ISSN:
Print - 2277 - 0593
Online - 2315 - 7461

Journal of Natural Science, Engineering and Technology

IMPACT OF ENLIGHTENMENT AND MONITORING ON THE USE OF LONG LASTING INSECTICIDE NETS FOR MALARIA PREVENTION AMONG CHILDREN UNDER FIVE YEARS IN A RURAL COMMUNITY IN AB-EOKUTA, NIGERIA

***[1]O.A IDOWU, [1]SAMUEL OGUNDEYI, [1]S.O SAM-WOBO AND [2]E. FABUSORO**

[1]Department of Biological Sciences, Federal University of Agriculture, Abeokuta
[2]Department of Agricultural Extension and Rural Development, Abeokuta, Nigeria.
***Corresponding author:** tomiwo2@gmail.com **Tel:** +2348033349340

ABSTRACT

The female Anopheles mosquito is the vector for human malaria and bites man mostly from 5pm to 7am, with maximum intensity between 10pm and 4am. This provides the basis for the use of Long Lasting Insecticide Nets (LLIN). A study to assess the impact of enlightenment, advocacy and monitoring on LLIN use for children under five years was conducted in Olugbo. A total of two hundred (200) children under five years were recruited into the study. Ethical clearance was received from the Ogun State Ministry of Health. Pre-tested questionnaires were administered to the respondents and blood samples were collected for malaria test before and after provision(Pre and Post intervention) of LLIN. The blood samples were analyzed at the laboratory using the QBC Malaria Test and ParaLens system. The subjects were divided into two groups of study (group that received LLIN, enlightenment on the importance of LLIN and assisted with LLIN hanging) and Control (group that merely received the LLIN without enlightenment or assistance). The subjects in the study group were monitored between 1600hrs to 2000hrs thrice a week. The pre intervention study result shows that the prevalence of malaria infection was 70% and 56% amongst the study and Control group respectively. The post intervention blood samples screening reveals that the prevalence of infection in the study group was 13% with low parasite density. In the Control group, however, the prevalence of infection was 60% and 38.33% of those infected had high parasite density. There is a significant difference ($P<0.05$) in malaria parasitaemia between both groups post intervention. This study shows that distribution of LLINs alone is not sufficient to reduce malaria morbidity and recommends that enlightenment and assistance with hanging of LLINs should form an integral part of mass distribution of LLINs by government and donor agencies.

Keywords: Malaria, LLIN, children <5, Enlightenment

INTRODUCTION

Human malaria is an infectious disease caused by a one-cell parasite of the genus *Plasmodium*, transmitted from person to person mainly through the feeding site of a female Anopheles mosquito, which requires blood meal to nurture its eggs (WHO, 1997). Malaria is one of the commonest cause of death in children and people of the reproductive age in Sub-Saharan Africa (Spector, 2002). The female Anopheline mosquito is the vector for human malaria biting mostly

from 17.00 to 7.00 hours, with maximum biting intensity between 22.00 and 4.00 hours (Afari *et. al*. 1995). This feeding behavior provides the basis for the use of Long Lasting Insecticide Nets (LLINs) when asleep. The LLIN is known to repel, disable or kill mosquitoes coming into contact with insecticide on the netting material. Randomized trials have demonstrated that LLINs are effective in preventing malaria morbidity and mortality (Afari *et. al*. 1995; Jonathon *et.al*., 2002 and Snow and Marsh, 2010).

In Nigeria, malaria is a major cause of morbidity and mortality. The disease is endemic throughout the country with seasonal variation in different zones of the country. At least 50% of the population suffers from at least one episode of malaria each year. The disease is the most common cause of outpatient clinic attendance across all age groups (FMoH, 2001). The results of the most comprehensive study on the malaria situation in Nigeria conducted across the six geographical zones have signified the public health importance of malaria, especially among risk groups. A survey conducted in Abeokuta, Nigeria reported a 75% awareness of the importance of insecticide treated nets (ITNs), 34% ITN possession and 26.6% ITN usage for the prevention of malaria among children under five years of age (Idowu *et. al*., 2011). Reasons for low level of net usage were associated with heat and problems with knowing how to hang the net. Based on these findings, this study was designed to assess the impact of enlightenment and provision of hanging assistance on LLIN usage and its effect on the prevalence of malaria among children under five.

