International Journal of Biomedical Materials Research
2016; 4(3): 49-57
http://www.sciencepublishinggroup.com/j/ijbmr
doi: 10.11648/j.ijbmr.20160403.17
ISSN: 2330-7560 (Print); ISSN: 2330-7579 (Online)

Adherence to Malaria Preventive Measures and Associated Factors in Badewacho District, Southern Ethiopia

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To cite this article:

Koyamo Darfiro, Berhanu Erko, Abebe Animut, Adugna Endale. Adherence to Malaria Preventive Measures and Associated Factors in Badewacho District, Southern Ethiopia. *International Journal of Biomedical Materials Research.* Vol. 4, No. 3, 2016, pp. 49-57.
doi: 10.11648/j.ijbmr.20160403.17

Received: September 28, 2016; **Accepted:** November 11, 2016; **Published:** January 3, 2017

Abstract: Malaria remains a major public health problem in Ethiopia threatening the lives of 68% of the population. At present, long lasting insecticidal nets and indoor residual spraying are the major malaria prevention and control methods in the country.This study was undertaken to assess adherence to currently available malaria preventive methods its associated factors inBadewacho District, Southern Ethiopia.A community based cross-sectional study was conducted between February and March, 2013. Systematic random sampling method was used to collect data on preventive measures from 138 households through semi-structured questionnaires administered to interviewees during home to home visit. The data was computed using a statistical soft ware SPSS version 16.0. A P-value <0.05 and 95% CI excluding 1 were considered statistically significant.The coverage and the proportion of households with one or more of their members utilizing mosquito nets in the district were 73.2% and 44.2% respectively. Net utilization of households with under-five year children was 32.1%. Dirtiness of the nets, lack of appropriate area for hanging, wearing out, and adherence to other preventive measures were mentioned as reasons for not using the nets. Only 63(45.7%) of the respondents knew that mosquitoes transmit malaria and most households sought treatment in public health facilities.Utilization of mosquito net was significantly associated with previous treatment for malaria in government health institutions and knowledge about malaria prevention methods.Coverage and utilization of the major malaria preventive measures was low in theBadewacho District, Southern Ethiopia. This indicates the necessity of health education to increase the community awareness in utilization of available malaria preventive measures to reduce the disease burden.

Keywords: Adherence, Malaria, Preventive Measures, Badewacho District, Ethiopia

1. Introduction

Malaria is an infectious disease caused by protozoan parasites belonging to the genus *Plasmodium* (Rajahram *et al.,* 2012). The disease is mainly transmitted by the bite of female *Anopheles* mosquitoes (*An*. mosquitoes) (Antonio-Nkondjio *et al.,* 2012; Peterson, 2009). There might also be transmission from infected mother to her fetus through placenta (Ouedraogo *et al.,* 2012), during sharing the same hypodermic needle (Chau *et al.,* 2002), and rarely by blood transfusion (Ali *et al.,* 2004).

The disease threatens the lives of more than 50% of the world's population in over 100 countries and causes serious economic and person-day loses (Modrek *et al.,* 2012; WHO, 2008). It is prevalent in tropical and subtropical regions of sub-Saharan Africa, Central and South America and Asia (Stratton *et al.,* 2008; WHO, 2010).Each year, it causes 225 to 244 million clinical cases and kills up to 1.2 million people worldwide (Murray *et al.,* 2012; WHO, 2010). It takes the greatest toll in young children (Loha and Lindtjørn, 2012b),

pregnant women (Henry *et al.,* 2012), displaced people (Williams *et al.,* 2013), refugees (Maroushek *et al.,* 2005), non-immune travellers and labourers entering into malarious areas (Askling *et al.,* 2005), and people living in rural areas with limited access to health services (Dev *et al.,* 2004). Currently, malaria is reappearing in areas under elimination of the disease (Atkinson *et al.,* 2012). About 81% of the cases and 90% of the deaths due to malaria occur in Africa (Murray *et al.,* 2012; WHO, 2011).

