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Long-Lasting Insecticidal Net Utilization and Associated Factors Among Pregnant Women in Asgede Tsimbla District, Northern Ethiopia, 2017

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ABSTRACT

BACKGROUND: Malaria among pregnant women contributes to maternal anemia, low birth weight, spontaneous abortion, and infant deaths. In response to this serious health problem, regular use of the long-lasting insecticidal net is the most cost-effective method of preventing malaria. However, in most developing countries, including Ethiopia, long-lasting insecticidal net utilization by pregnant women is uncertain.

OBJECTIVES: This study was conducted to measure the utilization of insecticidal net and to identify the associated factors with its utilization among pregnant women in Asgede Tsimbla district in 2017.

METHODS: A community-based cross-sectional study was employed and data were collected using interviewer-administered questionnaire. Systematic random sampling method was used to select 550 pregnant women. Data were entered into a computer using Epi Info (version 7) and exported to Statistical Package for the Social Sciences (version 21) for further analysis. Variables with *P*-value less than 0.05 were used to declare statistical significance between the dependent and the independent variables in multivariable logistic regression.

RESULTS: Among 550 pregnant women surveyed, 347 (63.1%) of the pregnant women slept under a long-lasting insecticidal net the night before the survey. Urban residence (OR [95% CI] = 1.9 [1.22-3.01]), family size of 3-5 and >5 (2.8 [1.53-5.22] and 2.4 [1.20-5.03], respectively), and history of malaria during their current pregnancy (3.0 [1.95-4.86]) were found to be the factors associated with pregnant women's long-lasting insecticidal net utilization.

CONCLUSION: Utilization of long-lasting insecticidal net was low, and place of residence, exposure status to malaria during their current pregnancy, and family size were the factors associated with long-lasting insecticidal net utilization.

KEYWORDS: Malaria, long-lasting insecticidal net, pregnant women, Asgede Tsimbla district

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Introduction

Malaria is still a frontier public health problem in the world and in Africa. Nearly, 3.3 billion individuals are at risk of malaria, with the highest risk of acquiring the disease in Sub-Saharan Africa (SSA). Approximately 80% of cases and 90% of deaths are estimated to be occurred in the World Health Organization (WHO) African Region, with children less than 5 years of age and pregnant women most severely affected.[1-4]

In response to this serious health problem, the Abuja Declaration for the initiative "*Roll Back Malaria*" in Africa was launched with a strategy to ensure pregnant women prevent malaria through the use of intermittent preventive treatment (IPT), use of antimalarial drug, and regular use of long-lasting insecticidal nets (LLINs).[5]

Unlike large parts of SSA countries, in Ethiopia, due to the unstable and seasonal pattern of malaria transmission, the protective immunity of the population is generally low and all age groups are at risk of infection and disease. Most malaria cases are observed in persons above 5 years of age, although children below 5 years and pregnant women are most vulnerable to the severe effects of infection.[6]

The status of LLIN coverage was measured in 2007 (66%), 2011 (62%), and 2015 (74%) Ethiopian Malaria Indicator Surveys (MIS) and showed tremendous achievements of LLIN utilization among pregnant women from 2011 to 2015.[6] Despite the activities about the distribution of LLINs, there are questions that remain unanswered. The extent to which people are aware and use nets is not understood clearly. Observation and rumors of not hanging nets at all, hanging nets in a wrong manner and place, using nets for different other purposes, and not giving priority to pregnant mothers are some of the factors which made pregnant mothers vulnerable to malaria. The perception and attitudes of pregnant women on the role of LLINs in the prevention of malaria, and proper and consistent use of LLINs are still other issues to be addressed in the local context.[7]

Studies indicated that physical discomfort while sleeping under LLIN, inability to hang available LLIN, lack of skill on hanging the nets, inadequate educational campaigns, lack of enough nets, risks of having malaria, and lack of knowledge on benefits of nets were some of the factors affecting LLIN utilization.[8,9]

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Only limited studies have been conducted in Ethiopia concerning utilization and associated factors of LLINs among pregnant women. The finding of this study will provide baseline information for malaria prevention and control program regarding the most vulnerable groups (pregnant women) and also for researchers, program planners, and decision-makers as an input.

Therefore, this study tried to answer the two research questions: (1) what is the magnitude of LLIN utilization of pregnant women in the district and (2) what are the factors associated with LLIN utilization in the study area.

