

Utilization of Insecticide-Treated Nets in Households for Under-5 Children and Associated Factors in East Meseke District, Gurage Zone, Southern Ethiopia

Authors: Kebede, Welyou, Tolcha, Alemu, Soboksa, Negasa Eshete, Negassa, Belay, Kanno, Girum Gebremeskel, et al.

Source: Environmental Health Insights, 17(1)

Published By: SAGE Publishing

URL: <https://doi.org/10.1177/11786302231164287>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.



Usage of BioOne Complete content is strictly limited to personal, educational, and non-commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Utilization of Insecticide-Treated Nets in Households for Under-5 Children and Associated Factors in East Mesekan District, Gurage Zone, Southern Ethiopia

Environmental Health Insights
Volume 17: 1–9
© The Author(s) 2023
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/11786302231164287



Welyou Kebede¹, Alemu Tolcha², Negasa Eshete Soboksa³ ,
Belay Negassa³ , Girum Gebremeskel Kanno³
and Mekonnen Birhanie Aregu³

¹Meskan District Health Office, Gurage Zone Health Department, Southern Nations & Nationalities Peoples Regional Health Bureau, Wolkite, SNNPR, Ethiopia. ²Department of Environmental Health, College of Health Science and Medicine Hawassa University, Hawassa, Southern Nations, Ethiopia. ³Department of Environmental Health, College of Health Science and Medicine Dilla University, Dilla, Ethiopia.

ABSTRACT

INTRODUCTION: Insecticide-treated nets (ITNs) are widely used tools that have been proven effective in preventing and controlling malaria. However, usage varies among households and can greatly affect the benefits of ITNs. Thus, this study aimed to assess the household utilization of insecticide-treated nets and its associated factors for under-5 children.

METHODS: A cross-sectional study was conducted in March–April 2020 in the East Mesekan district. A total of 591 households with under-5 children were chosen by using a systematic random sampling approach for the interviews. The data was collected using a pretested questionnaire. Epi-Data version 3.1 was used to enter data and SPSS version 21 for analysis. A *P*-value of .05 was considered statistically significant.

RESULTS: In this study, 58.2% (95% CI: [54.1%–62.2%]) of household participants used ITN for children under 5 years of age while sleeping the night before the survey. The study participants' overall knowledge and practice of malaria prevention were 27.1% and 23.9%, respectively. Having a family size of less than 5 (AOR = 0.60, 95% CI: [0.37–0.98]) and complaints of skin irritation (AOR = 0.43, 95% CI: [0.29–0.63]) significantly decreased ITN utilization. However, having 1 ITN (AOR = 2.15, 95% CI: [1.15–4.02]) or 2 ITNs (AOR = 2.58, 95% CI: [1.51–4.39]), as well as low (AOR = 2.07, 95% CI: [1.33–3.20]) and medium (AOR = 1.83, 95% CI: [1.11–3.02]) knowledge of ITN importance, increased ITN utilization significantly.

CONCLUSIONS: The households' use of ITNs for children under the age of 5 was inadequate. It was significantly associated with having a family size of less than 5, complaints of skin irritation, owning 1 or 2 ITNs, and having low and medium knowledge of its importance. It is recommended that continuous and progressive health awareness about the consistent use of ITN for malaria prevention in the study area be promoted.

KEYWORDS: Malaria prevention, ITNs utilization, factors associated, under-5 children, Ethiopia

RECEIVED: August 29, 2022. **ACCEPTED:** March 1, 2023.

TYPE: Original Research

FUNDING: The author(s) received no financial support for the research, authorship, and/or publication of this article.

DECLARATION OF CONFLICTING INTERESTS: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

CORRESPONDING AUTHOR: Negasa Eshete Soboksa, Department of Environmental Health, College of Health Science and Medicine Dilla University, Dilla, 419, Ethiopia. Email: yeroosaa@gmail.com

Introduction

Malaria has long been a significant public health issue in many tropical and subtropical developing countries, particularly in African nations like Ethiopia, where socioeconomic conditions are difficult.¹ The case incidence in the WHO African Region decreased from 373 to 225 per 1000 individuals at risk between 2000 and 2019, but it climbed to 234 in 2020, primarily due to service disruptions during the COVID-19 pandemic. The incidence decreased to 229 cases per 1000 individuals in 2021.² Due to its mountainous topography, varying winds, seasonal rainfall, and ambient temperatures, Ethiopia, one of the Sub-Saharan Africa (SSA) countries most severely affected by the pandemic, provides a variety of microclimates for malaria transmission.³ Malaria

affects over 60% of Ethiopians, and 68% of the country's land area is conducive to the disease's spread.⁴

A study showed that using an ITN lowers the prevalence of malaria parasitemia, which is used as a proxy for the disease's burden.⁵ All populations in malaria hotspot areas are at risk unless they have access to locally adequate insecticide-treated nets and a more robust healthcare system. An estimated 552 million ITNs were provided by the National Malaria Programs (NMP) between 2015 and 2017; the bulk (83%) were given out in sub-Saharan Africa (SSA).⁶ About 80% of ownership and use are widely regarded as the minimal condition for considering universal coverage. This is based on the assumption that 2 people typically share a net, so if 1 net is made available for every 2 members of a household, then everyone can utilize an ITN.^{7,8}



