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Insecticide Treated Nets Utilization and Associated Factors Among Under 5 Children and Pregnant Women in Hawwa Gelan Woreda, Kellem Wollega Zone

Paulos Mekonnen[1], Melese Tadesse Aredo[2, *], Hailu Fekadu Demise[2]

[1]Kellem Wollega Zonal Health Department, Oromia Regional State, Dembidolo, West Ethiopia

[2]College of Health Science, Arsi University, Asella, South East Ethiopia

Email address:

meletade13@gmail.com (Melese Tadesse Aredo)

[*]Corresponding author

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Abstract: Malaria remains a substantial public health and development challenge, causing 216 million cases and 445,000 deaths worldwide in 2016. Of these, 81% of the cases and 91% of the deaths occurred in Sub-Saharan Africa. Insecticide-treated nets have been at the forefront of efforts to prevent and control malaria at the community and individual levels. This study conducted a community-based cross-sectional evaluation among 824 households in Hawwa Gelan Woreda, Kellem Wollega Zone, aiming to assess the utilization and associated factors of Insecticide-Treated Bed Nets (ITNs) among pregnant women and children under 5 years old. The households with eligible individuals were identified through registration, and study units were selected using systematic random sampling techniques. The collected data were entered and cleaned using EPI-Info 7, and then transferred to SPSS version 21 for further analysis. Results revealed that 69.3% of children fewer than 5 years and 74.9% of pregnant women utilized ITNs. Notably, educational status was significantly associated with ITN use in both children under 5 years (AOR=1.76, 95%CI=1.17-2.65) and pregnant women (AOR=3.26, 95%CI=1.62-6.56). Moreover, rural residence was a noteworthy factor influencing ITN utilization in children under 5 years old (AOR=7.21, 95%CI=3.11-16.68). The findings signify the need for targeted community sensitization programs, particularly emphasizing the proper installation and use of ITNs, especially among children under 5 years and pregnant women, carried out by primary healthcare units and district health extension workers.

Keywords: Insecticide, Treated, Nets, Utilization, Pregnant and Under-5, Malaria

1. Introduction

1.1. Background

Malaria remains a major public health and development challenge [1]. It caused 216 million cases and 445,000 deaths worldwide in 2016, of which 81% of the cases and 91% of the deaths were from the Sub-Saharan Africa [2].

Despite a significant decline in morbidity and mortality, malaria remains a public health concern in Ethiopia. In 2013/2014, there were 324,203 outpatient visits for malaria among children under five, with 5,103 inpatient admissions and approximately 122 inpatient deaths reported [3]. To achieve the sustainable development goal, key technical strategies include improved and prompt access to effective treatment, increased use of insecticide-treated bed nets (ITNs), early detection and response to malaria epidemics, and improved prevention and treatment of malaria in pregnant women and young children in endemic areas [4].

As a signatory of the Abuja convention, Ethiopia has incorporated these global strategies into its national malaria prevention and control approach. While indoor residual house spraying with DDT has been ongoing for the last four to five decades, the use of insecticide-treated bed nets has

become an important option for malaria prevention in the country over the past decade. Currently, the country receives ITNs from various sources such as WHO and UNICEF and distributes them to the regional states. However, studies have shown that a majority of the distributed bed nets are not being used, and their current status, utilization proportion, and demand in the area are not well understood in Ethiopia or Africa as a whole [5, 6].

The burden of malaria in Africa is substantial, affecting the most vulnerable populations and contributing to high mortality rates. It is clear that continued efforts to prevent and control malaria are crucial, as well as the need for ongoing research and investment in new tools and strategies. By addressing the specific needs of high-risk groups and prioritizing effective interventions, progress can be made in reducing the impact of malaria in Africa and beyond. It is important for governments, organizations, and communities to work together to tackle this public health issue and improve the health and well-being of those affected by malaria. [1, 7].

Pregnant women are vulnerable because their natural immunity is reduced; thus, they are four times more likely to suffer from complications of malaria than non-pregnant women. Malaria is a cause of pregnancy loss, stillbirth, low birth weight, and neonatal mortality. Individuals with sickle cell and other low immune groups are also at higher risk [8].

