



ELSEVIER

<http://www.elsevier.com/locate/jiph>

# Perception and affordability of long-lasting insecticide-treated nets among pregnant women and mothers of children under five years in Ogun State, Nigeria

Adeniyi K. Adeneye<sup>a,b,\*</sup>, Ayodele S. Jegede<sup>b</sup>,  
Ezebunwa E. Nwokocha<sup>b</sup>, Margaret A. Mafe<sup>a</sup>

<sup>a</sup> Public Health Division, Nigerian Institute of Medical Research, 6 Edmond Crescent, P.M.B. 2013, Yaba, Lagos, Nigeria

<sup>b</sup> Department of Sociology, Faculty of the Social Sciences, University of Ibadan, Ibadan, Nigeria

Received 2 January 2014; received in revised form 27 March 2014; accepted 11 July 2014

## KEYWORDS

Perception;  
Use;  
Affordability;  
LLINs;  
Nigeria

**Summary** Despite the distribution of long-lasting insecticide-treated nets (LLINs) in Nigeria, access to and use of LLINs continues to be minimal. Little is also known about the perceived fair price people are willing to pay for LLINs in Ogun State, South-West Nigeria. Data were collected using semi-structured questionnaire among pregnant women attending antenatal clinics and mothers of under-five children in randomly-selected malaria holo-endemic communities of Ijebu North and Yewa North local government areas of Ogun State. Results showed that only 23.6% of 495 respondents owned and were using LLINs. One of the main reasons for non-use of LLINs was unaffordability of LLIN cost. 84.2% of the 495 respondents were willing to pay at a hypothetical price of ₦800.00 (US\$5.00) for a LLIN, 15.6% were unwilling and 0.2% was indifferent to buying it at the price. Their willingness

\* Corresponding author at: Public Health Division, Nigerian Institute of Medical Research, 6 Edmond Crescent, P.M.B. 2013, Yaba, Lagos, Nigeria. Tel.: +234 805 788 7698/816 945 3782.

E-mail address: [oakadeneye@yahoo.co.uk](mailto:oakadeneye@yahoo.co.uk) (A.K. Adeneye).

<http://dx.doi.org/10.1016/j.jiph.2014.07.008>

1876-0341/© 2014 Published by Elsevier Limited on behalf of King Saud Bin Abdulaziz University for Health Sciences. All rights reserved.

Please cite this article in press as: Adeneye AK, et al. Perception and affordability of long-lasting insecticide-treated nets among pregnant women and mothers of children under five years in Ogun State, Nigeria. J Infect Public Health (2014), <http://dx.doi.org/10.1016/j.jiph.2014.07.008>

to pay was significantly determined by education and occupation ( $p=0.00$ ). Health education strategies need to be developed to increase awareness and demand for LLINs. However, there is the need to take into account preferred access outlets and the diversity in willingness to pay for LLINs if equity to access is to be ensured in the study communities.

© 2014 Published by Elsevier Limited on behalf of King Saud Bin Abdulaziz University for Health Sciences. All rights reserved.

## Introduction

Malaria remains a major public health and development challenge globally, particularly in Nigeria [1,2]. Pregnant women and their unborn babies as well as children under five years of age are among the groups most vulnerable to malaria. Between 25 and 30 million women become pregnant annually in areas of Africa where malaria is endemic [3,4], and approximately 100 million episodes of malaria occur worldwide each year among children under five years of age. Thus, over one million deaths per year are attributable to the disease. Furthermore, with 60% of outpatient visits, 30% of hospitalizations and 20–25% of infant and child deaths attributable to malaria, an estimated 300,000 children die of malaria each year [5,6].

In Nigeria, malaria is holoendemic. It is estimated that approximately 97% of the more than 150 million Nigerian people are at risk of malaria [7]. The maternal mortality rate is 630 deaths per 100,000 live births, and the mortality rate for children under five is 143 deaths per 1000 live births [8]. Malaria causes up to 11% of maternal mortality and is consistently recorded as one of the five leading causes of mortality among children under five years. In addition to the direct health impact of malaria, its severe socio-economic burden on the country at large is estimated as an annual loss of approximately 132 billion naira due to treatment costs, prevention, and loss of work time [7].

Studies have shown that adequate malaria control could prevent 3–8% of infant deaths [3,9]. The use of long-lasting insecticide-treated nets (LLINs) has been shown to reduce the number of malaria episodes by as much as 50%, to reduce childhood mortality by 20% [10] and to provide protection for pregnant women, who are the most susceptible to malaria [11]. Epidemiological evidence, arising mainly from studies in the countries of Sub-Saharan Africa, suggests that sleeping under LLINs is a cost-effective and efficacious method of controlling malaria. For this reason, promotion of LLIN use has become a key malaria control strategy [12].

Widespread coverage of vulnerable populations, including pregnant women and children under five

years of age, with LLINs constitutes an important component of the strategy to control malaria. The targets of the 2000 Abuja Summit on Roll Back Malaria (RBM) call for 60% and 80% coverage of both pregnant women and children under five years of age by 2005 and 2010, respectively [13].

A major ongoing effort of roll back malaria (RBM), in line with the National Malaria Strategic Plan (NMSP) in Nigeria, has had the aim of scaling-up malaria prevention and treatment interventions to a universal scale [7,14]. Due to the 2000 Abuja Summit on RBM, the intervention policies and strategies based on the World Health Organization (WHO) recommendation for free distribution of LLINs were adopted in the country in 2001 [15], and the government has been proactive in promoting them [1,16]. These policies are being implemented nationwide, particularly in Ogun State, through the provision of LLINs and intermittent preventive treatment of malaria in pregnancy (IPTp) to pregnant women in attendance at antenatal clinics and through provision of LLINs to children under five years of age upon completion of immunizations [7,16,17].

