

# Assessment of Malaria Vector Control Measures (ITNs & IRS) Utilization and Factors Affecting it in Adama District, East Shoa Zone, Oromia Region Ethiopia, 2018

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**Abstract:** About 75% of landmass of Ethiopia is malaria-endemic, and 65% (58.5 million) of the population is estimated to be at risk of malaria infection. Malarious areas are targeted to receive key malaria control interventions (LLITNs and IRS) and we aimed to assess the utilization of ITN/IRS and factors affecting it. We conducted Community based Cross sectional study in Adama district from January 1-30, 2018 among 818 households using Multi stage sampling system followed by Simple random sampling method in selecting districts and camps. Bi-variate and multivariate logistic regression was used to calculate the association. Of 818 visited HHs 73% were utilizing ITN regularly and sprayed by IRS in the past one year. The prevalence rate of malaria was found to be six percent. Having good awareness about malaria transmission and control measures (AOR 1.4 (1.1-2), sharing one bed with a member of 3-5 compared to not sharing (AOR=0.7 (0.4-0.9), family head educational level of higher level compared to illiterate (AOR=4.8, 95% CI 1.1- 6.6), Employed family head Compared to Farmers (AOR=8.1, 95% CI 7.8-10.7) are significantly associated with ITN utilization. ITN utilization was influenced by Lack of knowledge, lack of education and family sharing one bed. Increasing the knowledge of community on malaria transmission and prevention methods including ITN proper usage is important.

**Keywords:** Malaria, Control Method, Barrier of Utilization of ITN/IRS, Adama, 2018

## 1. Introduction

Malaria is a tropical disease with high morbidity and mortality resulting in high economic and social impacts. Even though it has no vaccination, it is an absolutely preventable and treatable vector-borne illness which is caused by protozoal parasite of the genus *Plasmodium*. [1]

According to World Health Organization report in 2016, an estimated 216 million cases of malaria occurred worldwide in which 90% was from the WHO African Region. Of the 91 countries that had an indigenous malaria case in 2016, a decrease in malaria cases of more than 20% compared with 2015 was estimated in 16 countries, while an increase of a similar magnitude was estimated in 25 countries. The WHO regions of the Americas and Africa accounted for nearly 70% of the countries that had increases of more than 20% in 2016

compared with 2015. [2]

World Health Organization (WHO) has formulated different strategies to combat the high prevalence of Malaria in the world. The most commonly used methods to prevent mosquito bites are sleeping under an Insecticide Treated Nets and spraying the inside walls of a dwelling with an insecticide – an intervention known as IRS. Use of ITNs has been shown to reduce malaria case incidence rates by 50% in a range of settings, and to reduce malaria mortality rates by 55% in children aged less than 5 years in sub-Saharan Africa. Between 2014 and 2016, a total of 582 million insecticide-treated mosquito nets (ITNs) were reported as having been delivered globally, of which almost 505 million ITNs (87%) were delivered to countries in sub-Saharan Africa. [2]

In Ethiopia malaria constitutes a major public health problem and impediment to socio-economic development

where about 75% of landmass of the country is malaria-endemic and 65% (58.5million) of the population is estimated to be at risk of malaria infection.[3] According to the national strategy for malaria control, areas lower than 2,000 meters in altitude were considered to be malaria-endemic area and targeted to receive key malaria control interventions (long-lasting insecticidal nets (LLINs), & indoor residual spraying (IRS)) stating a national goal of 100% household LLINs coverage with a mean of two LLINs per household. [4]

In 2015, Ethiopian National malaria indicators survey indicated LLITNs utilization in Oromia region is found to be 59% which is less than expected. [5] As different study showed the utilization of ITN may be affected by different personal, social or environmental barriers. Under-five children and pregnant women are high risk groups and priority should be given. The study done in Mihrab Abaya Gamo Gofa zone shows ITN utilization among less than five children was about 37.2%. [6] Education level of the House Hold, awareness about ITNs, number of sleeping rooms in the HH, individual ITN-color preference, presence of children aged under 5 years in the HH, IRS status of the HH, awareness of malaria prevention, family size of the HH, and occupational status of the HH head are reported as affecting factors in different previous study. [7, 8] The study supported by President's malaria initiative and conducted in five districts of Jimma Zone in 2015 shows, the shape of ITN, low risk perception due to seasonality of malaria, saving nets for future use, decreased awareness, negligence and perceived low efficacy of LLITN are the major barriers. Again, the study conducted in Gambella also shows, sleeping in a member of more than three is more likely to use bed nets. [8] Other study done in Areka town Southern Ethiopia in 2015 reports among Households those are using ITN properly, 50.4% of them have good awareness about ITN utilization and similarly the study in west Gojjam zone done in 2014 shows knowledge has a significant association with ITN utilization. [10, 11] Adama District is one of Oromia region zone with many malaria risk factors and as information received from the district malaria expert report shows, in different time the distribution of ITNs and IRS was done. Despite this, Malaria illness remains the leading cause of morbidity indicating either low ITN/IRS coverage or poor ITN utilization in this district. Thus, this study helps to disclose the level of ITN utilization in Adama district and affecting factors thereby providing credible information for stake holder to achieve national malaria control strategic plan.

