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Mosquito-Avoidance Practices among Caregivers of Children Under Five in Somolu Local Government Area, Lagos State, Nigeria

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Abstract

Malaria control efforts currently lay emphasis on reducing transmission by limiting human-vector contact. Meanwhile, Mosquito-Avoidance Practices (MAPs) have been shown to be sub-optimal in urban areas, especially among under-five children (U-5C), resulting in high child morbidity and mortality. This study was therefore designed to investigate MAPs among caregivers of U-5C living in Somolu; an urban Local Government Area (LGA) in Lagos State, Nigeria.

A cross-sectional survey was conducted involving 394 female caregivers of U-5C. The LGA was stratified into three layers based on the level of planning and drainage using a geographic information system (GIS). Data were collected using a semi-structured, interviewer-administered questionnaire and were analysed using descriptive statistics and Chi-square test at p=0.05.

Mean age of respondents was 33.6±7.7 years. The proportion who mentioned mosquito nets as a MAP by strata were: S1-59.3%, S2-80.7% and S3-64.3%. Other MAPs reported included: spraying insecticide: S1-20.5%, S2-26.3% and S3-17.1%, shutting door after sunset: S1-9.6%, S2-10.5% and S3-11.4%, and clearing surroundings: S1-2.9%, S2-5.3% and S3-2.9%. Ownership of bed nets was: S1-76.0%, S2-75.4% and S3-68.6%, and out of these, S1-73.1%, S2-70.7% and S3-72.4% reported that their child slept under the net the night before the survey.

The most common mosquito-avoidance practice among caregivers of under-five children was the use of bed nets, and this did not differ by level of planning and drainage of the study site. Therefore, strategies to improve and sustain the use of bed nets and to promote the use of other effective mosquito-avoidance practices should be encouraged.

Keywords: *Malaria control, Mosquito-avoidance practices, Care-givers, Under-five children.*

Introduction

Malaria remains an overwhelming global health problem. It is a disease known to be associated with poverty and underdevelopment, and is a major scourge in the vast majority of tropical and subtropical regions of the world, particularly in the tropical regions [1,2]. In 2013, the estimated number of malaria cases was 198 million, and an estimated 584,000 deaths [3]. The highest mortality levels occur in sub-Saharan Africa, where children under 5 years of age account for 90% of all deaths due to malaria [4]. Malaria is the fourth leading cause of death of children under the age of five years in developing countries [5]. Although the under-five deaths have declined from 12.0 million in 1990 to 7.6 million in 2010 globally, this reduction is unequally distributed, with India and Nigeria together accounting for a third of under-five deaths worldwide [6].

Malaria is caused by the *Plasmodium* parasite and transmitted through the bite of an infected female *Anopheles* mosquito. The majority of malaria infections are caused by *P. falciparum*, the most dangerous of the four human malaria parasites. Other parasites are *P. vivax*, *P. ovale*, and *P. malariae*. Some major causes for this deleterious situation include: high malaria transmission intensity, limited access to adequate treatment, increasing parasite resistance to affordable and safe medicines, increasing vector resistance to widely used insecticides, delayed care-seeking and

inappropriate treatment at home or community level [7,8].

Symptoms and signs of malaria, which include headache, nausea and vomiting experienced by patients infected with *P. falciparum* are usually more severe than in other malarial infections, and there is a greater tendency towards the development of delirium, haemolytic jaundice and anaemia. This type of malaria is the most difficult to control; it causes severe disease and the mortality rate is much greater than in other forms [9-11]. Young children and pregnant women are the population groups at highest risk because of low immunity. Severe malaria in young children can present with such life-threatening complications as severe anaemia, respiratory distress, repeated convulsions and unconsciousness. Severe malaria can develop from uncomplicated malaria in a few hours, especially if the malaria has not been properly treated or is caused by a drug-resistant parasite. Severe malaria accounts for a third of all childhood deaths in Nigeria [12,13]. Children who survive cerebral malaria may develop neurological abnormalities like deafness, blindness, speech disorders, epilepsy and learning disabilities, which persist in a few children with significant impairment in their development and education [14]. Due to the high burden of malaria among pregnant women and children under the age of five years, targeting women in the reproductive age group and under-five children to deal with the disease has recently been widely recognized [14,12].