In Ethiopia, malaria is the leading public health problem where an estimated 75% of the land mass is malarious putting 68% of the population at risk. It is responsible for more than 2.5 million clinical cases, 460,000 confirmed cases and about 1,169 deaths every year (FMOH, 2006; WHO, 2009). During 2001 – 2005, the number of malaria cases in outpatient departments (OPDs), admissions and in-patient deaths has been increasing with an annual average of 3 million (FMOH, 2006; WHO, 2010). The nationwide child survival study has also documented that malaria affected school attendance by 20% and contributed to 47% of child deaths in Ethiopia (FMOH, 2006). In 2009/2010, malaria was the leading cause of OPD visits and health facility admissions (MOH, 2010). Distribution of the disease varies from place to place depending on climate and altitude (Alemu *et al.,* 2011; Woyessa *et al.,* 2012).In Ethiopia, malaria transmission is unstable and characterized by large-scale epidemics occurring every 5-8 years (MOH, 2012). Major transmission occurs from Sep-Dec after the main rainy season followed by Apr-May after short rainy season (MOH, 2012; Woyessa *et al.,* 2012).The country had suffered from the worst malaria epidemics in 1958 with an estimated three million cases and 150,000 deaths (MOH, 2003). Epidemics had also occurred in 1965/66; 1972/1973; 1980/81; 1987/88, 1992, 1998, 2003, and 2004 (MOH, 2003; FMOH, 2006).

In Ethiopia,malaria prevention and control activities such as case management, free distribution of long lasting insecticidal nets (LLINs) and IRS targeting epidemic-prone areas up to 2,500m of altitude started in 2005 (MOH, 2008). In 2006, the Federal Ministry of Health launched national five-year strategic plan for malaria prevention and control. The strategy targeted epidemic reduction by early diagnosis and treatment, selective vector control by providing all HHs with an average of two ITNs in malarious areas, increasing IRS coverage to 60% in epidemic-prone areas and environmental management, and information, education and communication to transmit all key malaria messages to increase community awareness (FMOH, 2006). The latest national strategic plan of the country (2011 – 2015) is aimed at eliminating the disease in areas with low malaria transmission and zero deaths due to malaria in moderate and high transmission settings (MOH, 2012).

Launching health education is also beneficial in malaria prevention and control (Legesse *et al.,* 2007). The utilization of nets by high risk groups mainly depends on education and training status of HH heads, and geographical location of HHs. Women's education and training on malaria related topics also have a significant role in the appropriate implementation of control programs including ITN ownership and use (Astatike and Feleke, 2009; Deribew *et al.,* 2012; Hwang *et al.,* 2010). Education status, income of HHs, and their living condition are prime determinant factors of malaria infection risk (Astatike and Feleke, 2009; Bekele, 2012). Education and income have significant association with subjects' knowledge on malaria preventive measures (Legesse *et al.,* 2007).

Early detection and treatment of cases results in reduced disease burden and transmission (Otten *et al.,* 2009). However, its efficacy depends on the correct use and dosage of antimalarial drugs (Kaona and Tuba, 2003). The distribution of ACT highly reduced malaria related morbidity and mortality in Zanzibar (Bhattarai *et al.,* 2007). Delayed presentation to treatment can be reduced by addressing transport cost, decentralization of services and increasing awareness of communities (Getahun *et al.,* 2010).

Malaria is the most common disease in the SNNPR state of Ethiopia in general and in West Badewacho District in particular. The general prevalence of the disease in the region is 5.4% with its peak 9.9% in central zones of the region where our study site lays (TCC, 2007). The major outbreaks of malaria occur after the main rainy season and last for about three months (October-December) followed by the minor transmission occurring from April to June (FMOH, 2006). LLINs, IRS, early detection and treatment, environmental management, and health education have been implemented by West Badewacho District Health Office. However, adherence to the controlling methods and its associated factors was not assessed to our knowledge. This study, therefore, was designed to measure adherence to current malaria control measures and its associated factors in the area.