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

ITNs, a popular malaria preventive method,⁹ have aided in lowering the burden of the illness for more than 20 years. Despite this, the usage is still below average. About 54% of all children under the age of 5 in SSA had slept under an ITN at night.^{10,11} It can provide a physical barrier to mosquitoes and offer malaria protection when used and maintained properly. ITNs are treated with an insecticide, which has a 3- to 5-year shelf life, or around 20 washes. ITNs are substantially more effective than non-treated nets because they have both an insecticide and a physical barrier. The insecticide prevents mosquitoes and, in most cases, kills or knocks them down, preventing the transmission of the malaria parasite even to people not protected by mosquito nets.¹²

According to a survey on ownership and use of long-lasting insecticidal nets in Ethiopia (2020), 66.8% of the households owned at least 1 ITN, and on average, households owned 1.8 ITNs. However, the night before the survey, 44.16% of the general population and 52.34% of children slept under ITN.¹³ On the other hand, the operational malaria plan for Ethiopia for the 2019 fiscal year states that during the 2015-16 period, nearly 30 million ITNs were supplied to homes in Ethiopia at risk of malaria.⁷ Although ITN distribution did not rely on registration to gather data on the number of children under the age of 5, pregnant women, and sleeping spaces for each household in malaria-endemic kebeles, an average of 2 ITNs per home was utilized for logistical and mathematical concerns.¹⁴

Even though a greater number of households in Ethiopia are using ITNs, usage is constrained by factors including home design and user habits. Due to a lack of awareness of the necessity for priority groups to sleep under ITNs at home, unsuccessful ITN use has been noted in numerous parts of Ethiopia.⁴ In Ethiopia's East Meseke District, Enseno, the research area may experience comparable conditions. Along with the aforementioned difficulties, fieldwork has revealed that people in the research area have been seen using ITNs for things besides preventing mosquito bites, like window coverings and hair accessories.

ITN utilization in households for children under the age of 5 during the survey's prior night and associated factors have been briefly studied in Ethiopia.^{11,15,16} However, to the author's knowledge, there are no attempted studies on the ITN utilization of households with under 5 children and associated factors in this study area. Thus, this study aimed to identify ITN utilization and associated factors among households with children under the age of 5 in the East Meseke District, Gurage Zone, Southern Ethiopia. The findings of this study will be used as a baseline for future related research by non-governmental organizations, regional health departments, and other health planners in implementing targeted malaria control strategies.

Methods and Materials

Study area, design, and period

A community-based cross-sectional study design was carried out from March 5 to April 22, 2020, in the East Meseke

District, Gurage Zone, Southern Nation Nationalities, and People Region. It is located 153 kilometers south of Addis Ababa, the capital city of Ethiopia. The area of East Meseke District is an estimated 1767 square kilometers with a total population of 82 139, with 49% men and 51% females dispersed over 3 urban and 14 rural kebeles.¹⁷ The rural population accounts for 77% of the total population, while the urban population accounts for 23%. The total number of households is estimated to be 16 762. There are 3 functional health centers and 14 functional health posts in the district. There were ten private clinics in the district and 4 pharmacies. As our preliminary survey indicated, ITN coverage in this district is almost entirely provided by non-governmental organizations funded by the Global Fund to Fight AIDS, Tuberculosis, and Malaria. The East Meseke District is found in a rift valley area with a varied landscape, predominantly covered with plateau formations, and variable temperatures.¹⁷

Sample size determination and sampling techniques

The required sample size was calculated using a single population proportion formula. In the calculation, we assumed a 63% population proportion based on a study conducted in Adami Tullu District, Oromia Regional State, Ethiopia, which stated that children had slept under ITNs among net-owning households during the previous night,¹⁸ a 5% margin of error at a 95% confidence level, a 10% non-response rate, and a design effect of 1.5. The final sample size was estimated to be 591.

Six kebeles (the smallest administrative structure) were selected from all the East Meseke District kebeles using simple random sampling. Then, lists of all the households found in each selected kebele were identified, and households with at least 1 under-5 child from each kebele were prepared in collaboration with the health extension worker from data prepared for immunization purposes. The sample was proportionally allocated to each kebele based on the number of households with under-5 children in each kebele. Households with under-5 children were selected through a systematic random sampling method for recruitment for interviews. From the list of households with under 5-year-old children, every seventh household in each group was chosen as a participant (Figure 1).

Study variables

The dependent variable of this study was the ITN utilization of households for under-5 children on the previous night. Whereas socio-demographic variables such as age, sex, educational status, religion, source of income, number of ITNs in the household, family size, sleeping pattern, and environmental variables like type of living room, place of residence, the season of the year, the roof of the house, number of sleeping rooms, cost-effectiveness, and sustainability, knowledge and practice—symptoms of malaria, causes and prevention of malaria, and perception of ITN use—were independent variables. With the use of 18 questions, the study participant's knowledge of the importance of ITN was assessed. A respondent was considered