In Nigeria, a child will be ill with malaria between 2 and 4 times each year. The financial loss due to malaria is estimated to be about ₦132 billion ($663,316,583) annually in form of treatment, cost, prevention and loss of man-hours [32]. Transmission of malaria occurs throughout the year, with a higher intensity in the southern parts of the country due to the longer rainy season that favours breeding of mosquitoes. The mosquito species that commonly transmit malaria are *Anopheles gambiae*, *An. funestus* and *An. arabiensis* [15].

Currently, the Nigerian malaria control programme emphasizes the behavioural change communication strategies as an integral part of the mass insecticide-treated net (ITN) distribution campaigns [13]. Understanding the local perceptions and practices could be of immense relevance to such interventions that seek to enhance a community's potential to adopt and sustain the use of ITNs. Arogundade *et al*. (2011) reported that misconceptions about prevention and causes of malaria have an impact on net usage even when ITNs are available.

In a study carried out in Nigeria, it was revealed that 40.3% of the respondents used insecticide spray every night to prevent malaria, whereas 4.4% used mosquito repellent cream, 23.8% cleared bushes around house, 25.5% slept under an ITN, 23.4% used mosquito coils and 26.2% destroyed mosquito breeding places [16]. Andrzejewski carried out a study in Ghana in which participants agreed that malaria could be prevented, and several mentioned methods through which mosquitoes can be avoided, like the use of mosquito coils, sprays, window screen as well as mosquito nets [17].

This study was carried out to investigate the various practices adopted by caregivers of under-five children (U-5C) to avoid mosquito bites and the effectiveness of such methods. The results obtained may be used by both malaria control officials and policy makers as a baseline to initiate acceptable intervention and community-based programme activities with regards to the health needs of caregivers of under-five children in relation to the socio-economic status of inhabitants.

Materials and Methods

Study Area

The study was carried out in Somolu Local Government Area (LGA), which is one of the twenty LGAs in Lagos State, Nigeria, and lies on the north of Lagos city. The LGA is densely populated (as at the last census in 2006, the population was 602,673) and it has an area of 12 km^2. Social infrastructures like roads, water, health facilities and educational institutions abound in the LGA. It is close to the lagoon and it is predominantly an Ijebu settlement with some Ilaje and Ijaw populations along the shoreline of the lagoon. There are also other tribes present due to migration.

Study Design

A descriptive, cross-sectional study was carried out to investigate geographical/ecological differentials in the

knowledge of malaria transmission and use of ITNs among caregivers of U-5C.

Sampling Technique

The study was carried out between June and July 2013. The study site was stratified into three strata, based on the road network system and the drainage system observed across the study site using Geographic Information System. This helped to control for environmental and topographical variation that is assumed to influence mosquito ecology. This resulted in three strata for the study site: (1): planned, well drained. Here, the streets were planned with a very good road network. (2): Planned, poorly drained. Here, the area had a good road network system with the streets linking each other; however, there were open drainage systems revealing litter-filled drains. (3): Unplanned, poorly drained. Here, the road network was poor, with pot holes serving as mosquito breeding sites; there was also the presence of blocked and water-logged drainage systems.

Figure 1 shows the LGA according to the level of planning and drainage system.

Sample size and sampling

The minimum sample size was estimated at a minimum of 394 using the formula for a single population proportion [18], considering the use of the cluster sampling method and the 95% confidence interval assumption, 5% margin error, 20% non-response rate and prevalence of use of ITNs among under-five children in South-western Nigeria as 28.8% [19].