## 2. Methods & Materials

### 2.1. Study Area & Period

This study was conducted in Adama District from January 1-15, 2018. It is one of the 12 woredas in East Shoa Zone of

Oromia regional State, around 100 km East of Addis Ababa having 41 rural Kebeles, 4 Suburban kebeles (the lowest division of administrative area) and 15 Factory camps with estimated total population of 193,885. Geographically Adama district found in Rift Valley and 95% of the villages in the District are located in the low land while 90% of populations are at risk of malaria transmission. Morbidity report from health facilities showed that, malaria is among the ten top causes of morbidity diseases.

#### 2.1.1. Study Design

Community based Cross-sectional study design was employed.

#### 2.1.2. Source Population

The source population was all households in Adama district including 15 Factory camps.

#### 2.1.3. Sampling Units

Our study unit was systematically selected Households owned at least one any type of ITNs and /or households sprayed by indoor insecticide chemicals at least one times in the year in the selected Kebeles and camps.

### 2.2. Sample Size Calculation

#### 2.2.1. Sampling Technique

The study units were identified by multi stage sampling technique followed by Simple random sampling method to identify primary sample and systematic sampling the final study unit. List of all Kebeles and camps in the district was used as sampling frame. The source of population was clustered as Malarias Kebele (35) and Camps (15) with a HH population of 84% and 16% respectively. All malarias Kebeles and camps identified by the district health office were selected and taken as primary sampling unit. Twenty percent of malarias Kebeles and 20% of factory camps were selected by Lottery method using the list of each cluster as sampling frame. Hence, seven malarious Kebeles and Three Factory camps were selected. On the second stage, households in each randomly selected Kebeles and camps were used as secondary sampling units. The number of households which to be selected from each identified Kebeles & Camps were determined by the households (population) proportion of respective Kebeles. Furthermore, the first house hold was selected by simple random sampling and the others were selected systematically by counting every nine houses. In cases when the selected Household is not fulfilled inclusion criteria of the study the next house was selected.

#### 2.2.2. Data Collection Procedure

We used structured questionnaire which were adopted from different literatures and customized. It was translated to Local Language from English Version for interviewers' administered house to houses data collection. Family head or a family member who are constantly living in the house and above 18yrs old was selected for face to face interview.

### 3. Result

#### 3.1. Socio Demographic Information

In our study, we achieved 100% respondent rate and since our study was fully focused on the households with at least one ITN or/ sprayed with indoor Insecticide, 100% of them owned at least one ITN (any type) and 596 (73%) of the visited house were sprayed with Indoor insecticide residual in the past one year. The median age of the participant was 33yrs (IQR=17). Among the total 818 visited households with family member of 3,537 about 209 people was treated for Malaria illness in the last year (2017) which accounts the prevalence of 6%. Of 818 participants 516 (63%) were Female population and the educational level of most of the

participant, 341 (42%), was Elementary level. In the study area the major source of family income was Farming which accounts about 565 (69%).

In the study area 578 (71%) of the House Holds (HHs) has habits of sharing one beds with family members among which more than half of them 315 (54%) HHs family Members sleeps by sharing a single bed or sleeping area with three to five family members of the same HH. Of 818 visited HHs under five children founds in 387 (47%) and 342 (88%) of them sleeps with their parents on the same bed. Among visited houses 583 (71%) HHs were made of corrugated-iron houses, while the majority 782 (96%) had separate sleeping room and 497 (61%) of them had two and more sleeping area (Table 1).