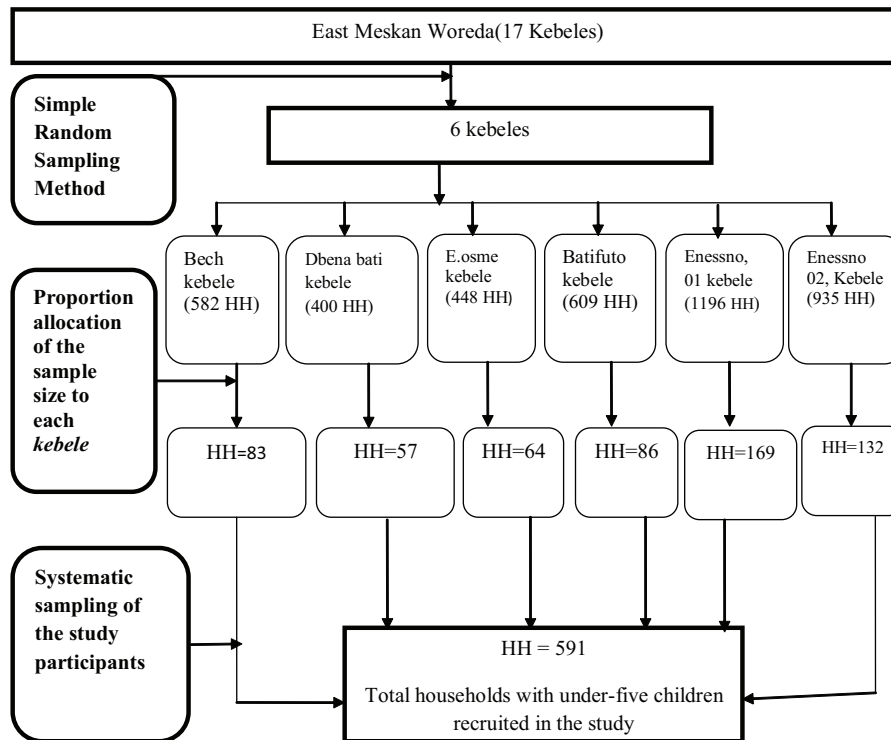


Figure 1. Schematic presentation of sampling procedures, East Mesekan District March 2020.

to have good knowledge if they correctly answered 14 or more questions, whereas those who answered 9 to 13 questions were considered to have medium knowledge, and others had low knowledge. Eight questions were used to evaluate the study participants’ ITN usage practices. We considered a respondent to have “good practices” if they correctly answered 6 or more questions, and we deemed them to have “medium practices” if they correctly answered between 4 and 6 questions or otherwise had “low practices.”

Data collection techniques

For data collection, a structured questionnaire adapted from a previously published study was used in this study.¹⁹ Eight diploma nurses for data collection who speak the local language and 2 environmental health professionals for supervision were recruited before data collection. Training for data collectors and supervisors was given for 3 days by preparing and using a training manual that was purposely prepared for this study, outlining tasks and interviewing techniques, with the provision of a field manual for data collection. Field supervision and daily meetings during data collection were intense to ensure the quality of the data. The heads of households provided the data. If they weren’t present, it was gathered from mothers/caregivers, or 18-year-old household members.

Data quality control and management

To maintain consistency, the adapted questionnaire was first written in English to meet the study’s objectives, then

translated from English to Amharic and back to English by a language professional. Supervisors and interviewers were given training. The pre-test was conducted in 30 households (5% of the sample size) to ask about the possession and use of insecticide-treated nets among children under the age of 5. The supervisors reviewed every questionnaire for completeness and logical consistency and had them counter-checked by the principal investigator. Data coding and data entry were checked at the beginning and throughout the work, and data cleaning was conducted at the end of the data entry.

Data analysis

The data was entered using the Epi-Data version 3.1 computer software package and exported to Statistical Package for the Social Sciences (SPSS) version 21 (SPSS Inc., Chicago, USA) for data cleaning and analysis. Percentages and distributions of respondents’ sociodemographic variables and other study factors were used to explain the data. To determine the association between household ITN utilization for children under the age of 5 and potential variables, bivariate and multivariable logistic regression models were used to obtain the crude odds ratios (COR) and adjusted odds ratios (AOR) with 95% confidence intervals (CIs). In the bivariate analysis, independent variables with a *P*-value of less than or equal to .25 were included in the multivariable analysis model to identify those significant factors associated with the outcome variable while controlling for other variables, and the level of significance was set at *P* ≤ .05.

Ethical clearance

Ethical clearance was initially obtained from Hawassa University College of Medicine and Health Sciences' Institutional Review Board (IRB) (Ref. No.: IRB/044/12). A formal letter was written to all concerned authorities, and permission was secured at all levels. The necessary amendments were made before the actual data collection took place. Interviews were carried out only with the full consent of the person being interviewed. Before each interview, the study's objectives were clearly explained, mentioning that the aim of the study was neither to evaluate the performance of the individual nor to blame anyone for weakness. Each respondent was assured that the information provided was confidential and would be used only for the purpose of research. Responses were kept confidential and anonymous.

Results

Socio-demographic

In this study, 591 households were included, with a response rate of 100%. More than half of the respondents were females (57.7%). Nearly half (45.9%) of the respondents were within the age group of 25 to 34. Almost all, 556 (94.1%), of the respondents, were married. Regarding educational status, 28.3% of the respondents had no formal education/were unable to read and write. Most of them, or 550 (93.1%) of the respondents' houses, were made of corrugated material. The mean (\pm SD) monthly income was found to be ETB 2088.92 (\pm 1588.79). Regarding the number of rooms for sleeping purposes, 290 (49.1%) of the respondents had 2 rooms for sleeping. More than two-thirds of households had radio/television during the survey. In terms of occupation, 265 (44.8%) of the respondents were farmers, while 147 (24.9%) were merchants (Table 1).

