

ORIGINAL ARTICLE

OWNERSHIP AND USE OF TREATED BED NETS IN URBAN COMMUNITIES OF ASSOSA ZONE, WESTERN ETHIOPIA

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ABSTRACT

BACKGROUND: *Even though, use of insecticide treated net is one of the proven malaria control strategies, its ownership and use vary from country to country and area of residence. The objective of this study was to assess determinants of insecticide treated net ownership by households and use by under-fives and pregnant women in the study community.*

METHODS: *A cross-sectional study was conducted in a sample of 581 households in three urban communities of Assosa zone, Western Ethiopia. Data were collected using structured questionnaires, analyzed using SPSS for windows version 12.0.1. Adjusted odds ratio and 95% confidence intervals were employed to test the strength of association and the criterion for statistical significance was set at 0.05.*

RESULTS: *Of 581 households, 254 (43.7%) had at least one mosquito net 34 (9.1%) of under-five children and 16 (23.19%) pregnant women reported sleeping under an insecticide treated net the night preceding the date of interview. Insecticide treated net ownership was significantly associated with wealth-status and knowledge about perceived benefit of sleeping under insecticide treated net of the respondent (adjusted OR = 3.79, 95% CI: 1.62, 8.88; adjusted OR = 3.02, 95% CI: 1.79, 5.1, respectively). Burning leaves as mosquito avoidance measure was negatively associated with ownership of insecticide treated net (adjusted OR = 0.2, 95% CI: 0.1, 0.41). The use of insecticide treated net was 10.6 times more likely for under-fives sharing the same sleeping place with their parents than not sharing the same sleeping place (adjusted OR = 10.6, 95% CI: 3.73, 27.2).*

CONCLUSION: *ITN or mosquito net coverage at household level was lower than the national target. Poor perception about ITNs, absence of mosquitoes, low socioeconomic and low educational status, cost, and unavailability of the ITN were identified as main barriers to possess and use ITN. Parents' wealth status and educational level were found to be determinants of use of ITN by children under five and pregnant women. Ensuring insecticide treated net availability is necessary to increase their ownership and use should be prioritized in the household as they are at the particular risk of severe malaria and death from it. This can be partly addressed through effective information, education, and communication of communities.*

KEY WORDS: *Ownership, Insecticide treated net, Malaria, Assosa, Ethiopia*

INTRODUCTION

Malaria is one of public health concerns in developing countries including Ethiopia, with increased burden among pregnant women and children under the age of five. The use of mosquito nets, particularly insecticide-treated nets (ITN), is a primary health intervention to reduce malaria transmission (1). It reduces malaria morbidity and mortality by providing barrier to infective mosquito bites and reducing mosquito density so that protects even those sleeping outside of the net within the same dwelling house and neighbors (2-6).

Insecticide treated net ownership and perceptions about the malaria illness particularly the households' perceived susceptibility to and the seriousness of illness has a direct relationship with pattern of net use (7,8). Past experiences on ITN use, better knowledge of malaria, recent incidence of malaria in the household and

family size were among the factors predicting ownership of ITN (9,10,11). Studies in various part of the world also indicated that socioeconomic status of the households like wealth and educational status have been shown to be important predictors of ITN possession and use (12-18). Determinants of ownership and use of ITN vary from country to country; and from district to district within the same country as well as by area of residence. Ownership of ITN may not also indicate its use by the vulnerable groups in the households. Several national surveys indicated considerable disparity between ITN possession and use. ITN possession was shown to range between 0.1% and 28.5%, while use among children less than 5 years old ranged between 0% and 16% (10). Thus, it is important to assess determinants of ownership and use that is applicable to the local context, or more broadly to programs that are using ITNs to reduce the burden of malaria. Therefore, this study designed to investigate the

determinants of ITN ownership by households and uses by children under-fives and pregnant women in urban communities of Assosa Zone, Western Ethiopia.

METHODS AND MATERIALS

Study area: The study was conducted in three Woreda towns (Assosa, Bambasi, Menge) of Assosa Zone. Assosa Zone is located 600 kilometers west of Addis Ababa in the Beneshangul Gumuz Region. The estimated households were 4606 for Assosa, 1512 for Bambasi, and 528 for Mengie towns. All four Kebeles of Assosa Town, Both Kebeles of Bambasi town and a kebele (the only Kebele) in Menge Town were included in this study. The detailed description of the study sites were also mentioned elsewhere (19).