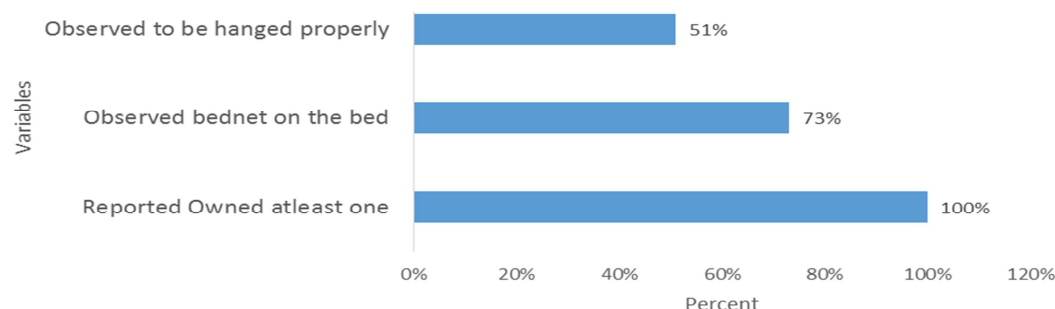
**Table 1.** Sleeping habits and housing conditions of study participants in Adama district, East Shoa zone Oromia region, Ethiopia, 2018.

Variables	Category	Frequency	Percent	95% LCI	95% UCI
Family shares one bed (n=818)	Yes	578	71%	67%	74%
	No	240	29%	26%	33%
Number of family member shares one bed (n=578)	Two and less	259	45%	34%	48%
	3-5 people	315	54%	41%	57%
	More than five	4	1%	0.5%	1.5%
Housing Conditions (n=818)	Thatch/leaf	235	29%	26%	32%
	Corrugated Iron	583	71%	68%	74%
Under five children present (n=818)	Yes	387	47%	44%	51%
	No	431	53%	49%	56%
Sleeping habits of under five children (n=387)	All children under 5years Sleep together	42	11%	7%	13%
	Sleep with both parents	342	88%	83%	91%
	Sleep with other family member	3	1%	0.8%	1.6%
Separate Bed rooms (n=818)	Yes	782	96%	94%	97%
	No	36	4%	3%	6%
Number of Sleeping Rooms/Bed (n=818)	One	321	39%	36%	43%
	Two	370	45%	42%	49%
	Three and more	127	16%	13%	18%

#### 3.2. Owner Ship & Utilization of ITNs

Of 818 participants, more than half of them 519 (63%) have more than one ITN (any type). House to house inspection was conducted during our assessment to observe the proper use of existing ITN for family. This was measured

by whether the bed nets are hanged over the bed properly or not. Among 595 (73%) households found to have at least one bed with bed net, about 178 (30%) of them was observed that not properly hanged as it prevents insect bite. Of the total HHs observed, only 417 (51%) of the households hanged ITN properly on the sleeping area (Figure 1).



**Figure 1.** Comparison of Reported and Observed Bed Net owner ship Vs utilization.

The most of bed nets found in house hold was LLINs type 542 (66%) and among those who owned retreat able types, 276 (36%), only 3 (1%) of them were retreated at most one per year. Lack of information and chemical was the main reason that the community complain for why they not retreat their bed nets regularly. In addition to using bed nets for malaria vector control in home, 596 (73%) of the visited

households were sprayed with IRS in the past one year.

Even though most of the visited family has more than two ITN (any type), when we compare the ITN owner ship and utilization, among those owns more than one ITN, 595 (63%), about 159 (27%) were utilizing only one ITN and among 299 households owned only one ITN, 83 (28%) of them were not using the existing ITN (Table 2).

**Table 2.** ITN Owner Ship and Utilization in Adama District, East Shoa, Oromia, 2018.

Variables	Category	Frequency	Percent	Wilson 95% LCL	Wilson 95% UCL
Number of ITN in HH (n=818)	One	299	37%	33%	40%
	Two	386	47%	44%	51%
	Three and above	133	16%	14%	19%
Number of sleeping Beds observed with Bed net (n=818)	One	377	46%	43%	50%
	Two	199	24%	22%	27%
	Three and above	19	2%	1%	4%
Types of ITN (n=818)	No sleeping places with bed net	223	27%	24%	30%
	Re treatable	276	34%	31%	37%
	LLITNs	542	66%	63%	69%
Retreated regularly (n=276)	Yes	3	1%	0%	3%
	No	273	99%	97%	100%
ITN hanged properly (n=595)	Yes	417	70%	66%	74%
	No	178	30%	26%	34%
Shapes of bed nets (n=818)	Conical	9	1%	1%	2%
	Rectangular	809	99%	98%	99%
IRS sprayed with in one year (n=818)	Yes	596	73%	70%	76%
	No	222	27%	24%	30%
Under five children in house member (n=818)	Yes	387	47%	44%	51%
	No	431	53%	49%	56%
<5 Children sleep under Bed net last night (n=387)	Yes	221	57%	52%	62%
	No	166	43%	38%	48%
Pregnant women in House Member (n=818)	Yes	110	13%	11%	16%
	No	708	87%	84%	89%
PLW used ITN last night (n=110)	Yes	67	61%	51%	70%
	No	43	39%	30%	49%