The RBM 'Strategic Framework for Coordinated National Action in Scaling-up Insecticide-Treated Netting Programmes in Africa' promotes coordinated national action and advocates for sustained public provision of targeted subsidies to maximize the public health benefits of treated nets and for support and stimulation of the private sector [18]. Since its inception in 2002, the Global Fund has been the leading international donor for malaria control alongside the United States' President's Malaria Initiative. Programs supported by the Global Fund have made an increasingly significant contribution to international aims such as those of RBM and the MDG. Through its network of partners and recipients, the Global Fund has supported malaria programs in 97 countries, including Nigeria. A total of 8.8 billion U.S. dollars in funding has been approved since 2002, with approximately 70% of that money for countries in Sub-Saharan Africa, including Nigeria. More than 310 million long-lasting insecticide-treated nets have been distributed by programs supported by the Global Fund [19].

However, despite the free distribution of LLINs in the country, which is both in line with the NMSP [7,14] and central to the RBM and Millennium Development Goals (MDG) objectives, access to and use of LLINs continues to be minimal [6,20,21]. The main limitation of LLIN implementation has been the inability of people to afford them rather than a lack of knowledge [11,22]. Entirely free programs are unsustainable due to a lack of government funds and the limited duration of donor support which sustains such programs. Hence, methods of mobilizing communities to pay for LLINs need to be pursued [23]. However, little is known about people's level of willingness to pay for LLINs or about their knowledge, perception and acceptance of the treated materials in Ogun State, Nigeria. Although this novel approach of malaria control is attracting enormous attention and being promoted in the country's RBM program, there is presently very little study-based evidence on the usage and social marketing of LLINs to support their extensive use in the context of rolling back malaria in communities of the state.

The focus of this paper is to report a sub-study on the perception and affordability of LLINs. This sub-study is part of a larger study that examined the knowledge, attitudes, and practices related to the malaria control program within the context of RBM among pregnant women and mothers of children under five years of age in selected communities of Ogun State, Nigeria.

## Methods

### Study area

The study was carried out in two randomly selected semi-urban local government areas (LGAs) of Ogun State located in the rain forest zone of southwestern Nigeria where malaria is holoendemic year round and the RBM program is being implemented. The LGAs are named Ijebu North and Yewa North, which are two of twenty LGAs in Ogun State. The Ijebu North and Yewa North LGAs are located 140 km northeast and 170 km north of Lagos in the rain forest zone of southwestern Nigeria. Two communities (Oru/Awa-Ilaporu and Mamu) in the Ijebu North LGA and two communities (Igbogila and Ijoun) in the Yewa North LGA were randomly selected for the study. The first study stage involved the random selection of these two LGAs from the 20 LGAs in Ogun State using a simple random sampling technique. Adopting the balloting approach, the names of the LGAs were written on pieces of paper, grouped into threes according to the

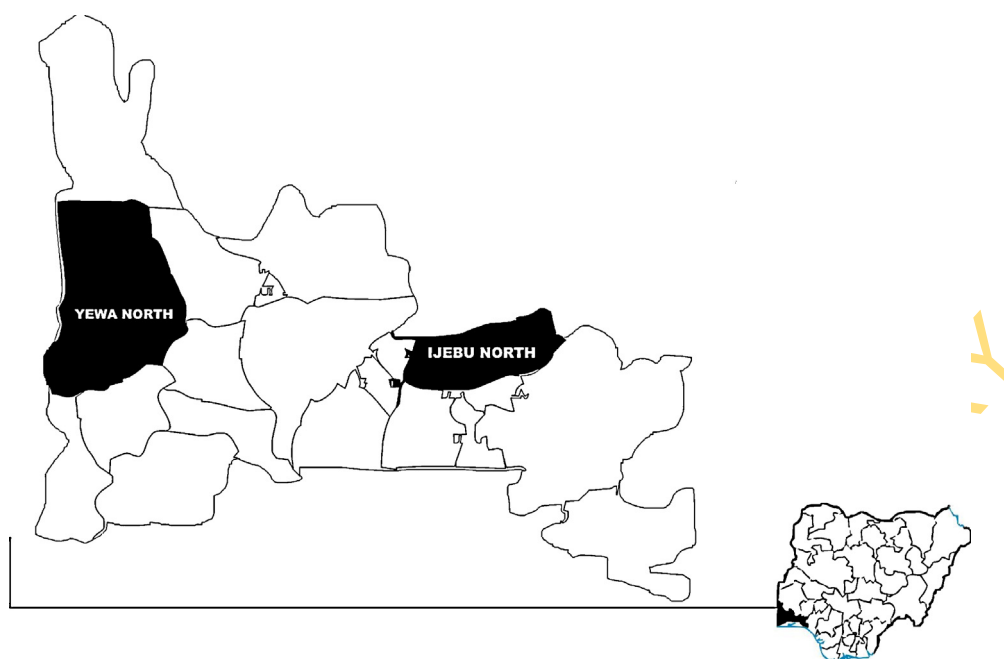
geo-political zone to which they belong, placed into three containers representing the three geo-political zones in the state, and shuffled, and one LGA was subsequently picked from two containers that were randomly selected from the three container choices. The second stage involved the selection of two communities in each of the LGAs, which was performed using the previously explained balloting approach without replacement. Here, the LGAs were used as the study units. The inhabitants of the two LGAs are predominantly farmers and traders, and there is a high transmission of malaria during the rainy season between April and November [24–26]. The location of the two study LGAs in Ogun State is displayed in Fig. 1.

Basic social amenities, such as roads, water, health facilities and educational institutions, are abundant in the selected LGAs. The health programs in each LGA are planned and managed by the Primary Health Care Department at the LGA headquarters. The health facilities found in the Ijebu North LGA include a General Hospital, 4 Primary Healthcare Centers (PHCs), 2 health clinics, 3 health posts and 23 private clinics. The Yewa North LGA also has a General Hospital, 2 PHCs, 1 rural health center, 7 health posts, 22 private clinics and an alternative health clinic [25,27,28].