Study design: This community-based cross-sectional study was conducted from January - February 2006. Study participants were heads/ spouses of households that were resident in the study areas for at least six months.

Sample size and Sampling techniques: The sample size was determined using Epi Info Version 6.04d statistical package for estimating two population proportions. The proportion of ITN ownership by wealth quintiles in other major towns of Ethiopia was 2% among the lowest and 24% among wealthiest socioeconomic groups (15). The aim was to detect a minimum of 22% difference between the lowest and highest levels of socioeconomic status with 80% power and 95% Confidence Interval (CI). Based on the above assumptions, a sample of 606 households including 10% for non-responses were determined. Samples were allocated proportional to the size of each kebele in the three towns. By constructing a sampling frame from data recorded for the 2005 national election, households were selected using a systematic sampling technique at an interval of every eleventh household. The first household was randomly selected from the first eleven households in the sampling frame.

Data collection: data were collected using a standard structured questionnaire adopted from the 2004 WHO/UNICEF guidelines for core population coverage survey (20), translated into Amharic and pre-tested. A total of twelve data collectors and three supervisors who speak the local languages (Amharic, Oromiffa or Berta) of the study communities were recruited from the respective study areas who were trained for two days on main purpose of the study and on how to conduct interviews. The heads of households or their spouses were interviewed in their own language. Supervisors checked for completeness of questionnaires every day. Incomplete questionnaires were returned to the data collectors on the following day for correction by revisiting the households. Five percent of the interviewed households were randomly selected and re-

interviewed by the supervisors to check the quality and validity of data.

Analyses: Data were entered, cleaned and stored into two different computers and analysed using SPSS for windows version 12.0.1. Bivariate analyses were carried out to identify independent predictors for further analyses using logistic regression. Independent variables that showed significant differences at p-value less than 0.05 were selected for logistic regressions. Logistic regression analysis was used to identify factors predicting ITN ownership by the households and its use by children under-five years of age and pregnant women. The strength of association was interpreted using the adjusted odds ratio at 95% CI and the level of significance was set at 0.05. Wealth quintiles were determined by asking the head of households or spouse about ownership of the durable household assets for each household. The asset categories included were based on the presence and/ or absence the specified asset item. A total of 23 different durable assets were identified and assigned as dummy variables. For each household asset a mean asset score was calculated and the normality of the distribution of the asset mean scores was visually assessed by plotting histogram. Then the asset mean scores were re-categorized into five different wealth quintiles of approximately the same number of households. ANOVA test was employed to determine whether there was a significant variation across the levels of wealth quintiles. Inequality in the ownership of ITNs between the poorest and well-off wealth quintiles were examined using equity ratio.

Ethical considerations: Ethical clearance and approval was obtained from Jimma University ethical committee. Informed written consents were obtained from all levels of the local government before data collection, and verbal consents obtained from individual respondents during data collection. The respondents were given the right to refuse to take part in the study or withdraw at any time during the interview. Privacy and confidentiality were maintained throughout the study.

The following operational definitions were used;

ITN: is a net that have been treated with insecticides permanently.

Ever treated net: a net that has been soaked with the recommended insecticide (permethrin or deltamethrine) within the past 6 months

Ownership of ITN: households who reported to own at least one ever treated nets or ITNs.

Use of ITN : households who reported that children under fives and pregnant women have slept under ITNs during the night preceding the date of interview.

RESULTS

Of 606 sampled households, 581(95.9%) participated in the study. Of these, 254 (43.7%) respondents reported that, they had at least one ITN and/or ever treated mosquito net. The average number of any mosquito net (including both untreated and ever treated net), ever-treated net and recently owned ITN per household was found to be 0.44, 0.34 and 0.09, respectively. Respondents in the poorest wealth quintiles reported to

have less access to any mosquito nets and ITN compared to those in well-off wealth quintiles with an equity ratio of 0.33:1 and 0.35: 1 respectively (Table 1). The median walking distance to the net distribution sites and the time period since the household had owned the ITNs were found to be 20 minutes and 19.9 (inter-quartile range is 3.3 months, respectively). One Hundred ninety (75%) was from public health delivery system and 64(25 %) were through private commercial sectors.

Table 2. Socioeconomic and Demographic determinants of the ITN ownership among the three urban areas, Assosa Zone, Western Ethiopia, 2006 (n = 581).