Knowledge of study participants

Knowledge on malaria. Almost all participants (570, or 96.4%) had heard of malaria. Five hundred two (88.1%) of those surveyed were aware that malaria was spread by mosquito bites. Fever was identified as the primary symptom of malaria by the majority of respondents (372, or 62.9%), followed by feeling cold. Four hundred seventy-three (80%) of the participants stated that children under the age of 5 were the most affected by malaria. In terms of malaria education messages, 562 (95.1%) respondents were reached through various mechanisms, and 453 (80.6%) of these messages were reached through health workers. Four hundred seventy-seven (80.7%) respondents said they prevented malaria by using ITN, and nearly half said they prevented malaria by spraying chemicals around the house (Table 2).

Knowledge on mosquito. In this study, 360 (60.9%) of the participants reported that mosquitoes troubled them. More than half (383, or 64.8%) of participants reported mosquito bites at

Table 1. Socio-demographic characteristics of the study participants, East Meseke District, March, 2020.

VARIABLES	CATEGORY	FREQUENCY (PERCENTAGE, %)
Sex of the respondent	Male	250 (42.3)
	Female	341 (57.7)
Age of respondents in years	18-24	80 (13.5)
	25-34	271 (45.9)
	35-44	208 (35.2)
	45-54	32 (5.4)
Residence	Rural	295 (49.9)
	Urban	296 (50.1)
Religion of respondent	Muslim	446 (75.5)
	Orthodox	107 (18.1)
	Protestant	38 (6.4)
Educational status of the respondent	Have no formal education	167 (28.3)
	Grade 1-4	90 (15.2)
	Grade 5-8	178 (30.1)
	Grade 9-12	98 (16.6)
	Above Grade12	58 (9.8)
Marital status of respondent	Married	556 (94.1)
	Unmarried	35 (5.9)
Number of household members	\leq 5	382 (64.6)
	>5	209 (35.4)
Number of under 5 children	1	371 (62.8)
	2 and above	220 (37.2)
Main material of the roof of house work	Thatched	41 (6.9)
	Corrugated iron	550 (93.1)
Number of rooms for sleeping purpose	1	98 (16.6)
	2	290 (49.1)
	3	160 (27.1)
	4	43 (7.2)
Household TV/radio ownership	Yes	412 (69.7)
	No	179 (30.3)
Occupational status of the respondent	Unemployed	28 (4.7)
	Farmer	265 (44.8)
	Merchant	147 (24.9)
	Daily laborer	80 (13.5)
	Government/private employ	72 (12.1)

Table 2. Knowledge about malaria among study participants, East Mesekan District, March, 2020.

VARIABLES	CATEGORIES	FREQUENCY (PERCENTAGE, %)
Have you heard of about malaria	Yes	570 (96.4)
	No	21 (3.6)
Cause of malaria		
Being bitten by mosquito	Yes	502 (88.1)
	No	68 (11.9)
Being in the rain	Yes	205 (36.0)
	No	365 (64.0)
Caught a cold	Yes	19 (3.3)
	No	551 (96.7)
Symptom of malaria		
Fever	Yes	372 (62.9)
	No	219 (37.1)
Feeling cold	Yes	321 (54.3)
	No	270 (45.7)
Headache	Yes	161 (27.2)
	No	430 (72.8)
Loss of appetite	Yes	272 (46.0)
	No	319 (54.0)
Body pain/joint pain	Yes	191 (32.3)
	No	400 (67.7)
Most vulnerable to malaria		
Under 5 children	Yes	473 (80)
	No	118 (20)
Any person	Yes	149 (25.2)
	No	442 (74.8)
Channels of malaria education message		
Having heard malaria education message	Yes	562 (95.1)
	No	29 (4.9)
Radio/TV	Yes	221 (39.3)
	No	341 (60.7)
Health workers	Yes	453 (80.6)
	No	109 (19.4)
Way of prevention from malaria		
Sleeping under ITN	Yes	477 (80.7)
	No	114 (19.3)
Chemoprophylaxis	Yes	206 (34.9)
	No	385 (65.1)
Spraying chemicals	Yes	280 (47.4)
	No	311 (52.6)

Table 3. Knowledge of the study participants regarding mosquitoes, East Mesekan District, Marh, 2020.

VARIABLES	CATEGORIES	FREQUENCY (PERCENTAGE, %)
Mosquitoes cause you any trouble	Yes	360 (60.9)
	No	231 (39.1)
Time of mosquito bite		
Morning	Yes	13 (2.2)
	No	578 (97.8)
Evening	Yes	277 (46.9)
	No	314 (53.1)
At bedtime	Yes	383 (64.8)
	No	208 (35.2)
The season of mosquito bites the most	During the rainy season	580 (98.1)
	During dry season	6 (1.0)
	All year round	5 (0.8)
Protect yourself from mosquitoes	Yes	549 (92.9)
	No	42 (7.1)
Methods of self-protection from mosquito		
Clean the house	Yes	424 (77.2)
	No	125 (22.8)
Use insecticide	Yes	84 (15.3)
	No	465 (84.7)
Use mosquito net	Yes	431 (78.5)
	No	118 (21.5)
Cloth window and doors	Yes	41 (7.5)
	No	508 (92.5)
Use traditional plants	Yes	15 (2.7)
	No	534 (97.3)

bedtime, and nearly all (580, or 98.1%) reported mosquito bites during the rainy season. Five hundred forty-nine (92.9%) of the respondents understood the importance of protecting themselves from mosquito bites using various mechanisms (Table 3).

