keessanii guutamuun isiniif raabasa. Gaafanoon gaafiilee lalaaftuu hanga 89 tokko qabdi. Hirmaatooni hayamamoo taatan hundi gaafiilee dhihaatan dubiftanii deebisaa waan sitti fakaate bilisa taatanii itti martu. Waan ifa hin tahini fi Kan hin dubifamne soda malee na gaafattu. Galmi ijoon isaa ragaa dhugaa qorannoo kanaaf oolu argachuun dhugaa jiru hubachuun adda baasuu qofa. Kana irraa ka'uun hojjattootni fi gaggeessoni keessan rakkoo isin qabadaniif furmaata barabaaduu ni dandahu. Waliigala daqiiqaa 30-45 isiniiraa fudhachuu danadaha. Sa'aa hojii nuuf laatan kanaaf galatoomaa janna. Kafaltiin kallatiin aragatan jiraachuu

baatuus; bu'aan rakkoo keessan furuu keessati qabu ol'aanaadha. Kanaafuu qalbii guutuun akka hirmaatan niin abdadha.

4. Miidhaa fi Bu'aa / risk and benefit:

Miidhaan kana irrati hirmaachuun mudatu haalaan xiqaadha. Kuniis sa'aa hojii keessanii nuuwaliin turuu qofa. Akuma olitti eerame kafaltiin bu'aan ammati aragamullen hin jiru. Garuu bu'aa qoranichaatirraa bu'aa guddaatu aragama. Kuniis ragaa qabatamaa argamu irra dhaabachuun gageessoni keessan karoora furmaata rakkoolee busaa ittisuufuuf isaan mudatu baafachuuf gargaara. Miilanumaan isiniis rakkoon keessan isiniraa furama.

5. Ofitti amantummaa /Confidentiality:

Ofittiamantummaa guutuu qabaachuu qabdu. Ragaan isin kennitan kamuu iccitiin eegamaadha. Odeefannoo fi bu'aan argamu kamuu qorannoo qofaaf oola. Ragaan dhunfaa hin jiru. Gaafannoon kamuu lakoofsa/koodiin guutama malee maqaan kessan hin bareefamu.

6. Mirga / Rights:

Hiramaannaa Qorannoo kanaan fedhinnaa qofaani, hirmaachuu fi Kan isiniti hin tolle taanaan yeroo feetanitti keessaa bahuufiis mirga guutuu qabdu. gaafii isinitti hin tolle agartaniis dhiisuuf mirga guutuu qabdu. Tahuus bu'aan qorannichaa waan murteessaa taheef amantaan fudhadheera.

7. Teessoo nama qunnamuu barbaaddanii / Contact address:

Dhimma Qoranichaas tahee adeemsa qoranichaa kamuu irrati gaaffii yookaanis yaada yoo qabaatan; Qorataa kan tahe; obbo: Ayaatullaah Yuusuf lakkoofsa bilbilaa; Mobil 0917233678 and 025 6665719 yookaaniis e-mailii "ayatulahyusuf@gmail.com". Akkasumas; Koree Naamusa qorannoo universitichaa / Institutional Health Research Ethics Review Committee (IHRERC) bilbila 0254662011 or P.O. Box 235, Harar, Ethiopia] taheen qunamuu fii yaada ibsadhaa.

8. Goolabbii waliigaltee fedhinnaan hirmaachuu / Declaration of informed voluntary consent:

Ani odeefannoo dhihaate hunda dubbiseera, ergaa guutuu, kaayyoo, adeemsa, naamusa, mirga hirmaatotaa, bu'aa fii miidhaa qorannicha isaatiis sirriti hubadheera. Kanaafuu qorannicha irratti fedha kiyya guutuun hirmaachuu kiyya mallattoo kiyyaaniin mirkaneessa.

