

# Malaria Control Strategies among Rural Dwellers in a Typical Nigerian Setting

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## ABSTRACT

**Background:** Malaria is a major public health problem in sub-Saharan African, including Nigeria, causing 63% of total outpatient attendance in health facilities, 30% under-five mortality, and 11% of maternal mortality. Malaria control practices remain a major strategy in the combat of this menace. Therefore, the aim of this study is to determine the malaria control strategies utilized among rural dwellers in the Ezza North local government area (LGA) of Ebonyi state. **Materials and Methods:** This is a cross-sectional study which employed systematic sampling technique in selecting 200 households in Ezza North LGA of Ebonyi state where households were allotted numbers and every second households were selected. The interviewer administered questionnaire that was used to interview one respondent per household. Data were analyzed using descriptive statistics and presented using frequency tables and charts. **Results:** The age range of respondents' was between 18 and 80 years with majority of 137 (68.5%) aged 18–40 years. The majority of respondents were females (59.5%), married (60.0%) while 23.0% had tertiary education. The prevalence of malaria within the preceding 6 months was 56.5%. Fourteen (12.4%) of those who suffered malaria in the preceding 6 months reported they were diagnosed using malaria rapid diagnostic test kits. Furthermore, 59.3% of them were treated using orthodox medicines. Control strategies practiced by respondents included a combination of environmental sanitation and other preventive measures. The findings revealed that 60 (30.0%) used door/window nets, 49 (24.5%) used indoor insecticidal spray, 38 (19.0%) used long-lasting insecticidal bed net, 24 (12.0%) used protective clothing's, 10 (5.0%) used mosquito repellent cream, and 4 (2.0%) used electronic insect catcher while 15 (7.5%) used coil/smoke to drive away mosquitoes. The type of environmental sanitation practiced by the respondents included; clearing of bushes/cutting down of water-bearing plants (28.5%), clearing of gutters and covering of potholes in the surrounding (28.0%), and removal of open water containers (9.0%) while 34.5% practiced a combination of the above-mentioned methods. Furthermore, 52.0% of respondents reported that the preventive measure they adopted was "effective." **Conclusion:** From the study, it is evident that the prevalence of malaria is still high due to inconsistent utilization of malaria prevention measures especially the use of long-lasting insecticidal treated nets (LLITNs) and poor environmental sanitation practices creating breeding sites for malaria vector. Therefore, there is a need to strengthen

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already existing intervention strategies like indoor residual spraying; furthermore, it is very necessary to scale-up long-lasting insecticidal nets coverage and increases uptake of intermittent preventive treatment among the pregnant women through health promotion activities.

**Key words:** Control strategies, Ebonyi state, malaria, Nigeria, rural dwellers

## BACKGROUND

Malaria is a life-threatening disease caused by the *Plasmodium* parasite. It was previously thought to come from fetid marshes, hence the name malaria, from the Italian, “bad air.” Roughly 120 species of *Plasmodium* exist and can be found in the blood of mammals, reptiles, and birds. The primary mode of transmission for malaria parasites is the mosquito. Those malarial parasites affecting humans are exclusively transmitted by the female *Anopheles* mosquito. The four human malarial parasites of primary public health concern are described as *Plasmodium* (or *P.*) *vivax*, *P. malariae*, *P. falciparum*, and *P. ovale*. *P. falciparum* and *P. vivax* are the two most common types of malaria, and *P. falciparum* is the most deadly.<sup>[1]</sup>

In Nigeria, malaria has proven to be the major public health problem confronting countries in the sub-Saharan Africa, thereby hampering their development, with a high proportion of its wealth being drained by this disease. It is the major cause of hospital visits, responsible for 60% of outpatient visits to health facilities, 30% of childhood death, 25% of deaths in children under 1 year, and 11% of maternal deaths.<sup>[2,3]</sup> Furthermore, this has resulted in huge financial loss from malaria (in the form of treatment cost, prevention, loss of man-hours etc.). The disease directly contributes to poverty, low productivity, and reduced school attendance. These problems have further been compounded by the high level of resistance to the first- and second-line antimalarial medicine in the country.

