MEDDOCS Open Access Publisher

ISSN: 2639-4391

Annals of Epidemiology & Public Health

Open Access | Research Article

Knowledge, Perception and Practices of Malaria Prevention and Treatment in Communities of Lagos and Niger States, Nigeria

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Received: Sep 15, 2020

Accepted: Nov 06, 2020

Published Online: Nov 10, 2020

Journal: Annals of Epidemiology and Public health

Publisher: MedDocs Publishers LLC

Online edition: http://meddocsonline.org/

Keywords: Knowledge; Perception; Health seeking behaviour; Malaria; Nigeria.

Abstract

Objective: Given that child survival and maternal health particularly as it relates to malaria-related targets in Nigeria has remained challenging, this study examined health-seeking behaviour of people suspected to have malaria on the disease prevention and treatment in Ikorodu and Borgu local government areas of Lagos and Niger States, Nigeria respectively.

Methods: This was a descriptive cross-sectional study conducted using semi-structured questionnaires and focus group discussions among fathers and mothers of under-five children in the study communities. In addition, in-depth interviews were held with community/opinion leaders and health workers. Data were analyzed using Statistical Package for Social Sciences version 20.0 and Text base Beta softwares.

Results: Most (82.7%) respondents correctly knew mosquito as malaria vector. There was gender difference in the knowledge of mosquito as malaria vector (χ^2=91.49, df=5, p<0.05). A larger number (39.7%) of respondents visit hospital for malaria treatment compared to self-treatment at home (38.5%) and pharmacy/chemist shop patronage (16.4%). Only half (50.0%) of respondents had Long Lasting Insecticidal Nets (LLINs) (59.5% Lagos State vs. 37.3% Niger State). In contrast, only 44.8% (48.7% Lagos State vs. 37.2% Niger State) actually used LLINs to prevent malaria. Level

Cite this article: Adeneye AK, Olukosi YA, Brai BIC, Oparaugo CT, Agomo CO, et al. Knowledge, Perception and Practices of Malaria Prevention and Treatment in Communities of Lagos and Niger States, Nigeria. A Epidemiol Public Health. 2020; 3(1): 1034.

of education significantly determined their probability of owning a LLIN (χ^2=57.60, df=10, p<0.05). Moreover, there was no gender difference in LLIN ownership [males 42.0% vs. females 46.4%] and use [males 45.2% vs. females 52.9%]. Only 44.5% have ever used ACT (36.7% Lagos State vs. 55.3% Niger State), and 24.6% preferred taking ACT compared to analgesics (33.5%) as their first choice drug for malaria treatment.

Conclusions: Results showed low use of LLINs and ACTs in populations studied. Public health education on these commodities need be intensified emphasising the benefits and dangers in their use and non-use respectively for improved health outcomes.

Introduction

Malaria remains a formidable disease of global public health importance despite decades of significant input of resources and efforts at control. Reported cases of malaria and estimated deaths due to malaria between 2010 and 2018 had declined globally [1], However, assessing progress in reducing the burden of malaria globally, malaria cases and deaths remain high [1,2].

The disease continues to claim the lives of more than 400,000 people each year, largely in sub-Saharan Africa. Children under the age of 5 are especially vulnerable given the fact that every two minutes a child dies from this preventable and curable disease [2] accounting for about 67% of malaria deaths worldwide in 2018 [1].

In 2018, an estimated 228 million cases of malaria occurred worldwide, compared with 251 and 231 million cases reported in 2010 and 2017 respectively [1]. It was estimated that 93% of malaria cases recorded worldwide in 2018 were reported in Africa [1], this is slightly an increase over the 92% reported in 2017 [2]. Six countries that accounted for more than half of all malaria cases worldwide in 2018 were from the sub-Saharan Africa. These included Nigeria (25%), the Democratic Republic of the Congo (12%), Uganda (5%), and Cote d'Ivoire, Mozambique and Niger (4% each) [1]. Nearly 80% of global malaria deaths in 2017 were concentrated in 17 countries in the African Region and India [2]. The scenario seems to have worsened with an estimated 85% of these deaths reported to be in 20 countries of these same regions in 2018 [1]. Six of these countries accounted for almost 50% of all global malaria deaths with Nigeria accounting for 24% [1].

