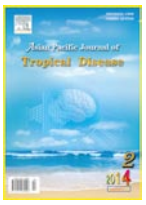
Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Disease

journal homepage: www.elsevier.com/locate/apjtd



Document heading doi: 10.1016/S2222-1808(14)60683-6

Community knowledge and practices as regards malaria in Ilorin City: implications for the elimination plan of the National Malaria Elimination Program

Abiodun Obembe[1,2*], Adedayo Oduola[3,4], Kehinde Popoola[2], Adeyemi Ajao[1]

[1]*Department of Biosciences and Biotechnology, Kwara State University Malete, Nigeria.*

[2]*Entomology Unit, Department of Zoology, University of Ibadan, Ibadan, Nigeria.*

[3]*Department of Zoology, University of Ilorin, Ilorin, Nigeria.*

[4]*Molecular Entomology and Vector Control Research Laboratory, Nigerian Institute of Medical , Research, Yaba, Lagos, Nigeria.*

ARTICLE INFO

Article history:
Received 17 Jun 2014
Received in revised form 24 Jun 2014
Accepted 11 Aug 2014
Available online 23 Aug 2014

Keywords:
Malaria
Knowledge
Practices
Malaria elimination
Ilorin
Nigeria

ABSTRACT

Objective: To examine malaria-related knowledge and practices among residents in Ilorin City to guide forthcoming malaria elimination action of the recently restructured Nigerian National Malaria Elimination Program.

Methods: Community-wide cross-sectional study was conducted in June 2012 using pretested structured questionnaire and interview schedule to collect information on perception, prevention and treatment of malaria among the residents.

Results: Majority of the respondents attributed malaria to mosquito bites and prevented the disease through multiple means including the use of long-lasting insecticidal nets (60%), insecticide sprays (54%) and mosquito coils (48%) alternatively. All the respondents spraying insecticides in the bedrooms shortly before bed time stayed outdoors during night hours. Fifty three percent of the respondents treated the last malaria episode at the hospital/clinic, and the remaining (47%) employed self-medication. Only 6.1% of those who engaged in self-medication used artemisinin combination therapy drugs.

Conclusions: Combined use of long-lasting insecticidal nets and insecticide sprays call for investigation of behavioural and physiological insecticide resistance in the mosquitoes present in this area. Night time outdoor staying behaviour mandated by spraying of insecticides and possible switch of the vectors to bite outdoor at early night hour also necessitate incorporation of outdoor mosquito control into the malaria elimination plan for this locality. Likewise, observation of self-medication in spite of high literacy levels implies that campaigns against such practice may not yield the desired result unless quality healthcare service is made affordable and accessible to all.

1. Introduction

Recent fall of malaria mortality rates by 33% in the World Health Organization African Region has been encouraging various anti-malaria programs and may have prompted the current efforts towards elimination of the disease around the world[1]. In Nigeria for instance, malaria control efforts of the Federal Government and its partners are now been followed-up upon by the recently renamed and restructured Federal Ministry of Health's anti-malaria program to attain malaria elimination.

*Corresponding author: Abiodun Obembe, Department of Biosciences and Biotechnology, Kwara State University Malete, Nigeria.
Tel: +2348064860782
E-mail: abiodunobembe@yahoo.com, abiodun.obembe@kwasu.edu.ng
Foundation Project: Supported by the action research grant of the Kwara State University Centre for community development (Phase II).

However, realization and sustenance of malaria elimination can only be achieved through sound community understanding of the disease given that it requires great focus on malaria transmission foci at a local level[2]. Also, the continued failure to consider community malaria-related socio-cultural factors which may be at variance with standard control measures accounts for the sustained prevalence of malaria in Africa[3]. Phenomenal outcomes such as dramatic reduction of malaria prevalence in Zanzibar from 40% in 2005 to 0.2%-0.5% in 2011/2012 (Tanzanian Health Ministry Information System, 2012 unpublished report) were achieved through understanding and redirection of residents' behavioural patterns as a strong support for the control measures administered[4]. It follows that malaria control measures need to revolve around the study of malaria-related knowledge and practices of each

target community to achieve malaria elimination. Proper understanding of how the people prefer to prevent and treat malaria is required to determine the appropriate measures for malaria elimination in the community. Besides, reports of malaria-related knowledge, attitudes and practices of members of a whole Nigerian community are scanty in literature compared to those regarding only a certain category of people in such communities[5-12].