### Study design

This is a cross-sectional study on the awareness, perception, use and affordability of LLINs in the context of the RBM program in the Ijebu North and Yewa North LGAs of Ogun State. The target populations for the study were pregnant women and mothers of children under five years of age. A total of 495 participants, composed of 233 mothers of children under five years of age and 262 pregnant women attending antenatal clinics, were interviewed during the household and clinic survey, respectively, in the selected communities.

Mothers of children under five years of age were selected using a multi-stage sampling process with a combination of simple random and systematic sampling [29]. For the clinic survey, the sampling frame for the selection of study units was a list of pregnant women registered for antenatal care at the selected health facilities. A two-stage selection procedure was used to select the pregnant women. The first stage randomly selected both public and private health facilities proportionally from the lists of health facilities in each LGA. In the second stage, a systematic sampling technique was used to select every  $n$ th registered pregnant woman from the antenatal registers at each of the health facilities visited on antenatal clinic days until the



**Figure 1** Ogun State map showing the study LGAs.

Source: Adeneye et al. [42].

required number of subjects was attained. The selected women were interviewed upon exiting the clinic. The names of those interviewed upon clinic exit were noted on each visit to the selected health facilities to avoid duplication of respondents. The lists of names were subsequently destroyed after data collection for confidentiality.

### Data collection procedures

The study involved clinic and household surveys. The data collection process first involved a foundational qualitative study of peoples' perceptions, beliefs and practices concerning malaria prevention and treatment, which was carried out in focus group discussions (FGDs). The outcome of this initial phase informed the content of the questionnaire used for this survey. Prior to the actual survey, pretesting was performed to ascertain the adequacy and consistency of the research design, data collection procedures and questionnaire.

The main sections of the questionnaire from which the focus of this paper was derived included those that probed the background characteristics of the respondent such as age, religion, level of education, marital status and occupation. Questions on respondents' awareness of LLINs and their use in malaria prevention in the home as well as on respondents' ability and willingness to pay for LLINs were also asked of both study populations. The response rate for the survey was 90.0% [495/550]

(91.0% for mothers of children under five vs. 89.1% for pregnant women).

### Ethical considerations

Approval to conduct the research was obtained from the state government's Ministry of Health, from the local government authority, and from community heads prior to the commencement of the study in the communities. Ethical approval for the research protocol of the larger study with the assigned number UI/EC/11/0075 was obtained from the University of Ibadan/University College Hospital (UI/UCH) Ethics Committee, and the study was carried out in accordance with universal ethical principles. Informed consent of all research participants was sought and obtained in written form using an informed consent form to signify willingness to participate in the research.

### Data analysis

The data for the study were entered and analyzed using EpiInfo 6.04, software developed by the Centers for Disease Control of the United States of America in collaboration with the WHO [30]. Statistical analyses of the data were conducted using analysis of variance and chi-square tests at a 95% level of confidence. Analysis of variance (ANOVA) was used to show the relationship between measurements of the mean and the variance ("random



error'') of each studied sub-group to determine whether the difference between the two groups was significant. A chi-square test, which is a non-parametric test of statistical significance for bivariate tabular analysis, was used to examine whether two different samples of people were significantly different enough in certain behavioral characteristics or aspects.

## Results

### Socio-demographic characteristics of respondents

The socio-demographic characteristics of the respondents are presented in Table 1. Of the 495 respondents surveyed, 262 (52.9%) were pregnant women and two hundred and thirty-three (47.1%) were mothers of children less than five years of age. Overall, 50.9% and 49.1% of the 495 respondents were from the Yewa North and Ijebu North local government areas, respectively. The ages of the respondents ranged from 16 to 40 years, with a mean age of 28.8 years (27.9 years among pregnant women vs. 28.7 years among mothers of children less than five years) and a median age of 30 years (30 years among pregnant women vs. 23 years among mothers of children less than five years). A large number (68.5%) of the respondents were Christians, and 97.6% were married. Most (81.0%) of the respondents had some formal education. The occupational distribution shows that most respondents were artisans (38.4%) and traders (25.9%). Of the two hundred and sixty-two pregnant women interviewed, 40.1% were from private hospitals and 59.9% were from public hospitals.

### Respondents' awareness and use of LLINs

Awareness of LLINs as a tool for malaria prevention was low. The results showed that less than half (45.5%) of the four hundred and ninety-five respondents (46.4% of mothers of children under five years of age vs. 44.7% of pregnant women) interviewed had seen or heard something about LLINs, as shown in Table 2. Statistical testing using ANOVA showed that those who had heard of LLINs had a mean age of 28.4 years, while those unaware of the material had a mean age of 29.1 years ( $p=0.09$ ). Pregnant women registered for antenatal care at public hospitals had a higher level of awareness of LLINs (56.7% aware) than those at private hospitals did (26.7% aware) [ $\chi^2 = 24.13$ ,  $df = 2$ ,  $p = 0.00$ ].

In contrast to the number of respondents who were aware of LLINs, only 23.6% owned and were using an LLIN for malaria prevention (27.9% of mothers of children under five years vs. 19.8% of pregnant women), as displayed in Table 2. Among pregnant women registered at public hospitals for antenatal care, 26.8% owned and used LLINs compared with 9.5% among those registered at private hospitals. The odds ratio of 0.29 has a 95% confidence interval of 0.13–0.64, and the chi square statistic with the Yates correction is 10.68 with a  $p$ -value of 0.00.

### Reasons for non-use of LLINs among respondents

The reasons for non-use of LLINs illustrated in Fig. 2 show that the most common reason given for not using a treated net was a lack of awareness about LLINs.