The WHO Lot Quality Technique sampling method (WHO, 2006) was used to select 394 caregivers of under-five children from the study communities. The WHO Lot Quality Technique was selected so as to make judgement about individual strata, and hence formulate policies to direct resources to the strata that need it most.

The number of grids to sample in each stratum was selected proportionately and the sample size was shared proportionately among the three strata.

The sample size determined for each stratum was divided by the number of grid cells selected for each stratum to determine the number of caregivers to be studied per grid. A coin was tossed at each grid, with head up signalling that data collection should start from the right of each grid, and tail up signalling that all houses on the left with caregivers of under-five children should be sampled until the number of households in each grid was achieved. The age range of the respondents was 53 (17-70years).

Data collection methods

A pre-tested, interviewer-administered semi-structured questionnaire was administered to caregivers with at least one child under the age of five.

The questionnaire was adapted from the study of Macintyre [20] in Kenya.

Data collection procedure

To obtain high-quality data, the selection and training of research assistants is the first step. A demonstration interview was conducted by the principal investigator who was also the field supervisor to show how a good and efficient interview is conducted. To ensure inter-observer agreement, the supervisor also conducted periodic spot-check re-interviews for each research assistant as well as observing each research assistant interview respondents at least once. There was also close supervision of research assistants and editing of completed interviews to ensure that accurate and complete data were collected (quality assurance). Further information, such as the caregivers' socio-demographic data as well as mosquito-avoidance-practice and ownership and usage of long-lasting insecticide-treated nets (LLINs), was elicited.

Ethical Considerations

The study was approved by the Nigerian Institute of Medical Research Institutional Review Board. Prior to data collection, permission was sought from Somolu Local Government. Informed consent was obtained from all caregivers before interviews commenced.

Results

Socio-demographic characteristics of respondents

The socio-demographic characteristics of the caregivers are summarized in Table 1. Three hundred and ninety-four caregivers were interviewed.

Signs and Symptoms of malaria as reported by respondents according to location

Figure 1 shows the response of the caregivers on questions relating to the signs and symptoms of malaria which they observed in their children. Headache was the most-reported symptom in stratum 1 (102 participants, 32.7%) and stratum 3 (18 participants, 25.75%), whereas in stratum 2 both headache and loss of appetite had the same rate of 16 (28.1%).

Mosquito breeding sites as reported by respondents

A summary of mosquito breeding sites as reported by the caregivers is shown in Table 2. In all strata, over 60% mentioned stagnant water as a mosquito-breeding site.

Cause(s) of malaria as reported by respondents

A summary of cause(s) of malaria reported by the caregivers is shown in Figure 2.

Mosquito avoidance practices

Figure 3 presents the methods the respondents mentioned they adopt to prevent their children from being bitten by mosquitoes. Across all strata, mosquito net was the mosquito avoidance method with the highest proportion among the respondents, 147 (64.4%) in stratum 1, 61 (68.4%) in stratum 2 and 62 (64.7%) in stratum 3.

Factors influencing choice of mosquito avoidance practices

The respondents were asked about the factors influencing the method they use to prevent mosquito bite in their under-five children and what informed their choice.

Multiple mosquito avoidance practices among caregivers of under- five children

Multiple mosquito avoidance practices among caregivers of under- five children refer to the practice of at least two of the following methods: mosquito net, mosquito repellent cream, spraying insecticide (aerosol), indoor residual spraying, use of window and door screen and clearing of bushes and surroundings. Overall, ~85% of the respondents practice just one of the methods listed above, whereas ~15% practiced two or more of the methods.

Relationship between socio-demographic characteristics and the use of multiple mosquito avoidance practices

The relationship between the socio demographic characteristics of the caregivers of under-five children and their use of multiple mosquito avoidance practices is shown in Table 4. There was no significant relationship between location and use of multiple mosquito avoidance practices; however, there was a significant statistical relationship between monthly earning ($p=0.000$), education ($p=0.007$) and the use of multiple mosquito avoidance practices.

