Original article

Knowledge and utilization of insecticide treated mosquito nets among freely supplied households in Wonago Woreda, Southern Ethiopia

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Abstract

Background: Free distribution of Insecticide Treated Nets (ITNs) for households in malarious areas is currently underway in Ethiopia to prevent malaria. Adequate follow-up of its utilization and status is lacking.

Objectives: To assess utilization of ITNs by households and under-five children, and the factors affecting its utilization among freely supplied households.

Methods: A community-based cross-sectional study was conducted in Wonago Woreda, Southern Ethiopia, in June and July 2006. Malarious *kebeles* of the study area were stratified into three strata based on their distance from Dilla Town (one of the towns in the Woreda), and 650 households freely supplied with at least one ITN were randomly selected using proportional allocation to size.

Results: Of the 944 freely supplied ITNs to 638 households, 649 (68.8%) were reported as being used by households. The use of at least one ITN was reported by 482 (75.5%) households, and under-five children who slept under ITN in the previous night were 452 (58.0%). Availability of separate bedroom significantly increased the use of ITN by households. In addition, possession of two or more ITNs and perception that ITN prevents from mosquito bite were significantly associated with utilization of ITNs by households and under-five children.

Conclusion: Not all ITNs supplied to households were used. Its utilization was affected by the unavailability of separate bedroom, less number of ITNs supplied and less perception of ITNs as main preventive measures of malaria. A strong health education program is needed for promoting the proper utilization of this newly adopted malaria control strategy. [*Ethiop.J.Health Dev.* 2008;22(1):34-41]

Introduction

Malaria remains a major public health problem particularly in sub-Saharan Africa. Each year, 300-500 million malaria cases lead to over one million deaths (1), of which 90% occur in sub Saharan Africa (2). In Ethiopia, malaria is a public health concern for all groups of the population, although children under-five years of age and pregnant women are at a higher risk (3). About 75% of the country's land surface is malarious and about two-thirds of the population is at risk of malaria infection (4). Malaria is also the leading cause of outpatient visits and deaths in the country (5). In Southern Nations and Nationalities and Peoples Region (SNNPR), about 65% of the population is living in malaria endemic areas (6).

Insecticide Treated Nets (ITNs) have become an important tool in the prevention of malaria (7). At present, several African countries started scaling up free distribution of ITNs (8). In Ethiopia, distribution of ITNs for the control of malaria was first introduced in 1997 (9). However, its coverage is about 24% of households with at least one ITN in 2005. The target for the next five years (2006 – 2010) is to achieve 100% coverage of all households in malarious areas with at least one ITN per households by 2007 (9).

ITNs should be used always to be fully effective (10). Its use may be hindered because of misconceptions about the cause and prevention of malaria (11). ITNs, unless long lasting, must be retreated after it has been washed three times or twice a year in areas that have mosquitoes all-year round (12). A survey done in 69 various regions of Africa revealed that reported use of ITNs during the preceding night by children under-five years of age was on average 55% (13). Other study in western Kenya also indicated that 30% of the freely distributed ITNs were unused (14).

Malaria has been the major health problem in Wonago Woreda. About 40% of the total population lives in 12 malarious *kebeles*, situated at altitude that ranges between 1400–1500m above sea level (15). The Woreda Health Office reported that 13,900 ITNs (64.6% coverage, assuming one ITN per household) were freely distributed between 2003 and 2005 with the support of UNICEF, WHO, Global fund and others (15). However, consistent follow-up of whether ITNs are properly used by households, their status such as presence of holes/tears and frequency of re-treatment information were lacking.

The aims of this study were to assess utilization of ITNs by households and under-five children, the knowledge of the community about malaria and benefit of ITNs, the status of ITNs, and the factors affecting its use among freely supplied households in Wonago Woreda, SNNPR.

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Subjects and Methods

A community-based cross-sectional study was conducted in June and July 2006. With an estimated population of 276,418 for 2004, Wonago Woreda is located in Gedeo Zone of SNNPR. Its administrative capital Wonago Town is located 372 km south of Addis Ababa. In addition, the Zonal Capital (Dilla Town) is also found in the Woreda. About 25% of the population lives in the urban and peri-urban areas of the Woreda. The rest of the population is mainly subsistence farmers who grow *Enset (Ventricosum E. edule)* as a staples and *Coffee (Coffea arabica L.)* as a cash crop (15).

