

Insecticide Treated Bed Nets Utilization among Pregnant Mothers and Associated Factors in Damot Pulasa District, Southern Ethiopia

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ABSTRACT

Background: Pregnant mothers are at considerable risk of malarial infection in Ethiopia. The distribution and proper utilization of insecticide treated bed nets is one of the effective interventions for preventing the death of pregnant mothers. There has been an increase in availability of insecticide treated bed nets; however, its utilization among pregnant mothers was unsatisfactory. **Methods:** A community based cross-sectional study was conducted in Damot Pulasa district, Southern Ethiopia, in January 2016. Pregnant mothers (n = 630) were the study population. A multistage sampling technique was used. Villages were randomly selected and a systematic random sampling method was used to select study participants. Data was entered into EPI Info version 3.5.4 and exported into SPSS version 20.0 for analysis. Binary logistic regression model was used to identify factors associated with the outcome variable, and finally multivariate logistic regression model was used to identify independent predictors of the outcome, with statistical significance set at $p < 0.050$ (95% confidence interval (CI)). **Results:** 72.5% (445) at 95% CI (72.1% - 73.6%) pregnant mothers slept under ITN the previous night before data collection. Maternal Education (AOR: 0.3; 95% CI: 0.2 - 0.5), maternal knowledge on malaria (AOR=6.9; 95% CI= 3.8 - 12.8) and ITN condition (AOR=9.3; 95% CI= 5.2 - 16.2) were independent predictors of ITNs utilization by pregnant women. **Conclusion:** utilization of ITN by pregnant mothers is lower in the study area. Emphasis should be given by policy makers and program planners to reduce maternal death by follow of proper and safe utilization of insecticide treated bed nets by pregnant mothers. Enhancing the decision-making power of pregnant mothers through education and advocacy has a significant impact on improving safe and proper utilization of insecticide treated bed nets.

Keywords: Pregnant mothers, Malaria, Insecticide Treated Bed Nets, Southern Ethiopia

Background

Malaria remains the leading cause of mortality and morbidity in low and middle income countries, with an estimated 3.2 billion global burden of infection. The vast majority of African countries are endemic to malaria, in which, over half a billion population lives at a higher risk of infection. In malaria-endemic areas of Africa, 30 million women become pregnant each year which is believed to be life threatening to both the mother and baby. Each year an estimated 10,000 of pregnant women and 200,000 of their infants dies as a result of malarial infection during pregnancy, and severe anemia due to mosquito bite [1].

Over the last few decades, appreciable strides have been made to prevent and control malarial infection in Ethiopia, particularly the introduction of insecticide treated bed nets utilization which is a promising tool to combat malaria among women during pregnancy. Insecticide treated bed nets have been known to reduce numbers of infective mosquito bites by 70 to 90 % in various geographical settings [2]. An insecticide treated bed nets is a mosquito net that repels, disables and/or kills mosquitoes coming in to contact with insecticide on the netting material and insecticide treated bed nets works in this case as a vector control intervention for reducing malaria transmission. Insecticide treated bed nets have been shown to reduce severe disease and mortality due to malaria in endemic regions and reduce all-cause mortality by approximately 20 % [3].

The mass scale-up of malaria control interventions, including early case identification and treatment, distribution of insecticide treated bed nets (ITNs), and indoor residual spraying of households with insecticides (IRS) have preferentially targeted those malaria endemic areas in Ethiopia. ITNs utilization in Ethiopia is limited due to lack of sustainable distribution and issues related to replacement of nets, seasonality of malaria epidemic, and poor knowledge of the community with regard to the link between mosquitoes and malaria.

Reports have suggested that, the impact of ITNs on reducing malaria episodes is well documented [4-6]. 15 million ITNs were distributed between 2010 and 2011 to replace long lasting insecticidal nets (LLINs) distributed previously and the recent national strategic plan targets that at least 80% of people at risk of malarial infection shall use ITNs properly and consistently whereby 100% of households in malaria-endemic areas should own one ITN per sleeping space by the year 2015 [7-8]. However, a huge discrepancy was reported between ownership versus use of ITNs. Studies quantified this difference as 95 % vs. 59 % (Kenya) and 70 % vs. 53.1 %

(Nigeria) [9-10]. Misconceptions about prevention of malaria by using mosquito net are discomfort, perceived low mosquito density, inconvenience to hang the nets, place of residence, economic and educational background, age and gender differences, and color of nets were among the reported reasons related to ITN utilization [11].