Socioeconomic and demographic	ITN ownership		Crude OR [95% CI]	Adjusted OR [95% CI]
	Yes (%)	No (%)		
Marital status				
Single (unmarried)	12(24.5)	37(75.5)	1.00	1.00
Currently married	223(46.5)	257(53.5)	2.68[1.36, 5.3]*	2.97[1.37, 6.45]*
Divorced	4 (25.0)	12 (75.0)	1.03[0.23, 3.8]	1.02[0.20, 4.80]
Widowed	15 (41.7)	21 (58.3)	2.20[0.87, 5.6]	2.69[0.94, 7.73]
Educational level				
No formal education	32 (28.8)	79 (71.2)	1.00	1.00
1 – 4 th grade	45 (36.0)	80 (64.0)	1.40[0.80, 2.4]	0.98[0.54,1.81]
5-8 th grade	54 (40.3)	80 (59.7)	1.67[0.90, 2.9]	1.09[0.588, 2.02]
9-12 th grade	73 (57.9)	53 (42.1)	3.40[1.90, 5.9]**	2.06[1.081,3.92]*
College/university	50 (59.5)	35 (40.5)	3.60[2.00, 6.6]**	1.28 [0.594,2.77]
Occupational category				
Job with variable income	101(31.6)	219(68.4)	1.00	1.00
Job with regular income	153(58.6)	108 (41.4)	3.1[2.2, 4.3]**	2.60[1.8, 3.7]**
Wealth quintiles				
Poorest	27 (19.1)	114 (80.9)	1.00	1.00
Next poorest	66 (42.6)	89 (57.4)	3.13[1.8, 5.30]**	2.45[1.4, 4.3]*
Medium	35 (54.7)	29 (45.3)	5.10[2.7, 9.70]**	4.10[2.07, 8.1]**
Next to well-off	68 (56.7)	52 (43.3)	5.50[3.2, 9.60]**	4.06[2.26, 7.3]**
Well-off	58 (57.4)	43 (42.6)	5.70[3.2, 10.1]**	3.60[1.96, 6.7]**
Willingness to pay for ITN for 25 Birr				
0=No	60 (24.6)	126 (40.3)	1.00	1.00
1= yes	187 (75.7)	187 (59.7)	2.1[1.45, 3.0]**	1.41[0.93,2.14]

Note: OR= Odds Ratio, * P < 0.05, and ** P < 0.001, CI = Confidence Interval

Table 1. Households ownership of mosquito net by wealth status and in the three urban areas, Assosa Zone, Western Ethiopia, 2006 (n = 581)

Background variables	HH with at least one net	HH with more than one net	Average number of nets per HH	HH with at least one ever treated	HH with more than one ever treated net	Average number of ever treated nets per HH	HH with at least one ITN	HH with more than one ITN	Average number of ITN per HH	Total HH
Study areas										
Assosa	180(45)	63 (15.6)	0.45	137(34)	45 (11)	0.34	43 (10.6)	18 (4.5)	0.11	404(69.5)
Bambasi	46(37)	20 (15.5)	0.37	38 (30)	17 (13)	0.29	8 (6.2)	3 (2.3)	0.06	129(22.2)
Menge	28 (58)	7 (14.6)	0.58	25 (52)	6 (13)	0.52	3 (6.3)	1 (2.1)	0.06	48 (8.3)
Wealth quintiles										
Poorest	27(19)	6 (22)	0.19	22(15.6)	6 (4.3)	0.16	5 (3.55)	0 (0)	0.04	141(24.3)
Next to poorest	66(43)	17(26)	0.43	55(35.5)	13 (8.4)	0.36	7 (4.52)	4 (2.6)	0.05	155(26.7)
Medium	35(55)	4 (11)	0.55	28(43.8)	3 (4.7)	0.44	7 (10.94)	1 (1.6)	0.11	64 (11.0)
Next to well-of	68(57)	29(43)	0.57	47(39.2)	20 (16.7)	0.39	21 (17.5)	9 (7.5)	0.18	120(20.7)
Well-off	57(57)	34(59)	0.57	48(47.5)	25 (24.8)	0.48	10 (9.9)	8 (7.9)	0.099	101(17.4)
Poorest: Well-off Ratio	0.33								0.35	

Note: HH = Households, Numbers in parenthesis are percentages.