The 12 malarious *kebeles* of the woreda were first stratified into three based on their distance from Dilla Town (urban *kebeles*, semi-urban *kebeles* located ≤5kms, and rural *kebeles* located >5kms from the town within the boundary of the Woreda). Socio-demographic factors that affect utilization of ITNs might be different as the location of households becomes far away from the town. Four *kebeles* were randomly selected for the study by proportional allocation to size (1 from the first, 1 from the second and 2 from the third strata). Freely supplied list of households with at least one ITN in the selected *kebeles* represented the sampling frame in this study.

The sample size was determined using a single population formula, by assuming 72% of households in Kenya used their freely supplied ITN (14), 5% margin of error, and 95 % confidence of certainty. Considered a 5% adjustment for non-response rate and 2 as a design effect, the calculated sample size was 650 households. The participated households were systematically selected from the ITNs freely supplied list of households from the chosen *kebeles*. All under-five years of children and pregnant women found in the selected households were included in the study. Then, the heads of households (or their spouse) were interviewed.

A structured and pre-tested questionnaire was used to collect information on socio-demographic factors, knowledge about the transmission and prevention of malaria, and utilization of ITNs. The status of ITNs was also inspected during day time by using structured check lists. Twelve 10th grade completed enumerators who can speak the local language (*Gedeoffa*) were trained for data collection. Two supervisors (sanitarians) were trained for coordination and data quality management. Data were entered into EPI-info version 6.04 and transferred to SPSS version 13 software package for analysis.

The study was reviewed and approved by the Ethical Committee of the Faculty of Medicine at Addis Ababa University. Then, written permission was obtained from the SNNPR Health Bureau and Wonago Woreda Health Office. Permission to undertake the study was also obtained from each *kebele* leader before the start of the study. Informed verbal consent was obtained from all respondents before every session of the interview.

Results

From 650 households visited in the four selected *kebeles,* data were collected on 638 (98.1 %). The majority 389 (61%) of the respondents were women and the rest 249 (39%) were males. Of which 324 (50.8%) were head of households and 314 (49.2%) were their spouses. The mean age of the respondents was 36.0 year (median=30.0 year) and the mean family size was 5.9. Of the total households, 456 (71.5%) had at least one child under-five years of age (in total 779) and 63 (9.9%) had pregnant women (one in each household). The larger proportion of respondents, 533 (83.5%) were from rural and the rest 105 (16.5%) were from urban area. Two hundred eighty six (44.8 %) of the respondents were illiterate (unable to read and write) and 352 (55.2%) of respondents were literate (formal education and able to read and write).

Knowledge of respondents about malaria transmission and ITNs use

From the total respondents, 270 (42.3%) mentioned mosquitoes as the main transmission mechanisms for malaria. The other means of transmission reported included: living near stagnant water (21.5%), get cold (7.2%), presence of wastes (6.3%), and drinking dirty water (4.7%) (Table 1). ITNs, as the main preventive measure of malaria, were reported by the majority, 399 (62.6%); followed by taking tablets (14.0%), proper disposal of wastes (10.7%), use of traditional remedies (3.4%), fumigation (3.4%), use of aerosol sprays (3.1%), and drainage of breeding sites (1.7%). The majority (77.9%) of respondents had ever heard/seen messages about ITNs. Most (97.5%) of the respondents believed that sleeping under ITN has a benefit, and only (5.2%) respondents reported problems associated with sleeping under ITN (Table 1).

ITN possession and utilization

All households (n= 638) that participated in this study were freely provided with at least one ITN by the Woreda Health Office. Three hundred fifty seven (56.0%) households were supplied with one, 256 (40.1%) with two, and 25 (3.9%) with three ITNs (Table 2). In total, 944 ITNs were supplied to the households included in this study. Of these, 649 (68.8%) were reported as being used by households (Table 2). Mean possession was 1.48 ITN per household (3.98 persons per an ITN).