### 3.3. Factors that Influencing ITN Utilization

Among factors those are suspected to have positive or negative impacts on ITN utilization and cross tabulated with households utilizing at least one bed nets regularly, the variables those have a p value of 0.2 and less were entered into multivariate logistic regression to avoid possible confounders. In multivariate analysis the variables with a p value of less than 0.05 are considered to have significant association with ITN utilization. Accordingly, Multivariate analysis showed that the participants who have good awareness about malaria transmission and control measures utilizes ITN properly 1.4 times more than the counterpart

(95% CI, 1.1, 2; P value 0.0123). The family who have a habit of sharing one bed with a member of 3-5 were 30% less likely to utilize ITN properly than those sleep alone (95% CI 0.7 (0.4, 0.9); p value 0.0396). Households with family head educational level of higher level were found to utilize ITN properly 4.4 times (AOR=4.4, 95% CI 1.1- 20.4; P value 0.0473) than illiterate family head and HH with Employed family head utilizes ITN 8.4 times (AOR=8.4, 95% CI 2.9- 24.8; P value 0.0001). In addition, the households where there were under five children were observed 1.9 times more likely to use ITN than those with had no under-five age children (Table 3).

**Table 3.** Multi variate analysis of ITN utilization influencing factors, Adama District, 2018.

S/n	Variables	Category	Utilize at least one bed net last night		COR (95% CI)	AOR (95% CI)	P Value
			Yes (n=595)	No (n=223)			
	Knowledge level (n=818)	Good	473 (80%)	163 (73%)	2.6 (1.8, 3.6)	1.5 (1.1, 2.21)	0.0468*
		Poor	122 (20%)	60 (27%)	Reference	1	
		Two and less	207 (35%)	52 (22%)	0.96 (0.6, 1.5)	1.3 (0.8, 2.3)	0.2647
	# of Person share one bed (n=818)	3-5 people	192 (32%)	123 (55%)	0.4 (0.3, 0.6)	0.7 (0.4, 0.9)	0.0396*
		More than 5	3 (1%)	1 (1%)	0.7 (0.1, 7.1)	1.1 (0.1, 11.9)	0.9488
		No sharing bed	193 (32%)	47 (21%)	Reference	1	
	Education (n=818)	Higher level	42 (7%)	2 (1%)	16.6 (3.9, 70)	4.4 (1.1, 20.4)	0.0473*
		Secondary	152 (26%)	5 (2%)	24 (9.5, 60.5)	10.4 (3.9, 27.7)	0.0000*
		Primary	247 (41%)	94 (42%)	2 (1.5, 2.9)	1.4 (1.2, 2.1)	0.0055*
	Occupation (n=818)	Illiterate	154 (26%)	122 (55%)	Reference	1	
		Employed	128 (22%)	4 (1.5%)	19.4 (17, 23)	8.4 (2.9, 24.8)	0.0001*
		Daily Laborer	65 (11%)	5 (2%)	7.8 (3.1, 10.8)	4.3 (1.7, 11.3)	0.0028*
	<5 children in the HH (n=818)	Trading	44 (7%)	1 (0.5%)	26.6 (23.1, 34.4)	11.1 (1.5, 84.2)	0.0203*
		House wife	6 (1%)	1 (0.5%)	3.6 (0.4, 30.2)	2.6 (0.3, 23.2)	0.3981
		Farmer	352 (59%)	211 (95%)	Reference	1	
		Yes	291 (49%)	96 (43%)	1.3 (0.9, 1.7)	1.9 (1.2, 2.8)	0.0025*
		No	304 (51%)	127 (57%)	Reference	1	

Note: \* Variables those are significantly associated with ITN utilization.