This study therefore investigated the knowledge and practices of residents in Ilorin, a north central Nigerian City, as regards malaria prevention and treatment in order to fill the existing information gap and also provide baseline information for the forthcoming malaria elimination program.

2. Materials and methods

2.1. Study area

Ilorin is located in north central region of Nigeria (8°30′ N and 4°35′ E). It serves as the capital city of Kwara State, covering an area of about 150 km^2 with an estimated population of 766 000 people[13,14]. The city is traditional in its entirety because of the domineering culture of its people that place core traditions, religion and old historical traits over every aspects of life[15]. Ilorin metropolis was considered as a community for this survey.

2.2. Study design and data collection

Descriptive cross-sectional survey approach was adopted for the study. Two hundred and eighty households in a total of 103 areas within the metropolis were randomly selected in June 2012.

Details of sample size determination are available elsewhere[16]. The sample unit for the study was the household and the head or his representative was requested to respond to a structured questionnaire administered by a team of pre-trained interviewers. The respondents were asked about their socio-demographic characteristics, knowledge and perception of malaria, malaria symptoms, the cause of malaria, period of last malaria episode, frequency of malaria occurrence, household method of malaria prevention, access to malaria education messages, knowledge of the source of mosquitoes and treatment seeking behavior.

2.3. Data analysis

Descriptive analysis was applied while Pearson *Chi*-square was used to determine the statistical significance of key observations and differences seen in cross tabulated variables using EPI Info 2007. Level of statistical significance was set at $P<0.05$.

2.4. Ethical consideration

The study was approved by the Nigerian Institute of Medical Research Institutional Review Board. Informed consent of each household head was obtained before they were enlisted in the study. The team of interviewers requested the household heads to be the respondent. In situations that the heads were not available, an adult representative who gives the informed consent also served as the respondent.

3. Results

3.1. Socio-demographic characteristics of respondents

Two hundred and fifty eight questionnaires were finally selected for analysis (7.8% non-response rate). In the 258 respondents, in terms of age, 136 (53%) were 30 years old and above, 103 (40%) were 25-29 years old and 19 (7%) were 18-25 years old. Most of the respondents were males [160 (62%)], while some others 98 (38%) were females. A total of 155 (60%) of the respondents were married while a sizeable number [91 (35%)] were single. Two hundred and three respondents (78%) had acquired tertiary education and only two people did not acquire formal education. Most of the respondents were engaged in formal jobs (48%) while a good number were students (23%), traders (13%) and skilled self employed workers (9%). Two religious denominations, Muslims (60%) and Christians (40%) were observed among the respondents while majority (62%) of the households was within the size range of 5-9 (Table 1).

Table 1
Socio-demographic profile of respondents.

Variables		*n*	%
Sex	Male	160	62
	Female	98	38
Age	18-25	19	7
	25-29	103	40
	30 and above	136	53
Household size	1-4	66	26
	5-9	159	62
	⩾10	33	13
Marital status	Single	91	35
	Married	155	60
	Divorced	2	1
	Widowed	7	3
	Separated	3	1
Education	Illiterates	2	1
	Primary	2	1
	Secondary	51	20
	Tertiary	203	78
Occupation	Formal jobs	124	48
	Student	60	23
	Trader	34	13
	Self-employed	23	9
	Farmer	7	3
	Others	10	4
Religion	Muslims	154	60
	Christians	104	40

3.2. Cause of malaria, breeding sites of mosquitoes and malaria preventive measures

Two hundred and fourty respondents (93%) attributed the cause of malaria to mosquito bites while some others mentioned cold weather (6%) and bad drinking water (9%)

in addition to other factors. Thirty-five (14%) respondents linked the cause of the disease to rain [10 (4%)], germs [16 (6%)], unbalanced diet [6 (2%)] and dirt [3 (1%)], while three (1%) others indicated that they did not know the cause of the disease (Table 2). Sex (χ^2=4.987, P=0.417) and level of education (χ^2=16.959, P=0.883) did not significantly (P>0.05) affect the knowledge of the cause of malaria among the respondents.