MATERIALS AND METHODS

Study Area

The study was carried out in Olugbo, a rural community in Ogun State, Nigeria. The community consists of fifteen adjoining rural villages, Obosokoto, Idi-Obi, Eleta, Aralamo, Akide, Yakoyo, Ogbosonde, Olugbo, Alagbayun, Ilafi, Iyanbu, Koku, Gbagura, Aariku, and Idi omo villages. The inhabitants are mainly farmers and traders.

Ethical Consideration

Ethical clearance was obtained from the Ministry of Health Oke – Ilewo, Abeokuta, Ogun-State. Permission was obtained from the village head and informed consent was obtained from the parents/guardians of the children under five before being enrolled into the study.

Study Design

A total of two hundred (200) children aged 0 –59 months were enrolled into the study. The enrolled children were in two groups: the Study group (group that received LLINs, enlightenment on the importance of LLINs, and assistance with LLIN hanging) and the Control group (group that merely received the LLINs without enlightenment or hanging assistance). Both groups were assessed for malaria before provision of the LLINs (Pre-intervention) and at the peak of the following malaria transmission season 4 months after LLIN provision (Post-intervention).

There was a mass mobilization for children in the communities used and systematic sampling method was used for enrollment of children into the study.

Pre Intervention and Questionnaire Administration

Pre-tested questionnaires were also administered to the parents/guardians of all the en-

rolled children in both groups. The questions were interpreted in the local language (Yoruba) to facilitate proper communication between the interviewer and the respondents. The questionnaires were aimed at assessing the respondents' knowledge, attitude and practice of malaria control prevention and treatment. The questionnaire also assessed LLIN awareness status, ownership and usage by parents/guardians for their children under five in the community and also to determine factors limiting the use of LLIN among the sample population.
Whole blood samples were collected from the subjects for malaria testing, and all malaria positive subjects were treated with Artemisin combination Therapy (ACT) for children under five years. LLINs were later distributed to the subjects and their home addresses collected to ensure a follow-up.

The Intervention

The intervention included free distribution of the LLINs to both Study and Control groups, while assistance with the hanging of the nets, enlightenment on the proper use of the LLIN and regular monitoring at night to encourage the use of the nets were only provided to the Study group.

Sample Collection

Blood samples were collected from the subjects by venipuncture, with the assistance of a pediatrician. The blood samples were stored in tubes containing EDTA anticoagulant and preserved on an ice-pack in a cold box and taken to the laboratory for parasitological analysis.

Parasitological Analysis

The blood samples were screened for *Plasmodium* species using the QBC Malaria Test and Para Lens microscopy system in the Parasitology Laboratory, Department of Biological Sciences University of Agriculture, Abeokuta, Ogun State. Samples were prepared according to the manufacturer's instructions. The presence of a sharp fluorescence green spot indicated positive parasitaemia. The following grading was used to quantitate parasitemia:

+ - 1 parasite per QBC field (Low density infection)
++ - 1– 10 parasite per QBC field (low density infection)
+++ - 11- 100 parasite per QBC field (High density infection

Post Intervention

A post intervention malaria screening was conducted at the peak of the following malaria transmission season (4 months after the intervention) to assess the impact of intervention.