ITNs were not found in 84 (13.2%) households at the time of the survey. The reasons for its absence included: lost or stolen (46.4%), used for other purposes (e.g., clothes, screen for windows) (25%), and thrown away as old (17.9%), gave to others (8.3%), and sold (2.4%) (Table 2). In addition, 72 (13.0%) of the households did not use their nets due to: housing construction problems (45.9%), absence of bed (19.4%), perception that ITN

Table 1: **Knowledge of respondents about the transmission mechanisms and preventive measures of malaria, ITN awareness and associated factors, Wonago Woreda, SNNPR, 2006**

Variables (n=638)	Male No (%)	Female No (%)	Total No (%)
Main transmission mechanism of malaria			
Bitten by mosquitoes	97 (15.2)	173 (27.1)	270 (42.3)
Living near collected water	73 (11.4)	64 (10.0)	137 (21.5)
Get cold	15 (2.4)	31 (4.9)	46 (7.2)
Presence of wastes	11 (1.7)	29 (4.5)	40 (6.3)
Drinking dirty water	11 (1.7)	19 (3.0)	30 (4.7)
Being hungry	2 (0.3)	12 (1.9)	14 (2.2)
Being in the rain	3 (0.5)	8 (1.3)	11 (1.7)
Other	14 (2.2)	25 (3.9)	39 (6.1)
I did not know	23 (3.6)	28 (4.4)	51 (8.0)
Main preventive measure of malaria			
Use ITN	166 (26.0)	233 (36.6)	399 (62.6)
Take tablets	29 (4.6)	60 (9.4)	89 (14.0)
Proper disposal of wastes	29 (4.6)	39 (6.1)	68 (10.7)
Use traditional remedies	6 (0.9)	16 (2.5)	22 (3.4)
Fumigants	4 (0.6)	18 (2.8)	22 (3.4)
Use insecticide sprays	6 (0.9)	14 (2.2)	20 (3.1)
Drainage	7 (1.1)	4 (0.6)	11 (1.7)
Other	2 (0.3)	5 (0.8)	7 (1.1)
Ever heard/seen education messages about ITNs			
Yes	217 (34.3)	280 (43.9)	497 (77.9)
No	32 (5.0)	109 (17.1)	141 (22.1)
Think that sleeping under ITN have benefit			
Yes	246 (36.3)	376 (53.9)	622 (97.5)
No	3 (0.5)	13 (2.0)	16 (2.5)
The benefits of sleeping under ITN (n=622)			
Don't get bitten by mosquito	226 (36.3)	343 (55.2)	569 (91.5)
Don't get bothered by other insects	74 (11.9)	121 (19.5)	195 (31.4)
Don't get malaria	44 (7.1)	59 (9.5)	103 (16.6)
To get warmth	9 (1.4)	14 (2.3)	23 (3.7)
Other	0 (0)	2 (0.3)	2 (0.3)
Believe that sleeping under ITN has problem			
Yes	13 (2.0)	20 (3.2)	33 (5.2)
No	236 (37.0)	369 (57.8)	605 (94.8)
Problems associated with sleeping under ITN (n=33)			
Difficult to getup at night	6 (18.2)	7 (21.2)	13 (39.4)
It is too hot to sleep under ITN	2 (6.0)	4 (12.2)	6 (18.2)
It takes time to tuck a net each night	1 (3.0)	4 (12.2)	5 (15.2)
Mosquito can still bite through ITN	2 (6.0)	2 (6.0)	4 (12.2)
No enough air when sleeping under	1 (3.0)	2 (6.0)	3 (9.0)
Other problems	1 (3.0)	1 (3.0)	2 (6.0)

could not prevent malaria (9.7%), fear of its toxicity (5.6%), and others such as absence of mosquitoes and difficulty to tuck a net (19.4%). This implies that 482 (75.5%) of the households used at least one of their freely supplied ITNs. Of all under-five children, 452 (58.0%) and of all pregnant women, 47 (74.6%) slept under ITN in the previous night before the survey day (Table 2).