Twenty seven (10%) of the total respondents did not know the breeding sites of mosquitoes, more than half (69%) attributed it to stagnant water, 31% replied that mosquitoes come from the bush while only two respondents stated that the source of mosquitoes is the soil (Table 2). There was no significant (P>0.05) association between the level of education and knowledge of mosquito breeding sites (χ^2=18.794, P=0.223) among the respondents.

Table 2

Respondents' knowledge on cause of malaria, source of mosquitoes and malaria preventive measures.

Variables		*n*	%
Cause of malaria	Mosquito bites	240	93.0
	Cold weather	15	6.0
	Bad drinking water	23	9.0
	Rain	10	4.0
	Germs	16	6.0
	Unbalance diet	6	2.0
	Dirt	3	1.0
	Don't know	3	1.0
Source of mosquitoes	Stagnant water	179	69.0
	Bush	81	31.0
	Soil	2	0.7
	Don't know	27	10.0
Preventive measures	Treated nets	156	60.0
	Insecticide sprays	139	54.0
	Mosquito coils	123	48.0
	Window or door net only	5	2.0
	Plant repellents	10	4.0
	Hygiene	4	2.0
	Untreated net	20	8.0
	Killing by hand	2	0.7
	Fumigation	1	0.4
	Herbs	2	0.8
	Repellent cream	32	12.0
	None	1	0.4

Note: Percentage total exceeds 100 because of multiple responses.

When asked of the malaria preventive measures, two percent of the respondents stated that they keep their environment clean, another 2% relied on window and door nets alone. About 8% used untreated nets, 4% spread plant-based mosquito repellents materials such as orange peels and/or burn the materials in their vicinity during the night while two other respondents (0.7%) killed the mosquitoes in their house by hand. Most of the other respondents employed chemical control in form of long-lasting insecticidal nets (60%), insecticide sprays (54%) and mosquito coils (48%) alternatively (Table 2). All the respondents sprayed insecticides in the bedrooms shortly before bed time stayed outdoors during night hours. The malaria preventive measures mentioned had a significant (P<0.05) link with the level of education (χ^2=702.271, P=0.000) of the respondents.

3.3. Period of last malaria episode, source of treatment and the type of drugs used.

Interestingly, 15 (6%) people claimed that they never have experienced any malaria episode so far in their lifetime. Fourty-three (17%) indicated that they experienced the last malaria episode the year before this study, and 30 respondents (12%) experienced the last malaria episode more than 2 years ago while more than half of the total respondents 143 (55%) had experienced at least one malaria episode during the last six months before the study (Table 3).

Table 3

Responses on period of last malaria episode, source of treatment and the type of drugs used.

Variables		*n*	%
Period of last malaria episode	≤6 months	143	55.0
	Last year	43	17.0
	Two years	27	10.0
	More than two years	30	12.0
	Never experienced malaria	15	6.0
	Total	258	100.0
Source of treatment	Hospital/clinic	128	53.0
	Self-medication	115	47.0
	Total	243	100.0
Type of drug used	ACTs	7	6.1
	Chloroquine	12	10.0
	Amalar (antifoliate)	8	7.0
	Fansidar (antifoliate)	8	7.0
	Artesunate (artemisinin)	39	34.0
	Laridox (antifoliate)	6	5.0
	Paracetamol/panadol	5	4.4
	Local herbs	26	23.0
	Can't remember	4	3.5
	Total	115	100.0

ACT: Artemisinin combination therapy.

One hundred and twenty eight (53%) of the 243 respondents that had ever experienced malaria treated their last episode at the hospital or clinic; the remaining 115 (47%) employed self-medication. Out of the 115 people, 6.1% used ACT-based drugs, 10% took chloroquine, 23% local herbs, 4.4% used paracetamol or panadol while some others 45% used anti-malaria drugs such as antifoliates (19%) and artemisinin (34%) (Table 3). Respondents' levels of education had no significant (P>0.5) association with treatment seeking behavior (χ^2=322.729, P=0.994) and the type of anti-malaria drugs (χ^2=19.368, P=0.932) used by the respondents.