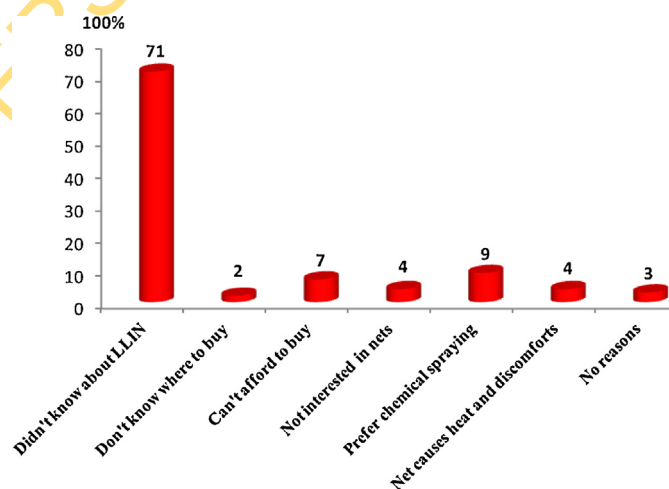


Figure 2 Reasons for non-use of LLIN by respondents.

**Table 1** Socio-demographic characteristics of respondents.

Socio-demographic characteristics	Pregnant women (n=262)		Mothers of under-5 children (n=233)		Total (n=495)	
<b>Local Government Area</b>						
	<b>Frequency</b>	<b>%</b>	<b>Frequency</b>	<b>%</b>	<b>Frequency</b>	<b>%</b>
Yewa North	133	50.8	119	51.1	252	50.9
Ijebu North	129	49.2	114	48.9	243	49.1
Total	262	52.9	233	47.1	495	100.0
<b>Communities</b>						
Igbogila	123	46.9	109	46.8	232	46.9
Ijoun	10	3.8	9	3.9	19	3.8
Oru/Awa/Ilaporu	108	41.2	96	41.2	204	41.2
Mamu	21	8.0	19	8.2	40	8.1
Total	262	52.9	233	47.1	495	100.0
<b>Religion</b>						
Christianity	193	73.7	146	62.7	339	68.5
Islam	69	26.3	83	35.6	152	30.7
Traditional	0	0.0	4	1.7	4	0.8
Total	262	52.9	233	47.1	495	100.0
<b>Marital Status</b>						
Never married	3	1.1	6	2.6	9	1.8
Married	258	98.5	225	96.6	483	97.6
Divorced	1	0.4	1	0.4	2	0.4
Separated	0	0.0	1	0.4	1	0.2
Total	262	52.9	233	47.1	495	100.0
<b>Education</b>						
None	52	19.8	42	18.0	94	19.0
Primary	86	32.8	52	22.4	138	27.9
Secondary	103	39.3	111	47.6	214	43.2
Post-secondary	21	8.0	28	12.0	49	9.9
Total	262	52.9	233	47.1	495	100.0
<b>Occupation</b>						
Unemployed	1	0.4	1	0.4	2	0.4
Housewife	23	8.8	20	8.6	43	8.7
Farming	41	15.6	17	7.3	58	11.7
Artisan	76	29.0	114	48.9	190	38.4
Civil servant	19	7.3	25	10.9	44	8.9
Professional (e.g. Banker)	8	3.1	12	5.2	20	4.0
Trading	86	32.8	42	18.0	120	25.9
Student	5	1.9	0	0.0	5	1.0
Other	3	1.1	0	0.0	3	0.6
No response	0	0.0	2	0.9	2	0.4
Total	262	52.9	233	47.1	495	100.0

### Sources and preferred outlets for accessing LLINs

The various outlets where the 117 respondents who used LLINs reported receiving the treated nets from included: public hospitals (67.5%), pharmacies

(15.4%), wholesale shops (10.3%), private hospitals (1.7%), and market vendors (1.3%). Only 1 respondent (0.8%) could not recall where she obtained the LLIN. When asked about which outlet was preferred for accessing an LLIN in their communities, the majority of respondents (87.9%)

**Table 2** Awareness, use of LLIN and perceived most vulnerable persons deemed fit for LLIN use among respondents by their status.

Awareness of LLIN among respondents by their status								
Respondent's status	Aware		Not aware		Undecided		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Pregnant women	117	44.7	144	55.0	1	0.4	262	52.9
Mothers of children under five years	108	46.4	124	53.2	1	0.4	233	47.1
Total	225	45.5	268	54.1	2	0.4	495	100.0
$\chi^2 = 0.15$ df = 2 p = 0.9259								
LLIN use among respondents by their status								
Respondent's status	Yes		No		Undecided		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Pregnant women	52	19.8	210	80.2	0	0.0	262	52.9
Mothers of children under five years	65	27.9	166	71.2	2	0.9	233	47.1
Total	117	23.6	376	76.0	2	0.4	495	100.0
$\chi^2 = 6.92$ df = 2 p = 0.0314								
Perceived most vulnerable persons deemed fit for LLIN use								
Persons deemed fit	Pregnant women		Mothers of children under five years		Total			
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Pregnant women	6	2.3	0	0.0	6	1.2	6	1.2
Spouse only	1	0.4	0	0.0	1	0.2	1	0.2
Children < 5 years only	152	58.0	155	66.5	307	62.0	307	62.0
Self and spouse	11	4.2	2	0.9	13	2.6	13	2.6
Self & grown-up children	1	0.4	2	0.9	3	0.6	3	0.6
Self & young children < 5 years only	91	34.7	73	31.3	164	33.1	164	33.1
Undecided	0	0.0	1	0.4	1	0.2	1	0.2
Total	262	52.9	233	47.1	495	100.0	495	100.0
$\chi^2 = 14.92$ df = 6 p = 0.0209								

preferred government hospitals. In contrast, very few preferred market vendors (3.5%), popular and trusted community members (3.0%), pharmacy/chemist shops (1.0%), or private hospitals (0.5%), while 4.0% did not respond. In Yewa North, the most preferred outlets were public hospitals (70.6%) and private hospitals (14.7%). On the contrary, public hospitals (70.0%) and pharmacies/chemist shops (20.2%) were preferred in Ijebu North. Similarly, while the pregnant women preferred accessing the treated nets from public hospitals (70.6%) and private hospitals (16.8%), the mothers of children less than five years of age preferred public hospitals (70.0%) and pharmacies/chemist shops (16.3%).