Ethiopia's high susceptibility to malaria makes it one of the most affected countries in Africa. Approximately 75% of the land in Ethiopia is considered to be prone to malaria, putting over 54 million people at risk. The majority of this land (which is below an altitude of 2000 meters) is affected by malaria, and around 68% of the population is vulnerable to infection. During epidemics, the rates of illness and death from malaria increase drastically, often reaching three to five times their normal levels. In combating malaria, insecticide-treated nets (ITNs) have emerged as a crucial tool, both at the community and individual levels. ITNs are particularly effective when deployed on a large scale in areas with high malaria transmission rates. However, there is a need to address issues related to ownership and usage compliance, as their benefits can only be fully realized if they are consistently utilized by the population [9].

Several systematic reviews of randomized controlled trials have confirmed the significant reduction in individual malaria risk associated with the use of ITNs, leading to a decrease in both morbidity and mortality rates [10].

This increase in ITN coverage was made possible through extensive efforts and investments from donors. However, despite the progress, the utilization coverage of ITNs among priority and high-risk groups remained low at 19%.

From 2005 to 2007, the distribution and utilization of ITNs saw significant improvement. ITN coverage increased 15-fold, reaching nearly 49% among children under five years of age and pregnant women in malaria-endemic areas. Additionally, households that owned at least one ITN saw a utilization rate of over 66%. These figures highlight the success of the scaling up efforts in Ethiopia. However, the disparities in utilization among different groups are concerning. It is clear that while the distribution of ITNs improved, ensuring proper usage remains a challenge [11].

To address this issue, additional efforts are needed to educate the population about the importance of ITN usage and to encourage proper utilization practices. This may include community awareness campaigns, targeted interventions for priority groups, and ongoing monitoring and evaluation to track progress and address any barriers to utilization. Overall, the progress made in increasing ITN coverage in Ethiopia is commendable. However, it is crucial to continue working towards improving utilization rates among high-risk groups to ensure maximum effectiveness in the prevention of malaria transmission [5].

This study intended to investigate the intra-household factors that affect the utilization of ITNs in households with children under five years old. Previous studies on ITNs among children under five years old have focused on the effectiveness of ITNs in controlling malaria, accessibility, availability, and ownership of ITNs. Oromia is Ethiopia's biggest area and accounts for the majority of the country's malaria-related health and economic burden, with three-fourths of the country's land mass being malarial [12].

A comparable amount of resources is used throughout the region, particularly in Woreda where malaria transmission is intense, to prevent and control the disease. Hawwa Gelan Woreda ranks in the top of these, with 95% of the land classified as malarous and 90% of the people at danger [13].

Locally, there is a severe dearth of knowledge and information on each household's current ITN coverage level. In particular, information on the percentage of pregnant women and children under five who use ITNs, as well as factors influencing family demand and utilization, were not evaluated in the research region. Furthermore, they were noted as information gaps that needed to be filled by researchers at all levels, including the regional, zonal, Woreda Health Office, and federal minister of health of Ethiopia [8, 14].

With this context in mind, the current study looked at the circumstances and attempted to close the gap. The objective of the data generation is to support the regional health bureau and local government in creating an implementation strategy and conducting an activity evaluation. Therefore, it is highly recommended to conduct periodic assessments of these efforts and the utilization among high-risk and priority groups.

1.2. Objective of the Study

To assess ITNs utilization and associated factors among households with children less than 5 years and pregnant women in Hawwa Gelan woreda, 2022.

1.3. Specific Objectives of the Study

1) To determine the proportion of ITNs utilization among households with under 5 years Children and Pregnant women.
2) To identify factors affecting utilization of ITNs.

2. Methods

2.1. Study Variables

2.1.1. Dependent Variable

Practice on ITN utilization: children less than 5 years of age and pregnant Women sleep under the net.

2.1.2. Independent Variables

1) Socio-Demographic characteristics:
(Sex, Age, Educational status, Religion,)
2) Source of Income
3) Health information
   a. Health information on prevention by ITNs utilization.
   b. Health information on giving priority for vulnerable group.
4) Environmental
   a. living room
   b. Place of residence
   c. Family size

2.2. Statistical Analysis

The data were entered, cleaned and Checked by EPI-Info and transferred to SPSS version 21 statistical package for further analysis. Data cleaning was performed to check for accuracy, and consistencies and missed values and variables. Descriptive statistics of the collected data was done for most variables in the study using statistical measurements. Frequency tables, graphs, percentages, means and standard deviations were used. Bivariate Binary logistic regression analysis was conducted primarily to check which variables have association with the dependent variable individually. Variables found to have association with the dependent variables at 0.2 probability were entered in to multivariate logistic regression for controlling the possible effect of confounders and finally the variables which have significant association were identified on the basis of Odds Ratio with 95%CI and 0.05 p-values to fit into the final regression model.