In Nigeria, malaria is endemic and remains the foremost public health problem, taking its greatest toll on children under age 5 and pregnant women, although it is preventable, treatable and curable. Malaria is responsible for 11% of maternal deaths and is consistently recorded as one of the five leading causes of mortality among children under five years in the country [3]. The prevalence of malaria (according to microscopy) among children under five years of age is reported to have declined from 42% in 2010 to 23% in 2018, with an average decline of 2.3% per annum [4].

The dominant vector species across the country transmitting the infection are *Anopheles gambiae* species [5].

The World Health Organization (WHO) recommends vector control (i.e. preventing mosquitoes from biting human beings) or chemoprevention (i.e. providing drugs that suppress infections) for the prevention of malaria in specific population subgroups (i.e. pregnant women, children and other high-risk groups) or for specific contexts (e.g. complex emergencies and elimination). The core interventions recommended by WHO to prevent mosquito bites are sleeping under Long Lasting Insecticidal Nets (LLINs) and Indoor Residual Spraying (IRS), these however can be supplemented by larval source management or other environmental modifications [2]. Overall, all LLIN indicators worldwide increased steadily since 2010 as the gap between the percentage of population at risk with access to LLIN and sleeping under LLIN has closed up [2].

The implementation of the vector control measures is to contribute to meeting the 2030 targets of the WHO's global malaria strategy and the milestones for 2020 and 2025 hoping universal access to malaria prevention and treatment interventions to populations will contribute to SDG Goal 3.8, which is to ensure universal health coverage. To achieve these milestones and targets, the amount of funding required is estimated at US$ 4.4 billion in 2017, increasing to US$ 6.6 billion by 2020 [2].

With increases in diagnostic testing in recent years, ACT treatment courses are now targeted towards patients who tested positive for malaria [2]. An estimated 2.74 billion treatment courses of Artemisinin-based Combination Therapy (ACT) were procured by countries over the period 2010–2017. During same period, about 1.45 billion ACT treatment courses were delivered by National Malaria Programs, of which 1.42 billion (98%) were in the WHO African Region where Nigeria belongs [2].

Deaths among children under five years often occur within two days of developing symptoms of malaria and women are four times as likely to get sick from malaria if they are pregnant and as twice as likely to die from the disease [6-10].

Studies showed that treatments for malaria are rarely sought at health facilities and are most often inappropriate or delayed [11-14]. Most early treatments for fever and uncomplicated malaria occur through self-treatment at home with antimalarial bought from patent medicine sellers [15,16]. Less than 15% of the malaria episodes treated at home are treated correctly. Most fevers in children (>60%) are treated with simple fever drugs, such as paracetamol and aspirin, but not with antimalarials. Even when antimalarials are purchased, they are commonly (> 80% of cases) administered in inappropriate doses [17].

Given the burden of the disease on maternal and child health situation in the country, the Federal Government of Nigeria in its desire and commitment to ensure the elimination of malaria at all levels of government in the country launched the National Malaria Policy in February 2015. The policy was conceived within the context of a malaria-free Nigeria to address core issues related to malaria prevention, diagnosis, and treatment; communication and social mobilization; and regulations regarding antimalarial commodities [18].

The study that examined knowledge, perception and practices of people suspected to have malaria on the disease prevention and treatment in Ikorodu and Borgu local government areas of Lagos and Niger States, Nigeria respectively on which this paper is based forms part of a larger study conducted to provide information on malariometric indices that could support logical deductions of interventional studies including vaccine, drug efficacy clinical trials to determine the efficacy of ACT and provide information on the status of ACT resistance in different ecological zones of Nigeria [19].

Methodology

Study settings

The study was conducted in rural communities of Ikorodu and Borgu local government areas of Lagos and Niger States in the South West and North Central zones of Nigeria respectively. Nigeria has a tropical climate with a wide range of climatic and vegetation conditions which makes it suitable for malaria transmission across the country. While Lagos is located in the mangrove swamp forest vegetation with total annual rainfall usually above 2,500 mm, Niger State is in the Guinea-Savannah vegetation of the country with annual rainfall amount in the range of 1,000-1,200 mm [3].