Methods

Study design, area, and period

This community-based cross-sectional study was conducted in Asgede Tsimbla district, northwestern zone of Tigray, Ethiopia, from January to June 2017. This zone is one of the administrative districts of north-west zone of Tigray regions, which is about 1107 km away from Addis Ababa (the capital city of Ethiopia) and 324 km away from Mekelle. It has 27 kebeles (smallest administrative unit), 7 health centers, and 17 health posts. Endabaguna is the main town of the district. In 2012/2013 Gregorian Calendar, the estimated population of the district was 161 139, of which 79 270 were male and 81 869 were female. The total households of the district were 36 623. The weather condition of the district is mostly "kola" (hottest weather condition) especially during the study period and almost all of the kebeles are at risk of developing the infectious disease, especially malaria. This district was purposively selected for this study because it is one of the malaria hotspot areas in Ethiopia.

Source and study population

All households with pregnant mothers in Asgede Tsimbla district were the source population. Randomly selected households with pregnant mother in the district and sampled pregnant mothers for participation were the study population.

Inclusion and exclusion criteria

Self-reporting pregnant women who stayed in the house the previous night of data collection and pregnant women who were seriously ill during data collection period were inclusion and exclusion criteria, respectively.

Sample size determination

The sample size was determined using a single-population proportion formula, assuming 35% proportion of pregnant women who were using their LLIN,[10] 95% confidence level, 5% margin of error, 1.5 design effect, and 5% of non-response rate.

Sampling procedures

From a total of 27 kebeles, 8 were randomly selected to have a representative sample of study subjects. Then, to draw a sampling frame, the total number of households with pregnant mothers was obtained from health extension workers of each kebele (small administrative unit in Ethiopia). The sample size was allotted to each selected kebele by probability proportional to size sampling method. Using systematic random sampling, every 11th household with pregnant mother in the selected kebeles was included in the study.

Data Collection Tools and Techniques

Data were collected using a structured interviewer-administered questionnaire prepared after reviewing the relevant literature. The questionnaire was developed first and translated to the local language, Tigrigna, and then back to English for consistency. Face-to-face interview was conducted by three diploma holder nurses under the guidance of one health officer for a month (see S1 Questionnaire in the Supplemental Material).

Data quality control

To assure the quality of data, data collectors were trained, the questionnaire was pretested in 5% of the total sample (28 pregnant women) of the study kebeles, and it was translated to local language, Tigrigna, and back to English. Regular and continuous follow-up was made by the principal investigator to monitor the quality of the data collection process, and every filled questionnaire was checked daily and feedbacks were given to data collectors.

Variables

In this study, LLIN utilization is the dependent variable. The independent variables were as follows: socio-demographic variables, LLIN utilization, recent attack of febrile illness/malaria, and number of LLINs the household owned.

Operational definition

Long-lasting insecticidal net is a factory-treated net that does not require any treatment. It is designed to maintain efficacy against mosquito vectors for at least 3 years. Long-lasting insecticidal net utilization is the use of standardized, properly hanged (mounted) net over the bed or the sleeping area, and pregnant women reported sleeping under the mosquito net the night preceding data collection.

Data analysis

Data were entered into a computer using Epi Info (version 7) software and exported to Statistical Package for Social Sciences (SPSS, version 21) for analysis. Frequency distribution of

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variables was done and presented using tables. Odds ratio (OR) with 95% confidence interval (CI) using binary logistic regression analysis (enter method) was used to determine the strength of the associations between dependent and independent variables. Variables with *P*-value less than or equal to 0.25 in the simple logistic analysis were taken to perform multiple logistic regression. Model fitness was checked using Hosmer-Lemeshow goodness-of-fit test having a *P*-value of 0.085. Variables with *P*-value less than 0.05 were considered as statistically significant predictors of the outcome variable in the final model.

Results

Socio-demographic characteristics of the respondents

A total of 550 pregnant mothers participated in the study with a response rate of 100%. The mean ± standard error age of the mothers was 32.1 ± 2.34 years. Most of the respondents (382, 69.5%) were from the rural community and almost all of the participants (532, 96.7%) were Orthodox Christian. Of the total respondents, 376 (68.4%), 526 (95.6%), and 525 (95.5%) were with no formal education, married, and housewife, respectively; 421 (76.5%) have at least 1 antenatal follow-up time to their nearby health institution during their current pregnancy (Table 1).

Long-lasting insecticidal net ownership, utilization, knowledge, and experience of malaria

Most of the participants (326, 59.3%) responded fever as a symptom of malaria, 498 (90.5%) responded malaria transmitted by mosquito bite, and 527 (95.8%) responded that bed net is the main prevention method of malaria. The proportion of pregnant women using LLIN the night before the survey was 347 (63.1%) with 95% confidence limit [58.7-66.7]. Overall, 214 (38.9%) of the women had experienced malaria during their current pregnancy and 263 (47.8%) of pregnant women own 2 LLINs per household (Table 2).