2.3. Ethical Considerations

The study was carried out after getting permission from the ethical review board of Arsi University College of Health Science Department of public health. A letter of support which indicates the objective of the study was written to Hawwa Gelan Woreda administration and health office from Arsi University Health Science. Permission letter was obtained from the zonal health Department, woreda administrators and woreda health office consciously for the selected kebeles. The purpose and importance of the study was explained to the participants. Data were collected after full informed verbal consent was obtained.

3. Result

3.1. Socio-Demographic Characteristics of Households

A total of 824 (100%) study subjects had participated in the study. Among these, very few 26 (3.1%) households were omitted from the analysis due to incomplete information.

Among these Rural and urban kebeles were 593 (74.3%) and 205 (25.7%), respectively (Table 1).

More than half (55.1%) of the respondents were females. The median age of the respondents was 30.00 and the mean age was 32.12 with SD± 10.721. More than half (60.8%) of respondents were Christian by their religion.

Farming is the major source of income for majority (58.6%) of the respondents; whereas government and private employee was for 5.8% of the respondents. Concerning the educational status of the respondents, nearly half (39.0%) of the respondents were illiterate, where 61.0%of the respondents were able to read and write and above.

Table 1. *Socio-demographic characteristics of respondents, Hawwa Gelan Woreda, Kellem Wollega Zone Oromia region, Sept. 2022.*

Characteristics	Number (%)	Remark
Sex of respondent		
Male	358 (44.9)	
Female	440 (55.1)	
Age in years		
18-24	220 (27.6)	
25-34	288 (36.2)	Mean=32.12
35-49	225 (28.2)	SD±= 10.72
≥50	65 (8.1)	
Educational status of respondent		
Illiterate	311 (39.0)	
Read and write	129 (16.2)	
Elementary (grade 1-8)	311 (39.0)	
Secondary (grade 9-12)	23 (2.9)	
Tertiary (college and university)	24 (3.0)	
Religion		
Christian	485 (60.8)	
Muslim	259 (32.5)	
Others	54 (6.8)	
Source of income		
Farm	468 (58.6)	
Trade	88 (11.0)	
Salary	46 (5.8)	
Others	196 (24.6)	
Bed room condition		
Separated	676 (84.7)	
Shared with others	122 (15.3)	

3.2. Prevalence of ITN Owning and Conditions Related to Household's Net

A total of 788 (98.7%) of the respondents self-reported that they own at least one bed net.

Among these, 4 (0.5%) households couldn't show any bed net during observation of household's bed nets. The assessment done on the number of bed net owned by a household, greater than half 561 (71.2%) own two bed net.

The assessment done on the reasons for non-owning net has showed that, among non-owners of bed net, lack of information where they get bed net was given as a reason for non-owning 10 households. All bed nets owned to the households were permanently treated.

The direct observation of household's bed net for any defect through the net has showed that among household's bed nets which were observed, 98 (12.3%) were inspected

with varying degree of visible defect /thorn, burn etc/ through the nets (Table 2).

Table 2. *Ownership of ITNs and conditions related to ITNs owned, Hawwa Gelan Woreda, Kellem Wollega Zone Oromia region, Sept. 2022.(n=798).*

Characteristics	Number (%)	Remark
Ownership of ITN (self reported) (n=798)		
Yes	788 (98.7)	
No	10 (1.3)	
Ownership of ITN confirmed by observation (n=788)	784 (98.2)	
Number of ITN/HH self reported (n=788)		
One	200 (25.1)	Mean=1.78 SD± = 0.49
Two	561 (70.3)	
Three+	27 (3.4)	
Type of ITN observed in HH		
Permanent	784 (100)	
Bed nets observed with defect	98 (12.3)	
Factors for not owning ITN (n=10)		
Lack of information	10 (100)	

3.3. Prevalence of ITNs Utilization Among Under 5 Years of Age Children

A total of 659 (82.6%) households were found with at least one less than five years of age children. Among these 496 (62.2%) and 163 (20.4%) were from Rural and urban respectively.