Insecticide treated net utilization practice. The majority of study participants (83.9%) reported that having an ITN is an advantage in that they do not get malaria. On the other hand, 89.3% of study participants stated that using ITNs had no benefit in terms of sleeping better. Regarding the disadvantages of ITN utilization, 73.4% of the study participants reported that ITN use during sleep was not too hot. Furthermore, 31.1% of study

participants reported skin irritation from ITN use, and another 23.9% reported that hanging the net each night takes time. In this study, 30.3% of participants owned 1 ITNs, whereas 28.6% of the study participants had 3 or more ITNs. On the other hand, this study shows that more than half of the respondents who were surveyed (62.3%) claimed they always use ITNs for under-5 children when sleeping, while 17.7% said they never do. More than half of the households in this study (58.2%, 95% CI: [54.1%-62.2%]) used ITN for children under the age of 5 the night before the survey. In terms of household ITN ownership, 91.1% were acquired in less than 12 months, and 8.9% were acquired between 12 and 24 months (Table 4).

Knowledge and practice of ITN utilization among households with under-5 children are shown in Figure 2. According to Figure 2, only 34.3% and 29.4% of study participants had good knowledge and practice of ITN use, respectively.

Factors associated with ITN utilization

After bivariate analysis, factors such as the households' residence, family size, the main material of the roof made, how long have you had your ITNs, number of ITN, presence of side effects of ITNs on skin irritation and knowledge about ITN were taken into account in the multivariable analysis. A significant association between ITN utilization for under-5 children in the study community and family size, the number of ITNs, presence of side effects of ITNs on skin irritation, having knowledge about ITN was found in a multivariable analysis ($P < .05$). The study participants' residence, the main material of the roof made and length of ITN they used, however, did not significantly affect their utilization of ITNs ($P > .05$).

The odds of ITN utilization for respondents who had 2 ITNs were 2.58 times higher (AOR=2.58, 95% CI: [1.54-4.39]) compared to those who had 3 ITNs. Respondents who didn't report skin irritation related to ITN utilization were 58% less likely to have ITN utilization (AOR=0.43, 95% CI: [0.29-0.63]) compared to those who reported skin irritation as a side effect of ITN utilization. Additionally, respondents who had low knowledge about ITN were 2.07 time more likely utilized ITN (AOR=2.07, 95% CI: [1.33-3.20]) compared to those who had good knowledge about ITN. On the other hand, the odds of utilizing ITN among rural residents were 14% lower (AOR=0.86, 95% CI: [0.56-1.30]) compared to urban residents, even though the difference was not statistically significant (Table 5).

Discussion

This study aimed to examine the household ITN utilization for under-5 children the previous night in East Mesekan District, Gurage Zone, Southern Ethiopia. According to the study's findings, more than half (58.2%) of the participants' children under 5 years old had slept under an ITN in the previous night. The current study finding was nearly similar to a

Table 4. Perception and attitude toward ITNs of the study participants with under-5 children East Mesekan District, March 2020.

VARIABLES	CATEGORIES	FREQUENCY (PERCENTAGE, %)
Advantage of ITN		
Do not get malaria	Yes	496 (83.9)
	No	95 (16.1)
Don't bother by other insecticide	Yes	73 (12.4)
	No	518 (87.6)
Sleep better	Yes	63 (10.7)
	No	528 (89.3)
Disadvantage of ITN		
It's too hot	Yes	157 (26.6)
	No	434 (73.4)
It takes time to hang the net each night	Yes	141 (23.9)
	No	450 (76.1)
Skin irritation	Yes	184 (31.1)
	No	407 (68.9)
ITN utilization		
The households' use of ITNs for children under the age of 5 the night before the survey	Yes	344 (58.2)
	No	247 (41.8)
With whom under-5 children slept under an ITN the previous night	With mother	134 (39.0)
	With both parents	210 (61.0)
Households ITN usage	Always	368 (62.3)
	Sometimes	47 (7.9)
	Seasonal	73 (12.3)
	Never	103 (17.5)
Number of ITNs owned by households	1	179 (30.3)
	2	243 (41.1)
	3 and above	169 (28.6)
In how many months have you had your ITNs for this household?	Less than 12 mo	538 (91.1)
	12-24 mo	53 (8.9)

study conducted in Senegal, which showed that 58.7% of households used ITN for children under-5 to sleep under it.²⁰ In contrast, a study conducted in Ghana found that households' ITN use for children under 5 years old was lower (41.7%) than the counterpart.²¹ This increased household ITN utilization for under-5 children in our study might be related to improved