Despite a continuous distribution of ITN, there is significant gap between ITN ownership and utilization. However, only few studies assessed the utilization of ITN among pregnant mothers in Ethiopia [12-13]. Therefore, this study determined the magnitude of Insecticide Treated bed Nets (ITNs) utilization among pregnant mothers and associated factors in Damot Pulasa District, Southern Ethiopia.

METHODS

Study area and setting

A community based Cross-sectional study, was conducted in 8 villages of Damot Pulasa district, located in Southern Nation Nationalities and Peoples Region (SNNPR), which is 360 KM from Addis Ababa, the capital of Ethiopia. All pregnant mothers living in the study area was the source population. Pregnant mother who was severely or critically ill during the study were excluded.

Sample size and sampling procedure

The sample size was determined by using a formula for estimation of single population proportion with the assumption of 95% confidence level, an error margin of 5% and the prevalence of ITNs use of pregnant mothers who slept under bed net the previous night in SNNPR (45.1%) – taken from a previous study [14]. After considering 10% non-response rate and multiplying by the design effect of 1.5 the total sample size was estimated to be 630.

Multistage sampling technique was used. There were 23 villages out of which, 8 were randomly selected for this study. For each village, probability proportional allocation to sample size was made according to the total number of households with pregnant women. Sampling frame of households with pregnant mother was known based on the ANC registration in the Damot Pulasa district health office. Finally, systematic random sampling method was used to select 630 households with pregnant mothers.

Data collection

The data was collected by a pretested structured questionnaire, adopted from the standard Ethiopian Demographic and Health Survey (EDHS) [20]; which was already prepared in English language and then translated to Amharic language. Eight data collectors, based on their previous experience, were recruited and trained for data collection, and three trained public health graduates supervised collection of the data. The research assistants read out the questions loud and the pregnant mothers answered every question accordingly. If prospective participants (*pregnant women from identified households*) were not found at home during the visit first, the data collectors made a second visit the next day to administer the questionnaire. Before the data collection all of the study subjects were oriented and well informed about the purpose of the study, and their right to accept, or refuse to participate in the interview. A pilot study was done in the same district, which was not included in this study.

Data quality control and management

Before the actual data collection, the questionnaire was pre-tested on similar setting outside the study area. The data collectors and supervisors were trained for two days on principles, ethical considerations, procedures, and details of the questionnaire. The principal investigator closely monitored the data collection process.

Completed questionnaires were checked for their consistency and completeness every day, and then entered into EPI-Info version 3.5.4 statistical software, and finally the data was exported to another statistical software package SPSS, version 20.0 for further cleaning and analyses. Statistical significance was set at $p < 0.050$ and 95% confidence interval.

Each selected exposure variables to the outcome variable was assessed by using Bivariate and multivariate binary logistic regression model to identify factors associated with low utilization of ITNs among pregnant mothers. To avoid an excessive number of variables and unstable estimates in the subsequent model only variables reached a p value < 0.2 by bivariate analysis and has association were kept in the multivariate analysis.

Operational Definitions

Pregnant women: is a maternal condition of having developing fetus in the mother womb and mother reported her as pregnant during survey.

ITN utilization: utilization of Insecticide Treated Bed Net by pregnant mothers during sleeping **Proper hanging of ITN:** Hanging and putting ITN under all around mattress properly in a way that it doesn't allow the entry of mosquitoes.

Good Knowledge: number of mother who score above the mean knowledge question

Proper care of ITN: Washing ITN by using ordinary soap and not using detergents like Berekina at a three-month interval and drying it under shadow.

In proper care of ITN: washing of ITN by using detergents like Berekina and drying it by using direct sun light exposure and washing it frequently.

Ethical considerations

Ethical clearance was obtained from Research and Ethical Committee of Wolaita Sodo University, School of Public Health. Informed verbal consent was obtained from each study subject prior to data collection, and the purpose of the study was explained to the respondents in advance. Confidentiality of the information and privacy of the respondents was maintained. During the data collection, each of study participants was communicated that their participation would be voluntary, and also they were told that as they can quit any time when even after the interview has started.