The ownership of the ITNs was found to be associated with factors such as marital status, occupation, and wealth status of the respondents after adjusted for other socio-demographic predictors. Married study participants reported almost three times more likely to own ITN compared to single study participants (OR = 2.97, 95% CI: 1.37, 6.45). Respondents who had job with regular sources of income were 2.6 times more likely to own ITNs compared to people with variable sources of income (OR = 2.6, 95% CI: 1.8, 3.7). Those in the medium, next to the well-off and the well-off wealth quintiles were also more likely to own ITNs compared to those in the poorest wealth quintiles (OR = 4.1; 95% CI: 1.4, 4.3; OR = 4.06, 95% CI: 2.26, 7.3; and OR = 3.6, 95% CI: 1.96, 6.7 respectively) (Table 2 and Fig. 1).

Having ITN information from health institution, Knowledge about the perceived benefit of sleeping under an ITN, and indoor mosquito resting place were positively associated with ownership of ITN after adjusted for other behavioral predictors (OR = 1.6, 95% CI: 1.02, 2.6, OR = 3.7, 95% CI: 2.3, 6.1 and OR = 2.03, 95% CI: 1.24, 3.33, respectively). Respondents who reported burning leaves or cow-dung as a measure against mosquitoes and those who used aerosol insecticides were 80% and 70% less likely to own ITNs, respectively compared to those who did not report these practices (OR = 0.2, 95% CI: 0.09, 0.37 and OR = 0.3, 95% CI: 0.16, 0.5), respectively (Table 3).

Figure 1. Household ownership of net by treatment status of the net and wealth quintiles in the three urban areas, Assosa Zone, Western Ethiopia, 2006 (n = 254).

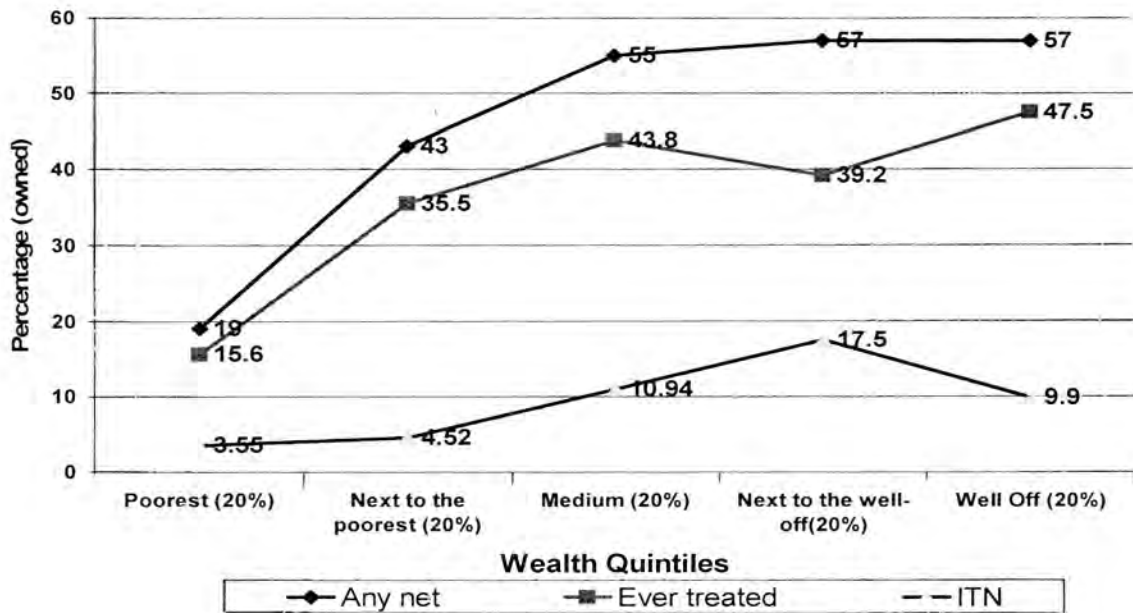


Table 3. Behavioral determinants of the ITN ownership among the three urban areas, Assosa Zone, Western Ethiopia, 2006.