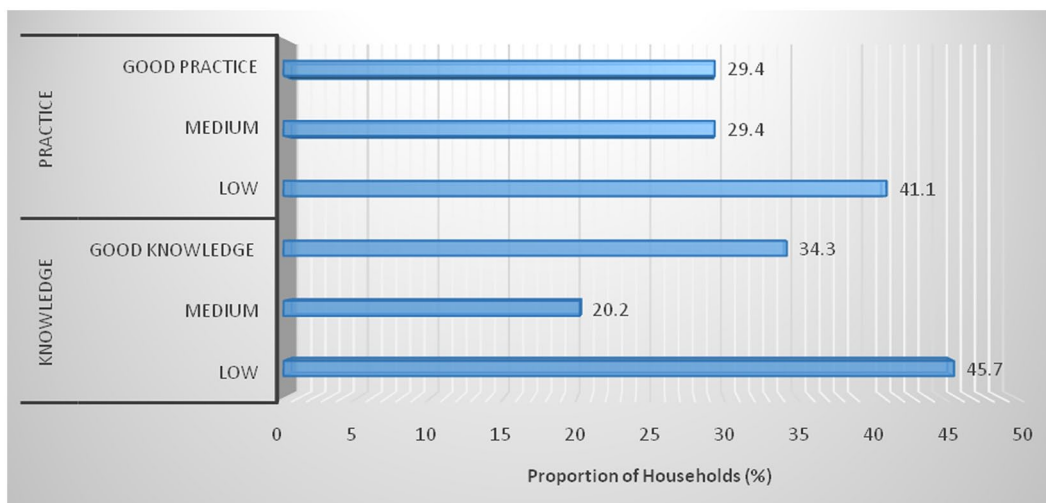


Figure 2. Knowledge and practice of ITN utilization among households with under-5 children in East Mesekan District, March, 2020.

Table 5. Bivariate and multivariable logistic regression model predicting the ITN utilization for under-5 children, East Mesekan District, March, 2020.

VARIABLES	CATEGORIES	UTILIZATION OF ITN		COR (95% CI)	AOR (95% CI)
		YES	NO		
Residence	Rural	180	115	1.26 (0.91-1.75)	0.86 (0.56-1.30)
	Urban	164	132	1	1
Family size	<5	217	165	0.85 (0.60-1.20)	0.60 (0.37-0.98)*
	≥5	127	82	1	1
The main material of the roof	Thatched	24	17	1.02 (0.53-1.93)	1.01 (0.49-2.05)
	Corrugated iron	320	230	1	1
How long have you had your ITNs	<12 mo	190	309	1.54 (0.81-2.93)	1.65 (0.94-2.87)
	12-24 mo	57	35	1	1
Number of ITNs in the home	1	101	78	1.48 (1.09-2.25)*	2.15 (1.15-4.02)*
	2	164	79	2.37 (1.58-3.54)*	2.58 (1.51-4.39)*
	3	79	90	1	1
ITNs side effect on skin irritation	No	84	100	0.48 (0.33-0.68)*	0.43 (0.29-0.63)*
	Yes	260	147	1	1
Knowledge on ITNs importance	Low	179	91	2.47 (1.70-3.59)*	2.07 (1.33-3.20)*
	Medium	75	43	2.19 (1.37-3.49)*	1.83 (1.11-3.02)*
	Good knowledge	90	113	1	1

*Significant at $P < .05$.

knowledge and awareness of education and the demand creation of the community through mass media, local and community radio, or television. But the proportion of households that used ITNs for under-5 children who slept under them during the night preceding a survey was lower than the proportion of households that possessed ITNs in the study area.

In the current study, around one-third of the participants of the study population perceived that there was skin irritation among their under-5 children, which was higher than a similar study in India, where one-fourth of the respondents of ITN users complained of skin irritation.²² Other problems infrequently mentioned by studies were daily time-taking,

mounting, or hanging of ITN during a sleeping time.²³ A similar study done in Bahir Dar, Amhara region, reported that it took time every night to mount or hang ITN during sleeping time. These were some of the potential underlying reasons that the people did not use ITNs in sleeping.²⁴

Regarding the malaria information, almost all of the respondents (96.4%) in the community heard the term malaria in our study. In a similar study conducted in Woreta town, North West Ethiopia, 95.8% of the participants heard about malaria.²⁵ Our study findings outperformed those of a study conducted in Kenya, which revealed that 91% of study participants had heard of the term malaria.²⁶ Therefore, this study's findings were better than those of the previous similar study. This improvement would be because they get this information on malaria education messages from health workers.

In order to ensure efficient use of prevention tools, knowing that malaria is transmitted by infected mosquito bites is essential. In this study, 88.1% of the respondents knew that malaria was transmitted by an infected mosquito bite. In a similar study in Woreta town, north-west Ethiopia, about 59.6% of respondents rated the bite of an infected mosquito as a way of malaria transmission.²⁵ The Ethiopia national malaria indicator survey of 2015 found that 75% of the respondents had malaria, which is transmitted by the bite of an infected mosquito.⁴ The current research showed more favorable outcomes than those of the previous; the possible reason for this difference could be increased community awareness from time to time through media or health information dissemination.

In our study, more than three-fourths of respondents identified children under the age of 5 as the most affected group in the community, and 62.9% of residents identified fever as a major symptom of malaria. The current result was lower than the following similar study, 87.1% of the participant's perceived fever, the main symptoms of malaria in Adami Tulu district, Oromia Regional state.²⁷ A similar study in Kenya explained that a symptom matching clinical descriptions of malaria, fever, or "hot body," was mentioned by 80.2% of the respondents.²⁸ More than half of the people in the study area were unaware of the signs and symptoms of malaria, such as headache, loss of appetite, and body pain or joint pain. This finding may have the drawback of implying that the main signs and symptoms of malarial illness were not distinguished from other diseases during education time by district health office professionals and kebele health extension workers.

In the current study, only 80.7% of the respondents claimed that ITN prevents malaria. Our study's finding was lower than the finding of a comparable Ugandan survey, which showed that 98.1% respondent claimed that ITN prevents malaria.²⁹ The possible reason for the difference might be related to the fact that, during and after distribution, the health information dissemination by health workers and others on the ITN for malaria prevention is low.

