

Knowledge, Attitude and Practice (KAP) about Insecticide Treated Net (ITN) usage against Malaria in Kolla Tembien district, Tigray, Ethiopia

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ABSTRACT

Optimal use of insecticide treated nets (ITNs) to prevent malaria in a community depends on vector behavior, mass distribution, knowledge and willingness of people to use the nets. This study was aimed at evaluating knowledge, attitude and practice (KAP) about ITNs at household level in rural sub-districts of Kolla Tembien. For this purpose, interview questionnaire containing KAP variables were administered to the randomly selected household heads. A total of 368 households were surveyed, and 70.10 % of the respondents were females. The \bar{X} number of occupants in the households surveyed was found to be 5.50. However, the \bar{X} number of ITNs owned by the households was found to be 1.07. Most of the respondents (82.34%) indicated ITNs prevent malaria through protection from mosquito bites. Seventy six percent of the respondents claimed children < 5 years of age should be given priority to sleep under ITN in the household. Only few respondents, 1.63%, considered pregnant women as priority groups to sleep under ITNs. Furthermore, about 63% of the respondents showed their willingness to buy ITNs if they are affordable. The responses by male and female household heads to most of the KAP questions were not significantly different ($P > 0.05$). Out of the 260 nets inspected for usage and physical condition during the survey period, more than 50% were kept in a box or other container in the households. Nets that were graded as clean and very dirty accounted for 25% and 25.77%, respectively. Physical inspection of the randomly sampled nets also revealed holes ranging from those that didn't allow a thumb to pass through (\bar{X} number = 3.47) to those that were wider than a closed fist (\bar{X} number = 1.64). The over all knowledge, attitude and practice of ITN usage was found to be satisfactory in the study district. However, the occupant net ratio must be narrowed and attention needs to be given to malaria vulnerable groups in the household. Continuous monitoring and evaluation of net usage after distribution should be instituted to avoid misuses and associated net damages in the study areas.

Key words: Malaria prevention, Insecticide treated nets, Tigray, Ethiopia

1. INTRODUCTION

Global incidence of malaria is estimated to be 250 million clinical cases annually leading to approximately 1 million deaths mostly of children under 5 years of age. *Plasmodium falciparum* causes most of the deaths in sub-Saharan Africa (WMR, 2008; WMR, 2005). Seventy five percent of the total landmass of Ethiopia is malarious and 68% of its population (48 million) is estimated to be at risk of malaria infection (WMR, 2008). Seventy five percent of Tigray regional State of Ethiopia is potentially malarious (Gehebreyesus et al., 1999). Kolla Tembien

district is one of the malarious districts in Tigray regional state (Cropper et al., 2000). Since 1950's, significant efforts have been done to control malaria in Ethiopia. However, the disease continues to be one of the major causes of illness, death and impediment to socioeconomic development in the country (FMoH, 2006). The national Malaria Control Program (MCP) of Ethiopia developed a strategic plan to reduce the burden of the disease by 25% in the year 2005 and by 50% in the year 2010. To meet the above mentioned goal, early diagnosis and effective treatment, selective vector control and epidemic prevention and control has been the main focus (FMoH, 2006). On the contrary, both the chemotherapy and vector control arms of malaria prevention mainly through indoor residual insecticide spray (IRS) are being challenged by the appearance of drug resistance *Plasmodium* parasites and insecticide resistant *Anopheles* mosquito vectors, respectively in sub-Saharan Africa including Ethiopia (Schunk et al., 2006; Teka et al., 2008; Bloland, 2001; Balkew et al., 2003; Balkew et al. 2006). This together with unstable nature of malaria transmission in Ethiopia (Negash et al., 2004), necessitates high distribution of ITNs to malaria prone areas as one of the major vector control strategies.