Independent variables	ITN ownership		Crude OR [95% CI]	Adjusted OR [95% CI]	
	Yes (%)	No (%)			
Sleeping under mosquito net prevents malaria	No	193(57.3)	52 (26.5)	1.00	1.00
	Yes	144(42.7)	144(73.5)	3.7[2.5, 5.4]**	3.59[2.15, 5.98]**
Treatment with drugs prevents malaria	No	45 (36.6)	200(48.8)	1.00	1.00
	Yes	78(63.4)	210(51.2)	0.61[0.4, 0.9]*	0.82[0.46,1.46]
Cleaning the surrounding prevents malaria	No	153 (50.7)	92 (39.8)	1.00	1.00
	Yes	149 (49.3)	139 (60.2)	1.6[1.1, 2.2]*	1.41[0.86, 2.30]
Have ITN information from Health Institution	No	140 (55.8)	113 (41.2)	1.00	1.00
	Yes	111 (44.2)	161 (58.8)	1.8[1.3, 2.5]*	1.65[1.04, 2.62]*
Mosquito avoidance practices: use smoke to avoid mosquitoes	No	18 (22.2)	223 (58.8)	1.00	1.00
	Yes	63 (77.8)	156 (41.2)	0.2[0.11, 0.3]**	0.19[0.10, 0.38]**
Mosquito avoidance: use aerosol insecticides	No	32 (34.0)	209 (57.1)	1.00	1.00
	Yes	62 (66.0)	157 (42.9)	0.4[0.16, 0.51]**	0.28 [0.16, 0.52]**
Mosquitoes rest in dark place inside the house	No	177 (50.3)	60 (34.1)	1.00	1.00
	Yes	175 (49.7)	116 (65.9)	1.95[1.34, 2.9]**	2.03[1.24, 3.33]*

Note: OR = Odds ratio, * $P < 0.05$, and ** $P < 0.001$, CI=Confidence Interval

Of the total 373 under-five children, 78 (20.9%) slept under any mosquito net and 34 (9.1%) under ITN during the night preceding the date of interview. Children belonging to the households in the poorest wealth quintiles reported having less access to any mosquito net or ITN compared to those in the well-off wealth quintiles (the poorest to well-off equity ratio = 0.6 and 0.0, respectively). Among the study participants, only 20 (30.3%) of pregnant women slept under any mosquito net and 18 (25.7%) of them slept under ITNs the night preceding the date of interview. Pregnant women who were in the poorest wealth quintile were more likely to have used ever treated net with an equity ratio of 1.46: 1 compared to those in the well-off level wealth quintiles (Table 4).

Children who shared the same sleeping place with either of their parents or both were 10.6 times more likely to sleep under any mosquito net or an ITN compared to those who slept on a separate bed or slept with the other family members (OR = 10.6, 95% CI: 3.9, 28.8). The respondents' wealth status was significantly associated with the children's likelihood of sleeping under an ITN or ever treated net. Children in all levels of the wealth quintiles, except those in well-off quintiles, were more likely to use ITN or ever treated net compared to those in the poorest wealth quintiles (OR = 4.5, 95% CI: 1.67, 12.2; OR = 5.57, 95% CI: 1.83, 17.0 and OR = 3.57, 95% CI: 1.27, 9.97 respectively) (table 5).

Table 4. ITN use by the children under-five age and Pregnant Mothers in the three urban areas, Assosa Zone, Western Ethiopia, 2006.

Background variables	< 5 children under any mosquito net last night	< 5 children who slept under ITN last night	Total number of children (n = 373)
	No (%)	No (%)	
Study town			
Assosa	38 (15.7)	25 (10.3)	242
Bambasi	17 (17.17)	6 (6.06)	99
Menge	23 (71.8)	3 (9.4)	32
Gender			
Male	32 (17.1)	16 (8.6)	187
Female	37 (19.89)	13 (6.9)	186
Wealth quintiles			
Poorest	8 (9.87)	0	81
Next to poorest	31 (31.0)	4 (4.0)	100
Medium	11 (25.56)	7 (16.3)	43
Next to well-off	18 (20.45)	16 (18.2)	88
Well-off	10 (16.4)	7 (11.5)	61
Poorest : Well-off ratio	0.6	0.0	
Background variables	Pregnant women who slept under any mosquito net last night	Pregnant women who slept under ITN last night	Total number of pregnant women (n = 66)
	No (%)	No (%)	
Study town			
Assosa	15 (27.78)	15 (27.75)	54
Bambasi	3 (37.5)	3 (37.5)	8
Menge	2 (50.0)	0	4
Wealth quintiles			
Poorest	3 (42.8)	1 (14.3)	7
Next to Poorest	8 (47.0)	5 (29.4)	17
Medium	1 (14.3)	2 (28.6)	7
Next to well-off	3 (16.7)	1 (5.6)	18
Well-off	5 (29.4)	2 (11.8)	17
Poorest : Well-off ratio	1.46	1.2	

Table 5. Determinants of ITN use by children under-five years of age in the three urban areas, Assosa Zone, Western Ethiopia, 2006 (n = 254).