The condition of ITNs

Among households who owned their ITNs (n=554) at the time of the survey, 242 (43.7%) were washed at least once, of which (71.5%) washed three or more times (Table 3). Two hundred thirteen (38.4%) ITNs had at least one hole/tear (>2cm), of these (40.4%) had >7 holes/tears. Among 427 ITNs (not long lasting ITNs) obtained before six months, most (97.0%) were not retreated. Lack of insecticide for re-treatment (85.5%) was the main reason for not re-treating the nets (Table 3).

Determinants of ITN utilization

Availability of separate bed room (Adjusted OR=1.98, 95% CI: 1.24-3.16), possession of two or more ITNs by households (Adjusted OR=2.03, 95%CI: 1.19-3.45) and perception of respondents that ITN prevents from mosquito bite (Adjusted OR=6.74, 95%CI: 4.38-10.39) were associated to the use of at least one of their ITNs by households (Table 4). Educational status of respondents, type of housing construction and ever heard messages about ITNs were not associated with the use of ITNs by households when adjusted with other factors. The address of respondents was not also associated with the use of ITNs (Table 4).

Table 2: **ITNs possession and utilization by households and under-five children, Wonago Woreda, SNNPR, 2006**

Characteristics	Frequency	Percent
Number of ITNs freely supplied for households		
One/household	357	56.0
Two/household	256	40.1
Three/household	25	3.9
Reported situation of ITNs (n=944)		
Currently used	649	68.8
Not used	295	31.2
Date when an ITN supplied (n=638)		
< 6 months	127	19.9
≥6 months	511	80.1
Availability of at least one of freely supplied ITNs (n=638)		
Yes	554	86.8
No	84	13.2
Reasons for unavailability of ITNs (n=84)		
Lost/stolen	39	46.4
Used for other purposes	21	25.0
Old; then thrown away	15	17.9
Given to others	7	8.3
Sold	2	2.4
Households reported use at least one of their available ITNs (n=554)		
Yes	482	87.0
No	72	13.0
Reasons for not using the available ITNs (n=72)		
Housing structure affects net use	33	45.9
Absence of bed	14	19.4
Nets do not prevent malaria	7	9.7
Afraid of its toxicity	4	5.6
Other	14	19.4
Frequency of using their ITN (n=482)		
Always	436	90.5
Often	46	9.5
Children under-five years age slept under ITN in the previous night (n=779)		
Yes	452	58.0
No	327	42.0
Pregnant women slept under ITN in the previous night (n=63)		
Yes	47	74.6
No	16	25.4

Table 3: **Condition of ITNs in households who owned nets, Wonago woreda, SNNPR, 2006**

Characteristics	Frequency	Percent
ITNs ever been washed (n=554)		
Yes	242	43.7
No	312	56.3
Frequency of washing (n=242)		
One to tow times	69	28.5
Three or more times	173	71.5
Presence of hole/tear on ITN (n=554)		
Yes	213	38.4
No	341	61.6
Number of holes/tears (n=213)		
1-7	127	59.6
>7	86	40.4
ITN retreated in the preceding 6 months (n=427)		
Yes	13	3.0
No	414	97.0
Reported reasons for no re-treatment (n=414)		
Lack of insecticide	354	85.5
Lack of skill	16	3.9
Lack of awareness about re-treatment	17	4.1
Other	27	6.5

Table 4: **Comparison of selected socio-demographic characteristics, condition of ITNs and knowledge of respondents with ITN use by households, wonago woreda, SNNPR, 2006**