### Perception of LLINs among respondents

Among the 117 respondents that used LLINs, the majority of them (97.4%) had a positive perception of the use of LLINs. On the contrary, 2.6% were indifferent in their response. Of those who

perceived net use positively, 50.9% considered it relatively more effective in preventing mosquito bites and 49.1% said that the net is more cost-effective than other means of preventing mosquito bites. Multiple regression coefficients showed that the two key factors associated with respondents' perceptions of LLINs were marital status (0.24) and education (0.20). Other factors that did not influence respondents' perceptions included religion, occupation and age.

### Respondents' perceptions of the most vulnerable individuals with the greatest need of LLIN in the household

When the respondents were asked who they deemed fit to use the LLIN if one was freely provided for their respective households, 95.0% of the pregnant women correctly identified both themselves and children under five years of age as the most vulnerable groups fit to use an LLIN, as highlighted in Table 2. Among mothers of children

**Table 3** Willingness to pay for LLINs among respondents by their LGA and community.

Local Governemnt Area	Willing to pay for LLINs?						Total	
	Yes		No		Undecided		Frequency	%
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Yewa North	181	71.8	71	28.2	0	0.0	252	50.9
Ijebu North	236	97.1	6	2.5	1	0.4	243	49.1
Total	417	84.2	77	15.6	1	0.2	495	100.0
$\chi^2 = 62.98$ df = 2 p = 0.0000								
Communities								
Igbogila	174	75.0	58	25.0	0	0.0	232	46.9
Ijoun	6	31.6	13	68.4	0	0.0	19	3.8
Oru/Awa/Ilaporu	199	97.5	4	2.0	1	0.5	204	41.2
Mamu	38	95.0	2	5.0	0	0.0	40	8.1
Total	417	84.2	77	15.6	1	0.2	495	100.0
$\chi^2 = 89.41$ df = 6 p = 0.0000								

under five years of age, 66.5% correctly mentioned children less than five years of age as the sole vulnerable group most in need of an LLIN. The respondents' level of education was found to significantly correlate with their perception of who was most vulnerable to malaria and required LLIN use in the household ( $\chi^2 = 34.96$ , df = 18,  $p = 0.01$ ).

#### Perceived fair price and willingness to pay for an LLIN among respondents

Overall, the cost of a treated net in the study communities, according to those that had knowledge of the cost, ranged considerably from free (incentive for attendees of antenatal and postnatal public clinics) to ₦1200.00 (US\$7.50) in the commercial market. In general, the average reported cost of a treated net in the study communities was ₦993.00 (US\$6.20) [₦932.00 (US\$5.83) in Yewa North vs. – ₦1030.00 (US\$6.44) in Ijebu North] with a median cost of ₦1000.00 (US\$6.25).

When the respondents were asked whether they would be willing to pay (WTP) if the LLINs were sold at a hypothetical price of ₦800.00 (US\$5.00) in their communities (because the free LLIN distribution is grossly below rational expectation), the majority (84.2%) of the 495 respondents were willing to pay

the cost of ₦800.00 (US\$5.00) for a treated net, while 15.6% were unwilling to pay. Indifference to this net price in regard to purchasing the material was reported in 0.2% of individuals. The respondents' willingness to pay (WTP) for LLINs according to their LGA and community of residence is presented in Table 3. Willingness to pay (WTP) was significantly determined by education ( $\chi^2 = 47.94$ , df = 6,  $p = 0.00$ ) and occupation ( $\chi^2 = 49.84$ , df = 18,  $p = 0.00$ ). Among the unwilling 15.6%, the reported reasons for being unwilling to pay for the treated material at the hypothetical price were: an inability to afford it (72.7%), a lack of work/money (26.0%), and a lack of need for the net (1.3%).

When the 15.6% of respondents who were unwilling to pay the hypothetical price of ₦800.00 (US\$5.00) were asked to provide prices they were actually willing to pay for a treated net, they mentioned prices ranging from ₦100.00 (US\$0.63) to ₦600.00 (US\$3.75). The mean reported price that the initially unwilling respondents were actually WTP was ₦423.38 (US\$2.65) [₦419.44 (US\$2.62) in Yewa North vs. ₦420.00 (US\$2.63) in Ijebu North] with a median of ₦400.00 (US\$2.50). The actual prices respondents perceived as affordable and were willing to pay for LLINs are presented in Table 4.

**Table 4** Perceived fair prices respondents were actually willing to pay for LLINs.

Perceived fair price willing to pay	Frequency	%
≤ ₦300 (US\$1.87)	12	15.6
₦301 (US\$1.88) - ₦500 (US\$3.12)	63	81.8
₦501 (US\$3.13) - ₦600 (US\$3.75)	2	2.6
Total	77	100.0



## Discussion

This study examined the awareness, perception, use and affordability of LLINs among pregnant women and mothers of children under five years of age in the Ijebu North and Yewa North LGAs of Ogun State. It is evident from the study that awareness and use of LLINs were low among the study populations. Overall, the study showed the low affordability of LLINs for these respondents despite their high WTP for the material for malaria prevention.

