Original article

Assessment of Distribution, Knowledge and Utilization of Insecticide Treated Nets in Selected Malaria Prone Areas of Ethiopia

Abebe Animut[1], Teshome Gebre-Michael[1], Girmay Medhin[1], Meshesha Balkew[1], Seife Bashaye[2], Aklilu Seyoum[3]

Abstract

Background: Insecticide Treated Nets (ITNs) reduce malaria related mortality and morbidity significantly. Taking this into account, the Ethiopian Federal Ministry of Health has been distributing ITNs to malaria prone areas of the country through the support of the Global Fund.

Objective: To study distributional coverage and assess the knowledge and utilization of insecticide treated nets in Ethiopia.

Methods: A cross-sectional study was conducted in 17 malarious districts targeted for the first phase free distribution of long lasting insecticide treats nets (LLITNs) by the Ministry of Health in 9 administrative regions from October 2005 to September 2006. Region specific list of malarious districts where MOH distributed ITNs was used as the sampling frame for stratified random sampling of districts. One kebele (sub district) was selected from each of the selected districts using simple random sampling, and 15% of the total households in the selected kebeles were selected using systematic random sampling. Upon obtaining informed consent from the household head or the oldest person in the household the questionnaire was administered and information was recorded. Data were double entered using EpiData version 3 and analyzed using SPSS version 12.

Results: A total of 3131 households were visited, and 51.6% of the respondents were males. The overall ITN distribution and utilization were 97.6% and 81.6%, respectively. The majority of households (53.2%) owned a single net per family, highest in Dire Dawa (93.7%) and lowest in Afar (17.6%). Thirty eight percent of the respondents owned two nets per household. Most of the respondents (91.1%) cited that ITNs are useful to control malaria either through prevention of mosquito bites (60%) or prevention of the disease (39%).

Conclusion: ITN distribution, utilization, knowledge of users and its acceptability were good considering the recent introduction of the products. However, the person net ratio gap should be narrowed and emphasis needs to be given to vulnerable groups. [*Ethiop.J.Health Dev.* 2008;22(3):268-274]

Introduction

Malaria is estimated to cause at least 300 million clinical cases and l million deaths each year, of which more than 90% are in Africa. *Plasmodium falciparum* causes the majority of infections and about 18% of deaths in children less than 5 years of age (1). Approximately 19-24 million pregnant women are at risk of malaria and its adverse consequences (2, 3). It also causes many other deaths through synergy with other infections and huge economic losses and disability adjusted lives every year (4).

Attempts to prevent the disease through anti-malarial drugs and insecticides are threatened due to the emergence and spread of drug resistant malaria parasites and insecticide resistant vector mosquitoes. This together with the increasing incidence of the disease heightened the need for the use of insecticide treated mosquito nets (ITNs) as one control method. ITNs reduce the burden of malaria significantly (5, 6), all-causes of child mortality and morbidity due to malaria (7-9) and clinical malaria, severe malaria and anaemia in infants and in children from 1 to 3 years of age (10). ITNs are also associated with improved growth and weight gain in infants and reduced maternal and placental malaria and maternal anaemia, resulting in reduced risk of low birth (10). There is now strengthened commitment of the global community to scaling-up ITN distribution for vulnerable groups in malaria endemic areas. ITNs are widely promoted as a means of preventing man-vector contact in the control of malaria (11).

In Ethiopia, 75% of the land mass is malarious and 68% of the population is at risk of infection (12). The number of re-treated and sold mosquito nets until the end of 2003 was about 425, 100 (1). The Federal Ministry of Health through support from the Global Fund has been distributing long lasting insecticide treated nets to malaria-affected areas starting end of August 2005 (13). Little is known about the knowledge and utilization of ITN receivers among people residing in malaria prone areas. In connection with these activities we thought it important to investigate the distribution and proper utilization of ITNs in some selected districts of the country.