Maqaa Daa'ima Hirmaatee_____

Maqaa fi Mallattoo Haadhaa/Guddifataa: _____Mallattoo_____ Guyyaa _____
Maqaa fi Mallattoo raga sassaabaa: _____Mallattoo_____ Guyyaa _____

8.6. English Version Questionnaire

Part I. Socio demographic and economic characteristics of the respondents

Sr. No	Questions	Alternative answer	Code
1.	How old are you?	_____	
2.	Sex of child	1.male __ 2. Female___	
3.	Your Religion?	1. Muslim 2. Orthodox 3. Protestant 4. Catholic 5. Others…	
4.	Where is your residence area	1.urban 2. Rural	
5.	What is your ethnic group	1.Oromo 2. Amhara 3. Guraghe 4.Somali 5. Tigrai 6. Others…	
6.	What is your current marital status	1.Married 2. Single 3. Divorced 4.widowed 5. No	

		response	
7.	What is your highest Education status?	1.Read/write 2. Primary 3. Secondary 4. College/ above 5. None educate	
8.	What is your main Occupation?	1. Government employee 2. Farmer 3. Merchant 4. House wife 5. Student 6. Teacher 7. Others	
9	Total person living in family		
10	Total underfive children in family		

Part II. Questions for assessing wealth index of family/household. Could you tell me if you have the following in your house/home?

	Asset type	Response (Circle your response)	
1.	Domestic animals related items	NO=0 (when your family have none)	Yes=1 (when your family have at least one)
01	Ox	No (0)	Yes (1)
02	Cow	No (0)	Yes (1)
03	Calf	No (0)	Yes (1)
04	Sheep	No (0)	Yes (1)
05	Goat	No (0)	Yes (1)
06	Horse	No (0)	Yes (1)
07	Donkey	No (0)	Yes (1)
08	Cock/Hen	No (0)	Yes (1)
09	Other/specify_____	No (0)	Yes (1)
10	Other/specify_____	No (0)	Yes (1)
2	Durable assets related items	NO=0 (when your family have none)	Yes=1 (when your family have at least one)
11	Television	No (0)	Yes (1)
12	Radio	No (0)	Yes (1)
13	Electricity	No (0)	Yes (1)
14	Refrigerator	No (0)	Yes (1)
15	Conventional telephone	No (0)	Yes (1)
16	Mobile phone	No (0)	Yes (1)
17	Car	No (0)	Yes (1)

18	Motorcycle	No (0)	Yes (1)
19	Cycle	No (0)	Yes (1)
20	Cart	No (0)	Yes (1)
21	Gold, money	No (0)	Yes (1)
22	Ownership of the owned living house	No (0)	Yes (1)
23	Ownership of agricultural land	No (0)	Yes (1)
24	Other/specify_____	No (0)	Yes (1)
25	Other/specify_____	No (0)	Yes (1)
3	Productive assets related items	NO=0 (when your family have none)	Yes=1 (when your family have at least one)
26	Plough Plow	No (0)	Yes (1)
27	Axe	No (0)	Yes (1)
28	Hoe	No (0)	Yes (1)
29	Shovel	No (0)	Yes (1)
30	Sickle	No (0)	Yes (1)
31	Modern beehive	No (0)	Yes (1)
32	Traditional beehive	No (0)	Yes (1)
33	Other/specify_____	No (0)	Yes (1)
34	Other/specify_____	No (0)	Yes (1)
4	Housing/Living house related characters	NO=0 (when your family have none)	Yes=1 (when your family have at least one)
35	Indoor plumping/ pipe water	No (0)	Yes (1)
36	Type of flooring	Earth/dung (0)	Cement/raw wood (1)
37	Toilet facility	Unsanitary or traditional pit latrine/ no toilet (0)	Sanitary or improved pit latrine/VIP latrine (1)
38	Other/specify_____	No (0)	Yes (1)
39	Other/specify_____	No (0)	Yes (1)
5	Other household related materials/ properties	NO=0 (when your family have none)	Yes=1 (when your family have at least one)
40	Sofa	No (0)	Yes (1)
41	Bed	No (0)	Yes (1)
42	Table	No (0)	Yes (1)
43	Chair	No (0)	Yes (1)
44	Stove	No (0)	Yes (1)

45	Other/specify_____	No (0)	Yes (1)
46	Other/specify_____	No (0)	Yes (1)

Part III. Environmental and Healthcare related Factors

Sr. No	Questioner	Alternative answer	Code
15.	Do you face any issue with housing condition?	1.pest infection 2. leakage 3. structural damage	
16.	Is HEW/health post available in your kebele?	1.Yes 2. No	
17	Have you received advice from HEW about malaria and ITN?	1. Yes 2. No	
18.	Is there health facility (health center/ Hospital) available within 10 km away from your residence?	1.Yes 2. No	