There are an estimated 300 million acute cases of malaria every year around the world resulting in more than 1 million deaths. Approximately 90% of these deaths occur in Africa, mostly in young children.<sup>[3]</sup> Up to 97% of the population is estimated to be at risk of the disease.<sup>[3]</sup> Dodoo *et al.* reported that out of 200 students who participated in the malaria parasite infection study, the prevalence rate of 61% was obtained in the pasts 3 months.<sup>[4]</sup> This is also similar to the reports of Anumudu *et al.*, 2006, who reported 61% and 59%, respectively.<sup>[5]</sup> The use of long-lasting insecticidal nets (LLINs) in Nigeria has been shown to reduce childhood mortality due to malaria by 25–30%, and a decrease in the number of malaria episodes by 50%.<sup>[3]</sup> Furthermore, the Nigerian Federal Ministry of Health estimates a financial loss from malaria (in the form of treatment cost, prevention, loss of man-hours etc.) to be roughly 132 billion naira per year (appropriately \$838,564,000 USD) with this, it is clear that

health is a prerequisite for economic development/prosperity. The disease directly contributes to poverty, low productivity and reduced school attendance in Nigeria.<sup>[2]</sup> The launching of the rollback malaria initiative in April 25,2000, and the commitment of all African leaders to fight the disease which kills over 1 million children and pregnant women every year was commendable. One of the key strategies to control malaria is effective case management. Unfortunately, this has received a major setback in the past years because of the high level of resistance to the first- and second-line antimalarial medicines, i.e., chloroquine and sulfadoxine-pyrimethamine. The WHO recommendation for effective antimalaria medicines ranges from 85% and above while the above mentioned antimalaria fall below WHO set standard. The national malaria treatment policy was reviewed during which the artemisinin-based combination therapies were introduced. These medicines are presently the most efficacious antimalarial treatment available with parasitemia clearance rate of 100%.<sup>[6]</sup> The therapeutic efficacy study in 2004 and a repeated test in 2009 has continuously demonstrated high efficacy of these artemisinin combinations therapy. In recent past, areas of high malaria transmission such as Nigeria, malaria treatment has been based mainly on clinical diagnosis which was presumptive, because malaria was considered one of the common causes of fever, but now treatment is based on confirmed diagnosis using rapid diagnostic tests (RDTs)/microscopy.<sup>[7]</sup>

With the deployment of several other control interventions such as LLINs and indoor residual spraying (IRS), and intermittent preventive treatment (IPT), there should have been emerging evidences of decline in the incidence of malaria in the country, but this seems no to be so. These have further been compounded by the increased rate of drug resistance malaria parasites and treatment relapse in recent times. This was confirmed at field visit to some health facilities in Ezza North local government area (LGA) of Ebonyi state, by the researcher, records indicated that most infants, young children, and pregnant women visiting the health facilities are due to malaria as documented in the hospital records. This motivated the research to identify the malaria control strategies utilized in the prevention of malaria in this rural population.

## MATERIALS AND METHODS

Cross-sectional study was used to assess the malaria control strategies utilized in Ezza North LGA. of Ebonyi state.

Ezza North is a LGA in Ebonyi state with administrative headquarters in the town of Ebiaji. Ezza North LGA falls under the central senatorial district of Ebonyi state, otherwise known as Ebonyi Central Senatorial District alongside Ezza South, Ikwo, and Ishielu LGAs. Ezza North LGA also forms a federal constituency alongside the Ishielu LGA. Its headquarters is at Ebiaji town. It has an area of 305 km<sup>2</sup> and a population of 145,619 at the 2006 census. The LGA is bounded to the North by Ohaukwu LGA, to the northeast by Ebonyi LGA, to the east by Abakaliki LGA, to the south by Ezza South LGA, and to the west by Onicha and Ishielu LGAs. Ezza North created in 1996 alongside other LGAs in the then new Ebonyi state used to be part of old Ezza LGA. It is a predominant Igbo town inhabited by Ezza people they are comprised traders, civil servants, students, artisans, and farmers, with low educational background.