Characteristics (n=638)	Households currently use at least one of their ITN		Crude OR 95% CI	Adjusted OR 95% CI
	Yes	No		
Age of respondent				
15-29	194	62	1.24(0.78,1.97)	0.85(0.54, 1.33)
30-44	185	53	1.38(0.86,2.23)	1.11(0.66,1.88)
≥45	103	41	1.00	1.00
Address (residence)				
Dilla town	89	16	1.74(0.95,3.16)	1.85(0.97, 3.51)
≤5 km. from the town	182	74	0.76(0.52,1.13)	1.35(0.71,2.58)
>5km from the town	211	66	1.00	1.00
Education of respondent				
Literate	282	70	1.73(1.20,2.49)**	1.31(0.88, 1.97)
Illiterate	200	86	1.00	1.00
Type of housing construction				
Corrugated Iron Sheet	306	67	2.31(1.60,3.35)**	1.45(0.89, 2.36)
Thatched/plastic roof	176	89	1.00	1.00
Have separate bed room				
Yes	359	83	2.56(1.76,3.73)**	1.98(1.24, 3.16)**
No	123	73	1.00	1.00
Number of ITNs supplied				
One	239	118	1.00	1.00
Tow or more	243	38	3.15(2.10,4.74)**	2.03(1.19, 3.45)**
Date when an ITN obtained				
<6 month	91	36	0.77(0.50,1.20)	0.82(0.44,1.52)
≥6 month	391	120	1.00	1.00
shape of ITN				
Rectangular	468	66	3.03(0.34,4.16)	1.17(0.30, 4.60)
conical	14	6	1.00	1.00
Color of ITN				
White	81	14	0.83(0.44,1.57)	0.92(0.46, 1.82)
Green or Blue	401	58	1.00	1.00
Means of transmission for malaria				
Mosquito bite	214	56	1.42(0.98,2.07)	1.08(0.70, 1.67)
Other	268	100	1.00	1.00
Main prevention method				
Use ITN	358	41	8.09(5.37,12.21)**	6.74(4.38, 10.39)**
Other	124	115	1.00	1.00
Ever heard messages about ITN				
Yes	389	108	1.85(1.23,2.79)**	1.38(0.85, 2.25)
No	93	48	1.00	1.00
Sleeping under ITN has a problem				
Yes	28	5	1.86(0.70,4.90)	2.32(0.93, 4.52)
No	254	151	1.00	1.00

**P-value <0.01 *P-value<0.05

It was found that possession of two or more ITNs by households (Adjusted OR=1.59, 95%CI: 1.03-2.46) and perception that ITN prevents from mosquito bite (Adjusted OR=5.14, 95%CI: 3.29-8.03) significantly increased the use of ITN by under-five children in the previous night (Table 5). Whereas, type of housing construction, availability of separate bed room, ever heard of messages about ITNs and respondents' perception of sleeping under ITN has a benefit were not associated with the use of ITNs by under-five children when adjusted with other factors (Table 5).

Discussion

This study reflects the importance of understanding the utilization of ITNs by the community and factors affecting its use. This finding highlighted that about 13.2% of the households freely supplied with ITNs did not own their nets, and an additional 13.0% did not use the nets at the time of the survey. It was also reported that about 42% of under-five children did not sleep under ITN in the previous night before the survey.

Table 5: **Comparison of selected socio-demographic characteristics, condition of ITNs and knowledge of respondents with ITN use by under-five children, Wonago Woreda, SNNPR, 2006**

Characteristic (n=638)	Number of children <5 who slept under ITN in the previous night		Crude OR 95% CI	Adjusted OR 95% CI
	Yes (n=452)	No (n=327)		
Age of respondent				
15-29	197	159	1.43(0.92, 2.21)	0.59(0.30, 1.13)
30-44	205	116	1.79(0.99, 3.25)	1.13(0.59, 2.15)
≥45	50	52	1.00	1.00
Address (residence)				
Dilla town	77	44	1.73(0.94, 3.20)	1.36(1.10, 3.65)*
≤5 km. from the town	160	131	0.95(0.62, 1.46)	1.44(0.91, 2.25)
>5km from the town	215	152	1.00	1.00
Education of respondent				
Literate	175	138	0.86(0.64, 1.15)	1.34(0.88, 2.05)
Illiterate	287	189	1.00	1.00
Type of housing construction				
Corrugated Iron Sheet	288	179	1.45(1.08, 1.94)*	1.14(0.67, 1.91)
Thatched/plastic roof	164	148	1.00	1.00
Have separate bed room				
Yes	335	210	1.59(1.17, 2.17)**	1.28(0.75, 2.18)
No	117	117	1.00	1.00
Number of ITNs supplied				
One	194	193	1.00	1.00
Tow or more	258	134	1.91(1.43, 2.55)**	1.59(1.03, 2.46)*
Date when an ITN obtained				
<6 month	82	70	0.81(0.57, 1.62)	0.91(0.51, 1.61)
≥6 month	370	257	1.00	1.00
shape of ITN				
Rectangular	439	217	1.71(0.75, 3.88)	0.74(0.21, 2.57)
conical	13	11	1.00	1.00
Color of ITN				
White	77	48	0.77(0.51, 1.15)	0.58(0.30, 1.09)
Green or Blue	375	180	1.00	1.00
Means of transmission for malaria				
Mosquito bite	197	127	1.21(0.91, 1.62)	1.17(0.74, 1.84)
Other	255	200	1.00	1.00
Main prevention method				
Use ITN	333	158	2.99(2.21, 4.04)**	5.14(3.29, 8.03)**
Other	119	169	1.00	1.00
Ever heard messages about ITN				
Yes	378	246	1.68(1.18, 2.39)*	1.52(0.89, 2.57)
No	74	81	1.00	1.00
Sleeping under ITN has a problem				
Yes	446	314	3.07(1.15, 8.18)*	3.32(0.75, 14.67_
No	6	13	1.00	1.00