Statistical analysis

The malaria test data obtained were analyzed with the information supplied on the questionnaires using chi-square analysis at 5% alpha level. The impact of education and monitoring on malaria parasitaemia between both groups were also analyzed using chi square (χ^2) analysis

RESULTS

The population enrolled consisted of 110 (55.0%) males and 90(45.0%) females. The pre intervention screening of the Study group recorded a prevalence of 70.0%, while the post intervention screening of the Study group showed a sharp, significant decline in malaria prevalence (13.0%; $P<0.05$). Data for the Control group, however, showed no statistically significant change in malaria prevalence (56.0% to 60%; $P=0.776$) for pre intervention and post intervention, respectively (Table 1).

Table 1: Prevalence of malaria among the Study and Control Groups Pre and Post LLIN Intervention

Groups	Malaria positive	Malaria negative	Total examined	p value
Study Group				
Pre intervention	70(70.0)	30(30.0)	100	
Post intervention	13(13.0)	87(87.0)	100	
Total	83(41.5)	117(58.5)	200	P=0.001
Control Group				
Pre intervention	56(56.0)	44(44.0)	100	
Post intervention	60(60.0)	40(40.0)	100	
Total	116(58.0)	84(42.0)	200	P=0.776

Quantification of pre intervention infection density in the Study group shows that 32 (45.7%) malaria positive subjects had high parasite density(HPD) and 38(54.29%) had low parasite density(LPD) . However, post intervention screening shows that all malaria positive subjects (13; 100.0%) in the Study group had low parasite density. Statistical analysis shows that there is a significant difference (P<0.05) in malaria parasite density in the Study group pre and post intervention. The pre intervention testing of density of malaria infection in the Control group shows that 14(25.0%) malaria positive subjects had high parasite density and 42 (75.0%) had low parasite density. The post intervention screening shows that 23(38.3%) malaria positive subjects had high parasite density and 37(61.67%) had low parasite density. There was no significant difference (P>0.05) between malaria parasite density in the Control group pre and post intervention (Table 2).

Table 2: Malaria parasite density among infected children in the Study and Control Groups (pre and post intervention)

Population			Malaria Positive			Malaria Negative
Group	Number Examined	Intervention Period	HPD N(%)	LPD N(%)	Total N(%)	Total N(%)
Study	100	Pre-intervention	32(45.7)	38(54.3)	70(70.0)	30(30.0)
	100	Post-Intervention	0(0)	13(100)	13(13.0)	87(87.0)
Control	100	Pre-intervention	14(25.0)	42(75.0)	56(56.0)	44(44.0)
	100	Post-Intervention	23(38.3)	37(61.7)	60(60.0)	40(40.0)

HPD- High Parasite Density; LPD-Low Parasite Density.

Awareness of importance of LLIN

A total of 42(21.0%) of the respondents at the pre intervention survey were aware of the importance of LLINs. The post intervention awareness increased to 122(61.0%), with the Study group constituting 100 (81.97%) respondents. A total of 5(2.5%) of the respondents owned at least one bed net prior to the intervention, as determined from direct observations of households (HH) bed net status. A close assessment done on the bed nets owned revealed that 2 (40.0%) respondents owned retreat able bed nets and 3(60.0%) owned baby nets that were untreated with any insecticide. None of the bed nets owned prior to intervention were Long Lasting Insecticide Nets (LLIN). At the post intervention assessment it was determined that all the respondents owned a LLIN as a result of the intervention.

Pre intervention assessment done on the subject groups to determine reasons for non-ownership of a LLIN identified the following explanations: lack of information (38.98%); high cost of LLINs (7.18%); and expectations that the government would distribute and provide free LLINs, therefore, no other means were attempted to acquire a LLIN (31.80%). During the pre-intervention survey, all respondents (200; 100.0%) expressed willingness to use the LLIN, if given freely, and each promised to have their child under five years sleep under the LLIN. The pre intervention usage level shows that no child under five was sleeping under a LLIN in these communities. However, at the post intervention assessment, 112(56.0%) of the children under five years slept under the LLIN, with the Study group constituting of 81.97% (100) of the total percentage of LLIN users. This indicates a 100% and 12% usage of LLIN in the Study and Control groups, respectively.