Independent variables	Under-five ITN use		Crude OR [95% CI]	Adjusted OR [95% CI]
	Yes (%)	No (%)		
Share the same bed (sleeping place) with their both of the parents /mothers				
No	5 (7.2)	64 (92.8)	1.00	1.00
Yes	77 (37.4)	129 (62.6)	7.6[2.9, 19.8]**	10.6[3.9, 28.8]**
Level of education				
No formal education	7 (13.7)	44 (86.3)	1.00	1.00
1-4 th grade	12 (20.0)	48 (80.0)	1.57[0.56, 4.3]	1.37[0.46, 4.0]
5-9 th grade	20 (35.1)	37 (64.8)	3.39[1.29, 8.9]*	3.3[1.17, 9.39]*
9- 12 th grade	30 (45.5)	36 (54.5)	5.2[2.06, 13.3]*	6.7[2.37, 19.08]*
College/University	13 (30.2)	30 (69.8)	2.7[0.97, 7.6]	2.8[0.9, 9.0]
Wealth quintiles				
Poorest	7 (11.3)	55 (88.7)	1.00	1.00
Next to poorest	25 (34.7)	47 (65.3)	4.2[1.66, 10.5]*	4.5[1.67, 12.2]*
Medium	15 (40.5)	22 (59.5)	5.36[1.92, 14.9]*	5.57[1.83, 17.0]*
Next to Well-off	23 (38.3)	37 (61.7)	4.88[1.90, 12.54]*	3.57[1.27, 9.97]*
Well -off	12 (26.1)	34 (73.9)	2.77[0.99, 7.7]	2.4[0.77, 7.4]

Note: OR = Odds Ratio, * P < 0.05, and ** P < 0.001, CI = Confidence Interval

DISCUSSION

Insecticide treated net program, currently reported coverage was far below the expected level, which was 60% as per key goal for malaria control in Africa for 2005 (21). Despite the fact that different sources of ITNs like public health institutions, private shops and open market were mentioned by the study participants, the overall proportion of the households that had at least one ever treated mosquito net and ITN was still low in the study area. However, this study showed higher proportion of possession when compared to study conducted elsewhere (10). This might be due to the high commitment of the Ethiopian government to increase ITN distribution. This is evidenced from the fact that the lion's share (75%) was through public health delivery system. In contrast to this finding other studies in Ethiopia and Uganda reported major sources of ITN to be commercial sectors (15, 22).

A wide gap was observed between levels of awareness for ownership of the ITNs in the study communities. The ratio of both ITNs ownership in the poorest to the well-off wealth quintiles was 0.35, showing wide equity gap between the poorest and well-off households. However this is a narrower gap compared to other study findings carried out in Ethiopia where ITNs ownership between the levels of socioeconomic status, i.e., 2% in the lowest vs. 24% in the highest social groups (15). In other study from Tanzania, the ratio of mosquito net ownership in the poorest to the least poor households was reported to be 0.3 in 1997 (22), which was improved to 0.6 after three years ITN intervention through social marketing.

Behavioral factors such as perceived knowledge about the benefit of sleeping under ITN and knowledge about mosquito behavior (biting time and resting place) were observed to be associated with ITN ownership when controlled for other factors. On the other hand, use of traditional mosquito avoidances methods like burning of leaves (smoking) and aerosol-insecticide were negatively associated with ownership of the ITNs. This finding agrees with results of studies done in other towns of Ethiopia and Burkina Faso (15, 23). Other factors observed in this study to be a barrier to own ITNs were lack of information about ITN and shortage of money to buy the net. These were the major factors affecting ownership of ITNs which was described in studies conducted in other African countries (16,22) and need to be addressed through effective behavioral change communications.

Forty four percent of those households had at least one ever treated mosquito net and among those who had nets, 40% reported that they did not sleep under any net the night preceding the date of interview because of various possible reasons. Environmental factors like hot weather and absence of mosquito nuisance are important reasons for not sleeping under any net. Others like technical factors related to the net (poor protection of the net from mosquito bites, hindering free air movement,

and difficulty to tuck the net each night) were also described in the research conducted in Eritrea (24). In addition, social and economic factors like forgetting and lack of adequate nets might have been some of the possible reasons for not using a net. Similar barriers to using ITN were also reported in other studies (15, 25).

The proportion of insecticide treated mosquito net use coverage among under-five children in the present study areas seems higher than in other studies in Ethiopia. The coverage levels reported for urban areas in the findings of the Ethiopian Demographic and Health Survey (EDHS) were 7.3% and 2.8% for mosquito net and for ITN, respectively, however they are still below the national target set by WHO (1,21).