3.4. Malaria symptoms experienced by the respondents

Headache was the most common symptoms (42%) experienced by the respondents during the last malaria

episode whereas cough was the least mentioned symptom (1%). Other noteworthy symptoms stated were high temperature/fever (46%), weakness (26%), pains (19%) and cold/chills (20%). All the 243 respondents that had ever experienced malaria gave multiple responses including at least one of the most common symptoms of the disease (Figure 1).There was no significant (P>0.05) association between the level of education and the symptoms (χ^2=696.120, P=0.732) mentioned by the respondents.

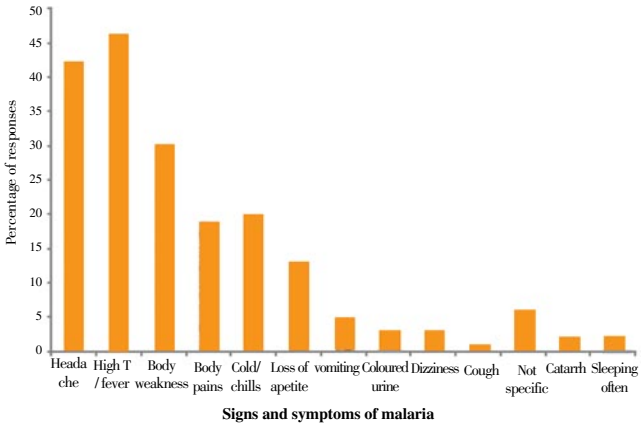


Figure 1. Malaria symptoms experienced by the respondents.

3.5. Frequency of malaria episode occurrence among respondents

The frequency of malaria episode occurrence among the respondents is presented in Table 4. Some of the respondents claimed that it was unpredictable (12%) while many others affirmed usual malaria episode occurrence quarterly (22%), biannually (29%) and yearly (37%).

Table 4

Frequency of malaria episode occurrence.

Variables		*n*	%
Usual frequency of malaria occurrence in the household	Quarterly	58	22
	Biannually	74	29
	Yearly	96	37
	Unpredictable	30	12
Malaria occurrence in the household in the last 3 months	Yes	162	63
	No	96	37
Frequency of respondent's malaria experience in the last 12 months	Once	101	39
	2-4 Times	73	28
	> 4 Times	12	5
	None	57	22
	Never experienced malaria before	15	6

Within the past twelve months before the study, many of the respondents (39%) have had only one malaria episode, 28% had experienced two to four episodes, a few others (5%) indicated over four malaria episode experiences while 22% did not suffer any malaria attack within the period. In the last three months before the study, 63% of the respondents stated that at least one person in their household had experienced malaria episode while the remaining 37% had no malaria episode experience in the household (Table 4). Sex (χ^2=5.900, P=0.207), knowledge of the cause of malaria (χ^2=25.149, P=0.196), level of education (χ^2=22.546, P=0.312) and areas of residence (χ^2=341.681, P=0.643) were insignificantly (P>0.05) associated with the frequency of self-reported malaria episode occurrence among the respondents.

3.6. Source and nature of malaria education messages heard by respondents

Most of the respondents had received various enlightenments on mode of malaria transmission, prevention and treatment from multiple sources. Two hundred and fourty seven (96%) of the 258 respondents have heard at least one message about malaria. Out of these, 31% heard about treatment of malaria, 59% were enlightened as regards prevention, 26% indicated that they were told of how the disease is transmitted, while 4% could not remember the message they heard.

Many of the 247 respondents heard these messages from their radio (43%), TV sets (24%) and school (19%) while some others got their information from health workers (22%) during the city-wide distribution of long-lasting insecticidal nets (Table 5). The levels of education of the respondents did not significantly (P>0.05) determine whether they had heard any malaria education message (χ^2=10.356, P=0.066).

Table 5

Source and nature of malaria education messages heard by respondents.

Variables		*n*	%
Heard any malaria education message?	Yes	247	96
	No	11	4
Source of message	Radio	112	43
	Health workers' visit	56	22
	TV set	63	24
	School	50	19
	Print media	45	17
	Friends/family	29	11
	Church/mosque	6	2
	Can't remember	3	1
Nature of message	Prevention	145	59
	Mode of transmission	64	26
	Treatment	76	31
	Others	7	3
	Can't remember	10	4

Note: Some of the percentage totals do not add up to 100 because of multiple responses.