In the present study, households with less than 5 family sizes were less likely to use ITN than households with 5 or more

family sizes. The findings of our study were not supported by a previous study, which found that having a family size of less than 5 increased the likelihood of using ITN compared to those respondents who had more than 5 or more children in other regions of Ethiopia.^{11,30} But, an investigation carried out in Burkina Faso revealed that the size of families did not significantly affect the use of ITNs for children under the age of 5.³¹ The possible explanation is that families frequently sleep in a single room, which could be a challenge due to a lack of convenient spaces that do not permit mosquito net hanging or because the sleeping room might be used for other purposes, as evidenced by studies conducted in Ethiopia and Uganda.^{32,33}

Skin irritation is a rare adverse effect mentioned by ITN users, along with headaches, nausea, and eye burning. If any of these effects do occur, they are minimal and transient.³⁴ In our study, households that experience skin irritation linked to an ITN side effect were less likely to use ITNs for their children under the age of 5. This might be related to the community's belief that children's bed nets are poison because of their delicate skin. As a result, most people advise against covering newborns' beds with bed nets.³⁵

In the present study, respondents who were less knowledgeable about the importance of ITNs were more likely to use ITNs for their children under the age of 5 than those who were more knowledgeable. Our study's findings were contradictory to those of a study conducted in Eastern Ethiopia.³⁰ This may be as a result of the ITNs they possessed being damaged, dirty, or difficult to hang in their home, as well as potential limitations in the questions we used to compute knowledge. There is a limitation to this study. Self-reported responses, which made up the majority of the data, were biased toward social desirability. Cross-sectional designs have the potential to make it difficult to prove a causal connection between causes and effects. It's possible that the 1 night prior to the survey, when the use of ITNs by children under the age of 5 was evaluated, did not accurately represent the long-term trend of ITN usage.

Conclusion

The utilization of ITNs by households for under-5 children was unsatisfactory, but it was better than the other study finding done at the country level in Ethiopia, and not all ITNs owned by households in the area were being used for under-5 children at the time of data collection. Fear of skin irritation, household size, and the number of ITNs they owned were identified as the main barriers to ITN use. It is recommended that continuous and progressive health awareness about the consistent use of ITN for malaria prevention in the study area be promoted.

Acknowledgements

The authors would like to express their gratitude to Hawassa University for the ethical letter. We are also grateful to all data collectors and study participants for their time and effort.

Author Contributions

WK, MBA, and AT conceptualize the study, collect the data, and conduct the analysis. The manuscript was written by MBA and NES. The manuscript was critically examined and reviewed by MBA, AT, WK, NES, BN, and GGK. The manuscript was read and approved by all authors.

Availability of Data

The corresponding author can be contacted for access to the data used for this manuscript, which can be distributed as needed.