The identification of children under five years of age as the most vulnerable group in need of LLIN use by more than half of the respondents, as shown in Table 2, is encouraging. On the contrary, it is disturbing that very few of the respondents, including the pregnant women who were interviewed, perceived pregnant women to be at an equally high risk of malaria as children under five years of age. There is therefore a need for intense and extensive public health education on malaria as a preventable disease that emphasizes those most at risk in the community. The health education program needs to further emphasize the consequences of malaria for a child under five years of age and for a pregnant mother and her unborn baby, as well as the importance of malaria prevention in these two groups of people. Health education also needs to emphasize the need within households to preferentially provide LLINs to pregnant women and children, especially those under five years of age, in cases where it is not possible to purchase one for every family member. For effective health education program implementation, there is a need for synergy between the State Ministry of Health, the National Malaria Control Programme managers and the National Orientation Agency under the Federal Ministry of Information and Communications in development of a public health education package to address the deficiencies in LLIN awareness and perception among the population. It is believed that this strategy will significantly contribute to increased awareness, demand and use of the treated nets, will thus help achieve the NMSP and MDG malaria targets by 2013 and 2015, respectively, and will continue contributing to improvements beyond these time points.

The observed percentage of respondents in the study communities who used LLINs is far from the percentage of populations at risk of malaria that was expected to be sleeping under LLINs by 2010. The low use of LLINs, with the RBM deadline now passed, could compromise the attainment of the MDG for malaria by 2015 in the study communities if urgent pragmatic measures are not taken to rapidly increase access to the LLINs.

This study illuminated a number of important issues occurring in everyday life that remain barriers to sustained LLIN use among respondents in the study communities. These issues may hinder the attainment of the NMSP and MDG targets of reducing malaria-related morbidity and mortality by 50% by 2015. The reasons reported by many respondents for non-use of LLINs included lack of awareness, issues of convenience, humid weather conditions, and perceptions of cost. These barriers to LLIN use in the study are similar to those reported by Galvin et al. [31]. It is encouraging that a large number of respondents, particularly those not using LLINs, mentioned very few disadvantages of the treated nets, as illustrated in Fig. 2, and that the reported advantages were mainly malaria prevention and avoiding mosquito bites. The reduction of mosquito bites as the main LLIN benefit perceived by many of the respondents is very encouraging and similar to the findings reported by Gunasekaran et al. [32] in a study on the use of LLINs in Orissa (now Odisha) State, India. These results provide an optimistic foundation for launching and planning promotional programs that will de-emphasize the perceived problems attributed to LLIN use by some respondents and will emphasize the benefits of LLIN use in the study area and state in general.

The low use of LLINs reported in the study is perhaps connected to the ability and willingness of the respondents to pay for LLINs in the study area because the products were not readily available to access by people. This is contrary to the expectation that the products are to be made available for free at designated hospitals for the target populations. The price that respondents were willing to pay for LLINs in this study was less than the real costs and subsidies are. Therefore, equitable affordability of the commodities in the study area needs to be facilitated. The inability to pay for the cost of LLINs by some of the respondents could perhaps be attributed to the disparity between the actual retail price of an LLIN and the average income of the study area. Approximately 63% of people in Ogun State, where the study was conducted, live on less than US\$1.00 (N160.00) a day [33] given that a large number of the respondents were subsistence farmers, artisans and petty traders who have been reported to earn low incomes in a study on understanding the low income population in Nigeria [34].

The willingness to pay (WTP) for LLINs in this study is similar to those WTP figures reported by Bhatia and Fox-Rushby [35] in a descriptive analysis of a household survey on willingness to pay for treated mosquito nets in Surat, India; by Legese

et al. [36] in a study of households' willingness to pay for LLINs in three urban communities of Assosa Zone, western Ethiopia; and by Gunasekaran et al. [32] in another study on LLIN acceptability and willingness to purchase and use LLINs in Orissa (now Odisha) State, India.

It is necessary that an LLIN distribution system in the study area takes account of the diversity in WTP for LLINs if it is to ensure equity in access to the nets for the target populations, as suggested by Onwujekwe et al. [37]. In view of the respondents' occupations being a strong determinant of their WTP for the treated nets, LLIN financing mechanisms are needed in the study area. It is believed that this will ensure that lower socio-economic groups and those at greater risk of malaria have equitable access to LLINs and are protected, as emphasized by Onwujekwe et al. [38]. Consequently, we suggest that social marketing of LLINs at a subsidized price or as a free supply and assurance of the availability of the commodity could encourage people, particularly those who cannot afford the commercial retail cost, to buy and use LLINs. Strategies that increase access to LLINs by creating a demand sustainable by market access also need to be developed for implementation.

We share the belief that assessing the willingness of people to pay for a product is a step toward informing policymakers about the amount households are prepared to pay. The outcome of such an assessment could motivate policy formulation on strategies to address the issue through cost-recovery schemes and the introduction of subsidies, as evident in a study that assessed a cost-effective approach to LLIN delivery in Kenya [22]. Nonetheless, the obtained mean and median WTP figures can also be used to guide policy decisions on appropriate pricing of LLIN materials.

Findings showed that the majority of the respondents had a preference for public hospitals as the main outlets through which LLINs could be effectively distributed in the study communities. The fact that a few others had access to the treated nets through private outlets indicated that these other outlets should be involved in the distribution network in the study communities. The findings demonstrated that distribution strategies that will increase net coverage in the study area need be adopted.

Furthermore, with a vibrant and successful retail system in the country, for example through selected private hospitals, patient medicine vendors and other retail outlets, a partnership between the public and private sectors should be considered for effective LLIN distribution. Among other things, the private sector can assist with increasing

the demand for malaria services by reaching isolated populations through commercial networks. This may be a seemingly ambitious goal, particularly given the difficulty of successfully influencing markets in the long run. However, unless this partnership is effectively implemented, thousands of people, as demonstrated by the results from the study area, will not benefit from LLIN use and the positive health impact it bestows.