Majority 652 (98.7%) of under five years of children survived in the household which has at least one bed net whereas the remaining 7 (1.2%) of the children had no access to ITNs.

Only 450 (69.3%) of under 5 years of age children had utilized bed net during the previous night of survey. Self-reported ITN utilization among <5 children was over reported when compared with direct observation (48.5%)

A total of 50 (7.7%) under 5 years children were utilizing bed nets with defect/varying degree of thorn, burn etc. (Table 3)

Table 3. *Insecticide Treated Net utilization among under 5 years of age children and conditions related to their bed net, Hawwa Gelan Woreda, Kellem Wollega Zone Oromia region, Sept. 2022.*

Characteristics	Number (%)	Remark
Under 5 yrs child in the HH (798)		
Yes	659 (82.6)	
No	139 (17.4)	
Access to ITN (n=659)		
Yes	652 (98.9)	
No	7 (1.1)	
Children utilize ITN previous night (n=652)		
Yes	450 (69.3)	
No	202 (30.7)	
Child sleeping under properly hanged ITN (n=450)		
Yes	315 (70)	
No	135 (30)	
Child sleeping under ITN with defect (n=652)		
Yes	50 (7.7)	
No	602 (92.3)	

3.4. Prevalence of Insecticide Treated Nets Utilization Among Pregnant Women

Two hundred and thirty one 231 (28.9%) of total households were assessed with at least one pregnant women. Among these, majority 175 (75.7%) were from rural and 56 (24.3%) were urban respectively.

More than half 170 (74.8%) of pregnant women had self-reported as utilizing bed net the previous night of survey. Furthermore, the assessment by place of residence showed that 136 (57.9%) of rural and 42 (17.9%) of urban had access to bed net at household level and were utilizing ITNs by history.

The direct observation done had shown that only 88 (38.0%) of pregnant women were directly observed while sleeping under bed net.

The observation of bed nets utilized by pregnant women showed that 74 (31.6%) of utilizes were observed sleeping under properly mounted mosquito net.

Three (1.3%) of pregnant women utilizing net were observed sleeping under bed net with defect (Table 4).

Table 4. *Insecticide Treated Net utilization among pregnant women and conditions related to their bed net, Hawwa Gelan Woreda, Kellem Wollega Zone, Oromia Region, Sept. 2022.*

Characteristics	Number (%)	Remark
Pregnant women in the HH (798)		
Yes	231 (28.9)	
No	557 (71.1)	
Access to ITN (n=231)		
Yes	227 (98.2)	
No	4 (1.7)	
Pregnant women utilize ITN previous night (n=227)		
Yes	170 (74.9)	
No	57 (25.1)	
Pregnant women sleeping under properly hanged ITN (n=88)		
Yes	74 (84)	
No	14 (15.9)	

Again self-reported utilization of ITNs among pregnant women was 57.9% and 17.9% in Rural and Urban respectively (Figure 1).

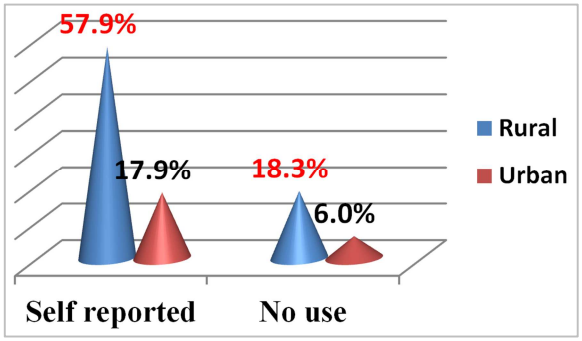

Figure 1. *Properly mounted ITNs utilization among under 5 children with direct observation by place of residence, Hawwa Gelan Woreda, Kellem Wollega Zone Oromia region, Sept. 2022.*

The proportion of pregnant women observed utilizing properly mounted (over the bed/place of sleep) mosquito nets in the area were 28.6% and 9% in Rural and Urban respectively (Figure 2).