Table 3: Showing the awareness, ownership and usage of LLINs by parents/ guardians for their children under 5 years

Variables	Frequency (%)			
	Pre intervention	Post intervention		
		Study Group	Control Group	Total
Awareness of an LLIN				
Yes	42 (21.0)	100(100)	100(100)	200(100.0)
No	158 (79.0)	0(0)	0(0)	0(0)
Ownership of an LLIN				
Yes	0(0.0)	100(100)	100(100)	200(100.0)
No	200 (100.0)	0(0)	0(0.0)	0(0)
Usage of LLIN				
Yes	0 (0.0)	100(100)	12(12)	112(56.0)
No	200(0.0)	0(0)	88(88)	88(44.0)

Parents/guardians in the Study group admitted to the fact that the use of LLIN reduced the frequency of fever in their children and therefore registered willingness to purchase another net if the ones provided wears out. Focal Group Discussion held with participants in the Study group revealed that, apart from killing mosquitoes, the LLIN also kills other insects such as houseflies and cockroaches, which may cause other health problems to the children in the community.

DISCUSSION

Long Lasting Insecticide Nets (LLIN) utilization for children under five years of age living in malaria endemic area is a recommended intervention for malaria control. Increasing the coverage of LLINs in itself is not adequate. Previous studies have indicated a low level of LLIN coverage and use in malaria endemic regions of the world (D'Alessandro *et al*., 1994). People within malaria endemic areas must be educated on the correct use of LLINs and be constantly monitored to encourage continuous usage if an impact on malaria morbidity are to be made.

This investigation of the impact of enlightenment and monitoring on malaria infection for children under five whose parents/guardians were provided and assisted with LLIN hanging (Study group) versus those whose parents were merely given the nets (Control group) showed a drastic reduction in malaria infection and parasite density among the Study group; This conforms to a report that ITN use reduces malaria mortality by 20% in Africa (Noor *et. al*., 2009). The intensity of malaria infection was also monitored in both groups (Study and Control groups) and data showed a decrease in parasite density in pre intervention versus. post intervention malaria positive subjects in the Study group. However, no significant decrease in parasite density was detected in the Control group pre and post intervention malaria positive subjects. These results further emphasize the importance of enlightenment and provision of hanging assistance to parents/guardians on the use of Long Lasting Insecticide Nets.

The pre intervention awareness of the importance of Long Lasting Insecticide Nets amongst the respondents was generally low, 21.0% despite the mass net campaign in Nigeria (Onwujekwe *et al.,* 2007). However, the introduction of LLINs to the parents/guardians of children under five years as well as enlightenment of the Study Group increased respondent awareness on LLINs from 21.0% to 61.0%. The low level of ownership and the high level of reliance on the government to provide LLINs is an indication of the level of poverty among the respondents who are mainly subsistence farmers. All respondents expressed willingness to use the net if given freely, which is similar to a study conducted (Idowu *et al.,* 2008 and DHS, 2009) which reported willingness of the respondents to own an ITN if made available by the government. This willingness to use LLINs did not translate to automatic use; data show that only 12% of the Control group respondents used the nets even when provided free. These results emphasize the fact that there is still a major gap between net possession and usage as also reported in an earlier study(Idowu *et al.,*2011*)*. The provision of hanging assistance to parents/guardians of children under five and monitoring of use in this study are identified as important measures to bridge the gap between net possession and high (100% in this study) usage among parents/guardians of children under 5 years of age.