Discussion

This study showed the various methods that caregivers of under-five children adopted to protect their children from mosquito bites. It also explored some of the factors influencing the choice of mosquito avoidance practice among the respondents. Some of the factors explored included socio-economic characteristics as well as knowledge of malaria among the respondents. The results of this study showed that caregivers are actively engaged in protecting their children from mosquito bites.

Our findings also showed that the respondents are knowledgeable of the signs and symptoms of malaria. Some of the signs and symptoms mentioned include: chills and rigour, headache, loss of appetite, fever, paleness of eyes and weakness in child. It is encouraging that most respondents knew the signs/symptoms of malaria, because the correct knowledge of the signs/symptoms would significantly influence the individual's ability to take early and appropriate action to treat malaria at the onset of any of its signs/symptom.

The mentioning of headache, loss of appetite, vomiting, chills, rigour and weakness as the major signs and symptoms of malaria by caregivers were similar to those reported in previous studies in Burkina Faso, Nigeria, Ethiopia, Uganda and Cameroon [21-25,28] and agrees with malaria symptoms in clinical case management.

Among the mosquito avoidance methods mentioned, the use of mosquito nets was the most frequently mentioned method. This does

not agree with the findings of Omole *et al.* in Oyo State [12], Chukwuocha *et al.* in Imo State [26] and Muhammad *et al.* in Kano State [27], in which the use of mosquito coils, aerosols and netted windows were the main mosquito avoidance methods. The reportedly high mosquito net usage in this study could be a result of their free distribution by the Local Government as well as health officials.

Our study results are similar to a study conducted in Ethiopia by Yewhalaw *et al.* [2], in which all respondents reported practicing at least one mosquito avoidance method, but contrary to studies carried out in Kenya and Cameroon in which some respondents did not practice any form of mosquito avoidance, and the most commonly practiced preventive method was environmental sanitation [20, 28]. Our results also differ from those of Oyewole and Ibidapo [29], in which the use of fans was the most reported mosquito-bite avoidance strategy. It is also different from that obtained by Hlongwana *et al.* [30] in South Africa, in which most of the respondents used mosquito coils and aerosols, whereas others did not use any method.

It should be pointed out that the fact that all the respondents practiced mosquito avoidance may not be due to explicit knowledge of malaria transmission but could be due to the term 'nuisance avoidance', in which the individual seeks to prevent being bitten or avoid the 'humming sound' so as to sleep peacefully. This aspect was not explored in this study.

The finding that more than half of the respondents across all strata reported using mosquito nets as a mosquito avoidance practice could be due to the state-wide free distribution of LLINs, and also to the distribution of LLINs to pregnant women during antenatal care. Although health education may be an important factor in the use of mosquito nets, the toxic irritant in the saliva of the mosquito which causes irritation may be the only reason for people to adopt the use of LLINs. It is worth noting that, despite having window and door screens, most of the respondents did not report their use as a form of mosquito avoidance method, with even more reporting shutting the door after sunset.

For there to be sustained reduction in malaria cases, individuals must not only perceive malaria as a problem, but also understand its origin and cause for there to be behaviour change. This is the basis of the Health Belief Model (HBM) and it is what drives the Behaviour Change Communication (BCC) programmes, in which sensitization of the community on the challenge at hand takes place before an intervention is put in place [31]. In the case of mosquito avoidance, the use of mosquito avoidance methods should be preceded by knowledge of the mosquito as being a carrier of the malaria-causing parasite.

Few studies have been carried out to determine the use of multiple mosquito avoidance practices [20]. In our study, a very low proportion (13%) engaged in multiple mosquito avoidance practices. This is contrary to the findings of Oyewole and Ibidapo [29], in which ~67% of the participants adopted multiple mosquito avoidance methods, although it was not stated whether there was an LLIN campaign or not. We could believe that more of the respondents adopt one mosquito avoidance method because the method they practice is effective in protecting their under-five children against mosquito bite [20]. There was no significant association between location and the use of multiple mosquito avoidance methods. This is contrary to the findings of Macintyre *et al.*, in which there was a significant association between stratification of study area and the use of multiple mosquito-avoidance behaviour [20]. However, this study corroborates some other findings of the same study by Macintyre *et al.* [20], in which significant association existed between education, monthly earning, wealth quintile, and the use of multiple mosquito avoidance method. This can be explained by the fact that those who are better educated, who earn well and have more expensive household items are usually exposed to more information and can also afford to get more mosquito avoidance methods.