PART IV. KNOWLEDGE ABOUT MALARIA

Sr. No	Questioner	Alternative answer	Code
24.	Have you heard about malaria?	1. Yes	
		2. No	
25.	How do we acquire malaria?	1. Mosquito bite	
		2. Bad season	
		3. I don't know	
		4. Other/specify_____	

26	How can we prevent malaria infection? (multiple response items about malaria transmission)	1. DDT spray 2. Source reduction 3. Drugs(prophylaxis) 4. ITN s utilization 5. I do not know 6. If other, specify_____
27	Do you know malaria be fatal if not treated?	1.Yes 2.No
28.	Do you know that children under five are at a higher risk of contracting malaria?	1.Yes 2.No

KNOWLEDGE ABOUT ITN (BED NET)

29.	Have you heard about bed nets?	1. Yes 2. No
30.	If Yes, what is it used for?	1. Protection against mosquito and insect bite 2. Affording good sleep 3. Others specify
31.	How does bed net prevent malaria transmission?	1. Physical barriers 2. Kills mosquito 3. Irritate mosquito 4. Not known 5. If other, specify_____
32.	How frequent and when should one use ITNs?	1. Every night 2. Seasonally 3. When Mosquito seen in the house

4. If other, specify_____

33. Where did you heard about the bed nets?

1. Television
2. Radio station
3. District health education
4. hospital/clinic
5. relatives/peers/neighbors'
6. Other reasons (specify_____

OWNERSHIP AND CONDITION OF ITN/BED NET

34. How many ITN/mosquito bed nets do you have(own) for your household/ family? _____

35. Observe and count the numbers of holes/ condition of ITN/ bed nets owned by the family or household? _____

PRACTICE OF ITN/BED NET

36. Do you consistently hang the ITN on your bed? 1. Yes 2. No

37. Did you sleep under ITN/mosquito bed net last night/previous night? 1. Yes 2. No

38. Did your child slept under ITN/ mosquito bed net last/previous night? 1. Yes 2. No

39. How frequent do you sleep under bed net?

1. Daily
2. Rarely; if rarely go to question no.40

40.	Which periods do you sleep under net?	1. During rainy season 2. During dry season 3.Other reasons(specify): _____
41.	Why do you use ITN during that period?	1. To prevent malaria 2. For warmth 3. A separation in the room

PART V. MOTHER ATTITUDE TO WARDS ITN USE

1. Using ITN every night is important to protect my child from malaria : 1.Disagree 2.Neutral 3.Agree

2. I believe using an ITN is effective in preventing malaria in under five children: 1. Disagree 2.Neutral 3. Agree

3. I am concerned about the safety of insecticide used in ITNs for my child: 1.Disagree 2.Neutral 3. Agree

4. I am more likely to use an ITN if I can see mosquitoes in the room 1.Disagree 2 Neutral 3. Agree

PART VI. MOTHER'S PERCEPTION ON MALARIA AND USING ITN

No	Perceived susceptibility to malaria	Disagree	Undecided	Agree
	I am afraid of I might contract malaria			
	I feel my chance of getting malaria is high.			
	I think that my child is at risk of malaria infection.			
	I am not confident that I might have not get malaria still.			
	Perceived severity of malaria			
5	If I get malaria it will be very serious and life-threatening			

1. If I get malaria I will give birth of low birth weight baby

9 If I get malaria I may lose consciousness

10 I believe that cerebral malaria can kill me soon

Perceived benefits of using Nets

11 In my opinion, sleeping under ITNs prevents malaria

12 I perceive ITNs protects mosquitoes bites

13 I perceive ITNs protects mosquitoes and other pests

14 I feel better health after I sleep under bed net

15 I expect to give healthy child if I use ITN

16 Sleeping under bed net save money on malaria treatment

17 Sleeping under bed net helps me to perform daily activity

Perceived barriers of ITNs utilization

18 The chemical in ITN is dangerous to my children

It is too hot to sleep my children under the net.