2. Materials and Methods

2.1. Study Area and Population

A community based cross-sectional study was conducted between February and March, 2013, in Badewacho District, Southern Ethiopia. The district is located 357 km south of Addis Ababa, in the Great Rift Valley. According to the 2007 population and housing census, the district is projected to have a total population of 98,781 in 2013. The total HHs was 20,159 with estimated 4.9 family sizes.The climatic condition of the district is generally a sub-humid type with mean annual temperature and rain fall of 17.7°C-27°C and 1450 mm-2100 mm, respectively. Its altitude ranges from1,775 m in Sapera to 2,195 m in Koto above sea level.

Data on adherence of the community to the available malaria preventive measures was collected using semi-structured questionnaire administered to individuals in selected HHs. All members of the HHs who lived in the selected sub-districts at least for 6 months and volunteered to respond to the questionnaire were included to the study.

2.2. Sample Size and Data Collection

The sample size was calculated using the formula for estimating single proportion; $N=Z^2PQ/D^2$. Where; Nis the minimum sample size required, Zis the critical value for a given confidence interval (1.96), Pis expected proportion of the event to be studied (estimated based on findings of previous studies), Q=1−P (proportion of the population represented with the sample), Dis margin of error or degree of accuracy desired (0.05). Assumptions utilization rate of mosquito net used to calculate the sample size was 9.9% (from previous study) 95% CI and 5% of margin of error = 1.96. Accordingly the total sample size was 138.

Systematic random sampling method was used to select study HHs. The first HH to be started was determined by using the table of random numbers as a lottery method. Then after, every 7^{th}(sampling interval) HHs was sampled until the sample size allocated for the study was obtained.Head of the selected HH or the next elder member of the HH was interviewed.

Data on socio-demographic status, access to health services, knowledge, attitude, and practice of the participants towards malaria preventive measures was collected using semi-structured questionnaires. The questionnaire was initially prepared in English and translated to Amharic prior to the study. Subjects were interviewed by using the local language, Hadiyisa, to minimize complications and increase their confidence in answering questions. The local leaders were used for translation task and indicate directions. During data collection in the field and at the end of each day, the questionnaires were reviewed and checked for completeness, accuracy and consistency by the principal investigator and corrective measures were taken.

2.3. Data Analysis

Data was coded on pre-arranged coding sheet by the principal investigator, entered and analyzed using SPSS version 16 statistical software. Tables and graphs were used to present frequencies of relevant findings. The relative contribution of each selected variables to the outcome of interest (adherence to preventive measures) was assessed by using logistic regression. The association between the dependent and independent variables was measured using p-value and 95% CI. P-value <0.05 and confidence intervals excluding 1 were considered as statistically significant.

2.4. Ethical Considerations

Ethical clearance was obtained from the Institutional Review Board of Aklilu Lemma Institute of Pathobiology, Addis Ababa University.Permission to undertake the study in the district was obtained from Badewacho District Health Office. Aim, purpose, benefits and method of the study was explained to the participants and verbal consent was obtained from them. They had the right to be involved or not in the study. The name and address of the interviewees was kept confidential.

3. Results

3.1. Socio-demographic Characteristics of the Study Population

The number of households included for the study on adherence to current malaria preventive measures was 138. Most of the interviewees were protestant religion followers. About 73.9%, 5.1% and 10.1% of the households had high risk groups (under five years children and pregnant women), opening in their house roof, and wall respectively.About 96% and 75% of HHs sealed their walls and roofs with mud and corrugated iron sheet, respectively. About 60% of the study HHs had more than five persons per households (Table 1).

Table 1. *Socio-demographic characteristics of study households, Badewacho District, Southern Ethiopia, 2013.*

Variables	Frequency (No.)	Percent (%)
Religion		
Orthodox	24	17.4
Catholic	3	2.2
Protestant	111	80.4
Presence of high risk group in the HH		
Present	102	73.9
Absent	36	26.1
The type of house roof		
Thatch	104	75.4
Corrugated iron sheet	34	24.6
The type of the house wall		
Mud	132	95.7
Thatch	1	0.7
Plant product	5	3.6
Presence of opening in the roof		
Present	7	5.1
Absent	131	94.9
Presence of opening in the wall		
Yes	14	10.1
No	124	89.9
Family size of HH		
2-5 persons per HH	55	39.9
6-9 persons per HH	72	52.2
more than 9 persons per HH	11	8.0

3.2. Malaria Preventive Measures

About 44.2% (61) of the study households head were trained on malaria related topics. Health education was delivered to 102(73.9%) households through home visiting health professionals and in the health facility. About 73.2% of the households in the study area had at least one long lasting insecticidal net during the survey (Figure 1).