4. Discussion

This study documents the knowledge, prevention and treatment of malaria among residents in Ilorin, Nigeria. The widespread link of malaria to mosquito bites, knowledge of malaria symptoms and the 72% claim of at least one malaria episode occurrence within the past twelve months before

the study are expected in a malaria endemic environment. This is in consonance with other studies in malaria endemic African localities where majority of the respondents associated mosquitoes with malaria and the majority were also familiar with at least one of the classical malaria symptoms[17-20].

High proportion 179 (69%) of the respondents in this study correctly mentioned the breeding sites of mosquitoes as stagnant water just as above 70% of other study populations did[5,19]. However, the proportion (10%) of respondents who had no idea of the mosquito breeding sites point to the need to ensure that the information is included in the malaria prevention messages disseminated to the people in this city. The information is necessary to sensitize individuals within the locality towards elimination of such stagnant water in order to gain community-wide malaria prevention benefits. The role of bush in aiding the collection of water for mosquitoes to breed should also be stated.

Two percent of the respondents relied on window and/or door nets alone as their malaria preventive measures. In the case of door net, frequent opening of the door during entry and exit of household members limits this barrier method of preventing human-vector contact. Further limitation to these methods exists in the fact that *Anopheles gambiae* s.s which is the major mosquito vector species in Nigeria is endophilic[21]. Likewise, the spreading or burning of plant based mosquito repellent materials such as orange peels by some respondents in this study and in other reports in Africa may also not do much because such materials are used during night hours spent outdoors and do not give protection when people finally retire to bed[2]. In addition, these materials will only be used when readily available and the effect of it may not last. Malaria prevention campaigns should therefore include explanations of the reasons why these other alternatives should not be relied upon. Almost all the respondents (99%) were using at least one mosquito control measure or the other probably because of their widespread knowledge of malaria prevention and link of the mosquitoes with malaria. This is a good position which should be explored and directed towards the use of proven mosquito control methods for maximum health benefits.

The most prominent method of malaria prevention observed among the respondents was the use of long-lasting insecticidal nets. This observation is consistent with reports from other African communities where long-lasting insecticidal nets have been massively distributed to the households in the study areas[22-24]. Most of the long-lasting insecticidal nets users in this study often engaged spraying of aerosol insecticides as alternatives against mosquitoes probably because of the inconveniences associated with long-lasting insecticidal nets use, reduced motivation of the residents to sleep under the nets and/or dissatisfaction with the vector control performance of the tool. This could also be due to rapid result delivered by insecticides spraying. A similar result to this was observed in Oyo, a neighbouring town, where 80% of respondents spray insecticides to prevent mosquitoes and malaria[6]. The use of aerosol insecticides (mostly pyrethroids) in addition to pyrethroid impregnated long-lasting insecticidal nets will increase indoor pyrethroid insecticide pressure thereby accelerating the resistance to this valuable class of insecticide-the only class approved for treating bed nets, in the mosquitoes. There is therefore the urgent need to investigate the susceptibility of the mosquitoes in this area to pyrethroids and other classes of insecticides used for vector control in order to guide forthcoming interventions appropriately. Insecticides spraying in the bedroom also mandate night time outdoor-staying behaviour in the bid to allow the smell and effect of the insecticide to wane. This could lead to the establishment of human-vector contact as observed in the results of other studies in neighbouring Nigerian localities where considerable *Anopheles* mosquito biting activities occur within the first few hours (17.00 p.m.-23.00 p.m.) of the night[25]. In addition, evidences of insecticide-induced mosquito behavioural resistance as seen in other Nigerian localities and beyond[25-29], meaning adaptation of the vectors to bite outdoors early in the night instead of the normal indoor late night, equally puts this study population at greater risks.