Methods

Study Sites and Data Collection: A cross-sectional study was conducted from October 2005 to September

[1]Aklilu Lemma Institute of Pathobiology, Addis Ababa University, P.O. Box 1176, Tel. 011-276-3091, Fax 011-275-5296, E-mail: animut2004@yahoo.com; [2]Ethiopian Federal Ministry of Health, Addis Ababa, Ethiopia; [3]Center for National Health Development in Ethiopia, Addis Ababa, Ethiopia

2006. A region specific list of malarious districts targeted and provided long lasting insecticide treated nets (LLITNs) by the Ministry of Health through the supported from the Global Fund were surveyed. The districts were: Mereb Lake and Tselemti in Tigray Region; Bahir Dar Zuria, Dembia and Metema in Amhara; Jimma Horo, Guto Wayu and Bedele in Oromia; Damote Woide, Sodo, Meskan and Bench in Southern Nations and Nationalities Peoples Region (SNNPR); Gambella town in Gambella; Debate in Benshangul-Gumuz; Buremudaytu in Afar, Hula-Asselisso in Dire-Dawa and Shinlie in Somali regions.

One kebele (sub district) was selected from each district using simple random sampling, and 15% of all households were selected using systematic random sampling. The decision on the 15% was made taking the diverse geographic distribution of study districts, cost of the project and the overall sample size that can be managed within the limit of the project. In each district, village guides and translators were nominated, together with kebele representatives, to work with the researchers during individual household survey. The head of each household or spouse was informed about the study and the designed questionnaire was read to each respondent, and the necessary information obtained and recorded. In the absence of the household head, the oldest individual in the household was interviewed.

The questionnaire was designed to collect information on population characteristics, net ownership, family size, knowledge about mosquito nets and malaria, level of education and source of nets, perception about the use of nets, frequency of sleeping under nets, groups of family members sleeping under nets, presence of unused nets in households, possibility of infection while using nets and frequency and problems while using. Knowledge about ITNs was measured using the informants' (respondents') exposure to educational messages and assessing their perception of ITNs use for the control of mosquito bite. The questionnaire was adopted from the questionnaire used from December 1999 to January 2000 in Uganda (14) was pre-tested and data were collected by the research team. In addition, visual inspection of net installation was done in every household visited by the researchers. Mosquito net tucking was demonstrated for those who had nets but did not use them.

Data Management: Data collected during the survey were checked in the field by the researchers and entered into computer using EpiData version 3 for single and double data entry. Analysis was performed using SPSS version 12. The proportion of respondents in each category of the target variable was determined for each region and overall.

Ethical Issue: This project obtained ethical clearance from the ethical committee of the Aklilu Lemma Institute of Pathobiology, Addis Ababa University and the National Ethical Committee. Verbal consent was obtained prior to interviewing the respondents.

Results

A total of 3131 households were visited in nine regional states of Ethiopia from October 2005 to September 2006. The sex composition of respondents was 51.6% males and 48.4% females. The majority (79.7%) were farmers and illiterate (66%). The rest were government employees (5.2%), merchants (4.2%), students (1.6%), private employees (0.7%), daily laborers (4.4%), jobless (3.1%) and others (1.1%). Thirty eight percent of the household heads had a history of febrile illness assumed to be malaria and 80.7% of them had at least one malaria infected family member according to the perception of respondents. Close to 43.3% of the households surveyed had a functioning radio whereas ownership of television was very low (2.5%).

Knowledge on the Use of Nets: Overall, 60.1% of the respondents had knowledge about nets, but varied from 22.1% in Afar to 79.9% in Dire Dawa (Table 1). The most important source of their information was health workers (59.1%). Health workers were the leading source of information in all the study districts except Somali, Gambella and Afar where radio took the primary role. NGOs played the highest role (27.8%) in delivering education about ITNs in Afar. Radio was the next most important source of awareness (34.3%). Kebele or peasant association representatives, schools, posters, newspapers, and others played minor role in providing information in most regions. Most respondents (91.1%) agreed on general use of ITNs; 60% to prevent mosquito bite (32.9% in Somalia to 80.8% in Afar) and 39% to prevent the disease (17.8% in Afar to 67.1% in Somali).