20 ITN is irritant to my children

21 Insecticide treated net is expensive to buy and replace

22 I forget to mount a net when sleeping during night

23 In my opinion hanging ITNs is inconvenient

24 There is no enough sleeping space to hang a net

25 In my opinion sleeping under ITN causes suffocation

26 I believe that I am resistant to malaria, so will not bother by mosquito

27 I don‘t have ITN in my house

Self-efficacy to use nets

28 I believe my children can sleep under ITN every night

29 I believe I can wash the net when dirty

30 I believe I can mend and use nets when being torn

3 1	I believe that can replace the Net when its age is >3 years		

PART VII. SOCIAL SUPPORT TO ITN USE

No.	Question	Category	Skip
	Does anyone discuss ways of your child healthy? For example, your husband, family members, or health workers	1.Yes 2.No	
	Does anyone do or say things to show they care about your child health? For example, your husband, family members, or neighbors.	1.Yes 2.NO	
	Does anyone talk with you about your feelings about sleeping under the ITN?	1.Yes 2.No	
	Does anyone encourage you to sleep your child under an ITN?	1.Yes 2.No	
	Does anyone remind you to sleep your child under the ITN?	1.Yes 2.No	
	Does anyone encourage you to talk with a health worker if your child has problem with sleeping under the Net?	1.Yes 2.No	

1.

2. Does anyone say it is good that you sleep your child under the ITN every night? 1.Yes 2.No

3. Does anyone hang or mount ITN over sleeping area to help your child sleep under it? 1.Yes 2.No

PART VIII. OBSERVATIONAL CHECK LIST FOR LLITN UTILIZATION
Now I would like to observe the ITNS and sleeping beds to see the condition of nets whether hanged correctly or not and verify what we have been talking so far.

1. Number of separate beds or places of sleep [_____]
2. The number of ITN observed in the household [_____]
3. The observed ITN is_____ (For the recent owned one)
    a. in package
    b. hanged
    c. Other specify_____- 36 -
    d. Number of beds /places of sleep observed with ITN hanged [_____]

That is the end of our interview. Thank you very much for taking time to answer our questions.

Data collector name and sig. _____ Date _____

7.7. Afan OromoVersion Questionnaire

Kutaa I. Amala hawaas-dimograafii fi Dinagdee deebii kennitootaa.

Lakk.	Gaaffilee	Deebii filannoo	koodii
1.	Umriin kee waggaadhan meeqa?	_____	
2.	Saala Daaimaa	1.Dhiira __ 2.Dubara___	

3.	Amantiin kee maali?	1. Muslima 2. Orthodoksii 3. Protestanii 4.Catholikii 5. Kan biraa…	
4.	Bakki jireenyaa kee eessa?	1.Magaalaa 2. Baadiyyaa	
5.	Sabni kee maali?	1.Oromoo 2. Amhaara 3. Guraghee 4.Somaali 5. Tigraay 6. Kan biraa	
6.	Haali Gaa'ela kee kan ammaa maal fakkatta?	1.Heerumte 2. Takkaa kan hin heerumne 3. Kan hiikte 4. kan haatti mana/abbaan manaa jalaa dute / du'e 5. kan deebisaa dide	
7.	Sadarkaan barumsaa nama bulchaa/ itti gaafatamaa manaa kanaa maali?	1. Dubbisuu fi barreessuu qofa 2. Sadarkaa tokkoffaa marsaa duraa 3. Sadarkaa lammaffaa 4. Kutaa 12 oli 5. Kan hin baranne	
8.	Hojiin nama bulchaa/ itti gaafatamaa manaa kanaa maali?	1.Hojjataamootummaa/ mitimootummaa 2. Qonnaan bulaa 3. Daldalaa 4. Haadha manaa 5.Barataa 6. Barsiisaa 7. kan biraa	
9	Baay'inni miseensa maatii keessani meeqa?		
10	Mana kana keessa daa'imman waggaa 5 gadii meeqa jirtii?		

Kutaa II. Gaaffilee waa'ee xiinxala qabeenyaa maatii /manaa. Wantootni kun yoo mana keetti argaman naaf himuu ni dandeessuu?

	Gosa qabeenyaa	Deebisaa (deebii itti mari)	
1.	Beeyladoota manaa wajjiin walqabate	miti=0 (yoo maatiin wantoota kana hin qabaanne)	Eyyee=1 (yoo maatiin wantoota kana tokkollee qabaate
01	Sangaa	miti (0)	Eyyee (1)
02	Sawwaa	miti (0)	Eyyee (1)
03	Jabbii	miti (0)	Eyyee (1)