The school delivery of LLINs could also be considered as a strategy of reaching school-aged children, particularly those under the age of five years. This could contribute to achievement of universal LLIN coverage, as emphasized by Noor et al. [39]. The National Strategic Plan for insecticide treated nets (ITNs) (NATNETS) is comprised of three core concepts: increasing the demand for ITNs, creating a national public-private partnership for developing a sustainable domestic commercial ITN market, and implementing targeted subsidies aimed at high-risk groups through a National Voucher Scheme. This program was successfully implemented in Tanzania [40,41] and could similarly be adopted in the malaria control program in these Nigerian study communities, and in Ogun State in general.

On a positive note, the findings of this study have offered insights for planning health promotional programs to increase awareness of and demand for LLINs in the study communities, after having showed a lag in the NMSP and RBM targets and the actual levels of awareness and LLIN use for malaria control. The study has illuminated some distal determinants of the malaria burden that cause underlying vulnerability to the disease in the study communities, including the socio-economic context and perceptions about environmental conditions and convenience as they relate to LLIN use. Future malaria control program action in the area therefore should include a broad-spectrum approach that will meaningfully address both the distal and fundamental determinants of the disease. Efforts also need to be intensified to make adequate information and LLINs themselves more available and accessible at an affordable cost to communities. This is important if appreciable progress toward the targets of the NMSP by 2013 and the Millennium Development Goals by 2015 is to be made in the study communities, the State and the country.

The major limitation of this study is the focus on two LGAs of Ogun State in one part of the country. A larger study, with an adequate sample size that is more representative of the geo-political zones of the country, is needed to provide findings that are better and more generalizable to the entire country. Thus, there is a need to replicate this study in varied settings across the State and the

country in general before widespread recommendations can be made. Nonetheless, this limitation does not undermine the validity of this study's findings.

## Conclusion

It should be emphasized that this study provides insights into how the LLIN distribution program implementation for malaria control can be improved in the immediate future in Ogun State and in the country at large. For wide coverage of LLIN use through equitable access among the population, malaria control program managers at the State and LGA levels should include provisions for subsidies to create sustained availability, affordability and increased use of LLINs.

## Authors' contributions

Adeniyi K. Adeneye (AKA) contributed to the conception and design of the study/data collection/data analysis/interpretation of data/manuscript drafting and review and Ayo-dele S. Jegede (ASJ), Ezebunwa E. Nwokocha (EEN), and Margaret A. Mafe (MAM) contributed to the design of the study/data collection/data analysis/interpretation of data/manuscript review.

## Conflicts of interest

*Funding:* No funding sources.

*Competing interests:* None declared.

*Ethical approval:* Not required.

## Acknowledgements

We sincerely acknowledge and thank the Research Assistants, the health workers of health facilities visited during the study and the people of the communities where the study was carried out for all of their support and cooperation.

This paper is dedicated to the loving memory of Dr. A.O. Amao who was the Medical Officer for Health and Head of the Health Department, Yewa North LGA, Ogun State. Dr. Amao passed away after the completion of the data collection for this study.

## References

- [1] Federal Ministry of Health. Federal Republic of Nigeria: national policy on malaria diagnosis and treatment.

- Abuja: Federal Ministry of Health, National Malaria and Vector Control Division; 2010.
- [2] World Health Organisation. World malaria report 2013. Geneva: World Health Organisation; 2013. Available at: [http://www.who.int/malaria/publications/world\\_malaria\\_report.2013/en/](http://www.who.int/malaria/publications/world_malaria_report.2013/en/) [accessed 24.03.14].
- [3] Steketee RW, Nahlen BL, Parise ME, Menendez C. The burden of malaria in pregnancy in malaria-endemic areas. *Am J Trop Med Hyg* 2001;64:28–35.
- [4] Rogerson SJ, Mwapasa V, Meshnick SR. Malaria in pregnancy: linking immunity and pathogenesis to prevention. *Am J Trop Med Hyg* 2007;77(Suppl. 6):14–22.
- [5] Federal Ministry of Health, National Malaria and Vector Control Division. Federal Republic of Nigeria: training manual for management of malaria in Nigeria. Abuja: Federal Ministry of Health; 2008. p. 6.
- [6] National Population Commission (NPC) [Nigeria] and MEASURE DHS ICF Macro. Nigeria demographic and health survey 2008. Calverton, MD: National Population Commission and MEASURE DHS ICF Macro; 2009.
- [7] National Population Commission (NPC) [Nigeria], National Malaria Control Programme (NMCP) [Nigeria], and ICF International. Nigeria Malaria Indicator Survey 2010. Abuja, Nigeria: NPC, NMCP, and ICF International; 2012.
- [8] World Health Organisation. Nigeria: health profile; 2012. Available at: [http://www.who.int/gho/countries/nga/country\\_profiles/en/index.html](http://www.who.int/gho/countries/nga/country_profiles/en/index.html) [accessed 30.07.12].
- [9] Guyatt HL, Gotink MH, Ochola SA, Snow RW. Free bednets to pregnant women through antenatal clinics in Kenya: a cheap, simple and equitable approach to delivery. *Trop Med Int Health* 2002;7(5):409–20.
- [10] Lengeler C. Insecticide-treated bed nets and curtains for preventing malaria. *Cochrane Database Syst Rev* 2004;2. CD000363.
- [11] Binka F, Akweongo P. Prevention of malaria using ITNs: potential for achieving the millennium development goals. *Curr Mol Med* 2006;6(2):261–7.
- [12] Ehiri JE, Anyanwu EC, Scarlett H. Mass use of insecticide-treated bednets in malaria endemic poor countries: public health concerns and remedies. *J Public Health Policy* 2004;25(1):9–22.
- [13] TDR News. Roll back malaria: spotlight on Africa. Geneva: World Health Organisation; 2000 [number 62].
- [14] National Malaria Control Programme [Nigeria]. World malaria day celebration 2012: stakeholders call for renewed partnership. *Malarial scope*. Abuja: National Malaria Control Programme, Federal Ministry of Health; August 2012.
- [15] World Health Organisation. World malaria report 2011. Geneva: World Health Organisation; 2011.
- [16] UNICEF and Federal Ministry of Health [Nigeria]. Treated bednets in Nigeria: analysis of the market for bednets, insecticides and ITNs in Nigeria. Abuja: UNICEF/Federal Ministry of Health [Nigeria]; 2002.
- [17] National Malaria Control Programme [Nigeria]. Malaria control in Nigeria 2005 annual report. Abuja: National Malaria Control Programme, Federal Ministry of Health; 2005.
- [18] Worrall E, Hill J, Webster J, Mortimer J. Experience of targeting subsidies on insecticide-treated nets: what do we know and what are the knowledge gaps? *Trop Med Int Health* 2005;10(1):19–31.
- [19] The Global Fund to Fight AIDS, Tuberculosis and Malaria. Fighting AIDS, tuberculosis and malaria; 2014. Available at: <http://www.theglobalfund.org/en/about/diseases/malaria/> [accessed 02.03.14].
- [20] Otubanjo OA, Mafe MA. Control of parasitic diseases of poverty: an overview of the Nigerian situation. *Zoologist* 2002;1(1):1–24.