RESULTS

Socio demographic Characteristics of respondents

A total of 614 study subjects participated in the study, yielding a response rate of 97.5 %.

Fourteen (84) percent of pregnant women were 20 years old or below, while eighty one (496) percent were followers of protestant Christianity. 36% (219) of pregnant mothers attained no formal education, while 82% (506) were house wives by occupation (Table 1).

Illiteracy rate were significantly higher in rural (38.2 %) than Urban (21.9 %) areas ($p < 0.03$). More than half of study participants were in second trimester, while 83.2% (511) of the study units were experienced pregnancy twice or more, Primigravida was more common in Urban (22%) than rural (14.2%) and multi gravida was more common in rural (84%) than urban (61%) (Table 1).

The mean (\pm SD) family size of the House hold was 5.68 (\pm 1.91). From 614 households with pregnant women 74.1% (455) had at least one under five children and a total of 516 under five children were identified from households with an average of 1.13(\pm 0.58) children per household. The mean number of sleeping room with \pm SD 2.11 (\pm 4.98) and majority of houses in the study area has two sleeping room 455 (74.1%).

The mean number of ITNs in the household with \pm SD 2.2(\pm 0.64), and majority of surveyed house hold has two ITNs 363 (59.1%) and only one pregnant mother in all surveyed 614 households.

From a total 169 (27.5%) pregnant mother who not sleep under ITN previous night 143(84.6 %) mentioned that ITN is not convenient to use, 9(5.3%) mentioned it is not effective and 4(2.4 %) mentioned that husband not support to use it.

Majority, 71.3 % (438) of respondent was living in corrugated iron sheet houses. Majority of house in the area has two sleeping room 74.1 % (455). Majority of households get ITN from government 71% (436) and the rest from nongovernmental organization free of any charge. Majority of those pregnant mothers get ITN within the last 12-month period 71% (436). 41.9 % of pregnant women's in study has a history of malaria attack in their index pregnancy and has visited health facilities for malaria treatment.

Knowledge on the cause, mode of transmission and prevention methods of malaria by pregnant mothers was relatively poor 56.7 % (348) below the mean. Study participants were asked to name the main symptoms of malaria, a total of 78.8 % mentioned fever, 68.9 % rigor or chills, 48.2 % headache and 23.1 % Loss of appetite; 77.9 % said that malaria is transmitted by the bite of mosquitoes. 22.1% of respondents believed that malaria is transmitted by a physical contact with a malaria patient, 14% by eating a stalk of maize or sorghum and 10% by exposure to cold.

Pertaining to the knowledge of the pregnant women about the methods of malaria prevention, 74.1 % reported that using ITNs in combination with other vector control measures could prevent malaria, and about 6.5 % perceived that malaria could only be prevented by indoor residual spraying (IRS). There was no significant difference between rural and urban respondents regarding the perceived symptoms and knowledge about malaria transmission and its preventive measures (Table 2).

Table 1: Socio demographic characteristics of pregnant mothers, Damo Pulasa district, Southern Ethiopia, January 2016

Variables	Category	Frequency (614)	%
Age of pregnant mother	≤20Yrs	84	13.7
	21_25yrs	198	32.2
	26_30Yrs	207	33.7
	>30 Yrs	125	20.4
Residence	Rural	518	84.4
	Urban	96	15.6
Marital status	Married	606	98.6
	Others	8	1.4
Maternal Occupation	House Wife	506	82.4
	Merchant	71	11.6
	Student	15	2.4
	Others	22	3.6
Level of Education	Not educated	219	35.7
	Primary School (1- 8)	280	45.6
	Secondary and above	115	18.7
Religion	Protestant	496	80.8
	Orthodox	62	10.1
	Catholic	56	9.1
Ethnicity	Wolaita	611	99.5
	Others	3	0.5
Number of Pregnancy	First pregnancy	103	16.8
	Second and above	511	83.2
Gestational age	First trimester	66	10.7
	Second trimester	310	50.5
	Third trimester	238	38.8
Family Size	≤4	166	27
	> 4	448	73
Number of under five Children	None	159	25.9
	one	396	64.5
	Two and above	59	10.2
Housing of mother	Local/thatched house	176	28.7
	Corrugated iron sheet	438	71.3