The communities surveyed included: Ijede in Lagos State and New Bussa (Masana, Monai, Tada and Yuna) in Niger State. The selected communities were of comparable socio-economic characteristics with the two communities being rural, having close proximity to large water bodies and economically dependent on the fishing and farming. While Ijede is where the Egbin Thermal Power Station is cited by the Lagos Lagoon, it is in New Bussa that the Kainji lake dam and the main hydroelectric power station for the country is situated Major ethnic groups in Ijede are Yoruba and while Bissans, Bokkos, Laru, Gungawa, Lupawa and Nupe, each with their own distinct language are predominant in New Bussa. However, Hausa is the language spoken by most of the people, while the predominant religion is Islam. According to Primary Health Care (PHC) records, the two communities are holo-endemic for malaria with both *Plasmodium falciparum* and *P. vivax* infections.

Study population

Everyone from the general population including males and females as well as young and old in the communities visited was invited to participate in the study that involved the screening for fever (axillary temperature ≥ 37.5°C), malaria by microscopy and malaria rapid diagnosis test.

Sampling procedures

The screening was carried out at central places that include palace, traditional ruler's house and school in the communities visited. The participants were selected using multi-stage sampling process with a combination of purposive and systematic sampling [20]. The first stage involved a purposive selection of the two States studied based on being in different ecological zones of the country. The second stage involved a systematic sampling of 761 (46.2%) of 1,648 those screened.

The sampling frame for the selection of the study units was the list of 1,648 people registered for malaria screening. They were randomly selected and interviewed on exit from the screening venues. Here, the names of those interviewed on exit from the screening venues were noted and marked in order to avoid duplication of respondents.

Data collection procedures

The study involved the use of pretested interviewer-administered semi-structured questionnaires, in-depth interviews and Focus Group Discussions (FGDs). The first section of the questionnaires contained questions on the background characteristics of the respondent such as age, religion, level of education, marital status, occupation and community. Questions in the other sections probed respondent's knowledge on the mode of malaria transmission, knowledge of signs and symptoms of malaria, prevention and treatment of malaria, knowledge and use of LLIN, and type of antimalarials used for malaria treatment. The questions further probed the respondents' health seeking behaviour with emphasis on knowledge, attitude, perception and practices of home management of malaria for children under five years old, types of antimalarials used, and the extent of awareness and use of LLIN in malaria prevention.

A total of four FGDs were conducted among adult males and females in the study communities of the two States respectively. In addition eight in-depth interviews were held with community/opinion leaders and health workers in primary health centres located within the study communities.

Ethical considerations

Approvals at the local government and community levels were obtained prior to the commencement of the study. Ethical approval for the research protocol for the larger study (Reference number IRB/14/257) was obtained from the Nigerian Institute of Medical Research Institutional Review Board (NIMR-IRB) and was carried out in accordance with universal ethical principles. The informed consent of all the research participants for the study was sought and obtained using an informed consent form.

Data analysis

The quantitative and qualitative data for each phase of the study were analyzed using Statistical Package for Social Sciences (SPSS) version 20.0 and the textual analysis programme, Textbase Beta softwares, respectively. Statistical analyses of the quantitative data were conducted using analysis of variance and chi-square tests at 95% level of significance.

Results

Socio-demographic Characteristics of Respondents

Of the 761 respondents surveyed, 283 (37.2%) were males and 478 (62.8%) were females. The distribution of the respondents according to community is: Ijede (57.7%); and New Bussa (42.3%) [Monai (27.9%); Yuna (6.6%); Masana (4.3%); and Tada (3.5%)]. Most respondents were traders (34.3%) and artisans (15.2%) and had most formal education (66.4%). The ages of the respondents ranged from 12 to 99 years, with a mean age of 38.0 years and a median of 43 years. The mean income of the respondents was ₦16,341.61 ($45.39) (₦18,158.43 [$50.44] Lagos vs ₦14,192.60 [$39.42] Niger). The socio-demographic characteristics of the respondents are presented in Table 1.

Respondents' knowledge and perception of cause and signs/symptoms of malaria

There was a general consensus in the focus group discussions and interviews that malaria is one of the common diseases affecting the health of people in the study communities. Aside from malaria, other health problems mentioned include cough, measles, dysentery, diarrhoea, stroke, rheumatism, skin rashes, sexually transmitted infections, and diabetes.