04	Hoolaa	miti (0)	Eyyee (1)
05	Re'ee	miti (0)	Eyyee (1)
06	Farda	miti (0)	Eyyee (1)
07	Harree	miti (0)	Eyyee (1)
08	Lukkuu	miti (0)	Eyyee (1)
09	Kan biraa ibsi_____	miti (0)	Eyyee (1)
10	Kan biraa ibsi_____	miti (0)	Eyyee (1)
2	Qabeenya meeshaalee yeroo dheeraaf turu	miti=0 (yoo maatiin wantoota kana hin qabaanne)	Eyyee=1 (yoo maatiin wantoota kana tokkollee qabaate
11	Televisoonii	miti (0)	Eyyee (1)
12	Raadoonii	miti (0)	Eyyee (1)
13	Humna Ibsaa	miti (0)	Eyyee (1)
14	Dilallessaa /firija	miti (0)	Eyyee (1)
15	Bilbila manaa	miti (0)	Eyyee (1)
16	Bilbila	miti (0)	Eyyee (1)
17	Makiinaa	miti (0)	Eyyee (1)
18	Dokdokkee	miti (0)	Eyyee (1)
19	Saaykilii	miti (0)	Eyyee (1)
20	Gaarii	miti (0)	Eyyee (1)
21	Warqii/ziqaya	miti (0)	Eyyee (1)
22	Manni jireenyaa kan ofii keessaniiti	miti (0)	Eyyee (1)
23	Lafa qonnaa kan keessan qabduu	miti (0)	Eyyee (1)
24	Kan biraa ibsi_____	miti (0)	Eyyee (1)
25	Kan biraa ibsi_____	miti (0)	Eyyee (1)
3	Meeshaalee oomishaa wajjiin walqabatan	miti=0 (yoo maatiin wantoota kana hin qabaanne)	Eyyee=1 (yoo maatiin wantoota kana tokkollee qabaate)
26	Nugiya Qonnaa	miti (0)	Eyyee (1)
27	Haxooftuu/shoggortuu	miti (0)	Eyyee (1)
28	Akaafaa jalaa	miti (0)	Eyyee (1)

29	Akaafaa	miti (0)	Eyyee (1)
30	Haamtuu	miti (0)	Eyyee (1)
31	Gaagura Ammayyaa	miti (0)	Eyyee (1)
32	Gaagura Aadaa	miti (0)	Eyyee (1)
33	Kan biraa ibsi_____	miti (0)	Eyyee (1)
34	Kan biraa ibsi_____	miti (0)	Eyyee (1)
4	Wantoota haala naannoo mana jireenyaa wajjin walqabatan	miti=0 (yoo maatiin hin qabaanne)	Eyyee=1 (yoo maatiin tokko illee qabaate)
35	Boombaa bishaanii	miti (0)	Eyyee (1)
36	Haala lafaa	Dachee /iddoo (0)	simintoo/mukaan afame (1)
37	Mana fincaanii	Qulqullina kan hin qabne/kan aadaa (0)	Mana fincaanii sadarkaa eeggate (1)
38	Kan biraa ibsi_____	miti (0)	Eyyee (1)
39	Kan biraa ibsi_____	miti (0)	Eyyee (1)
5	Meeshaalee kan biraa kan manaa wajjiin walqabatan	miti=0 (yoo maatiin hin qabaanne)	Eyyee=1 (yoo maatiin tokko illee qabaate)
40	Sofaa	miti (0)	Eyyee (1)
41	Siree	miti (0)	Eyyee (1)
42	Minjaala	miti (0)	Eyyee (1)
43	Cheerii	miti (0)	Eyyee (1)
44	Stova	miti (0)	Eyyee (1)
45	Kan biraa ibsi_____	miti (0)	Eyyee (1)
46	Kan biraa ibsi_____	miti (0)	Eyyee (1)

Kutaa III. Dhiibbaa Haala Naannoo fi Fayyaa wajjin walqabatu.