Conclusion

This study showed that caregivers of under-five children are actively engaged in mosquito avoidance practices, which include the use of mosquito nets, spraying aerosols, use of window and door screens and shutting doors after sunset.

The study also demonstrated that socio-economic factors, such as monthly earning, wealth quintile and education, influenced the

adoption of mosquito avoidance practices. The respondents reported that their choice of mosquito avoidance practice is because of the ease of use of the adopted method.

The frequent use of mosquito nets in the study area by caregivers of under-five children is due to health workers' advice and probably related to the fact that such mosquito nets were freely distributed to the community members.

The most common mosquito-avoidance practice among caregivers of under-five children was the use of bed nets, and this did not differ by level of planning and drainage system of the study site. Therefore, strategies to improve and sustain the use of bed nets and to promote the use of other effective mosquito-avoidance practices should be encouraged.

Figures and Tables

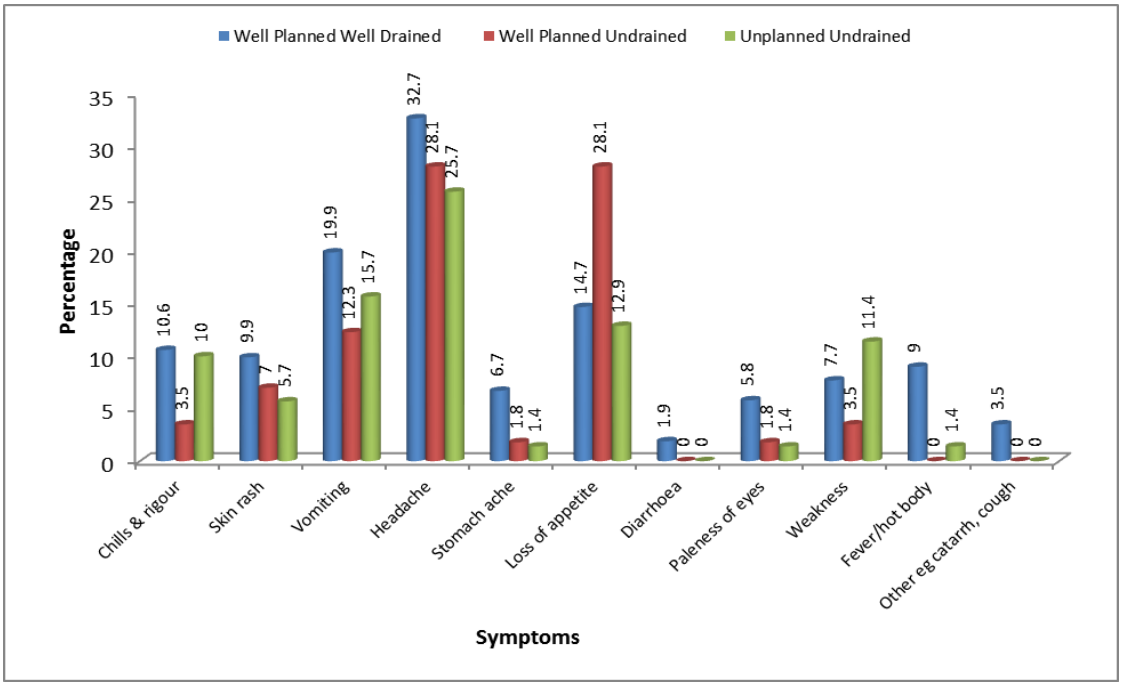

Figure. 1: Signs and Symptoms of Malaria as Reported by Respondents

Note: Multiple responses

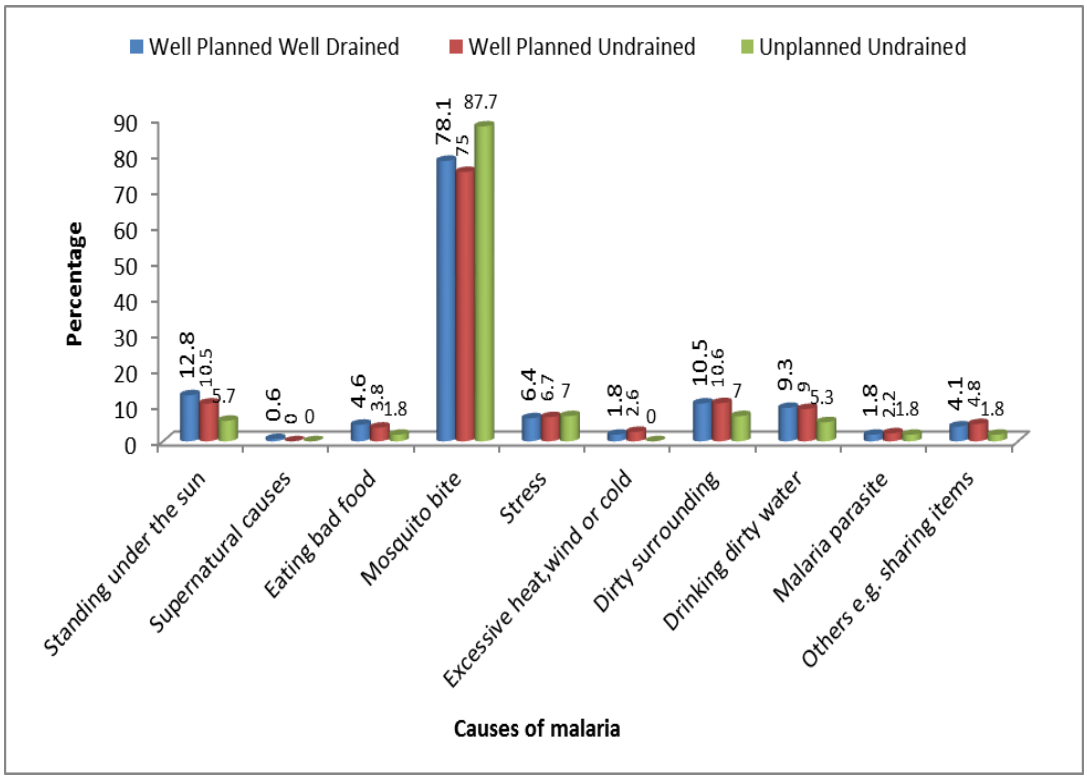

Figure. 2. Causes of Malaria as Reported by Respondents

Note: Multiple responses

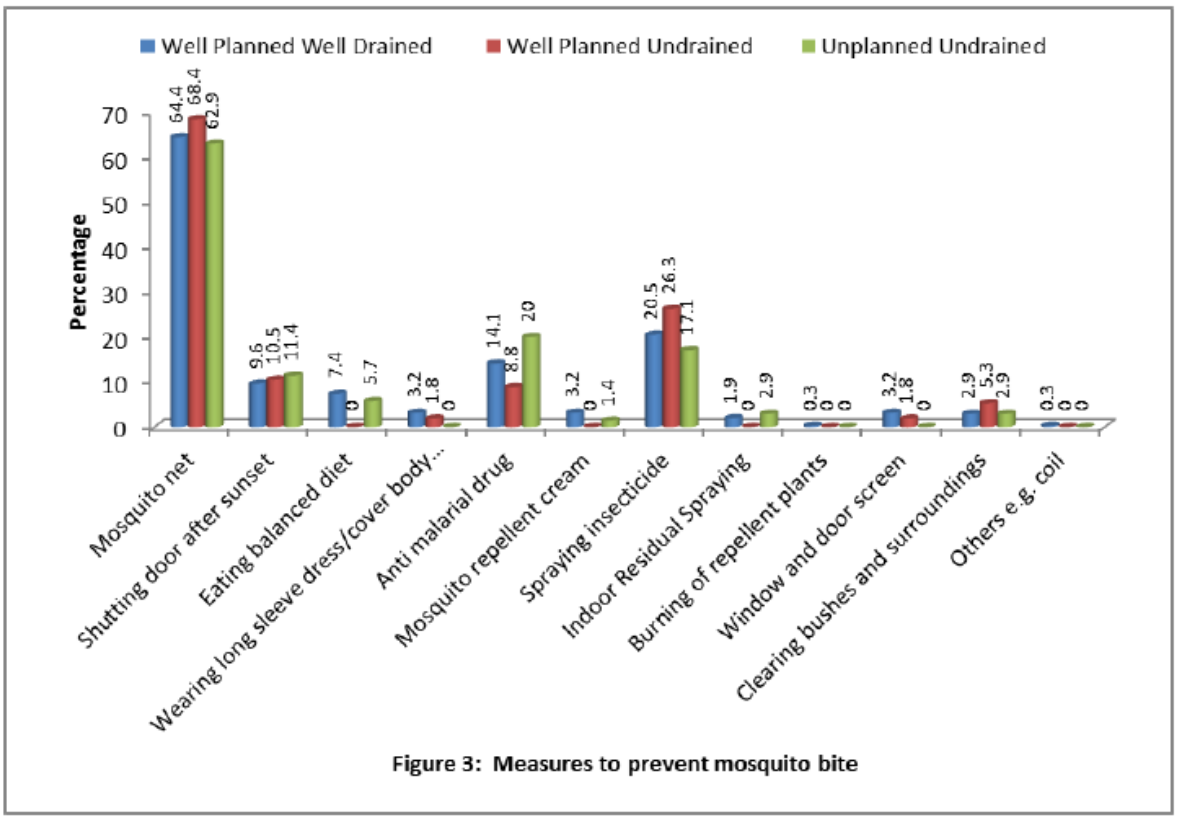

Figure. 3. Mosquito Avoidance Practices As Mentioned By The Respondents

Table 1. Socio-demographic characteristics of the care-givers. N= 394

Characteristic	**S1 n(%) N= 207**	**S2 n(%)N=89**	**S3 n(%) N=98**	**Total n (%) N=394**
Age group				
<20	8(3.8)	0(0)	0(0)	8(2.0)
20-29	56(27.2)	12(14.0)	22(22.9)	90(22.8)
30-39	107(51.9)	56(63.2)	15(15.4)	178(45.1)
40-49	27(13.1)	17(19.3)	20(20.0)	64(16.2)
>49	8(3.8)	3(3.5)	6(5.7)	17(4.3)