**P-value <0.01 *P-value<0.05

The findings indicate that the perception of respondents about mosquito bite as a main transmission mechanism for malaria, is less compared to a survey done in Aleta Wondo, Ethiopia which reported (62.5%) (16). Respondents' perception of net use as a main preventive measure for malaria was also less compared to 83.7% who responded similarly in the above study (16). The reason for this may be that the majority of respondents included in our study were from rural area, less access for health information. Whereas, about three-fourth of our respondents have ever heard of educational messages on mosquito nets, which is the highest compared with a national survey result (41.0%) (17).The occurrence of this difference might be due to the presence of extended promotion of ITNs currently underway in the country. In addition, only households who were freely supplied with ITNs were included in the present study. This has its contribution in increasing the exposure of people to educational messages.

The number of ITNs supplied to households was not enough compared to a study done in western Kenya, 1.46 persons per ITN (14). This implies a need to increase the number of ITNs supplied to households. The results also revealed that 31.2% of ITNs were not used. It is consistent with a study done in western Kenya where

about 30% of ITNs were unused (14). This study revealed that 58% of under-five children were slept under ITNs in the previous night which is similar with a survey done in malaria endemic countries in Africa, reported 55% (13). But, it is less compared to a study done in western Kenya (65.9%) (14). This might be due to the reason that priority was given for adults, so that a child slept with his/her elderly might not get a chance to use an ITN.

ITNs should be retreated twice a year; otherwise its effectiveness to kill mosquitoes and to prevent malaria decreases (11). This finding indicate that most ITNs obtained before six months were not retreated, is consistent with a study done in Alata Wondo (97%) (16). ITNs (not long lasting) must be retreated after it has been washed three times (11). This is because frequent washing can reduce its effectiveness (18). Presence of holes/tears on nets was also associated with malaria infection (16). Some ITNs had holes/tears ≥ 2cm which is almost similar with a study done in Tanzania, 45% of ITNs were in a bad condition (with more than 7 holes) (19). But, it is higher than a survey conducted in Malawi, 12.8% of owners reported that nets had holes >2cm (20). The reasons for this may be the absence of separate bed rooms to hang nets, long duration of ITNs, and frequent washing on rough surfaces.

Our finding revealed that availability of separate bed rooms increased the use of ITNs by households, which is in line with a study done in Kenya (14). This implies that distribution of nets without helping households how to improve their living room for hanging nets may not bring the desired result. In addition, provision of enough ITNs proportional to family size is advantageous for its use. On the contrary, households supplied with a single ITN may be confused to decide regarding who to sleep under it; as a result, they left it unused, sold or used it for other purposes. Perception of respondents that ITN use prevents mosquito bite is also associated with its use. This shows the importance of integrating distribution of ITNs with education of the community about its benefit. On the contrary, type of housing, educational status, and residence of households were not associated with the use of ITNs. The possible reason for this may be most of the respondents were from rural areas, so that their housing construction and their educational status is somewhat similar. One of the major limitations of this study was that reported use of ITNs by households was simply taken without any means of verification.