Lakk.	Gaaffiilee	Deebii filannoo	Koodii
15.	haala mana keessanitiin walqabatee wantoota kanaaf ni saaxilamtuu?	1.Ilbiisotaan faalamuu 2.Dhimmuuf 3.manni dulloomuu	

18.	Hojjattuun Ikisteeshinii fayyaa Qabalee keessanitti ni argamtii?	1.Eyyee 2.Miti	
19.	Ikisteeshiniin fayyaa irraa leenjii waa'ee Busaa fi Agoobaraa argattanii beektuu?	1.Eyyee 2. Miti	
20.	Dhaabbileen fayyaa kabalee keessanitti ni argamaa/dhiyaataa?	1.Eyyee 2.Miti	
21.	Yoo namni mana keessan keessaa Busaan dhukkubsate tajaajila akkamii argatu?	1. Kan Ammayyaa 2. Kan aadaa	

Kutaa IV. Beekkumsa waa'ee busaa

Lakk.	Gaaffilee	Filannoo deebii	koodii
24.	waa'ee dhibee busaa dhageesse?	1. Eyyee 2. Miti	
25.	Dhibeen busaa akkamitti nutti dhufti?	1. busaan ciniinamuun 2. Qilleensa badaan 3. kan biraa yoo tahe ibsi_____	
26	Dhibee busaa akkamitti of irraa ittifna?	1. Qoricha DDT itti raabsuun 2. Madda isii hirisuun 3.Qorichaan/ Talaalliin 4. Agoobara fayyadamuun 5. hin beekkamu 6. Kan biraa yoo jette ibsi_____	
27	Busaan akka nama miidhu/ ajjeesu ni beektaa yoo wal'aansa argachuu baatan	1.Eyyee 2.Miti	
28.	Daa'imman waggaa shanii gadii busaaf saaxilamoo akka tahan ni beektuu?	1.Eyyee 2.Miti	

Beekkumsa waa'ee Agoobaraa

29.	Waa'ee Agoobaraa dhageessee jirtaa?	1. Eyyee 2. Miti
30.	Yoo Eyyee jette, maaliif fayyada?	1. Busaa fi ilbiisotaan ciniinamuu ittisa 2. Hirriiba gaarii gochuuf dandeesisa 3. Kan biraa ibsi:_____
31.	Agoobarri akkamitti dhukkuba busaa daddarbuu ittisa	1. dahoo tahuufiin 2. Busaa ajjeesuun 3. Busaa arihuun 4. Hin beekkamu 5. kan biraa ibsi_____
32.	Yeroo hangamii fi yoom agoobara fayyadamna?	1. Galgala hunda 2. Darbee darbee 3. Yeroo busaan mana keenya keessatti argamte 4. yoo kan biraa jette ibsi_____
33.	Waa'ee Agoobaraa eessarraa dhageesse?	1. Televisoonii 2. Radoonii 3. Dhaabbata barnoota naannoo keessanii 4. Hospitala/kilinika 5. Firaa/shariika /Ollaa irraa' 6. kan biraa ibsi_____

Qabeenyummaa fi Haala Agoobaraa

26.	Mana kee keessaa agoobara meeqa qabdaa?	1._____
27.	Agoobara isaanii ilaalii iddoo ciccitaa isaa lakkaawi	_____

shaakallii Agoobaraa

28.	Osoo wal irraa hin cinne Agoobarri siree kee irratti fannifamee jiraa?	1. Eyyee 2. Miti
29.	Halkan edaa agoobara siree jala raftee?	1. Eyyee 2. Lakki/Miti
30	Daa'imni keessan halkan edaa agoobara jala rafee?	1.Eyyee 2.Miti
31.	Yeroo hangamiif agoobara jala raftu?	1. Guyyaa guyyaan 2. Darbee darbee; yoo darbee darbee jette, gara gaaffii 36 deemi
32.	Yeroo kam Agoobara fayyadamtu?	1. Yeroo roobaa 2. Yeroo caamaa 3.kan biraa ibsi: _____33.
33	Maaliif yeroo filatte san fayyadamtu?	1. Dhukkuba busaa ittisuuf 2. Hoo'insaaf 3. Mana gargar qooduuf

KutaaV. Ilaalcha haadholiin itti fayyadama Agoobaraa irratti qaban

1. Halkan hunda agoobara fayyadamuun daa'ima koo dhukkuba busaa irraa eega. 1.walii hin galu 2.yaada irraa bilisa 3.waliin gala

2. Agoobara fayyadamuun daa'ima umriin isaanii waggaa shanii gadii ta'e dhukkuba busaa irraa ittisuuf bu'a qabeessa jedheen amana. 1. walii hin galu 2.yaada kennuu irraa bilisa 3. Waliigalla

3.Nageenyi qoricha ilbiisotaa daa'ima kootiif agoobara keessatti fayyadamuu na yaaddeessa . 1.walii hin gallu 2.yaada kennuu irraa bilisa 3. waliigalla

4. Mana keessatti bookee busaa yoon argu carraan agoobara fayyadamuu koo guddaadha. 1.walii hin gallu 2 yaada kennuu irraa bilisa 3. waliigalla

Kutaa VI. Ilaalcha haadholiin busaa fi itti fayyadama Agoobaraa irratti qaban

No	Dhukkuba busaaf saaxilamummaa akka qaban itti dhaga'amu	Walii hin galu	Hin murteessin e	Walii galla

2.