ITNs Distribution: The distribution of LLITNs per household in the study areas was 97.6% ranging from 81.4 to 99.3% (Table 2). The majority of households (53.2%) owned a single net per family, highest in Dire Dawa (93.7%) and lowest in Afar (17.6%). Thirty eight percent of the respondents owned two nets per household and a small proportion (8.5%) had three or more nets. Multiple nets (≥2) per household was highest in Afar and lowest in Dire Dawa. The mean number of persons sleeping under a net was 3.3 and this ranged from 2.3 in Afar to 5 in Dire Dawa. The duration of acquisition of ITNs ranged from two weeks in Bahir Dar Zuria to 12 months in Shinile during the study.

ITN Utilization: The mean utilization rate of nets based on history of sleeping under nets in the previous night was 81.6% (Table 2). The majority of respondents (85.7%) used nets daily (Table 3). About 48% of them thought that the first to use ITNs should be children below five years old followed by children between 4 and 15 years old (22.2%) and adults (22.6%). Pregnant

women, who are among the most vulnerable, are reported to be the lowest users (1.9%). The daily use of nets by respondents was quite high except in Gambella where the occasional use of nets was more prominent (52%) than the daily use (37.6 %). Almost 85% of all adults slept under nets together with their under five children in the last previous night.

Only 9.7% (1.2 to 15%) had unused nets in their houses. The main reason for not using nets was absence or low level of malaria transmission at the time of the survey (80.4%). Other reasons included nets were not impregnated; unbothered by mosquitoes, assumptions that nets don't prevent malaria and nets not suitable to sleep in.

Most respondents perceived the frequency of malaria infection for those sleeping under insecticide treated nets (21.9%), was much less than those sleeping without nets (Table 4). However, about 22% of them believed that they could still get infected with malaria while using nets. More than 97% of the households found no problems while sleeping under nets. Problems mentioned by this very small percentage of respondents included nets are too hot to sleep under, time taking to tuck net every night, difficult to get up during the night, mosquitoes can still bite through the net and nets do not allow enough air through.

The sleeping pattern among the different population groups was assessed and most of the respondents (55.6%) expressed that children went to sleep between 7 pm and 8 pm followed by 8 to 9 pm (23.2%). Most adults reported that they go to sleep between 9-10 pm (39.5%) followed by 8-9 pm (30%). There was variation in the sleeping time of the different groups sampled from the study sites of the regions.

Discussion

Insecticide Treated Net (ITN) usage is increased in Ethiopia and large-scale distribution is underway to cover malarious areas. In this study, the overall distributional coverage and utilization of LLITNs were 97.6% and 81.6% respectively. This implies that the net distribution program is going well and has attained the Roll Back Malaria (11) and World Health Assembly (15) targets. This higher utilization, within a short period of experience, dictates the great role played by the MOH and acceptance of nets by users as a major malaria control tool. However, most households had a single net and on average four individuals shared a single net. Most parts of the country are epidemic prone and households require extra nets to reduce the occupant per net gap in order to attain sustainable control of the disease.

Those selected areas of Afar, Somali and Gumuz regional states have relatively low access to basic infrastructures and health education compared to other regional states. That was probably the reason why the role of health workers was minimal in delivering education regarding the importance and proper use of nets. Instead, radio played a dominant role for the dissemination of information on ITNs. It is therefore important that the concerned regional health bureaus should work more in deploying health workers to deliver health education. These areas are hot having high temperature sometimes close to 45^0C. This may affects ITN utilization. The experience in Gambella depicts this and most of the community members sleep under nets only occasionally. This occasional sleeping behavior would not protect them from malaria, as the disease is stable compared to other regions. These areas also experience a high level of dust that makes their nets dirty. This in turn urges them to wash their nets frequently. However, the washing frequency with respect to the level of efficacy is not studied and attention should be given for this. Moreover, the effect of dirt and soot on the killing efficacy of ITNs is not yet known.

The primary objective of ITN distribution in Ethiopia is to cover vulnerable groups, pregnant women and children below the age of five years. We found that children below five years was the group perceived to need to sleep under ITNS by the respondents. This is advantageous in that ITNs help to reduce mortality, anaemia and other malaria related indices (10) in addition to substantial reduction in clinical malaria (16, 17) and deaths (5, 18). ITNs are also reported to have beneficial impact on non-malaria related illnesses like reduction of body rash, acute diarrhea, vomiting or loss of appetite and increment in body weight in children (10).