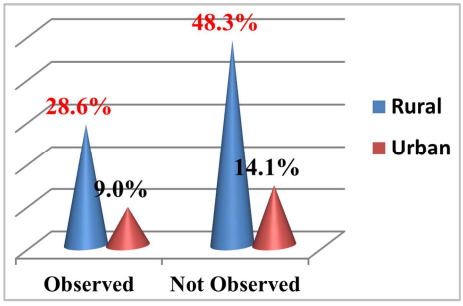

Figure 2. *Properly mounted ITNs utilization among pregnant women, with direct observation done by place of residence, Hawwa Gelan Woreda, Sept. 2022.*

3.5. Reasons for Not-Utilizing of ITNs Among High Risk Groups

The assessment done on the reasons for not utilizing bed net by under 5 years of age child among households who own bed nets has showed that, almost all 1173 (93.5%) of the respondents reason was forgotten to mount bed net during the night. A total of 9 (4.9%) of the respondents reason the absence of mosquito in the house and they believe that bed net is used only when mosquito is seen in the house. Similarly, 3 (1.6%) of the respondents had no reason to give for their non-compliance (Table 5).

Table 5. *Reasons for non-utilization of ITN among owners of ITNs, Hawwa Gelan Woreda, Kellem Wollega Zone Oromia region, Sept. 2022.*

Characteristics	Number (%)	Remark
Reason for child not utilizing ITN (among ITN owners) (n=199)		
Forgotten	173 (86.9)	
Mosquito not seen in the HH	9 (4.5)	
Others	3 (1.5)	
Reason for Pregnant women not utilizing ITN (among ITN owners) (n=51)		
Forgotten	43 (84.3)	
Mosquito not seen in the HH	5 (9.8)	
Others	3 (5.9)	

3.6. Reasons for Not-Utilizing of ITNs Among High Risk Groups

The assessment done on the reasons for not utilizing bed net by under 5 years of age child among households who own bed nets has showed that, almost all 1173 (93.5%) of the respondents reason was forgotten to mount bed net during the night. A total of 9 (4.9%) of the respondents reason the absence of mosquito in the house and they believe that bed net is used only when mosquito is seen in the house. Similarly, 3 (1.6%) of the respondents had no reason to give for their non-compliance (Table 5).

Table 6. *Reasons for non-utilization of ITN among owners of ITNs, Hawwa Gelan Woreda, Kellem Wollega Zone Oromia region, Sept. 2022.*

Characteristics	Number (%)	Remark
How ITNs prevent malaria (n=788)		
Physical barrier	586 (73.4)	
Kills mosquito	240 (30.1)	
Irritate mosquito	48 (6.0)	
Not known	9 (1.1)	
When to utilize ITNs (n=788)		
Every night	550 (68.9)	
Seasonally	224 (28.1)	
When mosquito seen in the HH	18 (2.3)	
Any problem when ITNs utilized (n=788)		
Yes	272 (34.5)	
No	516 (65.5)	
List of the problems (n=272)		
Prevent comfort	121 (44.5)	
Cause heat	90 (33.1)	
Lack of enough air	61 (22.4)	

3.7. Health Information Related to How ITNs Prevent Malaria

Health information of the respondents about how ITNs prevent has shown that majority 586 (73.4%) of the respondents were able to identify bed nets prevent mosquito bite (as a physical barrier), whereas less than half (30.1%) of the respondents have information that properly treated nets also act by killing mosquito. Only few (6.0%) responded that properly treated nets also act by irritating the mosquito as mechanism of action (Table 6).

Table 7. *Health information related to how ITNs prevent malaria, Hawwa Gelan Woreda, Kellem Wollega Zone, Oromia Region, Sept. 2022.*

Characteristics	Number (%)	Remark
How ITNs prevent malaria (n=788)		
Physical barrier	586 (73.4)	
Kills mosquito	240 (30.1)	
Irritate mosquito	48 (6.0)	
Not known	9 (1.1)	
When to utilize ITNs (n=788)		
Every night	550 (68.9)	
Seasonally	224 (28.1)	
When mosquito seen in the HH	18 (2.3)	
Any problem when ITNs utilized (n=788)		
Yes	272 (34.5)	
No	516 (65.5)	
List of the problems (n=272)		
Prevent comfort	121 (44.5)	
Cause heat	90 (33.1)	
Lack of enough air	61 (22.4)	