3. Carraan dhukkuba busaan qabamuu koo guddaa akka ta’e natti dhaga’ama.

4. Mucaan koo dhukkuba busaan qabamuuf saaxilama jedheen yaada.

5. Ammallee dhukkuba busaa qabaachuu dhiisuu danda’a jedhee ofitti amanamummaa hin qabu.

Hammeenyi dhukkuba busaa itti dhagahamu

1. Dhukkuba busaan yoon qabame baay’ee hamaa fi lubbuu namaa balaadhaaf saaxilu ta’a.

2. Yoon dhukkuba busaan qabame daaima ulfaatina xiqqaa ta’e dhaluun danda’a

3. Yoon busaan qabame mucaa koo dhabuun danda’a.

4. Yoon dhukkuba busaan qabame lubbuu koo dhabuun danda’a

5. Yoon dhukkuba busaan qabame of wallaaluun danda’a.

6. Dhukkubni busaa sammuu yeroo dhiyootti na ajjeesuu danda’a jedheen amana

Faayidaa Agoobara fayyadamuu irraa argamu jedhamee yaadamu.

1. Akka yaada kiyyaatti Agoobara jala rafuun dhukkuba busaa ittisa.

2. Ani agoobarri busaan ciniinamuu akka ittisu naan hubadha.

Agoobarri bookee busaa fi ilbiisota biroo akka ittisu naan hubadha.

3. Erga agoobara jala ciisee booda fayyaan gaariin natti dhagahama.

4. Yoon Agoobara fayyadame daa'ima fayyaa qabu naan kenna jedheen eega.

5. Agoobara siree jala rafuun wal'aansa busaa irratti maallaqa baastu qusata.

6. Agoobara siree jala rafuun sochii guyyaa guyyaa akkaan raawwadhu na gargaara.

Danqaawwan itti fayyadama agoobara busaa irratti mul'atan

1. Keemikaalli agoobara keessa jiru ijoollee kootiif balaa qaba.

2. Ijolleen koo agoobara jala rafuu baay'ee ho'aadha

3. Agoobarri ijoollee kootti nama aarsa

4. Agoobara bitachuu fi bakka buusuun qaala'aadha.

5. I forget to mount a net when sleeping during night.halkan yeroon rafu net mount gochuu dagadheera.

6. Akka yaada kiyyaatti agoobara fannisuun mijataa miti.

7. Bakki hirriibaa gahaan agoobara fannisuuf hin jiru.

8. Akka yaada kiyyaatti agoobara jala rafuun ukkaamsa namatti fida.

9. Ani dhukkuba busaa naan dandamadha jedheen amana,kanaaf bookee busaan ana hin dhiphisu.

10. Mana koo keessaa agoobara hin qabu.

Gahumsa agoobara fayyadamuuf

1. Ijoolleen koo halkan hunda agoobara jalatti rafuu danda'u jedheen amana.

2. Yeroo xuraa'u agoobara dhiquu danda'a jedheen amana.

3. Yeroo cicciramu agoobara sirreessuu fi itti fayyadamuu akkaan danda'u nan amana.

4. Yoo umriin isaa waggaa sadi ol ta'u agoobarri bakka buufamuu danda'a jedheen amana.

KutaaVII. Deeggarsa hawaasummaa agoobara fayyadamuuf

lakk.	Gaaffilee	Gosa yaada koodii
	Namni karaalee daaimni keessan itti fayyaa ta'u irratti mari'atu jiraa.fakkeenyaaf abbaan warraa kee,miseensonni maatii kee ykn hojjettoota fayyaa	1.Eyyee 2.lakkii
	Namni fayyaa daa'ima keessaniif dhimmamu isaa agarsiisu jiraa? Fakkeenyaaf abbaa warraa kee,miseensonni maatii ykn ollaan kee	1.Eyyee 2.lakkii