According to Griffin *et. al*.[30], the combined use of proven vector control tools (long-lasting insecticidal nets and indoor residual spraying) and effective anti-malarial drugs are not predicted to be sufficient for malaria elimination in the most endemic settings as a small percentage of mosquitoes biting outside could be enough to prevent the transition from very low to zero malaria transmission. Since malaria elimination connotes the permanent reduction of incidence of locally contracted malaria cases to zero[31], implementation of outdoor mosquito control measures will be required to achieve malaria elimination in this locality.

Malaria prevention messages were the most heard among the people. This, in addition to the high level of literacy, may have accounted for the low percentage (2%) of people who believed in hygiene as a means of mosquito control as compared to the 12% of such individuals reported among other population, where 17% of the people were illiterates[2].

The most prominent (43%) source of information in this study area as regards malaria was radio. Higher percentages of respondents with radio as the major source of information have been found among study populations elsewhere in Nigeria[12,32]. The reason is that it can be operated with batteries and easily carried everywhere compared to other sources like television sets which requires electricity supply. Health campaigns should therefore explore this medium the more in order to enable it to reach as many more households as possible.

The number of respondents who claimed never to have experienced any malaria episode (6%) was phenomenal considering that malaria is endemic in this area. These people should be understudied and possibly noted as future vaccine candidates. However, the result of the frequency of malaria occurrence within the past twelve months which showed that 33% of all the respondents have experienced the disease at least 2-4 times and above call for attention. Salihu and Sanni have also reported that 81% of respondents in another part of Kwara State recorded one case of malaria within the reference period of one month[33]. It may be correct to think that the respondents in this malaria endemic locality may have regarded every other fever they experienced as malaria. Yet, the symptoms claimed showed that the illness experienced could have been malaria. The reason for the recurrent malaria episode experienced could be frequent exposure to infective mosquito bites as well as quality of treatment sought or administered.

Fifty three percent of the respondents in this study treated the last malaria episode at the hospital/clinic. Most (84%) of these respondents who visited hospital/clinics were either students with access to school clinic facility or formal workers and their relatives privileged to use the health facility of their work place. Some of the formal workers enjoyed access to treatments in health facilities because of their registration with the National Health Insurance Scheme, an employer and employee contributory health scheme of the Nigerian Government. Extension of such health policies to the non-formal workers may encourage more people to visit hospitals for adequate treatment. Hlongwana *et al*. have also observed that 90% of respondents in a Swaziland community preferred to seek treatment in health facilities because of better quality and accessibility of health facilities[2].

On the other hand, fourty seven percent of the respondents in this study employed self-medication. Other works have shown the predominance of self-treatment in Nigerian localities[34-36]. Most (94%) of the 115 respondents who engaged in self medication used anti-malaria drugs other than ACTs. The use of artemisinin and its derivatives as monotherapies for the treatment of uncomplicated malaria as seen in this study has been discouraged because its partial clearance of malaria parasites promotes resistance to this critically important class of drugs[1]. Widespread drug resistant strains of the malaria parasite could have rendered the anti-malaria drugs ineffective thereby causing the frequency of malaria episode experienced by the respondents. The high price of ACT drugs as compared to other anti-malaria medications may have accounted for the low percentage (6.1%) of people using it among the respondents. Health policy makers should note from the observation of self-medication in spite of high literacy levels recorded here, that campaign against such practice may not yield the desired result except quality healthcare service delivery is made affordable and accessible to the residents.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgements

This investigation received partial funding under the action research grant of the Kwara State University Centre for community development (Phase II).

References

[1] World Health Organization. World Malaria Report 2012. Geneva: World Healthe Organization; 2012. [Online] Available from: http://www.who.int/malaria/publications/world_malaria_report_2012/report/en/. [Accessed on 8th December 2013]

[2] Hlongwana KW, Mabaso MLH, Kunene S, Govender D, Maharaj R. Community knowledge, attitudes and practices (KAP) on malaria in Swaziland: a country earmarked for malaria elimination. *Malar J* 2009; **8**: 29.

[3] Jombo GT, Mbaawuagu EM, Akaa PD, Alao OO, Peters EJ, Utsulo SJ, et al. Sociocultural factors influencing the control of malaria in an endemic city in north central Nigeria. *Int J Biol Med Res* 2010; **1**: 277-282.