ORCID iDs

Negasa Eshete Soboksa  <https://orcid.org/0000-0003-3451-175X>

Belay Negassa  <https://orcid.org/0000-0002-6212-8064>

REFERENCES

- Kendie FA, Hailegebriel W/kiros T, Nibret Semegn E, Ferede MW. Prevalence of malaria among adults in Ethiopia: a systematic review and meta-analysis. *J Trop Med.* 2021;2021:8863002-8863009.
- World Health Organization. World Malaria Report 2022. World Health Organization; 2020: 238.
- Emeka PC. The impact of malaria on the people of Anambra State Nigeria and their response to the disease. *J Infect Dis Ther.* 2017;5:324.
- Ethiopian Public Health Institute. Ethiopian National Malaria Indicator Survey 2015. Ethiopian Public Health Institute; 2016.
- Apinjoh TO, Anchang-Kimbi JK, Mugri RN, et al. The effect of insecticide treated nets (ITNs) on plasmodium falciparum infection in rural and semi-urban communities in the South West Region of Cameroon. *PLoS One.* 2015;10:e0116300.
- WHO. World Malaria Report 2018. WHO; 2018.
- USIAD. Ethiopia Malaria Operational Plan FY 2019- U.S. Presidents Malaria Initiative; 2019.
- Roll Back Malaria. Scaling Up Insecticide-Treated Netting Programmes in Africa (2nd edition, Revision 23). World Health Organization; 2005. Accessed February 1, 2020. <https://www.who.int/publications/m/item/scaling-up-insecticide-treated-netting-programmes-in-africa>
- WHO Global Malaria Programme. Achieving and Maintaining Universal Coverage With Long-Lasting Insecticidal Nets for Malaria Control. WHO; 2017:4. Accessed February 1, 2020. http://www.who.int/malaria/publications/atoz/who_recommendation_coverage_llin/en/
- Theiss-Nyland K, Lines J, Fine P. Can ITN distribution policies increase children's ITN use? A DHS analysis. *Malar J.* 2019;18:1-9.
- Admasie A, Zemba A, Paulos W. Insecticide-treated nets utilization and associated factors among under-5 years old children in Mirab-Abaya District, Gamo-Gofa Zone, Ethiopia. *Front Public Health.* 2018;6:1. Accessed February 1, 2020. www.frontiersin.org
- Chanda E, Remijo CD, Pasquale H, Baba SP, Lako RL. Long-lasting, insecticide-treated nets (LLIN) scale-up and hang-up programme: lessons from South Sudan. Vol. 92, Bulletin of the World Health Organization. 2014.
- Nigatu W, Sisay A, Haile M, Tesfaye G, Awel SA. A survey on ownership and use of long-lasting insecticidal nets in Ethiopia (2020). *Ethiop J Public Health Nutr.* 2022;5:36-43.
- FMOH. National Malaria Guidelines, Fourth Edition. Vol. 3rd. 2017:1-108. Accessed February 1, 2020. https://www.humanitarianresponse.info/sites/www.humanitarianresponse.info/files/documents/files/eth_national_malaria_guideline_4th_edition.pdf%0Ahttp://lifesavingcommodities.org/wp-content/uploads/2014/08/National-malaria-guidelines_2012.pdf
- Biadgilign S, Reda A, Kedir H. Determinants of ownership and utilization of insecticide-treated bed nets for malaria control in eastern Ethiopia. *J Trop Med.* 2012;2012:235015.
- Asnakech GG, Girsha WD. Assessment of long-lasting insecticidal net utilization and its associated factors among households in Adama district, Oromia Region, Ethiopia. *Sci J Public Health.* 2016;4:476-481.
- Central Statistical Agency, ORC Macr. Ethiopia Demographic and Health Survey 2000. Central Statistical Authority and ORC Macr; 2001:1-299. Accessed February 1, 2020. <http://www.dhsprogram.com/pubs/pdf/FR118/FR118.pdf>
- Lencha B. Insecticide treated net utilization among under-five children and household net ownership in Adami Tullu District, Oromia Regional State, Ethiopia: a community based cross-sectional study. *Qual Prim Care.* 2018;26:38-44.
- Haileselassie B, Ali A. Assessment of insecticide treated nets coverage for malaria control in Kafta-Humera District, Tigray : Possession versus use by high-risk groups. *Ethiop J Health Dev.* 2008;22:259-267.
- Elvire Mfueni B, Annie R, Catherine B, Edouard A, Ndéye Mareme S, Yves C. Socio-economic factors and ITN policies in Senegal, a country close to malaria elimination. *J Infect Dis Epidemiol.* 2022;8:254.
- Diema Konlan K, Japiong M, Dodam Konlan K, Afaya A, Salia SM, Kombat JM. Utilization of insecticide treated bed nets (ITNs) among caregivers of children under five years in the Ho Municipality. *Interdiscip Perspect Infect Dis.* 2019;2019:1-7.
- Sharma SK, Tyagi PK, Upadhyay AK, Haque MA, Agrawal OP. Efficacy, human safety and collateral benefits of alphacypermethrin treated long-lasting insecticidal net (InterceptorA®) in a hyperendemic tribal area of Orissa, India. *J Trop Dis.* 2014;02:1-8.
- Pulford J, Hetzel MW, Bryant M, Siba PM, Mueller I. Reported reasons for not using a mosquito net when one is available: a review of the published literature. *Malar J.* 2011;10:10.
- Berie Y. Factors affecting utilization of insecticide treated nets among people living with HIV/Aids in Bahir Dar city, Northwest Ethiopia. *Sci J Clin Med.* 2013;2:147.
- Alelign A, Petros B. Knowledge, attitudes and practices of malaria transmission and preventive measures in Woreta town, Northwest Ethiopia. *BMC Res Notes.* 2018;11:1-5.
- Zhou G, Li JS, Ototo EN, Atieli HE, Githeko AK, Yan G. Evaluation of universal coverage of insecticide-treated nets in western Kenya: field surveys. *Malar J.* 2014;13:351-358.
- Lencha B, Deressa W. Insecticide treated net utilization and its barriers among under-five children in Adami Tulu District, Oromia Regional State, Ethiopia: a qualitative study. *Glob J Med Res.* 2015;15:0-6.
- Mutua EN, Bukachi SA, Bett BK, Estambale BA, Nyamongo IK. Lay knowledge and management of malaria in Baringo county, Kenya. *Malar J.* 2016;15:486.
- Taremwa IM, Ashaba S, Adrama HO, et al. Knowledge, attitude and behaviour towards the use of insecticide treated mosquito nets among pregnant women and children in rural southwestern Uganda. *BMC Public Health.* 2017;17:794.
- Tesfaye T, Mengistie Alemu B, Egata G, et al. Insecticide-treated nets utilization and associated factors among pregnant women in Miesso woreda, Eastern Ethiopia: observational study. *Int J Womens Health.* 2022;14:445-453.
- Diabaté S, Druetz T, Bonnet E, Kouanda S, Ridde V, Haddad S. Insecticide-treated nets ownership and utilization among under-five children following the 2010 mass distribution in Burkina Faso. *Malar J.* 2014;13:1-8.
- Sena LD, Deressa WA, Ali AA. Predictors of long-lasting insecticide-treated bed net ownership and utilization: Evidence from community-based cross-sectional comparative study, southwest Ethiopia. *Malar J.* 2013;12:1-9.
- Bashinyora JB. *Utilisation of Insecticide Treated Nets in Households With Children Under 5 Years in Muhorro Sub County, Kibaale District, Uganda.* Dissertation. Makerere University; 2010.
- Ahorlu CS, Adongo P, Koenker H, et al. Understanding the gap between access and use: a qualitative study on barriers and facilitators to insecticide-treated net use in Ghana. *Malar J.* 2019;18:417.
- Yirsaw AN, Gebremariam RB, Getnet WA, Mihret MS. 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.* 2021;20:130.