The study population consists of both residents and natives of the area who are aged 18 years and above. This study was conducted between August 2018 and December 2018. A stratified sampling technique was used to select 200 respondents for the study. Ezza LGA has 22 district areas. The LGA was stratified by these district areas and five district areas were randomly selected, namely, Ekka, Nkomoro, Umueze-Koha, Amagu, and Nsokara. Simple random sampling was later used to select 40 households from each of these selected districts by balloting. The questionnaire was administered to the head of the household who were literate and interpreted in their local dialect for those who had no formal education.

The instrument used in the collection of data in this study was a self-administered questionnaire. The questionnaire was administered to the respondents after obtaining their consent and all necessary explanation given to the respondents. Advocacy visit to the village head/chief was done and permission to carry out the research was granted. During the data collection observation, oral interview and information given were assured of confidentiality. The questionnaire is made up of sections A and B. Section A addressed the socio-demographic features of the respondent. Section B dealt with the aim of the study. Data collected were collated and inputted into a Statistical Package for Social Sciences version 21.0. The analyzed data were presented using frequency distribution tables with percentage and charts.

## RESULTS

The result indicated that out of a total of 200 respondents, 119 (59.5%) of them were females while 81 (40.5%) were males. The majority of the respondents 137 (68.5%) were aged between 18 and 40 years. Thirty-five (17.5%) were aged 41–60 years while 28 (14.0%) were aged 6 years and above. The marital status of the respondents indicated that 120 (60.0%) were married while 80 (40.0%) were single.

The respondents that participated were predominantly farmers/traders 88 (44.0%), 42 (21.0%) were students/apprentices, 32 (16.0%) were artisans/others, and 38 (19.0%) were civil servants/professionals. The educational levels of the respondents showed that 46 (23.0%) attained tertiary education, followed by 49 (24.5%) who attained primary education, and 65 (32.5%) secondary, however, 40 (20.0%) had no formal education. The religious backgrounds of the respondents were majorly Christianity 165 (82.5%), Muslims 7 (3.5%), and traditional 28 (14.0%). This is shown in Table 1.

### Prevalence, method of diagnosis, and treatment option of malaria among the respondents

The prevalence of malaria among the respondents within the preceding 6 months was 56.5% ( $n = 113$ ). Malaria diagnosis was mainly through the use of clinical signs and symptoms 52.2%, followed by the use of microscopy 35.4%, while the least was through the use of malaria RDT (mRDT) as indicated in 12.4% of those that suffered malaria. Sixty-seven (59.3%) out of the 113 who suffered malaria indicated that it

**Table 1: Socio-demographic characteristics of the respondents**

Variables	Frequency $n=200$ (%)
Gender	
Male	81 (40.5)
Female	119 (59.5)
Age (years)	
18–40	137 (68.5)
41–60	35 (17.5)
61–80	28 (14.0)
Marital status	
Single	80 (40.0)
Married	120 (60.0)
Occupation	
Housewife/student/apprentice	42 (21.0)
Farmer/trader	88 (44.0)
Civil servant/professionals	38 (19.0)
Artisan/others	32 (16.0)
Level of education	
None	40 (20.0)
Primary	49 (24.5)
Secondary	65 (32.5)
Tertiary	46 (23.0)
Religion	
Christian	165 (82.5)
Muslim	7 (3.5)
Traditional	28 (14.0)

was treated using orthodox medicines, 32 (28.3%) used local traditional methods like the use of herbs and leave extracts to treat their malaria. However, 12.4% reported none use of any form of medication. This is shown in Table 2.

### Preventive strategies adopted for malaria control among the respondents

Preventive strategies adopted for malaria control among the residence of Ezza North LGA, Ebonyi state is presented in Figure 1 below. It indicated that the most utilized preventive measure is the use door and window nets as reported by 60 (30.0%) of the respondents, this followed by the use of indoor residual insecticidal spray (24.5%), use of LLINs was utilized by 19.0% of the respondents, also use of protective clothing's was indicated by 5.0% of the respondents, and use of coil and smoke to drive away mosquitoes was reported by 7.5% of the respondents while only 2.0% indicated use of electronic insect catcher.