Insecticide treated nets are reported to be highly effective in reducing childhood mortality and morbidity from malaria (Lengeler, 2004). In Ethiopia insecticidal net coverage has increased to 53.3% (FMoH, 2008). Nation wide distribution of ITNs especially long lasting insecticide treated nets (LLITNs) along with artemisinin-based combination therapy (ACT) has resulted in 73% reduction in in-patient malaria cases as well as 62% reduction in deaths in children under 5 years of age in Ethiopia (Otten et al., 2009). Like other malarious areas of Ethiopia, insecticidal nets are among the major malaria vector control strategies in malaria prone areas of Tigray region. Out of 717, 813 malaria exposed households in the region, 533, 939 (74.4%) households received at least one ITN (personal communication to representative of Malaria Department in Tigray Regional Health Bureau).

However, the success of ITNs depends on several factors such as, willingness of people to use nets, and behavior of the local vector(s) (WHO, 2006; Teklehaimanot et al., 2007).

Though, substantial increase has been reported regarding household insecticidal net ownership in Ethiopia, barriers ranging from house structure to user behavior are becoming obstacles for optimal use (NetMark, 2007). So far, there are limited data on knowledge, attitudes and practice of households about ITNs in malarious areas of Ethiopia in general and Tigray region in particular. Lack of knowledge regarding priority groups to sleep under ITNs in the household,

believing ITNs to have negative side effects and inappropriate usage frequency are reported to hamper effective utilization of ITNs in different parts of Ethiopia (Dagne and Deressa, 2008; Animut et al., 2008; Fettene et al., 2009). However, only little is known about knowledge, attitude and practice of ITN usage at household level in malarious areas of Tigray region in general and Kolla Tembein district in particular. Hence, this study was aimed at evaluating knowledge, attitude and practice (KAP) about ITNs at household level in rural sub-districts of Kolla Tembien district. This study also attempted to inspect the physical condition of ITNs owned by the randomly selected households in the study areas.

2. METHODOLOGY

2.1. Study areas and population

This study was carried out in four sub-districts of Kolla Tembien district in Tigray Region that are located at the periphery of Abiy-Adi town based on information on high prevalence of malaria in these areas (Hailemariam Alemayehu, personal communication). Moreover, Kolla Tembein district was selected for the current study because it is reported to be one of the highly malarious districts in the region that received large scale ITN distribution since the years 2005/2006 (personal communication to representative of Malaria Department in Tigray Regional Health Bureau). The population of the study sub-districts depends on subsistence farming for household food supply and income generation. ‘Hidmo’ (houses made up of stone wall and wooden roof covered with flat stones, mud, and thatch) account for the majority of houses in the study sub-districts while few houses were made of stone wall and iron roofs. In addition to indoor residual spraying (IRS) of houses with DDT or Malathion, ITNs have also been distributed to all malarious sub-districts by the district Health Bureau (Hailemariam Alemayehu, personal communication). The sub-districts involved in this study namely Bega Sheka, Getsekimlesley, Work Amba and Ataklti are different from each other with respect to altitude and geographical coordinates (Table 1).

2.2. Study design and sampling technique

The study sub-districts were selected based on their accessibility and proximity to the district capital, Abiy-Adi. Stratified, systematic random sampling was used for selection of a total of 368 households from all the four sub-districts. Decision on this sample size was made due to the budget and time limitations of the study. Close-ended interview questionnaire were first prepared

in English and then translated into the local language, Tigrigna, for data collection. Upon arrival to each sub-district, the team of three interviewers dispersed in different directions and marked every other household until approximately 90 households per sub-district were interviewed.

Table 1. Location of the study sites with altitudes and geographical coordinates.

<i>Name of the sub-district</i>	<i>Altitude (m.a.s.l.)</i>	<i>Geographical coordinates</i>	
		<i>North</i>	<i>East</i>
Bega Sheka	1747	13° 37.640 '	038° 55.734 '
Getsekimlesley	1840	13° 38.345 '	038° 57.615 '
Work Amba	1885	13° 43.895 '	039° 00.091 '
Ataklti	1992	13° 41.031 '	038° 57.375 '

2.3. Data collection and analysis

Data were collected from March-May, 2010. The rationale to conduct the study during this period was that malaria occurs through out the year in the study sub-districts however, with low rate (Cropper et al., 2000); and the district Health Bureau is mobilizing community health workers to ensure continuous use of ITNs among the households. Therefore, this study was conducted during the abovementioned period to see the knowledge, attitude and practice of households on sustainable use of ITNs throughout the year in the sub-districts.