Factors associated with LLIN utilization of the pregnant women

In the simple logistic regression analysis, place of residence, marital status, family size, malaria experience during their current pregnancy, perceived malaria severity, perceived barriers to LLIN utilization, and perceived self-efficacy to use LLIN are the factors which showed significant association with LLIN utilization. In the multiple logistic analysis, place of residence, family size, and malaria experience in their current pregnancy were found to be the factors associated with pregnant women's LLIN utilization.

Pregnant mothers from the rural community were 71% less likely to use LLIN compared with pregnant women from the urban community (AOR [95% CI] = 0.29 [0.15-0.54]). Pregnant women from the family size of 3-5 (5.1 [2.3-11.4])

Table 1. Socio-demographic characteristics of pregnant women in Asgede Tsimbla district, northwestern Ethiopia, 2017.

VARIABLES	FREQUENCY (N)	%
Maternal age		
⩽24	162	29.5
25-34	309	56.2
⩾35	79	14.4
Residence		
Urban	168	30.5
Rural	382	69.5
Religion		
Orthodox	532	96.7
Muslim	18	3.3
Educational status		
No formal education	376	68.4
Have formal education	174	31.6
Marital status		
Married	526	95.6
Others	24	4.4
Occupation		
Housewife	525	95.5
Others	25	4.5
Occupation of husband		
Farmer	488	88.7
Others	62	11.3
Number of sleeping rooms		
1	478	86.9
⩾2	72	13.1
Family size		
⩽2	97	17.6
3-5	298	54.2
>5	155	28.2
ANC visit		
Yes	421	76.5
No	129	23.5
GA		
<28	196	35.6
⩾28	354	64.4

Abbreviations: ANC, antenatal care; GA, gestational age. Mean age ± SD = 27.7 ± 5.4. Mean GA ± SD = 27.5 ± 6.8.

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Table 2. LLIN ownership, utilization, knowledge, and experience of malaria among pregnant women in Asgede Tsimbla district, 2017.

VARIABLES	FREQUENCY (N)	%
Symptoms of malaria		
Fever	326	59.3
Chills	432	78.5
Head ache	274	49.8
Back ache	231	42.0
Coma	210	38.2
Convulsion	405	73.6
Mode of transmission		
Mosquito bite	498	90.5
Stagnant water	125	22.7
Over working heavy work	23	4.2
Hunger/empty stomach	27	4.9
Eating dirty food	128	23.3
Drinking dirty water	27	4.9
Cold or changing weather	162	29.5
Methods of prevention		
DDT	286	52.0
Bed net	527	95.8
Herb spray	27	2.3
Avoid cold weather	23	4.9
LLIN utilization		
Yes	347	63.1
No	203	36.9
Malaria during the current pregnancy		
Yes	214	38.9
No	336	61.1
Number of LLINs per household		
1	180	32.7
2	263	47.8
⩾3	107	19.5

Abbreviations: DDT, dichlorodiphenyltrichloroethane; LLIN, long-lasting insecticidal net.

and >5 (4.8 [1.9-12.0]) were 5 times more likely to use LLIN than mothers with 1-2 family size. Utilization of LLIN was 75% less likely among those who did not experience malaria compared with those who experience malaria during their current pregnancy (0.25 [0.14-0.46]) (Table 3).

Discussion

This study realized that the LLIN utilization rate of the pregnant mother was 63.1% (95% CI = [58.7-66.7]). Place of residence, family size, and malaria experience in their current pregnancy were found to be the factors associated with LLIN utilization among pregnant women. This study showed that almost 60% of the respondents said that fever is the clinical manifestation of malaria, which was lower than the study from Raya Azebo district which was 96.7%.[11] A total of 512 (93%) of the respondents reported that malaria transmission is by mosquito bite. This finding was higher than the study done in Adama[12] and comparable with the studies from Nigeria[11] and Raya Azebo[11] which were 80.5%, 96.7%, and 90.2%, respectively. Overall, 542 (98.5%) of the respondents reported that malaria transmission can be prevented by effective utilization of long-lasting insecticidal bed net. This was much higher than the studies conducted in Raya Azebo[11] and Adama[12] districts which were 64.8% and 56.1%, respectively.

The study showed that the pregnant women who slept under the LLIN the night before the study was 63.1%. This study was slightly lower with the studies done in Nigeria among pregnant women (73%), a systematic review from 10 African countries (79%), Uganda (73%), and Ethiopia (74%).[13-16] But it was higher than the studies from northern Uganda (35%), Nigeria (19.2%), and Adama district (14.7%).[12,17,18] However, the finding of this study was in line with the studies conducted in Raya Alamata (69%) and Raya Azebo (58.4%) districts.[7,17] The reason for this discrepancy could be the difference in endemic property of the area for malaria and the willingness of health professionals in the woreda to distribute LLIN and to give health education and awareness at different times about the importance of LLIN.