Some of the environmental sanitation practiced by the respondents included the following; clearing of bushes/cutting down of water-bearing plants (28.5%), clearing of gutters and covering of potholes in the surrounding (28.0%), and removal of open water containers (9.0%) while 34.5% practiced a combination of the above-mentioned methods, as presented in Figure 2.

Furtherance to that, 28 (14.0%) reported they slept inside mosquito net the previous night. Most of the respondents, 170 (85%), affirmed that the application of insecticide can prevent/control malaria. Frequency of environmental sanitation in their surroundings indicated that the majority of the respondents clear their surrounding monthly 93 (46.5%), followed by weekly 71 (35.5%), daily 30 (15.0%), and least implemented yearly 6 (3.0%). The majority of the respondents said that the preventive measure they used was

effective 104 (52.0%), while 96 (48.0%) indicated it was ineffective, as shown in Table 3.

## DISCUSSION

### Socio-demographic characteristics of the respondents

The study indicates that among the study population, 59.5% were females, this may be due to the fact that most women stay at home to carter for the family and take care of their children unlike men who leave the house for places of livelihood, and therefore more women were at home as this was a household study. The majority of 68.5% of the respondents were within the ages of 18–40 years; this was expected as the majority of Nigerian population were youth and also since the majority of the respondents were married, and this represents the active reproductive age of women. The result indicated that 44.0% of the respondents were farmer/traders, farming and petty trading is the major occupation of the people in this locality and other rural

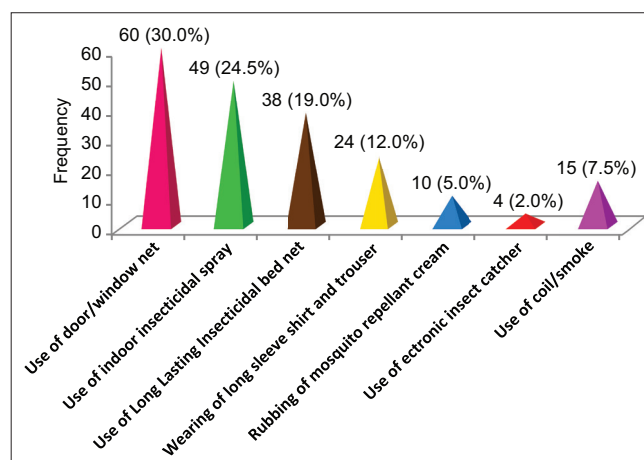


Figure 1: Preventive measures mainly utilized for malaria control

**Table 2: Prevalence, method of diagnosis, and treatment of malaria among the respondents**

Variables	Frequency n=200 (%)
Suffered malaria in the past 6 months	
Yes	113 (56.5)
No	87 (43.5)
If yes, how was it diagnosed (n=113)	
Through malaria rapid diagnostic test	14 (12.4)
Microscopy	40 (35.4)
Using only signs and symptoms	59 (52.2)
How was it treated (n=113)	
Through the use of orthodox medicine	67 (59.3)
Through the use of traditional medicine	32 (28.3)
No treatment given	14 (12.4)

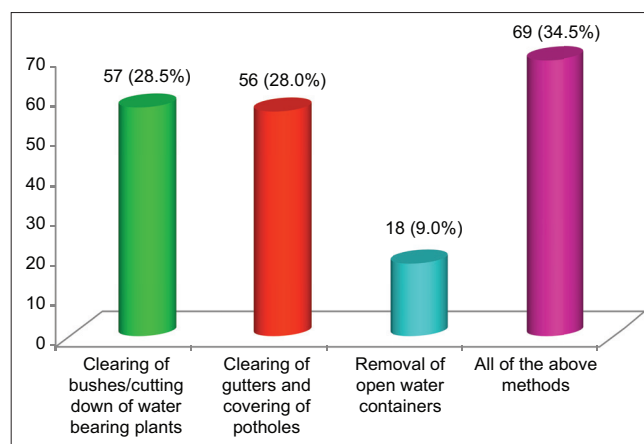


Figure 2: Method of environmental sanitation practiced by the respondents

**Table 3:** Use of mosquito net, frequency of environmental sanitation, and perception of the preventive measure adopted by respondents