In conclusion, the survey indicated that even though two third of ITNs owned by households were reported to be used, most nets obtained before six months were not retreated, frequently washed, or had holes/tears. Therefore, their efficacy to prevent malaria is compromised. Possession of ITNs by households was also found to be not proportional to their family size. The reported use of freely supplied ITNs by households or under-five children was significantly affected by the unavailability of bed room, less number of ITNs in the households and less perception of ITNs as a preventive measure for malaria control.

Finally, it is recommended to strengthen health education activities about the benefit and utilization of ITNs to the community. The number of ITNs supplied to households should be increased. In addition, ITNs should be re-treated every six months or/and distribution of long lasting ITNs should be strengthened. Further study using direct observation at sleeping time rather than reported use is important to assess proper deployment of ITNs.

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References

1. Roll Back Malaria. The Africa malaria, [cited 2006 Jan 25]; Available from: http://www.rbm.who.int; 2006.
2. World Health Organization. Malaria in the World. Tropical Disease Control, ctd/TDT/96.12; 1996.
3. Central Statistical Agency [Ethiopia] and ORC Macro. 2006. Ethiopia Demographic Health Survey; 2005:165-177.
4. Adhanom T, Deressa W, Witten KH, Getachew A, Seboxa T. Malaria. In: Berhane Y, Hailemariam D, Kloos H, editors. Epidemiology and Ecology of Health and Disease in Ethiopia. Shama Books; 2006:556-576.
5. Federal Democratic Republic of Ethiopia Ministry of Health. Health and health related indicators. Planning and Programming Department, Addis Ababa; 2006.
6. SNNPR Health Bureau Annual report; 2005/06.
7. Diallo D, Cousens S, Cuzin-Duattara N, Nebie I, Hboude-Sanogo E, Esposito F. Child mortality in West African population protected with ITN for a period of up to 6 years. Bull World Health Org. 2004;82(2):85-90.
8. World malaria report, 2005, [cited 2006 Jan 22]; Available from http://www.rbm.who.int/wmr 2005/html/2-1htm.
9. Ministry of Health. National five-year strategic plan for malaria prevention & control in Ethiopia, 2006-2010. Addis Ababa: 2006.

10. Curtis CF, Mnzava AE. Comparison of household spraying and ITNs to malaria control. Bull World Health Org. 2000;78(12):1389-1400.
11. World Health Organization. Instructions for treatment and use of insecticide treated mosquito net, WHO/CDS/RBM/2002.41; 2002.
12. Hamel MJ, Odhacha A, Roberts JM, Deming MS. A survey of home treatment of children with fever, bed net use and attendance at antenatal clinics. Malaria control in Bungoma district, Kenya. Bull World Health Org. 2001;79(11):1014-1023.
13. Korenromp EL, Miller J, Cibuiskis RE, Cham MK, Alnwick D, Dye C. Monitoring mosquito net coverage for malaria control in Africa: Possession versus use by children under-five years. Trop Med Int Health. 2005;8(8): 693-703.
14. Alaii JA, Hawley WA, Kolczak MS, Terkuile FO, Gimnig JE, Vulule JM, et al. Factors affecting use of permethrin-treated bed nets during a randomized control trial in western Kenya. Am J Trop Med Hyg. 2003;68(4):137-141.
15. Wonago Woreda Health Office second quarter report to SNNPR Health Bureau; 2005.
16. Wassie E. Assessment of effectiveness of ITNs for malaria prevention in under-five children, Alata Wondo; MPH thesis submitted to the Department of Community Health, Faculty of Medicine, Addis Ababa University; 2005. (Unpublished).
17. Jima D, Tesfaye G, Deressa W, Woyessa A, Kebede D, Alamirew D. Baseline survey for the implementation of ITNs for malaria control in Ethiopia. Ethiop J Health Dev. 2005;19(1):16-23.
18. World Health Organization. Malaria Control in WHO Africa Region. Turning resources in to results. Annual Reports; 2003.
19. Erlanger T, Enayati A, Hemingway J, Mashinda H, Tami A, Lengeler C. Field issues related to effectiveness of insecticide treated nets in Tanzania. Medical & Veterinary Entomology. 2004;18(2):153-160.
20. Holtz TH, Marum LH, Mkandala C. ITN use, anemia, and malaria parasitemia in Blantyre district, Malawi. Trop Med Int Health. 2002;7(4):220-230.