## 4. Discussion

The national strategy for malaria control recommended 100% of ITN coverage with high proportion and mean of two LLITNs per households in malarious area [4]. Parallel to this recommendation, most of the dwellers of Adama district (66%) were found to own LLITNs. The cross tabulation of IRS with types of ITN in the household showed that families those owned LLITNs were 31% less likely to use IRS for dwelling house wall spray (COR=0.69 95% CI 0.5-0.9, P value 0.0318). However, only 63% of households owned two and more ITN (any types) which is too much lower than national recommendation. This finding is higher than the study findings done in Harari regional state in 2015 [12] which were 57.9% and are lower than the findings in Gambella Region which is 68.4% in 2014 [13]. As we observed during data collection, the ITN found in the most of HHs were very aged which was distributed three and four years back. Because of handling problem and ageing of the nets, most of observed ITNs were damaged. Hence, they throw it away after it torn without replacement. Probably this is the reason why most of households were observed having less than the mean recommended number of ITN per house.

Despite 100% owning of any types of ITN or spraying IRS in the district, we identified the overall Malaria prevalence among visited households to be 6% which is lower than prevalence reported in 2013 study in this district (13.17%). [11] This shows 50% declining of malaria infection in the district within four years which a line with the national PMI target. On the other hand, the existence of this much prevalence of malaria, despite high coverage and better utilization of ITN reported, may be due to ITN proper utilization (hanging) problem observed in the district which was out of visited households only 51% was hanged properly. In addition, it may be due to aged or worn out of existing ITN which lacks its integrity and effectiveness to prevent Mosquito bite.

The overall utilization in Adama district in 2017 was about 73% which is higher than the overall utilization in Oromia region in 2015 [14] and similar with the utilization level in Harari region in 2014 [12]. ITN utilization among under five children (57%) and pregnant women 61%) in Adama district was higher than reports from national malaria indicator survey in 2015 which was 43.3% and 41.7 respectively in Oromia region [14]. ITN utilization among under five children in Adama district is also higher than the study results in Mihrab Abaya, Gamo Gofa zone in 2016 which was only 37.2% [15]. This difference may be due increased community awareness created by health extension workers about ITN utilization and prioritization. But, still this finding is not satisfactory regarding Children and pregnant mother prioritization which needs improvement because this is very vulnerable age groups among the community.

On the other hand, significant association was observed among HH those have at least one under five children and ITN utilization in our study area in which Families where there

were under five children utilize 1.9 times (AOR=1.9, 95% CI 1.2- 2.8, p value 0.0025) more likely to utilize ITN than the counterpart. This may also the result of improved community awareness on vulnerability of under five children for malaria infection and so that they tend to use ITN for their children.

The odds of utilizing ITN was 1.5 times higher among participants those have good awareness about Malaria transmission and control measures compared to those who have poor awareness. This finding is supported by the similar study done in West Gojjam zone in 2014 (AOR=3, 95% CI=1.7-5.4) [6], In Mihrab Abaya Gamo Gofa Zone in 2016 (AOR=2.51, 95% CI 1.17, 5.37) [10] and in Itang, Gambella zone which shows 72% less likely to use ITN among those have poor knowledge (AOR=0.28, 95% CI 0.15-0.53) [13]. Families where 3-5-member shares one bed were found to be 30% less likely to use ITN compared to those not shares one bed. This aligns with the study done in Itang, Gambella zone in 2016 (AOR=0.19, 95% CI 0.1-0.38) [13]. On the other hand, employed Family head is 8.4 times more likely to use ITN properly than Farmers (AOR=8.4, 95% CI 2.9-24.8, p value 0.0001). This may be due to those Employed peoples are more educated than the farmers and have better awareness about malaria transmission and control measures.

## 5. Conclusion

In our study area despite high coverage and utilization of ITN/IRS, the prevalence of Malaria was very high. Most of the households owned the minimum requirement of ITN as national target. Improper ITN utilization was observed which was significantly associated with Knowledge level of family head, Occupation of family head, number of family members sharing one bed, and Educational level of family head. On the other hand our study reveals that ITN utilization was not influenced by number of ITN, Family size and monthly income of the family in Adama District.

## 6. Recommendation

To improve ITN utilization and decrease malaria transmission in the district, continuous health education including demonstration of how to hang nets is important. In addition increasing the knowledge level of the community on malaria transmission and control measures so that they know the importance of ITN is critical activities for malaria control. Again Continuous house to house observation of proper bed net utilization could increase the utilization of ITN/IRS.

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