Results showed that 678 (89.1%) of respondents interviewed have had malaria in the past while 4.3% claimed never to have had malaria and 6.6% were undecided. The perceived cause of malaria among the respondents as shown in Figure 1 shows that 82.7% correctly mentioned mosquito bite as the transmission route of malaria infection. It is interesting that more than half of the respondents also felt that both stress (51.1%) and

sun (49.9%) were causes of malaria despite their correct knowledge of mosquito being the vector for malaria infection. There was gender difference in the knowledge of mosquito bite as the transmission route of malaria infection ($\chi2=91.49$, df=5, $p<0.05$).

Many of the FGD participants and respondents interviewed in the community survey had correct knowledge of the signs/symptoms of malaria. The main signs/symptoms mentioned by respondents in the survey are illustrated in Figure 2.

How soon treatment is given at home for malaria among respondents

When asked what they do when they or their children have malaria, a large number (39.7%) of the respondents reported treating going to the hospital for treatment. Other actions respondents mentioned taking when having malaria were: Treatment at home (38.5%); going to chemist shop or pharmacy (16.4%); visiting a traditional healer (1.0%); and going to the church and or mosque (0.1%). While 3.4% were undecided on the action taken when having malaria, 0.3% responded doing nothing.

On how soon respondents usually take whatever first action they usually take after the onset of the signs/symptoms of malaria, 36.5% of respondents reported that they take action within the home or seek appropriate healthcare outside the home within 24 hours of onset of malaria signs or symptoms. Most (45.7%) mentioned seeking care between 24 and 48 hours, and 11.7% reported they usually seek care after 48 hours. However, 6.0% of the respondents did not respond.

Use of LLINs and other preventive measures respondents take against malaria

Only half (50.0%) of the respondents interviewed claimed to own the long lasting insecticidal nets (LLINs) (59.5% Lagos State vs. 37.3% Niger State). In contrast, only 44.8% (48.7% Lagos State vs. 37.2% Niger State) actually use the LLINs to prevent malaria. The ownership and actual use of LLINs by respondents according to State is illustrated in Figure 3. Respondents' level of education significantly determined their probability of owning a LLIN ($\chi2=57.60$, df=10, $p<0.05$). In contrast, their level of education had no significant relationship with their using LLIN or not ($\chi2=10.26$, df=5, $p>0.05$). Moreover, there was no gender difference in the ownership [males 42.0% vs. females 46.4%] ($\chi2=1.39$, df=1, $p>0.05$) and use [males 45.2% vs. females 52.9%] ($\chi2=4.43$, df=2, $p>0.05$) of LLIN among the respondents.

It is important to emphasise that 0.3% of respondents who actually use the LLIN is judged to have been wrongly using the treated material by using it for window screening instead of hanging it over the bed when sleeping.

Three hundred and thirty-three (97.6%) of those actually using the LLIN perceived the treated material as very effective in protecting one from mosquito bite. However, a very few of this category of respondents reported that the LLIN use causes heat (0.9%) and complained of some reactions that included body itching and sting in the eyes (0.3%).

Sources of LLINs owned by respondents are presented in Table 2.

Other preventive measures respondents reported taking against malaria were: use of window/door screens (59.5%), chemical spraying with insecticides (54.3%), clear bushes around the home (38.9%), close windows (35.9%), clear drainages (32.2%), drain stagnant water surrounding the home (31.4%), cover body with cloth when sleeping (24.8%), sleep under untreated nets (21.6%) and burn mosquito coil (20.6%). A very few (0.5%) pointed out taking other malaria preventive measures such as taking herbal prophylaxis and closing doors.

Most (50.2%) of respondents reported spending more than ₦500.00 ($1.39) with an average of ₦728.64 ($2.02) (₦783.87 [$2.18] Lagos vs. ₦654.53 [$1.82] Niger) in protecting themselves and household from malaria. The summary of how much respondents spend every month to protect themselves or their children from malaria is presented in Table 3.

Who respondents deemed fit to use LLINs

On the one hand, only about a quarter (25.8%) of the respondents deemed young children under five years fit to use the LLIN assuming only one LLIN is provided their respective households based on their priority of household members health. On the other hand, none of the respondents mentioned pregnant women as fit to use the LLIN for malaria prevention. Table 4 presents who the respondents deemed fit to use the LLIN.

Use of act and preferred drugs for malaria treatment among respondents

Only 44.5% of respondents reported ever to have used ACT in treating past bouts of malaria (36.7% Lagos State vs. 55.3% Niger State). On the contrary, 28.9% reported never to have taken ACT for malaria treatment while 10.8% can't remember/don't know and 16.7% did not respond.