Pregnant women from the urban community were more likely to use LLIN compared with the pregnant women from the rural community (AOR[95% CI] = 1.9 [1.22-3.01]). This was comparable with the studies done in Nigeria,[16] a systematic review from SSA,[18] and Adama district.[12] This difference in utilization of LLIN by residence may be explained by women from the urban community who were near to health professionals/health institution, mass media, and education and hence may be aware of malaria and LLIN importance.

Pregnant women with a family size of >5 and 3-5 (AOR[95% CI] = 2.4 [1.20-5.03] and 2.8 [1.53-5.22], respectively) were more likely to use long-lasting insecticidal bed nets than pregnant women with a family size of 1-2. This was inconsistent with a study from eastern Ethiopia which shows that the family size of more than 4 was less likely to use LLIN than their counterparts.[8] The reason may be explained by women from household with large family size who may be exposed many times to health institutions for different health service utilizations for each of the family members and hence may get information or awareness about malaria prevention methods compared with women with

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Table 3. Factors associated with LLIN utilization among pregnant women in Asgede Tsimbla district, northwestern Ethiopia, 2017.

VARIABLES	USE LLIN (%)	NOT USE LLIN (%)	COR [95% CI]	AOR [95% CI]
Residence				
Urban	48 (28.6)	120 (71.4)	1.7 [1.15-2.5]	1.9 [1.22-3.01]
Rural	155 (40.6)	227 (59.4)	1	1
Maternal age				
⩽24	76 (46.9)	86 (53.1)	1	1
25-34	88 (28.5)	221 (71.5)	2.2 [1.4-3.2]	1.9 [0.2-3.1]
⩾35	39 (49.4)	40 (50.6)	0.9 [0.5-1.5]	0.9 [0.48-1.8]
Sleeping rooms				
1	171 (35.8)	307 (64.2)	1	1
⩾2	32 (44.4)	40 (55.6)	0.69 [0.42-1.14]	1.3 [0.76-2.5]
Family size				
1-2	49 (50.5)	48 (49.5)	1	1
3-5	87 (29.2)	211 (70.8)	2.4 [1.54-3.96]	2.8 [1.53-5.22]
>5	67 (43.2)	88 (56.8)	1.34 [0.80-2.23]	2.4 [1.20-5.03]
Malaria history during current pregnancy				
Yes	48 (22.4)	166 (77.6)	2.96 [2.01-2.96]	3.0 [1.95-4.86]
No	155 (46.1)	181 (53.9)	1	1
Number of LLINs				
1	60 (33.3)	120(66.7)	1	1
2	95 (36.1)	168(63.9)	0.88 [0.59-1.31]	0.61 [0.37-1.02]
⩾3	48 (44.9)	59(55.1)	0.61 [0.37-1.0]	0.78 [0.40-1.51]

Abbreviations: AOR, adjusted odds ratio; COR, crude odds ratio; LLIN, long-lasting insecticidal net.

small family size. This can also be explained by households having large family size who may get more nets and pregnant women from this household may have better access of it and is more likely to use the net.

Pregnant women who had experienced malaria during their current pregnancy were 3 times more likely to use LLIN than their counterparts (AOR[95% CI] = 3.0 [1.95-4.86]). This may be due to mothers who had a history of malaria, and taking anti-malarial drugs before might provide information about how to prevent the disease using different malaria prevention methods during health institution visit. Furthermore, pregnant women living in higher transmission areas with high rate of mosquito breeding and having history of malaria are considered to be more familiar with the risks of malaria during pregnancy and thus it may provoke them to use nets compared with women who do not get malaria.

Since the assessment of LLIN utilization was based on self-report, utilization may be susceptible to overestimation. Since it was a onetime data, it may not give clue about sustainable (long-term pattern) utilization of LLIN.

Conclusion

As pregnant women were more susceptible to malaria compared with the other population, utilization of LLIN was low compared with most studies in Ethiopia, except studies done in Raya Alamata and Raya Azebo. Long-lasting insecticidal net utilization is statistically associated with residence, family size, and malaria history during their current pregnancy. Target-specific intervention among pregnant women through local training and supervision about malaria and sleeping under LLIN (information, education, and communication) should be promoted in the district.

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Author Contributions

TA and BG developed the proposal, analyzed data, and wrote the report and the manuscript. BG and HG organized the overall process. HG, TA, and BG contributed to manuscript writing, data collection, and analysis. All authors checked and accepted the final manuscript.

Availability of Data and Materials

The authors declare that this research is their original work and the datasets used and/or analyzed during this study are available from the corresponding author on reasonable request.

Ethical Approval and Consent to Participate

Ethical approval and clearance were obtained from Aksum University ethical review board. After all necessary explanation about the purpose of the study, its procedure, and assurance of confidentiality, consent was obtained from the respondents.

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