Similar difference was observed in ITN ownership between wealth groups inequalities in both any mosquito net and ITN use, between children in the poorest and well-off wealth quintiles in the present study. This big difference in lowest to well-off equity ratio for any mosquito net and ITN in this study implies inequalities among the economic level of the people. These findings could give insight to concerned bodies that children in the poorest segment of the population are less protected against malaria compared to those in well-off households and demands free distribution of ITN. The Proportions of the pregnant women who slept under ever treated net and under an ITN the night preceding the date of interview were higher than that reported in the NetMark survey and in the result of the Ethiopian Demographic and Health Survey (1, 15).

Parents' wealth, education status, and sleeping arrangements affect ITN or ever treated net use by the children under-five years of age. Sleeping arrangement has been investigated as they are directly related to use of ITN or mosquito net particularly of the children under-five years of age (25). In the present study children who shared the same sleeping place with their parents had more access to ITN (ever treated net) compared to those who did not share sleeping place indicating that priority was not given for under-five children. The primary person protected was not the child rather the child benefited because it happened to share beds with their parents. This result was consistent with findings of studies in other African countries (22, 23, 25, 26).

This study has some limitations; first, the study was conducted in January and February when the malaria transmission was low and might result in under estimation the use of nets by the vulnerable segment of the populations. However, the area is known for year round transmission of malaria and there were favorable environments for mosquito breeding as it was raining during the data collection period. Secondly, the study units for determinant of ITN use were households rather than children and pregnant women. However, the sample size was enough as showed in the result with narrow confidence intervals.

In conclusion, ITN or mosquito net coverage at household level is lower than the national target. Poor perception about ITNs, the absence of mosquitoes, low

socioeconomic and low educational status, cost, and unavailability of the ITN were identified as main barriers to possess and use ITN. Moreover, the primary protection was not for under-five, though priority should be given to under fives and pregnant women as set in the policy by Ethiopian Ministry of Health (ref). Parents' wealth status and educational level were found to be determinants of use of ITN by children under five and pregnant women. They should be prioritized for ITN use in the household as they are at the particular risk of severe malaria and death from malaria. Utilization of ITN by under fives and pregnant women in the households should be improved through health education.