Interviews were administered to household heads or their representatives to collect data. Interview questionnaire contained variables such as characteristics of households, demographic information on the respondents and KAPs (knowledge on the role of ITNs in malaria prevention, mode of malaria prevention by ITNs, priority groups to sleep under ITNs in the family, when and where to use ITNs, other benefits of ITNs in the household and interest to buy ITNs if supplied). Observational check list containing variables such as net position, presence or absence of hole, presence or absence of repairs and general condition (cleanliness) were used for physical inspection of one ITN that was randomly selected from each of the net owning households. If present, holes were classified into three (1) holes that didn't allow a thumb to pass through; (2) holes that didn't allow a closed fist to pass through; and (3) holes that were wider than a closed fist. Cleanliness of nets was rated based on the type of spoiling dirt at least on one of the four surfaces. Consequently, nets in which at least one of the surfaces was stained with dust, soot and

household liquid dirt were graded as very dirty; nets in which at least one of the surfaces spoiled with soot and dust were graded as dirty; nets in which at least one of the surfaces spoiled with only dust were graded as a bit dirty; and nets in which all the four surfaces were free from dust, soot and household liquid dirt were graded as clean. Data was analyzed using X^2 tests. The analysis was carried out using SPSS version 10 (SPSS, Inc. USA).

3. RESULTS

3.1. Characteristics of households

A total of 368 households have been surveyed during the study period and out of these, 70.65% were found to own at least one ITN. On the other hand, the mean number of individuals sleeping under one ITN and the mean number of total occupants in the households surveyed were found to be 3.13 and 5.50, respectively. Consequently, nearly half of the occupants in the households surveyed rely on a single ITN to prevent malaria transmission (Table. 2).

Table 2. Characteristics of households surveyed for insecticide treated nets (ITNs) usage in rural sub-districts of Kolla Tembein.

Variables	
\bar{X} Number of occupants \pm (SD)	5.50 \pm (1.9)
\bar{X} Number of ITNs received during previous distribution \pm (SD)	1.89 \pm (0.78)
\bar{X} Number of ITNs owned at present \pm (SD)	1.07 \pm (0.90)
\bar{X} Number of individuals sleeping under one bed net \pm (SD)	3.13 \pm (0.83)
% of households possessing at least one ITN	70.65
% of households without bed nets	29.35
House types	
% of 'Hidmo'	88.86
% of stone wall and iron roof houses	10.87

3.2. Demographic information

About 258 (70%) of the household heads involved in the study were females. Majority of the respondents (89.40%) are illiterate and live on subsistence small scale agriculture for household food supply and income generation. Large proportion of the respondents (41.07%) fall in age categories between 35 and 39 years while about 60% of the remaining respondents fall in age categories younger or older than the aforementioned age range (Table 3).

3.3. KAPs about ITNs

Knowledge, attitude and practices with regard to ITN use is summarized in table 4. Concerning knowledge of household heads about the role ITNs, 82.34% of respondents reported that they use the nets for protection from mosquito bites. Only 1.09% of the respondents claimed ITNs to protect them from malaria, the disease. More than fifty seven percent of the interviewees have also reported that they sleep under ITNs every night. Regarding groups who are given priority to sleep under ITNs in the household, 76.63% of the respondents indicated children below five years of age to be given priority. While 12.23%, 3.80% and 1.63% of the respondents believed priority should be given to whole family, old family members and pregnant women, respectively. Furthermore, a total of 63.04% of the interviewees had positive attitude towards buying ITNs if supplied by some body or organization with an affordable price while the rest of the respondents, 36.96%, preferred free distribution by the government.

Table 3. Demographic information on respondents in rural sub-districts of Kolla Tembein.

(Note: * includes of traditional gold mining in the study area).