χ^2= 12.721, df= 8, p = 0.122				
Marital status				
Currently married	182(87.8)	86(96.5)	95(96.5)	363(92.1)
Others	25(12.2)	3(3.5)	3(3.5)	31(7.9)
χ^2= 4.186, df= 2, p = 0.123				
Occupation				
Unemployed	45(21.5)	16(17.5)	13(12.9)	74(18.8)
Student	25(11.9)	8(8.8)	10(10.0)	43(10.9)
Artisan	21(10.3)	6(7.0)	10(10.0)	37(9.4)
Trader	102(49.4)	58(64.9)	62(62.9)	222(56.3)
Civil servant	14(7.1)	2(1.8)	4(4.3)	20(5.1)
χ^2= 9.530, df= 8, p = 0.300				
Educational status				
No formal Education	15(7.4)	6(7.0)	4(4.3)	25(6.3)
Primary	9(9.3)	6(7.0)	13(12.9)	38(9.6)
Secondary	111(53.8)	58(64.9)	62(62.9)	231(58.6)
Tertiary	61(29.5)	19(21.1)	20(20.0)	100(25.4)
χ^2= 6.339, df= 6, p = 0.386				
Wealth Quintile				
Lowest	43(20.8)	12(14.0)	20(20.0)	75(19.0)
Second	36(17.3)	27(29.8)	24(24.3)	87(22.1)
Middle	38(18.3)	27(29.8)	20(20.0)	85(21.6)
Fourth	44(21.2)	11(12.3)	21(21.4)	76(19.3)
Highest	46(22.4)	12(14.0)	14(14.3)	72(18.3)
χ^2=13.897, df= 8, p = 0.084				