Table 2 Insecticide treated bed net utilization among pregnant mothers, Damot Pulasa district, Southern Ethiopia, January, 2016

Variables	Category	Frequency (614)	%
Number of ITN	One	62	10.1
	Two	363	59.1
	Three and above	189	30.8
Number of ITN in use(Observation)	None	79	12.8
	One	226	36.8
	Two	270	44
	Three	39	6.4
Time of getting ITN	≤12 month	436	71
	>12month	178	29
ITN general condition	Good condition	503	81.9
	Torn and need repair	111	18.1
History of malaria in pervious pregnancy	Yes	257	41.9
	No	357	58.1
Transmission of malaria	By mosquito bite	461	77.9
	other	136	22.1
Symptom for malaria	Yes	587	95.6
	No	27	4.4
Method of prevention	Yes	455	74.1
	No	159	25.9
Knowledge on Malaria	Good	226	43.3
	Poor	348	56.7

Insecticide Treated Bed Nets (ITNs) Utilization

A total of 72.5% (445) at 95% CI (72.1%, 73.6%) pregnant mothers slept under Insecticide Treated Bed Nets (ITNs) the night before the start of data collection.

Factors associated with the use of ITNs by pregnant women: Multivariate logistic regression model was used identify factors significantly associated with the utilization of ITNs among pregnant mothers. After adjusting for confounding variables, maternal education (AOR=3.4, 95% CI= 2.0, 5.6), maternal knowledge on malaria (AOR=6.9, 95% CI= 3.8, 12.8) and ITN condition (AOR=9.3, 95% CI= 5.2, 16.2) were independently associated with bed net utilization by pregnant mothers.

Table-5: Factors associated with insecticide treated bed net utilization (ITNs) among pregnant mothers in Damot Pulasa district, Southern Ethiopia, January 2016

Variables	Category	ITN use by pregnant mothers		
		Yes (%)	No (%)	AOR(95%CI)
Age of the women	≤20years ⁺	54(64.3)	30(35.7)	1.00
	21-25years	141(71.2)	57(28.8)	1.03(0.5, 2.2)
	26-30 years	158(76.3)	49(23.7)	1.9 (0.8, 4.1)
	>30 years	92(73.6)	33(26.4)	1.4(0.6, 3.4)
Education of the women	Illiterate ⁺	135(61.6)	84(28.4)	1.00
	Literate	310(78.5)	85(21.5)	3.4 (2.0, 5.6)*
Number of sleeping room	Single ⁺	30(63.8)	17(36.2)	1.00
	Two	331(72.7)	124(27.3)	0.5 (0.2, 1.2)
	Three	84(75)	24(25)	0.5 (0.2, 1.4)
Family size	≤ 4 ⁺	113(68.1)	53(31.9)	1.00
	> 4	332(74.1)	116(25.9)	1.4(0.8, 2.5)
Malaria in pervious pregnancy	Yes	223(86.8)	34(13.2)	0.3 (0.2, 0.5)*
	No ⁺	222(62.2)	135(37.8)	1.00
Housing type	Thatched House	115(65.3)	61(34.6)	0.6(0.2, 1.06)
	Iron Corrugated ⁺	330(75.3)	108(24.7)	1.00
ITN condition	Good	420(83.5)	83(16.5)	9.3(5.2, 16.2) *
	Torn & need repair ⁺	25(22.5)	86(77.5)	1.00
Knowledge of ITN	Good	250(94)	16(6)	6.9 (3.8, 12.8) *
	Poor ⁺	195(56)	153(44)	1.00

➤ *Statistically significant at $P < 0.05$ and *** at $P < 0.001$ + Reference group

DISCUSSION

This study was conducted to determining the magnitude of Insecticide Treated Bed Nets (ITNs) utilization among pregnant mothers and factors associated. The ownership and magnitude of bed net utilization among study subjects in the district is 100 % and 72.5 %, respectively. Regarding the place of residence, about 72.1% of pregnant women in rural villages and 75 % of study participants in urban villages utilize bed net during previous night and this proportion was similar in both urban and rural area which disagree with the study conducted at Northern and Western parts of Ethiopia [14], and this disparity could be due to the poor emphasis given to the uneven distribution of bed net in the district by the concerned body despite the endemicity and seasonal epidemic occurrence of malaria.