1.	Namni waa'ee miira kee yommuu agoobara jala daa'ima ciibsitu sitti dubbatu jiraa?	1.Eyyee 2.lakkii
2.	Namni muca kee agobara siree jala akka cibsitu si yaadachisu jira?	1.Eyyee 2.lakkii
	Namni daaimni keessan agoobara jala rafuu irratti rakkoo yoo qabaate hojjeta fayya waliin akka haasooftu si jajjabeessu jiraa.?	1.Eyyee 2.lakkii
3.	Namni halkan hunda daaima kee agoobara siree jala yoo ciifte gaariidha siin jedhu jiraa.	1.Eyyee 2.lakkii
4.	Namni daaimni keessan akka jala rafu gargaaruuf bakka ciisichaa irratti agoobara fannisu jiraa?	1.Eyyee 2.lakkii

KutaaVIII. Cheeckliistii itti fayyadama saaphana siree ilaaluun guutamu.Haala saaphana siree fi itti fayyadama keessanii sirrii tahuu fi dhiisuu isaa akkuma wwaliin haasawaa turre amma immoo mirkaneessuuf, saaphana siree fi siree ciisichaa keessan ilaaluun barbaada.

1. Baay'ina siree (iddoo) ciisichaaf adda ba'e [_____]
2. Baay'ina saaphana siree mana keessatti argame [_____]
3. saaphana siree mana keessatti argame _____ [saaphana siree isa dhiyeenya fudhatme]

A . paakii ta'ee /aguugamee jira [in package]
B . rarraafamee jira
C . biroo (ibsi)_____
D . Baay'ina siree (iddoo) ciisichaa saaphana siree rarraafame waliin adda ba'e [_____
Kun xumura gaaffii keenyaati.Yeroo keessan fudhattanii gaaffii keenya waan nu deebiftaniif galatooma.
Nama ragaa funaane _____ Mallattoo _____ Guyyaa _____

8.8. Curriculum Vitae

1. Background information

Full Name: - Ayatulahi Yusuf Ali

Sex: Male Age: 35

Place of birth: Ganda Alisho, Goromuti Woreda, East Hararge Zone.

Date of birth: - 16/08/1982 E.C.

Tel .Phone No: - 0917233678

Email: ayatulahyusuf@gmail.com

Nationality: - Ethiopian

Address: - Goro Muti, Oromia, Ethiopia

2.Educational background

S/n	Name of school	Place	Grade	Year in E.C.
1	Bubisa primary school	G/muti	1-6	1990-1995
2	Walensu primary school	Meta	7-8	1996-1997
3	Chelenko secondary school	Meta	9-10	1998-1999
4	Chelenko preparatory school	Meta	11-12	2000-2001
5	Jimmaa University	Jimma	BSc degree	2002-2006

3.Ministry Exam; scored average of 83.15 with 99.9 percent

4.Tenth national Exam: scored 4:00

5.University entrance exam: scored 324 out of 500

6.Qualification: - BSc. Degree In Biomedical Engineering (CGPA 3.13)

7.Research Title

8.Language skill

No	Language	Listening	Reading	Speaking	Writing
1	English	Excellent	Excellent	Excellent	Excellent
2	Afan Oromo	Excellent	Excellent	Excellent	Excellent
3	Amharic	Excellent	Excellent	Excellent	Excellent

9.Work experience

S/n	Responsibility	Organization	Years in E.C.
1	Biomedical Engineering	Haramaya General Hospital	2007-2008
2	Biomedical Engineering	East Hrarghe Zonal Health Office	2009-now

10.Social skills and competences

Ability to work under pressure, adaptability and stress tolerance

Hard working and motivated in community-based field work and research

Developing teams and work in team environment with trust each other

Professionalism, respect, dedication and sincerity with peers and staffs

11.Technical skills and competences

Familiar with health care system

Very good communication and interpersonal skill

Very good in different computer application and softwares

Strong belief in team work and participatory management

12. Hobbies and special interests

Reading and conducting health researches

Reading books and journals

Exploring internet (journals)

13.References

1. Mr. Mohammadin Kabirhussen (BSc, MSc), Head of East Hararghe Zonal Health Office. Phone No: 0930374604

2. Mr.Alemayo Deresa (BSC, MSC,), Lecturer at Haramaya University, College of Health Science and Medicine. Phone No: 091784170