Variables	Frequency n=200 (%)
Slept inside mosquito net the previous night	
Yes	28 (14.0)
No	172 (86.0)
Frequency of environmental sanitation	
Daily	30 (15.0)
Weekly	71 (35.5)
Monthly	93 (46.5)
Yearly	6 (3.0)
How do you rate the current preventive measure you utilize	
Effective	104 (52.0)
Ineffective	96 (48.0)

communities in the Eastern part of the country. Only 31.5% attained tertiary education; this shows the literacy rate of the respondents. The result also indicated that they were predominantly Christian population (81.5%).

### Prevalence and knowledge of malaria

This study shows that all the respondents 100% have heard of malaria and 88.0% also heard of malaria prevention, the majority 30.0% were through health facilities among the residence of Ezza North LGA of Ebonyi state. This could be due to regular health education at health facilities during an antenatal visits and routine immunization on malaria causes, treatment, and prevention. The study also indicates the malaria prevalence rate of 56.5% among the respondents within preceding 6-months. Most diagnoses of malaria 43.4% were through the use of mRDT and least confirm diagnosis of 21.2% through microscopy, while 59.3% of treatment using orthodox medicines and lowest 12.4% no treatment given respondents. Although 79.5% of the respondents said that malaria was caused by the bite of an infected mosquito and least respondents, 3.5% said is staying under the sun. These relate with the report of 40.9% prevalence rate by Uneke *et al.*,<sup>[8]</sup> and higher than that of Okocha *et al.*<sup>[9]</sup> who reported 30.2% prevalence within the southeast locality while (National Manufacturing Competitiveness Programme, 2008) reported that malaria is the major cause of hospital attendance and malaria account for over 60% of out-patient visit in Nigeria and is responsible for 30% and 11% mortality rate in children and pregnant women, respectively.<sup>[10]</sup> Malaria infection poses greater dangers in special groups such as sickle cell anemia patients, emigrant from non-endemic region, pregnant women, and children under 5 years of age. This contrast sharply with the findings of Dodoo *et al.*,<sup>[4]</sup> of 200 students participated for malaria

parasite infection, the prevalence rate of 61% was obtained in the past 3 months, this result collaborates with the findings of Anumudu *et al.*<sup>[5]</sup> who reported 61% and 59%, respectively. The high risk and prevalence of malaria 56.5% in Ezza North LGA, Ebonyi state, reveal that malaria infection is endemic in the area. The high prevalence of malaria could be due to some factors such as availability of breeding sites for malaria vectors, inadequate use of long-lasting insecticide treated net (LLITN), amount of rainfall, and poor treatment of malaria diseases among others. High prevalence of malaria may be a result of inadequate protection against mosquito bites, practices promoting mosquito breeding and access of mosquito to the people as well as the failure of vulnerable population to use proven and effective intervention strategies of malaria prevention, control, and treatment.

### Environmental methods adopted for malaria control

This study shows that 85.5% of the respondents said that environmental sanitation can prevent/control malaria, 46.5% of the respondents' carryout environmental sanitation in their surroundings daily and at least 3.0% yearly. The methods adopted by the respondents among the residence of Ezza North LGA of Ebonyi state shows that all of the above 34.0% practiced all the methods mentioned as to include clearing of bushes/cutting down of water-bearing plants, clearing of gutters and covering of potholes, and removal of open water containers. This practice is in cognizant with the law enacted and enforced by Ebonyi state government on environmental sanitation to their citizens; these enhance prevention and control of communicable and non-communicable diseases and vectors, for example, malaria and mosquito. This agrees with the report of Amoran *et al.*, where a total of 300 households were recruited into the study on the influence of environmental sanitation on the prevalence of malaria in a rural town in Southwestern Nigeria.<sup>[11]</sup> Only 4.7% were regularly involved in daily cleaning of the environment outside their houses and 95.3% were aware that dirty environment increases the risk of contracting malaria. The prevalence of malaria attacks in the past 6 months among respondents was 56.5%. Regular cleaning of respondent's environment outside their houses was statistically significantly associated with the prevalence of malaria in the households studied.