The utilization rate of mosquito nets the households by one or more of their members a day before the survey was 61(44.2%). The environmental management activities undertaken among the households were very low. Only 32(23.2%) of the households interviewed had one or more of their members participated in the community malaria control campaign in their life time. Draining stagnant water, earth fill of open pits, and cleaning the environment were activities undertaken during the campaign. The IRS acceptance rate was high with in the study population (Table 2). About 95%

(131) of HHs had IRS in February, 2013. Only two HH owners refused IRS to their houses complaining that the chemical used for IRS facilitates overgrowth of bed bugs and harm their domestic animals. Five HHs lost spraying opportunity due to lack of awareness about the program. Most HHs sought treatment in health facilities. 95% of HHs had been treated in health institutions for malaria infection previously (Table 2).

Dirtiness of the nets, lack of appropriate area for hanging, wearing out, and adherence to other preventive measures were mentioned as reasons for not using the nets. More than 75% of the non users complained that the nets were too dirty. About 90% of HHs kept their LLINs below three years before discarding (figure 3).

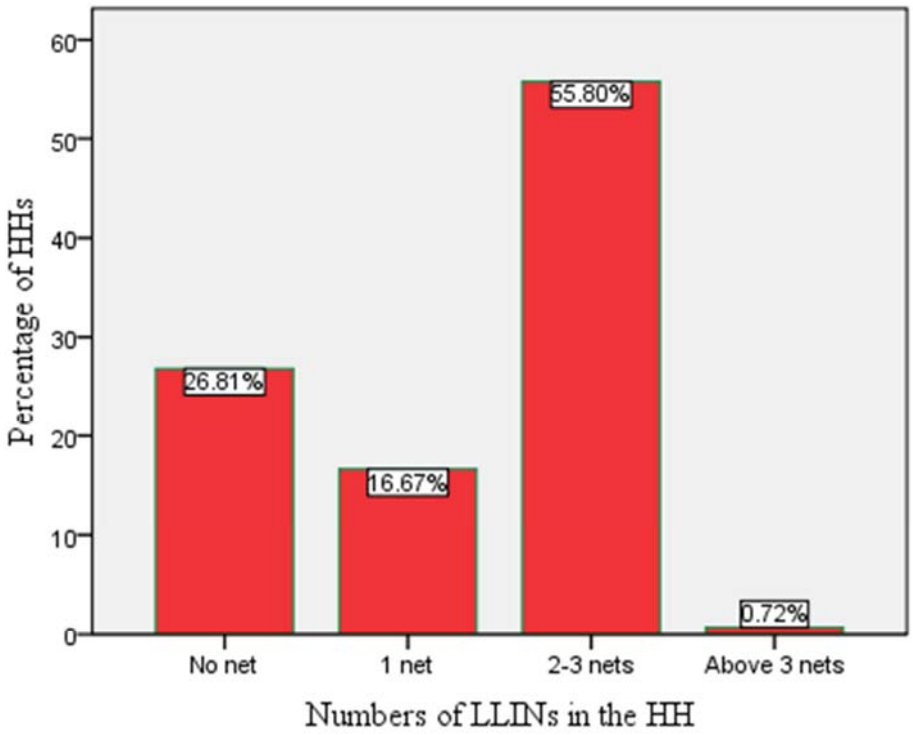

Figure 1. *Graph indicating the coverage of LLINs in Badewacho District, Southern Ethiopia, 2013.*