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REFERENCES

1. Central Statistical Agency (CSA) [Ethiopia] and ORC Macro. Ethiopia Demographic and Health Survey 2005. Addis Ababa, Ethiopia and Calverton, Maryland, USA: CSA and ORC Macro, 2006.
2. Takken W. Do insecticide treated nets have an effect on malaria vectors? *Tropical Medicine and International Health*; 2002; 7 (12): 1022-1030.
3. WHO/RBM. Insecticide treated mosquito nets interventions: A manual for national malaria control program managers. Roll back Malaria, WHO, Geneva, Switzerland, World Health Organization; 2003.
4. Kuile FO, Terlouw DJ, Phillips-Howard PA, Hawley WA, Friedman JF, Kolczak MS, et.al. et.al; Impact of permethrin-treated bed nets on malaria and all-cause Morbidity in young children in an area of intense perennial Malaria transmission in western Kenya: cross-sectional survey, *American Journal of Tropical Medicine and Hygiene*; 2003; 68(Suppl 4): 100-107.
5. Binka FN, Indome F, and Smith T. Impact of spatial distribution of Permethrin-Impregnated bed nets on Child Mortality in Rural Northern Ghana, *American Journal of Tropical Medicine and Hygiene*; 1998; 59(1):80-85..
6. Phillips-Howard PA, Nathlen BL, Wannemuehler KA, et.al. Impact of Permethrin-treated beds nets on the incidence of sick child visits to peripheral health facilities, *American Journal of Tropical Medicine and Hygiene*; 2003;68: 38-43:
7. Kampala city council, Mosquito net coverage, base line assessment in 5 parishes of Kampala. Kampala city council, Kampala Uganda, 2000.
8. Rakhshani F, Ansari Moghadam AR, Alemi R, and Moradi A. Knowledge, perceptions and prevention of malaria among women in Sistan va Baluchestan, Islamic Republic of Iran, *Revue de Santé de la Méditerranée Orientale*; 2003;9(3):248-256.
9. Booth CM, MacLean JD. Knowledge, treatment seeking and socio-economic impact of malaria on the Essequibo coast of Guyana. *McGill Journal of Medicine*; 2001; 6:17-25.
10. Korenromp, EL., Miller, J., Cibulskis, RE., Kabar Cham, M., Alnwick, D. and Dye, C. Monitoring mosquito net coverage for malaria control in Africa: Possession Vs. use by children under five years, *Tropical Medicine and International Health*; 2003; 8(8): 693-703.
11. Central Statistical Agency (CSA)[Ethiopia] and ORC Macro. Ethiopia Demographic and Health Survey 2000. Addis Ababa, Ethiopia and Calverton, Maryland, USA: CSA and ORC Macro, 2001.
12. Howard N, Chandramohan D, Freeman T, Shafi A, Rafi M, Enayatullah S, Rowland M. Socio-economic factors associated with the purchasing on Insecticide treated bed nets in Afghanistan and their implications for social marketing, *Tropical Medicine and International Health*; 2003; 8(3): 1043-1050.
13. Macintyre K, Keating J, Sosler S, et.al. Examining the determinants of Mosquito avoidance practices in two Kenyan cities, *Malaria Journal*; 2002: 1:14. <http://www.malariajournal.com/content/1/1/14>
14. Nuwaha F. Factors influencing the use of bed nets in Mbarara municipality, *American Journal of Tropical Medicine and Hygiene*; 1992: 65(6): 877-887.
15. NetMark. NetMark 2004 survey on insecticide-treated nets (ITNs) in Ethiopia. A regional partnership for sustainable malaria prevention; updated; September 2005 <http://www.netmarkafrica.org/research/quantitative/2004%20HH%20Surveys/Ethiopia%20all%209-23-05.pdf>.
16. Worrall E, Basu S, Hanson K. The relationship between socioeconomic status and malaria: a review of the literature. Background paper prepared for "Ensuring that malaria control interventions reach the poor", 5th -6th September 2002, London http://www.doh.gov.za/issues/malaria/red_reference/cross_cutting/Economics/eco7.pdf
17. Rashed S, Johnson H, Dongier P, et al. Determinants of the permethrin impregnated bed nets (BIB) in Republic of Benin: The role of women in the acquisition and utilization of PIBs, *Social Science and Medicine*; 1999; 49: 993-1005.
18. Tumwesigire S, Watson S. Health seeking Behavior by families of children suspected to have malaria in Kabale: Uganda, *African Health Sciences*; 2002; 2 (3): 94-98.

19. Legesse Y, Tegegn A, Belachew T, Tushune K. Knowledge, Attitude and Practice about Malaria Transmission and Its Preventive Measures among Households in Urban Areas of Assosa Zone, Western Ethiopia, *Ethiopian Journal of Health Development*; 2007; 21(2): 157-165.
20. Roll Back Malaria, *Measure Evaluation*, World Health Organization, and UNICEF. Guidelines for Core Population Coverage Indicators for Roll Back Malaria; Calverton, Maryland: 2004.
http://www.rbm.who.int/partnership/wg/wg_monitoring/docs/GuidelinesForCorePopulationFINAL9-20_Malaria.pdf
21. WHO/CDS/RBM Deceleration, African Summit on Roll Back Malaria, Abuja, Nigeria WHO, Geneva Switzerland, World Health Organization; April 2000 (17).
22. Okello-Ogono F. Knowledge, Attitude, and Practices related to malaria and Insecticide treated nets in Uganda. Baseline survey: December 1999 – January 2000, the Republic of Uganda, Ministry of Health; 2001.
http://www.psi.org/resources/pubs/Country1_Uganda.pdf.
23. Okrah J, Traoré C, Palé A, Sommerfeld J, and Müller, O. Community factors associated with malaria prevention by mosquito nets: an exploratory study in rural Burkina Faso, *Tropical Medicine and International Health*, 2002;7(3):240-248.
24. Macintyre K, Keating J, Okbaldt YB, et.al. Rolling out insecticide treated nets in Eritrea: examining the determinants of possession and use in malarious zones during the rainy season, *Tropical Medicine and International Health*; 2006; 11(6): 824–833.
25. Mugisha F, Arinaitwe J. Sleeping arrangements and mosquito net use among under-fives: result from Uganda demographic and Health survey. *Malaria Journal*; 2003; 2:40.
<http://www.malariajournal.com/content/2/1/40>
26. Tyagi P, Roy A, Malhotra MS. Knowledge, awareness and practices towards malaria in communities of Rural, semi-rural and bordering areas of east Delhi, India. *Journal of Vector Borne Disease*; 2005; 42:30-35.