### To access other preventive measures adopted for malaria control

The study shows other adopted preventive measures to include the use of LLINs use of insecticides and other mechanical barriers. The result of the study revealed that only 58.5% sleeps inside LLIN last night among the respondents. It is because the LLINs are free of charge according to the Ebonyi State Malaria Elimination Programme. This agrees with the policy on the implementation of LLINs in Nigeria,<sup>[3]</sup> which stated that LLINs coverage and net ownership above 50% is a successful campaign and scale-up net use through

routine distribution (antenatal care, Expanded Programme on Immunization /National Programme on Immunization, and CDDs). The use of insecticides according to the study shows that the majority of the respondents 38.5% uses Otapiapia; these may be due to affordability, availability, accessibility of WHOPEs recommended insecticides in Ezza North LGA of Ebonyi state. The majority of respondents 39.5% were using door and window nets, use of smoke 35.5%, wearing of long sleeve shirt and trousers 13.0%, robbing of mosquito repellent cream 9.5%, and use of electronic insect catcher 2.5% in prevention of malaria. This is because most of the residence of Oroke Onuoha village belong to the low socio-economic status and therefore cannot afford using IRS, larviciding, knockdown insecticides, installing nets on the doors and windows, and electronic insect catcher. Although the use of otapiapia does not meet the recommendations of WHOPEs on insecticide use in Nigeria. As indicated above, there is a significant result on the prevalence of malaria among the residence of Ezza North LGA that does not adopt proven strategies for malaria prevention. However, the prevalence of malaria was higher in those that are single than in married couple and self-medication/no treatment is more in single adult than in children and married. This is due to their non-adherent/attitude toward the use of appropriate measures/strategies for malaria prevention, such as sleeping inside LLINs, WHOPEs approved insecticides, and environmental sanitation. These increases the number of breeding sites for mosquito and exposing themselves to mosquito bites which transmit malaria. The study also shows that 52.0% of the recruited interviewers said that methods used in prevention/control of malaria are effective and least 4.5% said not effective. According to national guideline on IPT and prevention of malaria, Federal Ministry of Health, National Malaria and Vector Control<sup>[12]</sup> states that prevention is an effective means of controlling malaria in an endemic region and to ensure greater achievement, individuals should sleep inside LLITN and increase take up of IPT by pregnant women and agrees with the reports that has been marked increase in the number and size of villages and cities in developing countries, without corresponding increase in preventive services and measures that inhibit the breeding of malaria vectors resulting to the increase of malaria cases.<sup>[13]</sup>

## CONCLUSION

Based on the result obtained and discussed, conclusion can be made as follows, that malaria prevalence is high in Ezza North LGA, Ebonyi State. This may be due to poor environmental management creating many breeding sites for malaria vector and poor use of other effective intervention strategies for malaria prevention and controlling such as IPT uptake and IRS. Although it was observed in this study that majority of the respondents sleeps inside LLINs, uses insecticides, for example, Otapiapia, and baygon including environmental sanitation practices. Adequate use of an effective intervention

strategies still remain a challenge due to their attitude the interventions. The major limitations to the study were limited fund for the research, participants' refusal to consent for the research and timing for data collection which was during the raining season when farming exercise is at its peak.

## RECOMMENDATIONS

Using this study, the following recommendations were put forward.

1. To prevent/control and successfully eradicate malaria, effective vaccine is considered in addition to the existing intervention strategies such as LLINs, IRS, and larviciding
2. It is necessary to strengthen already existing intervention strategies such as IRS, larviciding scale-up LLINs coverage, and increase uptake of IPT among pregnant women
3. There is a need for screening and educative program which are the fundamental ways to improve knowledge about malaria in rural areas
4. Institutionalizing home management of malaria at Ezza North LGA of Ebonyi state will help to reduce malaria prevalence and progression to severe malaria. This is a level of malaria care at the community before referral to the health facility, the personnel involve called role model caregivers made up of retired but not tired health personnel in their respective community. This is also a strategy to ensure coverage on interventions and adequate management of uncomplicated malaria by National Malaria Control Programs.