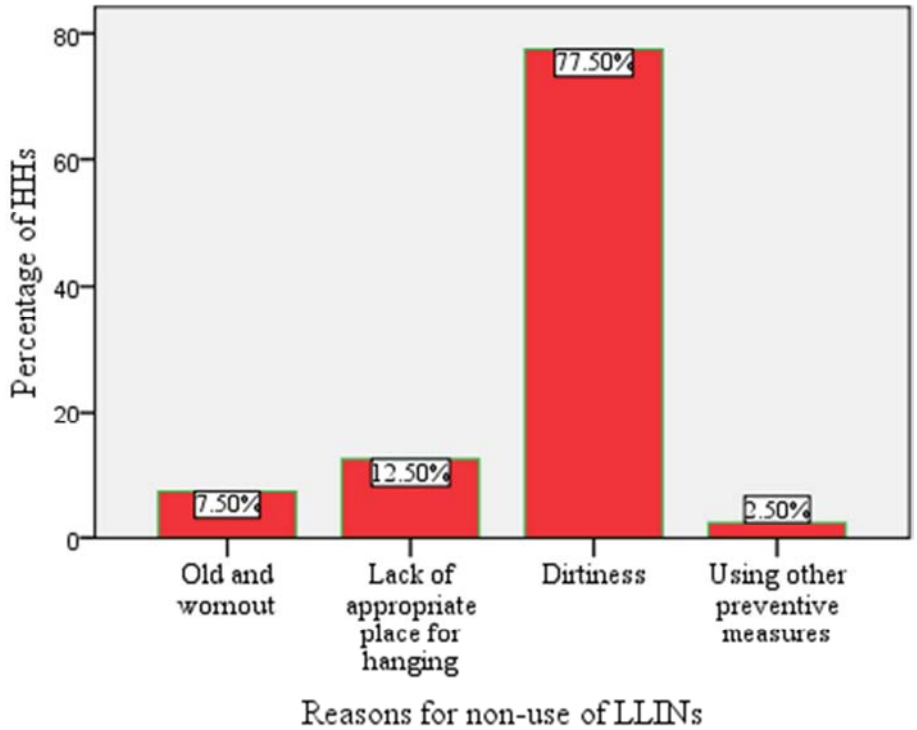

Figure 2. *Graph indicating reasons for non-utilization of LLINs in Badewacho District, Southern Ethiopia, 2013.*