Insecticides treated bed net (ITN) utilization among pregnant women in the study area is higher than the study done in Nigeria (53.1 %), Ethiopia malaria indicator survey report for the region (MIS 2011) (54.8%) and the study done in Raya Azebo district (58.4%) [10,14, 18]. This could be due to the massive distribution of bed nets to the district with intensive community health education and promotion which was made nine months earlier than the commencement of the study. However, the utilization of ITN is lower than WHO recommendation of (80 %) utilization and community based cross-sectional study done at Afar regional state (79%) [12, 13]. This could be due to poor practice of pregnant mothers to properly utilize the distributed and available ITN in the study area.

Ownership and utilization of bed net during data collection is 100% vs. 72.5% which is comparable with studies conducted at Kenya 95% vs. 59% [9], and (Nigeria) 70% vs. 53.1% [10]. Logistic regression model has identified significant association between pregnant mothers' ITN utilization with maternal educations, maternal knowledge on malaria and ITN general condition.

Mothers who attended grade 1 and above were 3.4 times more likely to utilize ITN during the night than mothers who didn't attended any formal education, (AOR = 3.4; 95% CI: 2.0, 5.6). This finding was consistent with a study done in Raya Azebo district, Northern Ethiopia [18]. This could be attributed to the fact that people who attended formal education were better aware of importance of malaria prevention methods including ITN

through reading, mass media and attending different training at community level. Findings from studies conducted in the Uganda and Nigeria shows a negative association, were a lower educational level was significantly associated with higher rates of ITN use among pregnant women [16, 17]. This could be due to differences in recoding of the outcome variable.

The finding of this study, across rural and urban areas, indicated that pregnant mother with good knowledge on the transmission of malarial infection were 6.9 times more likely to use ITN as compared to their counterparts with (AOR = 6.9; 95% CI: 3.8 - 12.8). Knowledge on mode of transmission and preventive measures of malaria among pregnant women on the finding of this study was poor compared to the study conducted at Northern Ethiopia [18]. This could be due to lack of follow up by the health authority to the households of pregnant mothers after mass community health education regarding proper and safe utilization of ITN.

The association of misconceptions about the relationship between mosquito bite and malaria through health education messages is very critical for the success of malaria prevention and control using ITNs. The findings of this study indicate that the symptoms of malaria among pregnant women were well-known similar to other studies conducted in different regions of Ethiopia [15, 16]. About 74.1% of the study participants in this study reported ITNs use and other preventive measures of malaria, and specifically 72.1% mentioned ITN, 6.5% mentioned IRS and 41.4% mentioned environmental and other vector control to prevent malaria which is less than study conducted in Raya Azebo district, Northern Ethiopia [18].

According to this study, pregnant mothers who were infected by malaria during their previous pregnancy, were 3.7 times more likely to utilize ITN as compared to their counterparts who did not experienced malarial infection during pregnancy, with (AOR = 3.7; 95% CI: 2.2 - 6.3). This could be due to the higher level of community participation during the health education and health promotion service given by health care providers in the primary health care centers of the study area.

This study indicates that pregnant mothers who were having good condition ITN in the household are 9.3 times more likely to use ITN during sleeping as compared to their counterparts who don't have good condition ITN, with (AOR = 9.3; 95% CI: 5.2 - 16.2). This finding was consistent with the study conducted in other parts of Ethiopia [19].

CONCLUSION

Utilization of ITN by pregnant mothers is lower in the study area. A higher emphasis should be given by policy makers and program planners to reduce maternal death by education and follow of the proper and safe utilization of insecticide treated bed nets by pregnant mothers. Educating mothers and enhancing their decision-making power has a significant impact on improving ITN utilization and preventing malarial infection during pregnancy.

Ethics approval and consent to participate

Ethical clearance was obtained from Research and Ethical Committee of Wolaita Sodo University, School of Public Health. Informed verbal consent was obtained from each study subject prior to data collection.

Consent for publication

Not applicable

Availability of data and material

The datasets during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that this study is free of any competing financial and non-financial interests.

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Authors' contributions

TFB; was involved in principal role in the conception of ideas, developing methodologies and writing the article. AAS and MTB participated in the, interpretation and writing. All authors read and approved the final version of the manuscript.

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