Variables (n=368)	No. (%)
<i>Age range in years</i>	
15-19	08 (2.17)
20-24	18 (4.89)
25-29	38 (10.33)
30-34	42 (11.41)
35-39	69 (41.07)
40-44	32 (8.69)
45-49	31 (8.42)
50-54	46 (12.50)
55-59	21 (5.71)
60-64	36 (9.78)
65-69	11 (2.99)
70-74	09 (2.44)
75-79	04 (1.09)
80-84	03 (0.81)
<i>Sex</i>	
Female	258 (70.10)
Male	110 (29.89)
<i>Education</i>	
Illiterate	239 (89.40)
1-6 grades	30 (8.15)
7-8 grades	05 (1.36)
> 8 grade	04 (1.09)
<i>Occupation</i>	
Small scale	365 (99.18)

agriculture	
Others*	03 (0.81)

Table 4. Knowledge and attitudes of household heads about ITN usage in rural sub-districts of Kolla Tembein.

Variables (n= 368)	No. (%)	Variables (n= 368)	No. (%)
<i>ITNs prevent malaria transmission</i>		<i>Preference on the type of ITN</i>	
Agree	359 (97.55)	None treated nets	06 (1.63)
Disagree	09 (2.44)	Conventional ITNs	159 (43.21)
Do not know	02 (0.54)	LLITNs	144 (39.13)
<i>Mode of malaria prevention by ITNs</i>		No idea	59 (16.03)
By avoiding mosquito bites	303 (82.34)	<i>ITN usage</i>	
By avoiding any insect bite	55 (14.94)	Difficult	17 (4.62)
By avoiding malaria	04 (1.09)	Easy	344 (93.48)
By avoiding dust and dirt	01 (0.27)	No idea	07 (1.90)
By other means	04 (1.09)	<i>Side effects associated with ITN utilization</i>	
Do not know	01 (0.27)	No side effects	322 (87.50)
<i>Priority groups to sleep under ITNs in the households</i>		Minor side effects	35 (9.51)
Children < 5 years of age	282 (76.63)	Do not know	11 (2.99)
Adults with ages > 18 years	03 (0.81)	<i>Factors that damage ITNs in the household</i>	
Pregnant women	06 (1.63)	Long exposure to sun while drying after washing	51(13.86)
Old (aged) family members	14 (3.80)	Dust and dirt	17 (4.62)
Guests	02 (0.54)	Inappropriate handling	229 (62.23)
Equal priority for all family members	45 (12.23)	Rats and other domestic animals	22 (5.98)
Others	14 (3.80)	Fire	03 (0.81)
Do not know	02 (0.54)	Using bed nets for other purposes	11 (2.99)
<i>Frequency of ITN use by households</i>		Frequent washing	15 (4.08)
Every night	211 (57.34)	Do not know	20 (5.43)
Sometimes	11 (2.99)	<i>Other benefits of ITNs</i>	
During transmission season	143 (38.86)	Avoid dust, fleas and bed bugs	154 (41.85)
Other times	04 (1.09)	Do not know	214 (58.15)
<i>Rooms where ITNs are used in the house</i>		<i>Willingness to buy ITNs</i>	
Living room	09 (2.44)	Yes	232 (63.04)
Where there is mud sleeping surface/ bed in the house	355 (96.45)	No	136 (36.96)
Kitichen	04 (1.09)		

3.4. Physical status and usage of nets inspected

Out of 260 nets observed during the survey period, 52.31% were kept in a box or other container. Besides, 3.46 % of the nets observed were used as a cover on mud sleeping surfaces in the

household. Only 12.31% of the nets observed were found to be hanging and ready for use. More than 30% of the nets observed were graded as a bit dirty while the proportions of nets graded as clean and very dirty were 25% and 25.77%, respectively (Table 5).

Table 5. Physical conditions of a randomly selected insecticide treated nets (ITNs) from households that own at least one net with respect to usage and cleanliness in rural sub-districts of Kolla Tembein.