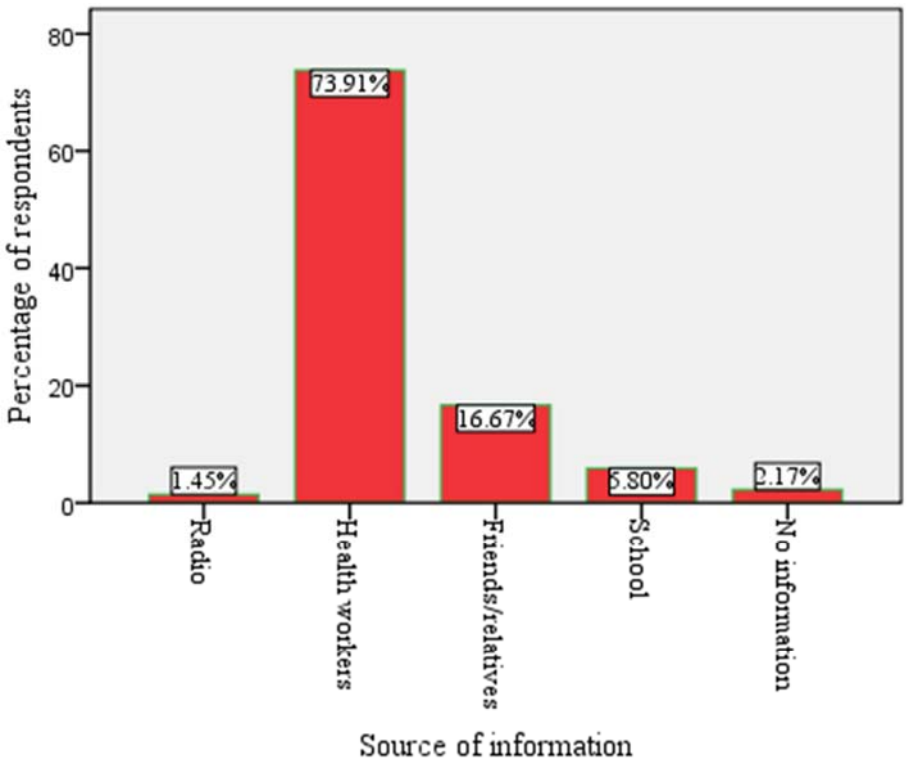

Figure 3. *Information sources of interviewees about malaria in Badewacho District, Southern Ethiopia, 2013.*

In bivariate analysis, the net utilization in the area was significantly associated with the type of health facility visited by the HH members previously for treatment ($p<0.05 = 0.026$; 95% CI: 1.152–9.165), participation in community malaria control campaign ($p<0.05 = 0.02$; CI: 0.167–0.061), wealth status of the HH ($p<0.05 = 0.018$; 95% CI: 1.165–5.251), and knowledge level of interviewees about malaria preventive measures ($p<0.05 = 0.006$; 95% CI: 0.177–0.753). After adjusting for all possible confounding variables, the type of health facility visited for treatment and knowledge level about malaria prevention measures of interviewees become statistically significant. Significant numbers of participants had been utilizing the nets among HHs with previous history of visiting government health institutions (GHIs) and knowledgeable about malaria prevention measures. Family size, presence of high risk groups in HH, training status of HH heads on malaria related topics, knowledge about malaria transmission and symptoms have no association with insecticide treated net utilization in both bivariate and multivariate logistic regression (Table 3).

Table 2. *Adherence of households with malaria preventive measures, Badewacho District, Southern Ethiopia, 2013.*

Variable	Frequency	Percent
Participation in environmental management		
Yes	32	23.2
No	106	76.8
Utilization of LLINs previous night		
Yes	61	44.2
No	77	55.8
IRS acceptance		
Yes	131	95
No	7	5
Preferred place for treatment		
Health institutions	134	97.1
Use left over drugs	4	2.9

Table 3. *Socio-demographic characteristics and KAP of interviewees and their association withutilization of mosquito nets, Badewacho District, Southern Ethiopia, 2013.*

	Utilization of LLINs			
Variable	**Yes**	**No**	**P- value**	**Calculated p-value**
	No (%)	**No (%)**	**(95% CI)**	**(95% CI)**
Family size of study HH				
2-5 persons	19(34.5)	36(65.5)	0.081(0.861, 12.769)	
6-9 persons	35(48.6)	37(51.4)	0.358(0.498, 6.874)	
10 and more	7(63.6)	4(36.4)		
Presence of high risk group in the HH				
Yes	43(42.2)	59(57.8)	0.416(0.640, 2.941)	
No	18(50.0)	18(50.0)		
Training status of HH head on malaria				
Yes	31(50.8)	30(49.2)	0.165(0.313, 1.219)	
No	30(39.0)	47(61.0)		
Knowledge on symptoms of malaria				

	Utilization of LLINs			
Variable	**Yes**	**No**	**P- value**	**Calculated p-value**
	No (%)	**No (%)**	**(95% CI)**	**(95% CI)**
Know*	54(46.2)	63(53.8)	0.280(0.220, 1.550)	
Not know*	7(33.3)	14(66.7)		
Monthly income of HH head				
Poor	37(37.8)	61(62.2)	0.018(1.165, 5.251)	0.122(0.843, 4.268)
Well	24(60.0)	16(40.0)		
Knowledge on malaria transmission				
Know**	33(52.4)	30(47.6)		
Not know**	28(37.3)	47(62.7)	0.077(0.935, 3.647)	
Knowledge on malaria prevention				
Know***	21(53.2)	18(46.2)	0.006(0.177, 0.753)	0.031(0.200, 0.925)
Not know***	40(40.4)	59(59.6)		
Place of treatment				
GHI	46(40.0)	69(60.0)	0.026(1.152, 9.165)	0.043(1.037, 9.383)
Left over drugs	2(50.0)	2(50.0)	0.488(0.244, 19.276)	
GHI and PHI	13(68.4)	6(31.6)		
Participation in community malaria control campaign				
Yes	20(62.5)	12(37.5)	0.020(0.167, 0.855)	0.072(0.186, 1.075)
No	41(38.7)	65(61.3)		