Results presented in Table 5 show that only 24.6% of the respondents preferred taking ACT as their first choice drug for malaria treatment compared to 33.5% who take analgesics as their first choice drug for malaria treatment.

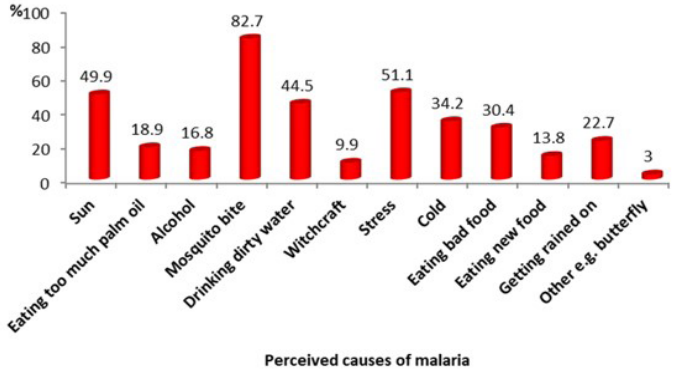

Figure 1: Perceived causes of malaria among respondents.

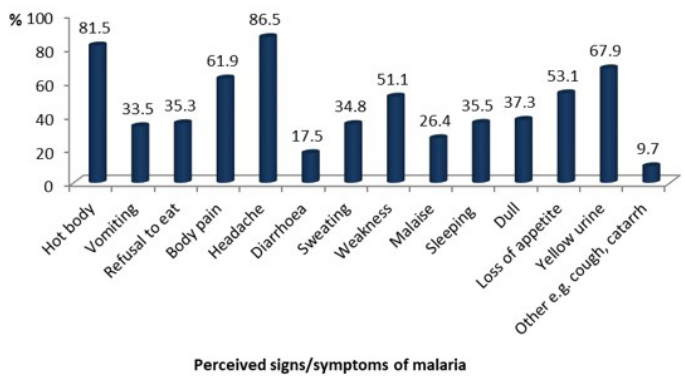

Figure 2: Respondent's perceived signs/symptoms of malaria.

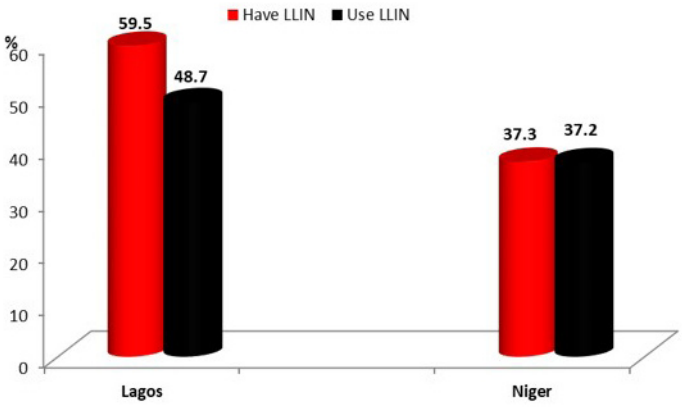

Figure 3: Ownership and actual use of LLINS by respondants according to state.

Table 1: Socio-demographic characteristics of respondents.