[4] Haji KA, Khatib BO, Smith S, Ali AS, Devine GJ, Coetzee M, et al. Challenges for malaria elimination in Zanzibar: pyrethroid resistance in malaria vectors and poor performance of long-lasting insecticide nets. *Parasit Vectors* 2013; **6**: 82.

[5] Muhammad RH, Hamisu BA, Binta BM. Knowledge, attitude and practices on malaria in Kano metropolis. *World J Life Sci Med Res* 2011; **1**(4): 83-87.

[6] Adedotun AA, Morenikeji OA, Odaibo AB. Knowledge, attitudes and practices about malaria in an urban community in south-western Nigeria. *J Vector Borne Dis* 2010; **47**: 155-159.

[7] Singh R, Musa J, Singh S, Ebere UV. Knowledge, attitude and practices on malaria among the rural communities in Aliero, Northern Nigeria. *J Family Med Prim Care* 2014; **3**(1): 39-44.

[8] Adeneye AK, Jegede AS, Mafe MA, Nwokocha EE. Community perceptions and home management of malaria in selected rural communities of Ogun State, Nigeria. *Int J Malar Res Rev* 2013; **1**(3): 22-34.

[9] Houmsou RS, Amuta EU, Wama BE, Hile TD, Bingbeng JB. Occurrence of malaria in children under five years: knowledge, attitudes and perceptions among mothers in a Nigerian semi-urban area. *J Sci Res Rep* 2014; **3**(8): 1127-1134.

[10] Akaba GO, Otubu JA, Agida ET, Onafowokan O. Knowledge and utilization of malaria preventive measures among pregnant

women at a tertiary hospital in Nigeria's federal capital territory. *Niger J Clin Pract* 2013; **16**: 201-206.

[11] Adegun JA, Adegboyega JA, Awosusi AO. Knowledge and the preventive strategies of malaria among migrant farmers in Ado-Ekiti Local Government Area of Ekiti State, Nigeria. *Am J Sci Ind Res* 2011; **2**(6): 883-889.

[12] Okwa OO, Soremekun BM, Adeseko O, Raheem AM. Artisans and traders' knowledge, attitude and practices of malaria in selected areas of Lagos, Nigeria. *Global Adv Res J Med Med Sci* 2012; **1**(3): 68-74.

[13] Ajibade LT, Fatoba PO, Raheem UA, Odunuga BA. Ethnomedicine and primary healthcare in Ilorin, Nigeria. *Indian J Tradit Knowledge* 2005; **4**(2): 150-158.

[14] National Population Commission. *2006 Population and housing census of the federal republic of nigeria: national and state population and housing tables: priority tables*. Vol 1. Abuja: National Population Commission; 2009.

[15] Olawepo RA, Obayelu HI. Predicting cohort fertility in a traditional urban centre: an example from Ilorin, Nigeria. *Int J Humanit Soc Sci* 2012; **2**(8): 34-42.

[16] Obembe A, Anyaele OO, Oduola AO. Lessons from the implementation of LLIN distribution campaign in Ilorin Kwara State, Nigeria. *BMC Public Health* 2014; **14**: 514.

[17] Kinung'hi SM, Mashauri F, Mwanga JR, Nnko SE, Kaatano GM, Malima R, et al. Knowledge, attitudes and practices about malaria among communities: comparing epidemic and non-epidemic prone communities of Muleba district, North-western Tanzania. *BMC Public Health* 2010; **10**: 395.

[18] Appiah-Darkwah I, Badu-Nyarko SK. Knowledge of malaria prevention and control in a sub-urban community in Accra, Ghana. *Int J Trop Med* 2011; **6**(3): 61-69.

[19] Aderaw Z, Gedefaw M. Knowledge, attitude and practice of the community towards malaria prevention and control options in anti-malaria association intervention zones of Amahara national regional state, Ethiopia. *J Trop Dis* 2013; **1**: 118.

[20] Opare JKL, Antobre-Boateng A, Afari E, Wurapa F, Abankwah J, Kyeiwa-Asante D, et al. Community knowledge and perceptions on malaria and its prevention and control in the Akwapim north municipality, Ghana. *Int J Trop Dis Health* 2014; **4**(1): 82-93.