Consistency between possession and use is very important for proper use although it depends on socio-economic factors such as wealth; access to health care and education (16-18). The study population is a farming community and does not meet these factors. However, the effort made by health workers and radio broadcast was important in raising their awareness towards ITNs. Gender and age may influence the use of ITNs within households. Most women stay up late at night preparing food and doing other household activities as they shoulder the majority of work burden. Males also stay late at night particularly during harvesting seasons. Hence, they may get infected before bed. Infections of such type may confuse them regarding the efficacy of mosquito nets in controlling malaria and greatly reduce their demand for nets. This could be one of the reasons why a substantial number of respondents perceived the possibility of infection with malaria while having ITNs in their homes. Having bed net doesn't confirm protection from malaria unless there is proper use and strong adherence. Net owners should learn/know the behavior of

Table 1: **Knowledge and perception of respondents about ITNs in selected malaria prone areas of Ethiopia, 2006**

	Amhara (n=1102)	B. Gumuz (n=127)	Oromia (n= 567)	SNNPR (n=546)	Gambella (n= 161)	Afar (n=77)	DireDawa (n=164)	Tigray (n=298)	Somali (n=89)	Total (n= 3131)
Informed about nets	44.3	51.2	75.7	76.6	54.7	22.1	79.9	69.8	41.6	60.1
Source of information										
Health workers	42.0	64.6	61.5	63.9	46.6	22.2	78.6	87.5	13.5	59.1
Radio	42.8	36.9	36.4	28.7	62.5	33.3	25.2	13.9	78.4	34.3
Kebele/peasant representatives	3.9	1.5	1.2	18.4	1.1	0.0	0.0	4.8	0.0	6.0
Friends	3.9	3.1	2.8	2.6	0.0	0.0	0.8	1.0	0.0	2.5
Church/Mosque	4.7	0.0	1.4	0.7	9.1	0.0	0.0	1.0	0.0	2.2
TV	0.6	0.0	0.0	0.0	36.4	11.1	1.5	1.0	13.5	2.2
Schools	0.8	7.7	0.9	0.5	5.7	0.0	0.8	7.7	2.7	2.0
NGO's	0.4	1.5	0.0	0.7	3.4	27.8	0.0	0.0	2.7	0.8
News papers	0.2	0.0	0.2	0.5	2.3	0.0	0.8	1.0	0.0	0.5
Posters	0.0	0.0	0.0	0.0	9.1	0.0	0.0	0.0	0.0	0.4
Others	14.3	6.2	3.5	9.6	1.1	5.6	3.1	1.9	0.0	7.4
Perception about the use of nets										
Nets are useful	94.3	94.5	89.4	97.1	88.2	93.5	98.8	97.3	88.4	91.1
Reasons given										
Prevent mosquito bite	66.5	52.1	45.1	65.6	80.0	80.8	54.4	51.4	32.9	60.0
Prevent malaria	32.4	47.9	53.3	32.7	20	17.8	45.6	48.2	67.1	39.0
Prevent other insects	1.1	0.0	1.6	1.7	0.0	1.4	0.0	0.4	0.0	1.1

Table 2: **Family size, net ownership and number of persons sleeping under a net in selected malaria prone areas of Ethiopia, 2006**

Region	**Percent of households having at least one net**	**Percent of respondents slept under nets the previous night**	**Number of nets per household**			**Mean number of occupants to one ITN**
			1	**2**	**≥3**	
Amhara (n=1102)	99.2	88.4	55.7	32.9	11.4	2.9
B/Gumuz (n=127)	98.4	81.4	71.6	21.6	6.9	3.9
Oromia (n=567)	99.1	84.8	45.9	52.3	1.8	3.1
SNNPR (n=546	99.3	79.9	54.3	36.8	9.0	3.9
Gambela (n=161)	81.4	35.5	45.6	42.1	12.3	2.8
Afar (n=77)	96.1	92.2	17.6	51.4	31.1	2.3
DireDawa (n=164)	97.0	68.3	93.7	6.3	0.0	5.0
Tigray (n=298)	96.6	83.9	46.2	48.6	5.2	3.0
Somali(n=89)	92.1	66.5	26.8	54.9	18.3	2.8
Total (n=3131)	97.6	81.6	53.2	38.3	8.5	3.3