Socio-demographic characteristics	Lagos Frequency %	Niger Frequency %	Total Frequency %
Age (in years)			
≤24	65 14.8	96 29.8	161 21.2
25-34	110 25.1	84 26.1	194 25.5
35-44	103 23.5	50 15.5	153 20.1
45-54	82 18.7	30 9.3	112 14.7
≥55	78 17.8	56 17.4	134 17.6
No response	1 0.2	6 1.9	7 0.9
Total	439 57.7	322 42.3	761 100.0
Sex			
Male	116 26.4	167 51.9	283 37.2
Female	323 73.6	155 48.1	478 62.8
Total	439 57.7	322 42.3	761 100.0
Religion			
Christianity	208 47.4	0 0.0	208 27.3
Islam	218 49.7	321 99.7	539 70.8
Traditional	13 3.0	1 0.3	14 1.8
Total	439 57.7	322 42.3	761 100.0
Education			
None	2 0.5	5 1.6	7 9.0
Primary	104 23.7	40 12.4	144 18.9
Secondary	208 47.4	51 15.8	259 34.0
Tertiary	85 19.4	18 5.6	103 13.5
Quranic/Arabic	0 0.0	202 62.7	202 26.5
Other	40 9.1	6 1.9	46 6.0
Total	439 57.7	322 42.3	761 100.0
Occupation			
Artisan	74 16.9	42 13.0	116 15.2
Unemployed	27 6.2	10 3.1	37 4.9
Farming	4 0.9	84 26.1	88 11.6
Housewife	5 1.1	51 15.8	56 7.4
Privately employed	43 9.8	1 0.3	44 5.8
Civil servant	30 6.8	25 7.8	55 7.2
Trading	184 41.9	79 24.5	263 34.3
Other	72 16.4	30 9.3	102 13.4
Total	439 57.7	322 42.3	761 100.0
Monthly income			
None	70 15.9	68 21.1	138 18.1
< ₦10,000	112 25.5	138 42.9	250 32.9
₦10,001 - ₦20,000	148 33.7	39 12.1	187 24.6
₦20,001 - ₦30,000	31 7.1	32 9.9	63 8.3
₦30,001 - ₦40,000	23 5.2	18 5.6	41 5.4
₦40,001 - ₦50,000	14 3.2	6 1.9	20 2.6
> ₦50,000	32 7.3	16 5.0	48 6.3
No response	9 2.1	5 1.6	14 1.8
Total	**439 57.7**	**322 42.3**	**761 100.0**

Table 2: Sources of LLINs owned by respondents.

Sources of LLINs	Frequency (n=381) %
Chemist shop/Pharmacy	4 1.0
Market vendor	9 2.4
Retail/wholesale shop	4 1.0
Private clinic	1 0.3
Government clinic	300 78.4
Gift from relations/friends	6 1.6
Other	57 15.0

Table 3: How much respondents spend on malaria prevention per month.

Amount spent on malaria prevention	Lagos Frequency %	Niger Frequency %	Total Frequency %
< ₦500	206 46.9	152 47.2	358 47.0
₦500 - ₦1,000	97 22.1	109 33.9	206 27.1
₦1,001 - ₦1,500	48 10.9	28 8.7	76 10.0
> ₦1,500	74 16.9	26 8.1	100 13.1
Undecided	14 3.2	7 2.1	21 2.8
Total	439 57.7	322 42.3	761 100.0

Table 4: Who is deemed fit to use LLIN by respondents.

Person deemed fit for LLIN use	Frequency (n=761)	Percentage
Self only	119	15.6
Spouse	18	2.4
Grown-up children (above five years)	44	5.8
Young children (under five years)	196	25.8
Self and spouse	22	2.9
Self and grown-up children	14	1.8
Self and young children	161	21.2
Undecided	187	24.6

Table 5: Respondents' preferred drugs for malaria treatment.

Preferred drugs for malaria treatment	Frequency % (n=761)
ACT	187 24.6
Analgesics	255 33.5
Herbs/*Agbo*	40 5.3
Chloroquine	55 7.2
Sulphadoxine pyrimethamine	52 6.8
Antibiotics	5 0.7
Artemisinin (Monotherapy)	22 2.9
Other e.g. Mixagrip	1 0.1

Discussion

The study showed most respondents had correct knowledge of mosquito bite as the main route of malaria transmission though many still had misconceptions about the cause of malaria infection. More health education targeting this latter group of people in the communities by Malaria Control Programme officers at the State and LGA levels therefore becomes important to demystify the erroneous beliefs shared by some of the respondents about the cause of malaria. It is believed that the correct knowledge of mosquito bite as the main route of malaria transmission by all will make them appreciate the their susceptibility to mosquito bite, seriousness of the consequences and benefits and likelihood of taking recommended action by sleeping in LLINs.

The use of LLIN and ACT reported in the study are below the targets of the 2014-2020 National Malaria Strategic Plan of ensuring at least 80% of the targeted population utilizes appropriate preventive measures and all individuals with confirmed malaria seen in private and public health facilities are treated with effective anti-malarial drug by 2020 [21].

The geographical difference in the ownership and use LLIN among respondents of the two States studied could be attributed to the massive push to deliver LLINs to every household in Lagos State where the State government as at 2012 had distributed about 4.2 million LLINs to pregnant women during visits to antenatal clinics and LLINs to under-five children on completion of immunization using hospital-based and house-to-house approaches. Nevertheless, it is disappointing that ownership and actual use of LLINs observed in this study is still far below the past expected Roll Back Malaria (RBM) targets of 60% by 2005 and 80% by 2010 on awareness and access to LLINs [22,23], and at the same time far from the 80% targeted for 2020 in the country's 2014-2020 National Malaria Strategic Plan [21].