Note: Multiple responses

Table 2. Mosquito breeding sites as reported by respondents

	S1 n(%)	**S2 n(%)**	**S3 n(%)**	**χ^2**	**df**	**p-value**
Stagnant water	126(60.9)	54(71.9)	78(80)	10.460	2	0.005*
Uncovered water container	19(9.0)	8(8.8)	3(2.9)	2.973	2	0.226
Gutters and ditches	61(29.5)	34(38.6)	41(41.4)	5.738	2	0.057
Waste containers	11(5.4)	3(3.5)	1(1.4)	2.29	2	0.032*
Dredges from construction site	13(6.1)	0(0)	4(4.3)	3.847	2	0.146
Broad leaves of plants and weeds	7(3.5)	5(5.3)	0(0)	3.215	2	0.200

*****significant at 5% level of significance

Table 3. Factors mentioned that influenced the choice of mosquito avoidance practice N=394

*What informed choice of preventive measure	Well planned, well drained stratum n (%)	Well planned, not well drained stratum	Not planned, not well drained stratum	χ^2	df	p-value
Affordability	21(10.3)	15(14.0)	11(11.3)	1.374	2	0.503
Media	65(31.4)	33(36.8)	28(28.1)	0.660	2	0.719
Perceived Effectiveness	30(14.4)	19(21.1)	10(10.0)	3.103	2	0.212
Health worker	77(37.3)	23(26.3)	41(42.1)	6.494	2	0.039
Friends/neighbour	11(5.1)	0(0)	6(5.7)	3.172	2	0.205
Readily available	3(1.3)	0(0)	1(1.4)	0.766	2	0.682
Easy to use at home	7(3.2)	2(1.8)	1(1.4)	0.915	2	0.633
Total	207	89	98			

Table 4. Relationship between Socio demographic characteristics and multiple mosquito avoidance practices

Variable	Use of multiple mosquito avoidance practices					
	Yes	No	Total	χ^2	df	p-value
Location						
Stratum 1	42(20.4)	164(27.6)	206(79.6)	0.977	2	0.614
Stratum 2	9(10.1)	80(89.9)	89(100)			
Stratum 3	7(7. 1)	91(92. 9)	98(100)			
Monthly earning						
Less than ₦20,000	20(17.9)	92(82.1)	112(100)	20.558	4	0.000*
₦21,000-₦40,000	8(16.7)	40(83.3)	48(100)			
₦41,000-₦60,000	3(17.7)	14(82.3)	17(100)			
₦60,000 and above	9(45)	11(55)	20(100)			
Difficult to say	18(9.1)	179(90.9)	197(100)			
Wealth quintile						
Lowest quintile	8(10.1)	71(89.9)	79(100)	11.536	4	0.021*
Second quintile	5(6.3)	74(93.7)	79(100)			
Third quintile	12(15.2)	67(84.8)	79(100)			
Fourth quintile	14(17.9)	64(82.1)	78(100)			
Highest quintile	19(24.1)	60(75.9)	79(100)			
Education						
None	5(20.0)	20(80.0)	25(100)	12.252	3	0.007*
Primary	7(18.4)	31(81.6)	38(100)			
Secondary	21(9.1)	210(90.9)	231(100)			
Tertiary	25(25)	75(75)	100(100)			

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