Nearly 74% of the interviewees heard about malaria from health professionals followed by 23(16.7%), 8(5.8%) and 2(1.4%) who got information from friends/relatives, school and radio respectively. The rest 3(2.2%) have no information at all (Figure 3).

Table 4. *Reported knowledge of respondents about malaria preventive measures in Badewacho District, Southern Ethiopia, 2013.*

Variable	Frequency	Percent
Early detection and treatment	9	6.5
Draining stagnant water	4	2.9
Clearing the vegetation	5	3.6
Using mosquito nets	32	23.2
Non preventable disease	2	1.4
Personal hygiene and environmental sanitation	46	33.3
Taking antimalarial drugs and using mosquito nets	13	9.4
IRS and using mosquito nets	3	2.2
Draining stagnant water and using mosquito nets	7	5.1
Fumigation of leaving homes, personal hygiene and environmental sanitation	1	0.7
Treatment, IRS and draining stagnant water	2	1.4
Treatment, draining stagnant water and using mosquito nets	6	4.3
Treatment, IRS, draining stagnant water and using nets	8	5.8

The knowledge of respondents about malaria transmission, prevention and control measure was not considerable even among HHs with trained heads (Table 4). Only 63(45.7%) of the respondents knew that mosquitoes transmit malaria. Dirt surrounding was mentioned as a risk for malaria transmission by 32(23.2%) of the respondents. 37(26.8%) of the interviewees perceived that poor personal hygiene, malnutrition, cold weather, contaminated food, exposure to sun, in combination with dirt surrounding, each other, or alone can enhance malaria transmission. The remaining 6(4.3%) refused to respond for these questions. Minor malaria transmission routes such as transmission from infected mother to her fetus through placenta, sharing of needles to inject intravenous drugs and blood transfusion were reported with none of the respondents.

46(33.3%) of the respondents thought personal hygiene and environmental sanitation prevent malaria. Utilization of mosquito nets and early detection and treatment were recognized as malaria preventive measures by 32(23.2%) and 9(6.5%) of respondents respectively (Table 4).

Majority of respondents mentioned at least three of the common clinical symptoms of malaria such as fever, vomiting, chills, shivering; headache, backache, joint pain, thirsty and loss of appetites were reported by the study population (table 5).

Table 5. *The knowledge level about malaria symptoms in Badewacho district, southern Ethiopia, 2013.*

	Frequency (No.)	Percent
Know a single symptom	1	0.7
Know two of the symptoms	15	10.8
Know three of the symptoms	65	47.1
Know four of symptoms	35	25.4
Know five of the symptoms	15	10.9
Know six of symptoms	1	0.7
Not know any symptom	6	4.3

4. Discussion

Early diagnosis and treatment of cases, LLINs and indoor spraying with residual insecticides are being used as the major preventive measures of malaria in Ethiopia (MOH, 2012). Selective vector control with LLINs, IRS, and early detection and treatment with ACT (Otten *et al.,* 2009; Okell *et al.,* 2012;Loha and Lindtjørn, 2012a)recognized as effective methods of malaria prevention and control. Environmental management has also been used as effective operation as malaria control in collaboration with other methods (Castro *et al.,* 2009). Information, education, and communication too have significant role in malaria prevention and control strategies (MOH, 2012).

The present study revealed that 73.2% of HHs in Badewacho District had at least one net which was lower than the report by Baume *et al.* (2009). The coverage can be

assumed as under achievement relative to FMOH target for 2012 (MOH, 2012). However, it was relatively higher than in 2009 which was 67.5%. The coverage of the nets in Badewacho District was similar to that of Arbaminch area during 2007(75.1%) (Astatike and Feleke, 2009; Bekele, 2012). It was also nearly the same to the report from Ruanda in 2010 (76%) (Karema *et al.,* 2012). This study indicates that the number of nets available in some of the study HHs were not sufficient for the respective number of family members (MOH, 2012).