N= number of respondents

SNNPR= Southern Nations Nationalities Peoples Region

Table 3: **Frequency of sleeping under nets and perception of respondents' towards the priority groups sleeping under ITNs in selected malaria prone areas of Ethiopia, 2006**

	Amhara (n= 1102)	B.Gumuz (n= 127)	Oromia (n= 567)	SNNPR (n=546)	Gambela (n= 161)	Afar (n=77)	Dire Dawa (n=164)	Tigray (n= 298)	Somali (n=89)	Total N= 3131
Frequency of sleeping under ITNs										
Daily	84.3	96.6	98.2	90.9	37.6	97.2	99.4	72.4	61	85.7
Occasionally	2.3	3.4	1.4	8.1	52.0	1.4	0.6	22.9	9.7	7.4
During transmission season	13.2	0.0	0.4	0.8	9.6	1.4	0.0	4.7	29.3	6.8
Weekly	0.0	0.0	0.0	0.2	0.8	0.0	0.0	0.0	0.0	0.1
Others	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Perceived Priority groups who should sleep under ITNs										
Children below 5 yrs	36.7	49.6	53.4	63	33.6	58.9	65.2	47.2	41.5	47.8
Children b/n 5-14 yrs	27.2	29.4	22.8	18.4	16.0	15.1	10.8	17.3	22.0	22.2
Adults	27.7	21.0	21.0	13.0	49.6	19.2	16.4	15.8	24.1	22.6
Pregnant women	1.8	0.0	0.0	0.0	0.0	0.0	0.6	10.9	10.8	1.9
Others	6.6	0.0	2.8	5.6	0.8	6.8	7.0	8.8	1.2	5.5

Table 4: **Percent of respondents perceiving use of ITNs for malaria prevention in selected malaria prone areas of Ethiopia, 2006**

	Amhara (n = 1102)	B. Gumuz (n= 127)	Oromya (n= 567)	SNNPR (n=546)	Gambella (n= 161)	Afar (n=77)	Dire Dawa (n=164)	Tigray (n= 298)	Somali (n=89)	Total N= 3131
Persons can be infected while sleeping under nets	36.5	26.8	1.4	6.2	36	33.8	8.5	28.3	20.2	21.9
Perception on frequency of infection while using nets										
Less than non-users	80.5	97.0	50.0	72.5	63.8	100.0	100.0	94.0	38.9	80.9
Equal to non-users	1.2	0.0	0.0	3.0	12.1	0.0	0.0	0.0	27.8	2.7
More than non-users	0.2	0.0	0.0	0.0	13.8	0.0	0.0	0.0	33.3	2.2
Don't know	18.0	3.0	50.0	24.2	10.3	0.0	0.0	6.0	0.0	14.2

mosquitoes and their respective biting hours. This helps them to sleep under their nets during the actual biting hours.

This study shows that most household members slept under nets daily. This is encouraging as ITNs reduce entomologic indices (21, 22) and morbidity and mortality in humans (7, 16). However, this utilization is crude and does not constitute proper use. Malaria is seasonal and characterized by epidemics every two, three or four years. This may affect the adherence of households towards ITNs. The degree of adherence with ITN use and its association with reduced malaria protection is unknown (23). However, protection may occur without understanding the nature of the relationship between disease aetiology and behavior (24). Almost all respondents perceived that nets are useful to control mosquitoes and malaria. Households' desire for mosquito avoidance and correct knowledge of malaria transmission are strong determinant of ITN usage (24, 25) and adherence.

Although the distribution of insecticide treated nets is a program launched only recently by the Ethiopian Government with the help of the Global Fund and other partners, the coverage and utilization is very high. However, the ITN distribution and awareness programs that are underway in different districts of the country should underline the need for improved sleeping arrangements to maximize proper utilization at household level.

Acknowledgments

The Global Fund and Federal Ministry of Health are acknowledged for providing the fund to complete this investigation. The regional health bureaus, the district health center bureaus, representatives of peasant associations or kebeles are highly acknowledged for facilitating the work reported here. Finally, the contribution of technicians of Aklilu Lemma Institute of Pathobiology, Addis Ababa University is greatly appreciated.

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