Variable (n=260)	No. (%)
Net usage	
Nets stored in a box or other container	136 (52.31)
Nets hanging and ready for use	32 (12.31)
Nets as cover of mud sleeping surfaces	9 (3.46)
Nets at other position	83 (31.92)
Cleanness	
Clean nets	65 (25)
A bit dirty nets	79 (30.38)
Dirty nets	49 (18.85)
Very dirty nets	67 (25.77)

Holes ranging from those that didn't allow a thumb to pass through (\bar{X} number = 3.47) to those that were wider than a closed fist (\bar{X} number = 1.64) were detected on nets inspected suggesting the range of physical damage of the nets. Stitches were the most commonly observed types of repairs (\bar{X} number = 0.27) where as very few nets (\bar{X} number = 0.004) were observed to be repaired with patches (Table. 6).

4. DISCUSSION

There was no significant difference among the responses provided by the different age groups of the interviewees to KAP variables including knowledge on the role of ITNs in malaria prevention, mode of malaria prevention by ITNs, priority groups to sleep under ITNs in the family, when and where to use ITNs, other benefits of ITNs in the household and interest to buy ITNs if supplied ($P > 0.05$). Similarly, the responses provided by male and female household heads to KAP variables including knowledge on the role of ITNs in malaria prevention, mode of malaria prevention by ITNs, priority groups to sleep under ITNs in the family, when and where to use ITNs, other benefits of ITNs in the household and interest to buy ITNs if supplied were not significantly different ($P > 0.05$).

Table 6. Physical conditions of a randomly selected insecticide treated nets (ITNs) from households that own at least one net with respect to type and number of holes and repairs in rural sub-districts of Kolla Tembein.

Variable (n=260)	$\bar{X} \pm (SD)$
Holes	
That didn't allow a thumb to pass through	3.47 ± (6.25)
That didn't allow a closed fist to pass through	1.55 ± (2.71)
Wider than a closed fist	1.64 ± (1.96)
Repairs	
Stitches	0.27 ± (1.16)
Knots	0.06 ± (0.36)
Patches	0.004 ± (0.06)

However, physical inspection of a randomly selected ITN from each of the study households identified nets with poor cleanliness, holes and inappropriately placed in the houses surveyed. On the other hand, the imbalance between the number of occupants and number of ITNs owned per household can hamper its effective utilization.

Awareness of the study subjects to associate mode of malaria prevention by ITNs via protection from mosquito bites is much higher (82.34%) in the present study but lower (51.4%) in a similar study carried out in other parts of Tigray, Mereb Lake and Tselemti (Animut et al., 2008). Most of the interviewees in this study (57.34%) claimed ITNs to be used by the household every night. Previous studies have also reported similar frequency of ITNs use by rural and urban households in different parts of Ethiopia including Tigray (Jima et al., 2005 Fettene et al., 2009; Animut et al., 2008). Most (57.34%) of the households claimed to use ITNs every night throughout the year. This frequency of ITNs use might be ensured due to continuous health education provided by community health workers in the study sub- districts. Furthermore, in the present study household heads (38.86%) indicated malaria transmission seasons to be the second important periods when ITNs are used in higher frequency. However, in Mereb Lake and Tselemti few household heads (4.7%) reported lower frequency of ITNs use during transmission seasons (Animut et al., 2008).

Most of the interviewees (76.63%) involved in this study identified children bellow five years age to be the priority groups to sleep under ITNs in their household. On the other hand, very few respondents (1.63%) perceived pregnant women as a priority group to sleep under ITNs. These

results are consistent with the findings of Animut et al (2008) from Mereb Lake and Tselemti. The results of both of these studies suggest adequate knowledge among respondents regarding the vulnerability of children less than five years of age to malaria. However, the respondents in both of these studies didn't have sufficient knowledge regarding vulnerability of pregnant women to malaria in terms of prioritizing them for ITN use in the household.

This study revealed most of the people in the sub-districts (93.7%) to have appropriate knowledge regarding ITNs use. However, actual inspection of ITNs has shown difficulties in net usage such as hanging of nets on the wall without using it and keeping them in their packages. Most of the ITNs inspected were not hanged appropriately. This may be due to the fact that the rectangular net occupies most of the spaces in the house; nails used to hang the nets cannot pierce the stone wall of the traditional 'hidimo' houses and sleeping surfaces made of mud are narrow and have no space to tuck the nets in.