[21] Awolola TS, Brooke BD, Hunt RH, Coetzee M. Resistance of the malaria vector *Anopheles gambiae* s.s. to pyrethroid insecticides in Nigeria. *Ann Trop Med Parasitol* 2002; **96**: 849-852.

[22] Legesse Y, Tegegn A, Belachew T, Tushune K. Knowledge, attitude and practice about malaria transmission and its preventive measures among households in urban areas of Assosa zone, western Ethiopia. *Ethiop J Health Dev* 2007; **21**(2): 157-165.

[23] Mazigo HD, Obasy E, Mauka W, Manyiri P, Zinga M, Kweka EJ, et al. Knowledge, attitudes and practices about malaria and its control in rural northwest Tanzania. *Malar Res Treat* 2010; doi: 10.4061/2010/794261.

[24] Abate A, Degarege A, Erko B. Community knowledge, attitude and practice about malaria in a low endemic setting of Shewa Robit Town, northeastern Ethiopia. *BMC Public Health* 2013; **13**: 312.

[25] Oyewole IO, Awolola TS. Impact of urbanization on bionomics and distribution of malaria vectors in Lagos, southwestern Nigeria. *J Vector Borne Dis* 2006; **43**: 173-178.

[26] Moiroux N, Gomez MB, Pennetier C, Elanga E, Djènontin A, Chandre F, et al. Changes in *Anopheles funestus* biting behavior following universal coverage of long-lasting insecticidal nets in Benin. *J Infect Dis* 2012; **206**: 1622-1629.

[27] Yohannes M, Boelee E. Early biting rhythm in the afro-tropical vector of malaria, *Anopheles arabiensis*, and challenges for its control in Ethiopia. *Med Vet Entomol* 2012; **26**: 103-105.

[28] Govella NJ, Ferguson H. Why use of interventions targeting outdoor biting mosquitoes will be necessary to achieve malaria elimination. *Front Physiol* 2012; **3**: 199.

[29] Russell TL, Govella NJ, Azizii S, Drakeley CJ, Kachur SP, Killeen GF. Increased proportions of outdoor feeding among residual malaria vector populations following increased use of insecticide-treated nets in rural Tanzania. *Malar J* 2011; **10**: 80.

[30] Griffin JT, Hollingsworth TD, Okell LC, Churcher TS, White M, Hinsley W, et al. Reducing *Plasmodium falciparum* malaria transmission in Africa: a model-based evaluation of intervention strategies. *PLoS Med* 2010; doi: 10.1371/journal.pmed.1000324.

[31] Roll Back Malaria Partnership. The global malaria action plan for a malaria-free world. Geneva: Roll Back Malaria Partnership; 2008. [Online] Available from: http://www.rollbackmalaria.org/gmap/toc.pdf [Accessed on 8th December, 2013]

[32] Amaechi EC, Ukpai OM. Knowledge, attitude and practices about malaria among mothers and care-givers in Aba South Local Government Area, Abia state, Nigeria. *Anim Res Int* 2013; **10**(3): 1786-1791.

[33] Salihu OM, Sanni NA. Malaria burden and the effectiveness of malaria control measures in Nigeria: a case study of Asa Local Government Area of Kwara State. *J Econ Sustain Dev* 2013; **4**: 295-308.

[34] Iwueze MO, Ezugbo-Nwobi IK, Umeanaeto PU, Egbuche CM, Anaso CI. Knowledge, attitude and management practices on malaria: a case study of Amansea, Awka North Local Government Area of Anambra State, Nigeria. *Biosci J* 2013; **1**(1): 32-38.

[35] Balogun ST, Jibrin J, Tahir R, Bassi PU, Balogun FA, Fehintola FA. Perceptions of artemisinin-based combination therapies among Nigerian women seven years after adoption as first line drugs. *Am J Res Commun*. 2013 [cited 2014 Jan 8]; [about 20 p.]. Available from: http://www.usa-journals.com/wp-content/uploads/2012/11/Balogun.pdf

[36] Jombo GTA, Araoye MA, Damen JG. Malaria self medications and choices of drugs for its treatment among residents of a malaria endemic community in West Africa. *Asian Pac J Trop Dis* 2011; **1**(1): 10-16.