## DECLARATIONS

### Ethics approval and consent to participate

Permission to conduct the study was gotten from School of Health Ethical Committee Board, Federal University of Technology Owerri. Also Advocacy visit to the village head/ chief was done and permission to carry out the research was granted. Verbal consent was obtained from the participants after all necessary explanations were given; this was deemed appropriate because of the general literacy level of the residents. During the data collection observations and information gotten were handled with utmost confidentiality.

### Availability of data and material

The data used for this research was gotten from field survey conducted by the researchers and can be made available on request.

## AUTHORS' CONTRIBUTIONS

CICE and UWD conceived the study, contributed in drafting the study and performed the statistical analysis.

SMO, MM, UE, and LCC synthesized the analysis and interpreted findings.

EAO, AIO, EBO, and CPE designed the questionnaire and also contributed in the drafting of the manuscript.

AJU, ULI, QKD, and UFA did the literature search and participated in data collection.

All authors participated in critical review of the manuscript and approved the final manuscript.

## REFERENCES

1. World Economic Forum, Global Health Initiative. Guidelines for Employer-based Malaria Control Programmes. Lubombo: World Economic Forum, Global Health Initiative; 2006.
2. Chukwu EO. Estimates of rural poverty level and income distribution in Ebonyi state of Nigeria. *Niger J Agric Food Environ* 2012;8:52-61.
3. National Malaria Control Programme. Guidelines on Harmonized Focus Antenatal Care Services and IPT. Nigeria: National Malaria Control Programme; 2012.
4. Dodoo D, Atuguba F, Bosomprah S, Ansah NA, Ansah P, Lamptey H, *et al.* Antibody levels to multiple malaria vaccine candidate antigens in relation to clinical malaria episodes in children in the Kassa Nankana district of Northern Ghana. *Malar J* 2011;10:108.
5. Anumudu CI, Adepoju A, Adediran M, Adeoye O, Kassim A, Oyewole I, *et al.* Malaria prevalence and treatment seeking behaviour of young Nigerian adults. *Ann Afr Med* 2006;5:82-8.
6. Federal Ministry of Health. National Malaria and Vector Control Programme Framework for Integrated Vector Management. Abuja, Nigeria: Federal Ministry of Health; 2005.
7. Federal Ministry of Health. National Malaria Control Programme Guideline on IPT and Prevention of Malaria. Abuja, Nigeria: Federal Ministry of Health; 2011.
8. Uneke CJ, Ogbu O, Nwojiji V. Potential risk of induced malaria by blood transfusion in South-eastern Nigeria. *Mcgill J Med* 2006;9:8-13.
9. Okocha C, Ibeh CC, Ele PU, Ibeh CN. The prevalence of malaria parasitaemia in blood donors in Nigerian teaching hospital. *J Vector Borne Dis* 2005;42:21-4.
10. Federal Ministry of Health, National Malaria Control Programme. Guideline on Monitoring, Evaluation and Tracking of Malaria Data. Abuja, Nigeria: Federal Ministry of Health, National Malaria Control Programme; 2008.
11. Amoran OE, Onwumbe OO, Salami OM, Mautin GB. The influence of environmental sanitation on prevalence of malaria in a rural town in South-Western Nigeria. *Niger J Med* 2014;23:254-62.
12. Federal Ministry of Health, National Malaria and Vector Control. Guidelines for Diagnosis and Treatment of Malaria. Abuja, Nigeria: Federal Ministry of Health, National Malaria and Vector Control; 2011.
13. Fondjo E, Robert V, Le Goff G, Toto JC, Carnevale P. Urban malaria in Yaounde (Cameroon). 2. Entomologic study in 2 suburban districts. *Bull Soc Pathol Exot* 1992;85:57-63.

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