Utilization rate of mosquito nets in Badewacho District HHs, by one or more of their members, a day before the survey was 44.2%. This utilization rate was lower compared to that of the Arbaminch area and Assosa Zone of Western Ethiopia (Astatike and Feleke, 2009; Legesse *et al.,* 2007). As documented by Astatike and Feleke (2009), Legesse *et al.* (2007), and Batisso *et al.* (2012), the proportions of HHs utilizing the nets were 60%, 71% and 58% respectively which were lower compared to Badewacho District. Utilization of the nets was significantly affected by the type of health facility visited during the previous infection and knowledge of interviewees about malaria prevention measures. This strengths the need for provision of malaria related health educations in governmental health facilities besides treatment. In this study, it was reported that, the majority of respondents abstained from utilizing the nets because of dirtiness of the net unlike in the previous one which was due to wearing out (Batisso *et al.,* 2012).

Maintaining the recommended shelf life of LLINs was mandatory in preserving the coverage and utilization of it (Batisso *et al.,* 2012). In this study, 90% of HHs discarded their LLINs without utilizing at least for three years. This strictly contradicts with the idea of FMOH (MOH, 2012).

IRS is one of the major malaria preventive measures recommended in areas with high incidence rate, high malaria transmission, occurrence of epidemic outbreaks, and with natural or man-made disasters (MOH, 2012). 131(95%) of study HHs were sprayed during the previous IRS program. This was comparable to the coverage described by Beer *et al.* (2013) in Tanzania. Malaria was also still the problem of the study area. This might be due to the loss in potency of chemicals with time or insecticide resistance (Balkew *et al.,* 2012; Bradley *et al.,* 2012).

The knowledge about malaria transmission and preventive measures was suggested in previous studies to minimize malaria burden (Tobgay *et al.,* 2013). This study indicated that the proportion of respondents knowledgeable about the route of malaria transmission and its preventive strategies were 45.7% and 28.3% respectively. There was no much difference in the knowledge about malaria transmission among the residents of Badewacho District, Assosa Zone of Western Ethiopia, and in some highland areas of Ethiopia where malaria has been recently introduced. But, the respondents knowledge about the preventive strategies of the disease was lower than that of Assosa with reported percentage of 48 (Legesse *et al.,* 2007; Legesse and Deressa, 2009).

Awareness of Badewacho District residents on the symptoms of the disease was relatively high. This might be due to frequent occurrence of the disease in the study population. 84% of respondents knew three or more of major malaria symptoms such as fever, vomiting, chills, shivering, headache, backache, joint pain, thirsty and loss of appetite. Most of the respondents preferred health institutions for malaria treatment. The knowledge level of respondents was similar to that of Adami Tulu District but the preference of health institution for treatment was higher in this case (Deressa, 2007).

Despite the limited knowledge, attitude and practices about malaria prevention and control measures, 95% of the houses were sprayed during the previous IRS program. Small proportion of the HHs left without spraying due to reported reasons and the result was similar to that of Tanzania (Kaufman *et al.,* 2012). The insecticides used for the program were carbamate insecticides specially propoxur which was previously recommended by FMOH and other stake holders (MOH, 2012; Yewhalaw *et al.,* 2011). One of the limitations of this study was that we used a cross-sectional study design, which is a snapshot of a single point in time and misses the seasonal trends of mosquito net utilization rate in the study area.

5. Conclusions

The community adherence to current malaria preventive measures was generally low in the study site compared to the national target. The coverage and utilization of LLINs, and participation in environmental management activities were generally low. The insights gained from this study suggest a number of issues to be considered in the area of malaria prevention and control strategies. The scheme to elongate the shelf life and replace worn out nets should be launched in all levels of stake holders. Community mobilization and advocacy should be strengthened to increase the community's awareness on malaria transmission and preventive measures.

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