These findings on the usage of LLINs show that none of the respondents were using a LLIN pre intervention. This is also similar to a study (Idowu *et al.,* 2007) on knowledge, attitude and practices of pregnant women in Abeokuta, which reported that only 0.2% of the respondents were using an ITNs. The findings in the present investigation indicate that most people within the study area who are directly responsible for the well being of children under five years old are not aware of the importance of LLINs in malaria control, which has a great implication on disease morbidity(Osero *et. al.,*2005). However, this study reveals that the enlightenment and the subsequent personal experience of the respondents in the Study group has greatly improved their perception of LLINs and that enlightenment and continuous monitoring are an important intervention for malaria control. This efficacy in enlightenment and monitoring is also observed in the Study Group respondents' willingness to purchase another LLIN if the net given to them gets mutilated.

This study, therefore, recommends that enlightenment, assistance with hanging of LLIN and continuous monitoring should form an integral part of mass distribution of LLIN by government (FMoH, 2009) and donor agencies.

ACKNOWLEGEMENT

The QBC ParaLens and QBC Malaria Test used for this study were provided by QBC Diagnostics, Port Matilda, Pennsylvania, U.S.A.

REFERENCES

Afari, E.A., Appawu, A., Dunyo, S., Baffoe-Wilmot, A., Nkrumah, F.K. 1995; Malaria infection, morbidity and transmission in two ecological zones in Southern Ghana. *Africa Journal of Health* Science. **2**: 315 -318

D'Alessandro, U., Aikins, M.K., Langerock, P. B., Greenwood, B.M 1994. Nationwide survey of bed net use in rural Gambia. *Bulletin of World Health Organization* **72** (3): 391-394

FMOH (Federal Ministry of Health), Nigeria. Annual Report 2001.

Federal Ministry of Health (FMoH) and National Malaria Control Programme: Nigeria strategic plan 2009- 2013.

Idowu, O. A., Mafiana, C., Luwoye, I., Adehanloye, O. 2007. Perceptions and home management practices of malaria in some rural communities in Abeokuta, Nigeria. *Travel Medicine and Infectious Disease, Volume 6, Issue 4*, Pp 210-214.

Idowu ,O.A., Mafiana, C., Sotiloye, D 2008. Traditional birth home attendance and its Implications for malaria control during pregnancy in Nigeria. *Transactions of the Royal Society and Tropical Medicine and Hygiene* 102: 679-684.

Idowu O.A, Sam-Wobo S.O, Oluwole A S, Adediran A.S 2011. Awareness, possession and use of Insecticide Treated Nets (ITNs) for prevention of malaria in children under five in Abeokuta, *Journal of Paediatrics and Child Health* 47:117-121

Jonathon L. S, Bruce A. L, Alexander Z, Sydney R; 2002.How will the reduction of tariffs and taxes on insecticide treated bed nets affect household purchases?*Bulletin of the World Health Organization* 80 (11):892

DHS: ***Nigeria Demographic and Health Survey*****. Calverton**: MEASURE DHS; 2009.

Noor A, Mutheu, JJ., Tatem, A.J., Hay, S.I., Snow, R.W. Insecticide-treated net coverage in Africa: mapping progress in 2000-07. *Lancet* 2009, 373:58-67

Onwujekwe, O.E., Chima R, Shu E, Nwagbo, D., Okonkwo, P. 2007. Hypothetical and actual willingness to pay for insecticide treated nets in five Nigerian communities. Tropical Medicine and International Health 6(7): 545- 553.

Osero J.S., Otieno, M.F., Orago A.S. 2005. Maternal use of insecticide treated net in the prevention of malaria among children under five years in Nyamira district, Kenya; *East African Medical Journal*; 82(10):495-500

Snow, R.W., Marsh, K. Malaria in Africa. Progress and prospects in the decade since the Abuja Declaration. *Lancet* 2010;376:137-9.

Spector W.G. 2002. *An Introduction to General Pathology.* 3rd ed. Churchill Livingstones, Harcourt Brace and Company Ltd. pp.225.

World Health Organization. 1997. Division of control of Tropical disease. WHO Pesticide Evaluation Scheme methods for the control of vectors and pest of public health importance.

(Manuscript received: 13th February, 2014; accepted: 28th August, 2014).