3.8. Factors Associated with ITNs Utilization Among Under5 Year's Children and Pregnant Women

In bivariate analysis, educational status of participants, place of residence, health information on ITNs prevention as priority and identification of under 5 years as priority were factors showing significant association with ITNs utilization among under 5 years children. Other variables like sex of the respondent, Age of the respondent and source of income were not showed significantly association with ITNs utilization among under 5 years children in bivariate analysis; Whereas educational status of participant, health information on ITNs prevention as priority and identification of pregnant women as priority were factors showing significant association with ITNs utilization among pregnant women. Other variables like sex of the respondent, Age of the respondent, place of residence and source of income were not showed significantly association with ITNs utilization among

pregnant women in bivariate analysis.

In multivariate analysis, some variables were significantly associated with ITNs utilization among under 5 years children and pregnant women. The assessment done with educational status has showed that children from literate parents were more likely utilized bed net than under five years of age children from illiterate parents, (AOR=1.76,95%CI=1.17-2.65). Similarly, children from parents who live in urban have utilized ITNs more likely than from rural dweller's, (AOR=7.21, 95%CI=3.11-16.68).

Although adjustment done for confounding factors has not demonstrated significant association between parents who have positive health information about importance of ITNs and ITN utilization, (AOR=1.23, 95%CI=0.81-1.88), children from parents who identified that under five years of age children as high risk and priority groups as well, (AOR=1.35,95%CI=0.87-2.11).

The analysis done on ITNs utilization among pregnant women also varies between socio-demographic characteristics of the respondents. The assessment done with educational status has showed that pregnant women from literate parents have about 3 times more utilized ITNs than those from illiterate parents, (AOR=3.26,95%CI=1.62-6.56).

Table 8. *Factors associated with Utilization of ITNs among under 5 years of age children by selected socio demographic and health information of the respondents, Hawwa Gelan Woreda, Sept. 2022.*

Characteristics	Child Utilized ITNs		COR (95%CI)	AOR (95%CI)
	Yes	No		
Educational status				
Illiterate	98	162	1.0	1.0
Literate	106	292	1.66 (1.192-2.33)*	1.76 (1.17-2.65)**
Marital status				
Single	76	39	1.0	
Married	359	150	0.81 (0.53-1.25)	0.40 (0.23-0.75)**
Divorced	11	12	2.33 (0.86-5.25)	0.71 (0.24-2.08)
Widowed	5	2	078 (0.15-4.20)	0.38 (0.06-2.50)
Separated	3	1	0.65 (0.07-6.45)	0.16 (0.01-1.86)
Place of residence				
Rural	191	303	1.0	1.0
Urban	13	151	7.32 (4.04-13.27)*	7.21 (3.1-16.68)**
Bed room condition				
Separated	404	157	1.0	
Shared	50	47	2.42 (1.21-3.01)*	2.04 (1.26-3.31)**
Family size				
<5	202	78	1.0	
>=5	252	126	1.30 (0.92-1.82)	1.07 (0.74-1.54)
Source of income				
Farming	11	26	1.97 (0.77-5.06)	1.61 (0.57-4.56)
Trade	12	56	0.81 (0.39-1.69)	2.30 (0.96-5.49)
Salary	135	258	1.0	1.0
Health information ITNs prevention as priority				
No	107	72	1.0	1.0
Yes	97	282	1.81 (1.30-2.53)*	1.23 (0.81-1.88)
Identification of <5 as priority				
No	62	98	1.0	1.0
Yes	142	356	1.586 (1.09-2.30)*	1.35 (0.87-2.11)

* Significant COR
** Significant AOR

Table 9. *Factors associated with Utilization of ITNs among pregnant Women by selected socio-demographic and health information of the respondents, Hawwa Gelan Woreda, Sept. 2022.*