- [21] Adeneye AK, Jegede AS, Mafe MA, Nwokocha EE. A pilot study to evaluate malaria control strategies in Ogun State, Nigeria. *World Health Popul* 2007;9(2):83–94.
- [22] Guyatt HL, Snow RW. Impact of malaria during pregnancy on low birth weight in sub-Saharan Africa. *Clin Microbiol Rev* 2004;17:760–9.
- [23] Onwujekwe O, Chima R, Shu E, Nwagbo D, Okonkwo P. Hypothetical and actual willingness to pay for insecticide treated nets in five Nigerian communities. *Trop Med Int Health* 2001;6(7):545–53.
- [24] Ekanem OJ. Antimalaria activities in Nigeria: historical perspectives. *Malaria Soc Nigeria Newsl* 1996;1(1):2–6.
- [25] Omikunle T. Ogun State annual and investment digest. Lagos: Visionlink Nigeria Ltd.; 1999.
- [26] Ayanlade A, Adeoye NO, Babatimehin O. Climate change/variability and malaria transmission in sub-Saharan Africa: a case of Nigeria. In: *Climate change and security: an international conference on the occasion of the 250th anniversary of the Royal Norwegian Society of Sciences and Letters*. 2010.
- [27] Information, Youth, Sports and Culture Division, INLG. Ijebu North local government: past and present. Ijebu Ode: Take Bola Enterprises; 1997.
- [28] Yewa North Local Government. Wind of change in Yewa north local government, Ogun State. Ayetoro: Information Department, Yewa North Local Government; 2003. p. 7–9.
- [29] Varkevisser CM, Pathmanathan I, Brownlee A. Designing and conducting health system research projects, vol. 1: Proposal development and fieldwork. Amsterdam/Brazaville: KIT Publishers and International Development Research Centre/Africa Regional Office of the World Health Organisation; 2003.
- [30] Smith PG, Morrow RH. Field trials of health interventions in developing countries: a toolbox. 2nd ed. London: Macmillan Education Limited; 1996. p. 266.
- [31] Galvin KT, Petford N, Ajose F, Davies D. An exploratory qualitative study on perceptions about mosquito bed nets in the Niger Delta: what are the barriers to sustained use? *J Multidiscip Healthc* 2011;4:73–83.
- [32] Gunasekaran K, Sahu SS, Vijayakumar KN, Jambulingam P. Acceptability, willing to purchase and use long lasting insecticide treated mosquito nets in Orissa State, India. *Acta Trop* 2009;112(2):149–55.
- [33] National Bureau of Statistics [Nigeria]. Nigeria poverty profile 2010. Abuja: National Bureau of Statistics; 2012.
- [34] Enhancing Financial Innovation and Access. Understanding the low income population in Nigeria. *Enhancing Financial Innovation and Access*; 2011. Available at: <http://www.efina.org.ng/assets/Documents/EFInAUnderstanding-the-Low-Income-Population-in-NigeriaFDG-ReportMarch-2011.pdf> [accessed 16.08.12].
- [35] Bhatia MR, Fox-Rushby JA. Willingness to pay for treated mosquito nets in Surat, India: the design and descriptive analysis of a household survey. *Health Policy Plan* 2002;17(4):402–11.
- [36] Legese Y, Tegegn A, Belachew T, Tushune K. Households willingness to pay for long-lasting insecticide treated nets in three urban communities of Assosa Zone, western Ethiopia. *Ethiop Med J* 2007;45(4):353–62.
- [37] Onwujekwe O, Hanson K, Fox-Rushby J. Inequalities in purchase of mosquito nets and willingness to pay for insecticide-treated nets in Nigeria: challenges for malaria control interventions. *Malar J* 2004;3:6.
- [38] Onwujekwe O, Hanson K, Fox-Rushby JA. Who buys insecticide-treated nets? Implications for increasing coverage in Nigeria. *Health Policy Plan* 2003;18(3):279–89.
- [39] Noor AM, Kirui VC, Brooker SJ, Snow RW. The use of insecticide treated nets by age: implications for universal coverage in Africa. *BMC Public Health* 2009;9:369.
- [40] Mwisiongo A. Country assessment: Tanzania. Prepared for the HLSP Institute; 2005 [unpublished].
- [41] World Health Organisation. Partnerships for malaria control: engaging the formal and informal private sectors. Geneva: World Health Organisation; 2006 [TDR/GEN/06.1].
- [42] 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* 2013;1(3):22–34.

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

**ScienceDirect**