About 42% of the interviewees in the present study pointed out protection from dust, fleas and bed bugs to be among additional benefits they obtain from ITNs. Such additional benefits may have positive impact on the frequency of ITN use by the households. However, from the observational component of the present study, it was possible to identify households that misuse ITNs in an attempt to get any one of the aforementioned benefits. During the survey period it was not uncommon to observe households misusing ITNs as bed sheets and covers of bed, mattresses, or mat. Such misuses of ITNs were also reported by a study conducted in Oromia and Amhara regions, Ethiopia (NetMark, 2007). Similarly, misuse of ITNs for fishing and drying fish was reported from fishing communities living adjacent to Lake Victoria, Kenya (Minakawa et al., 2008). Furthermore, nearly all of the respondents in this study (99.18%) are engaged in subsistence small scale agriculture and are observed to misuse ITNs as a cover of harvested crops and for sun drying crop grains.

Most of the household heads (87.50%) reported absence of negative side effects associated with the use of ITNs except few respondents who claimed minor side effects such as skin rash in young children. Furthermore, majority of the interviewees (63.04%) have interest to purchase ITNs in cash if they are provided with an affordable price. This result is consistent with the finding of Jimma et al. (2005) in urban kebeles of Southern Nations Nationalities and Peoples Region (SNNPR), Oromia and Amhara Regional States.

Physical inspection of randomly selected ITNs has shown that more than 50% of the ITNs inspected were not hanged as bed nets but stored in a box or other containers. Some households were found to have new ITN with unopened package. One of the major reasons claimed by some of the household heads regarding storing nets in a container was to save the nets for future use as there was no recent distribution. Pervious study by NetMark (2007), also confirmed similar findings.

This study rated the nets inspected into very dirty, dirty, a bit dirty and clean based on the type of spoilage dirt on at least one of its surfaces. In this regard about 25% of the nets inspected were rated dirty because of spoilage of at least one of its surfaces with dust, soot and household liquid dirt. The type of spoilage on at least one of the surfaces of the nets may be due to poor handling by the households. Nets observed in households that do not have separate Kitichen were highly spoiled with soot. Mud plastered roof of the traditional 'hidmo' house and misuse of nets for agricultural activities such as drying grains and covering harvested crops and cattle feed (hay) may be responsible for spoilage of the nets with dust in the study areas. On the other hand, using nets to filter drinking water, boiled butter or oil in the households might render them to be stained with liquid dirt. All the above spoilage factors may play their role in reducing the efficacy of ITNs against mosquito vectors as indicated by Fettene et al., 2009.

In this study variables such as presence and type of holes, presence and type of repairs and overall cleanliness of the nets inspected were also used as parameters to determine the level of damage. Holes are also used in a pervious study by Fettene et al. (2009) to determine the level of net damage. However, these authors didn't classify holes into different categories based on their diameter. Abrasions resulting from poor net handling might be responsible for the holes identified in this study. In households that do not have kitchen, fire might also contribute its part to create holes of different sizes on net surfaces.

5. CONCLUSION AND RECOMMENDATIONS

The present study evaluated the overall knowledge, attitudes and practices of insecticide treated mosquito net (ITN) usage to be satisfactory among the study subjects however; most of the respondents in the study area gave no priority to pregnant women to sleep under ITNs. On the other hand, there was imbalance between family size and number of ITNs owned by the households. Physical inspection of nets sampled from net owning households revealed misuses

and ITN damages. Therefore, awareness creation regarding proper use of ITNs is necessary. There is also a need for implementation of continuous monitoring and evaluation of usage after ITN distribution in-line with prioritizing vulnerable groups of the population, children and pregnant women. Furthermore, ITN manufacturers must consider house types in which the nets are used as ‘one size fits all’ doesn’t work for ITN under housing conditions in the study area.

6. ACKNOWLEDGEMENTS

This study received financial support from the College of Natural and Computational Sciences (CNCS), Mekelle University. The regional and Kolla Tembien district Health Bureaus as well as representatives of the sub-districts are highly acknowledged for facilitating the study. We are grateful to Mr. Solomon Tesfay and Mr. Solomon Amare, Technical Assistants in the Department of Biology, Mekelle University for their help during field data collection.

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