Characteristics	Pregnant women utilized ITNs		COR (95%CI)	Adjusted OR (95%CI)
	Yes	No		
Age of respondents in years				
18-24	49	15	1.0	
25-34	77	20	0.85 (0.39-1.81)	0.83 (0.34-2.04)
35-49	45	15	1.09 (0.48-2.48)	0.74 (0.26-2.14)
>=50	7	7	3.27 (0.98-10.81)	1.83 (0.41-8.12)
Educational status				
Illiterate	29	44	1.0	1.0
Literate	28	134	3.15 (1.69-5.87)*	3.26 (1.62-6.56)**
Source of income				
Farming	1	11	0.20 (0.23-1.81)	0.26 (0.03-2.47)
Trade	9	20	0.27 (0.03-2.13)	0.39 (0.05-3.29)

Characteristics	Pregnant women utilized ITNs		COR (95%CI)	Adjusted OR (95%CI)
	Yes	No		
Salary	37	108	1.0	1.0
Health information ITNs as priority				
No	29	60	1.0	1.0
Yes	28	118	049 (0.29-0.90)*	1.64 (0.79-3.37)
Identification of pregnant women as priority				
No	29	61	1.0	1.0
Yes	28	117	0.54 (0.30-0.99)*	0.99 (0.47-2.10)

* Significant COR
** Significant AOR

4. Discussion

One of the most crucial strategies for preventing malaria in highly endemic places, such as Hawwa Gelan woreda, is the use of insecticide-treated nets. Even though the Ethiopian Federal Ministry of Health makes a significant effort to boost ITN ownership in all malaria-endemic regions, several obstacles have been identified to ITN efficient use. The most effective utilization technique should be used to evaluate the existing circumstances. As a result, the combination of direct observation techniques and self-reported data collecting was used in this study.

450 (69.3%) children under the age of five and 170 (74.9%) pregnant women were observed to use ITNs during the previous night of data collection, accounting for the total ITN usage.

The results were consistent with a little deviation from studies conducted in Tanzania in 2012 63.9%; [15, 16], Nairobi in 2016 (62.7%); and Harari, Ethiopia (2015) (73.3%). It was, however, greater than 37.2% from a research done in Gamo-Gofa, Ethiopia, and lower than 86.7% from a study done in Tanzania [17].

The research's findings indicate that the average number of bed nets owned by households—1.78, SD±.49—were nearly identical to the data—1.8 per household—obtained from another study conducted in the Democratic Republic of the Congo [24]. By comparing the mean number of beds and places of sleep owned by households (which is 1.15 with SD±0.36) with the mean number of bed nets in the region, the evaluation has demonstrated the shortage of bed nets. The lack of bed nets in the home is thought to have an impact on vulnerable populations' usage of ITNs; therefore, this should be taken into consideration while developing a strategy to eradicate malaria.

The results of this study indicate that, with regard to the variables influencing a household's failure to possess a bed net, 10 (1.3%) of the respondents expressed dissatisfaction about their lack of knowledge during free distribution. One explanation stated by respondents—among those without homes—was a lack of information. Due to higher transmission intensities and limited access to preventative and curative healthcare, impoverished rural areas typically experience higher rates of malaria infection than other populations. Therefore, there should be a strong focus on home health education and ITN dissemination.

Regarding the use of ITNs, 162 (36% of children under 5) and 74 (43.5%) of expectant mothers were seen dozing off behind permanent bed nets. This circumstance is thought to increase the effectiveness of the net and lower the chance of contracting malaria [19-21]. As such, there should be cause for worry over the woreda health office's periodic delivery of permanent (LLIN) kits.

One interesting finding from the survey is that 82.5 percent of the participants stated that mosquito bites are the cause of malaria transmission. This is less than the approximately 94.9% found in the research conducted in Ethiopia's Wolayta Zone [21]. The use of ITNs was favoured by more than half (57.8%) of the respondents as the most important way to combat malaria in homes. The endeavor to increase ITN coverage and usage among disadvantaged populations may benefit from such high awareness [9, 22].

According to the assessment of the health data on the identification of high-risk groups, 691 (86.6%) and 410 (51.4%) of the respondents, respectively, regarded children under the age of five as priority and high-risk groups. Conversely, pregnant women were classified as priority groups by 44% and high-risk groups by 75.4% of the respondents, respectively. Once more, this is significantly more than the 28.9% achieved from the Tanzanian study [24]. These indicated that pregnant women received less attention, which appears to be a significant issue in the country's attempt to lower the maternal death rate [1, 23, 18, 19]. Therefore, the information education and behavioral change communication strategy at should take into account the designation of pregnant women as a high-risk and priority category in the malaria preventive project.