Similarly, the poor perception of respondents about which household member is deemed fit to use the LLIN assuming only one LLIN is provided their respective households and their observed misplaced priority of household members' health particularly as it concerns prevention of malaria among pregnant women and under-five children leaves much to be desired. Given that most of the respondents in the study did not perceive children under five years and pregnant women as the most vulnerable groups to malaria infection, the communities studied need to be sensitised on the importance of the need to give priority to children under five years and pregnant women when taking actions relating to malaria control particularly as it relates to use of LLIN by both vulnerable groups and access to intermittent prevention of malaria in pregnancy by pregnant women both at the household and community levels.

Adequate and appropriate health education using a myriad of information, education and behavioural change communication (IEC/BCC strategies therefore need be carried out to educate beneficiaries of government LLIN distribution programme and others who own LLINs on the most effective way of using the treated material to yield the most desired outcome. This will help prevent the wrong use of LLINs for window screening and at the same time improve knowledge on prioritised groups of people for LLIN use given their vulnerability to malaria as observed among a few respondents in the study. Improving this poor perception is believed will contribute to the reduction of maternal, neonatal and under five child deaths attributable to malaria. In the long run, In the long run, this is anticipated to contribute to the attainment of the target of SDG 3.1 is to reduce the global maternal mortality ratio to less than 70 per 100,000 live births and SDG 3.2 is to reduce neonatal mortality to at least as low as 12 per 1000 live births and under-5 mortality to at least as low as 25 per 1000 live births by 2030 [24] in Nigeria that presently accounts for 24% of all global malaria deaths [1].

The fact that fewer respondents reported taking action within the home or seek appropriate healthcare outside the home within 24 hours of onset of malaria signs or symptoms compared to those who do same between 24 and 48 hours or more and results in Table 5 showed poor chemotherapeutic practices among the respondents. It is apparent that many people are not aware of ACTs, hence the continuous use of the declassified antimalarials including chloroquine and sulphadoxine-pyrimethamine for malaria treatment. Intensive health education on the importance of prompt use of ACT in the communities particularly among those in Lagos State as the first-line treatment drug as emphasized in the National Policy on Malaria Diagnosis and Treatment document [25] becomes paramount. This suggests the urgent need to intensify health education on malaria treatment emphasizing the dangers of delay in early and appropriate treatment as essential components of the home management of malaria program aimed at achieving target of SDG 3.3 to eliminate malaria by 2030 [24].

The monthly household expenditure for malaria prevention relative to income reported in the study representing 4.5% (4.3% Lagos vs. 4.6% Niger) given other health expenditures aside malaria management corroborate the economic burden

of malaria. This affirms how malaria exerts a severe social and economic burden on households and the nation at large, retarding the gross domestic product (GDP) by 40% annually and costing approximately 480 billion naira ($1.33 billion) in out-of-pocket treatments and prevention expenditures [26].

Declaration of funding

This work was supported by the Nigerian Institute of Medical Research, Lagos.

Declaration of financial/other relationships

All authors are employees of the Nigerian Institute of Medical Research (NIMR) which received financial support for this study from the NIMR. None of the researchers has any financial interest or benefit that has arisen from the direct applications of this research.

Authors' contributions

This work was carried out in collaboration among all authors. Authors ATS and OYA were involved in the conception, design of the study and writing of the protocol, all authors were involved in the data collection, and OAK performed the statistical analysis. AAK was involved in the interpretation of the data, and AAK, BIC, ACO, OHI, AAO, AOO, AO, OAB and OAK wrote the first draft of the manuscript. Authors AAK, ATS and OYA managed the literature searches. All authors read and approved the final manuscript.

Disclosure statement

No potential conflict of interest was reported by the authors.

Acknowledgements

The authors wish to thank to the traditional leaders and residents of the communities where the study was conducted for their cooperation and support throughout the study period. We also appreciate the contributions of the research assistants and the Malaria Control Officers of Borgu LGA, Niger State and Ikorodu LGA, Lagos State towards the successful completion of this work. We sincerely acknowledge the financial support of the Nigerian Institute of Medical Research.

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