Regarding the primary mode of action of ITN, the majority of respondents (73.4%) are aware that it functions as a physical barrier, and 30.1% are aware that it kills mosquitoes. It is thought that regular LLIN kit delivery and extensive home instruction will optimize this.

While 68.9% of the respondents are aware that insect repellent (ITN) should be applied nightly, roughly 28.1% of respondents said they would rather use ITN in certain seasons or during times of the year when there are more mosquitoes in the house. This reaffirmed the findings (34%) from the Ghanaian research; however, individuals can be encouraged to use ITN according to the seasons as malaria infections can recur year-round [11, 16, 19].

Sixty-three percent of the respondents think there are no

issues while employing ITNs. According to the assessment by the place of residence, 28.6% of respondents who live in rural areas express dissatisfaction about the drawbacks of ITN. Among these, rising heat within the net was the main criticism voiced by 30.4% of the respondents. This was shown to be comparable to prior research [8]. In general, urban residents received better health information than rural residents regarding ITN's ability to prevent malaria. Furthermore, this study demonstrates that urban people were shown to be much more.

In the area, homes with at least one bed net were home to three-fourths of the youngsters and pregnant women. This was shown to be significantly more and positive than the 5.8% gain in the

When bed nets are used properly, most of the time they are installed over the bed for children and pregnant women. However, 15% of children and almost 20% of pregnant women have been seen to use bed nets in different ways (under mattresses, cover cloths, and sheets).

In terms of the appropriate use of mosquito nets (correct mounting), direct observation of pregnant women and children under five years old reveals that just 28.2% and 11.0%, respectively, In addition, the nets were examined for flaws, and it was discovered that 1.3% and 3.1% of the expectant mothers and toddlers, respectively, had slept beneath a net with varied levels of thorns. These circumstances are thought to have a major impact on the net's effectiveness and increase the probability of malaria infection among pregnant women [19].

Since malaria infections in the region occur year-round, using bed nets exclusively during specific seasons and when there is a high mosquito population may expose susceptible populations to infection. Therefore, it is advised to regularly educate individuals about health issues in order to motivate them to use them consistently.

In general, respondents' educational status, place of residence, and health information were strongly correlated with the underutilization of ITN among children under 5 and pregnant women (AOR=1.76, 95%CI=1.17,2.65) and (AOR=7.21, 95%CI=3.11,16.68), respectively. As a result, there needs to be a lot of emphasis placed on encouraging people to use LLINs.

4.1. Limitation of the Study

1. As the study was cross-sectional it was not possible to establish causal-effect relationship between variables (chicken or egg dilemma).
2. As some Health Extension workers were participated in the data collection, the utilization report might be biased.

4.2. Recommendation

Significant proportions of fewer than 5 years age children and pregnant women were not utilizing ITNS. Hence, the following recommendations were given.

1. As it is one of 17 health extension package; Practice dependent elder illiterate people's education should be strengthened.
2. All primary health care units (PHCUs) in the district, health extension workers and women's development army would be conduct community sensitization campaign on ITNs mounting and utilization especially on under-5years old children and pregnant women.
3. Continuous and strengthened awareness creation sessions by PHCUs on ITNs utilization of under-5 years old children should be maintained in immunization sessions, under five clinics, and in any population gatherings concurrently.
4. As a long-term plan, the local government could devise standard housing program so that each family member would sleep in a separate sleeping space.

5. Conclusion and Implications for Translation

Even if the intended outcome was not met, the ITN coverage in the region is good when compared to the majority of findings in this nation. Pregnant women and young children were not the only residents in the region using mosquito nets. Living in rural regions was a major factor in the reduced ITN usage of children under the age of five, while illiteracy was a significant factor for pregnant women and children under the age of five.

The results of this study were submitted to the Hawwa Gelan woreda and the Kellem Wollega zonal health department, where the research was conducted. Additionally, the findings will be published in regional or worldwide publications for wider distribution.

Compliance with Ethical Standards

Financial Disclosure

Our institution as well as all authors have no extra budget for publication process.

Ethics Approval

The ethical aspect of this paper was approved by iinstitutional review board of Arsi University College of health Sciences.

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Conflicts of Interest

The authors declare no conflicts of interest.

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