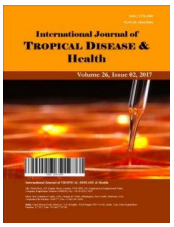

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Malaria Preventive Practices among Under-five Children in Rivers State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author NIP wrote the first draft, author OM carried out the statistical analysis and results. Author CAN reviewed the first draft. All authors read and approved the final draft and are part of the Niger Delta Development Company (NDDC) Professorial Chair on Malaria Elimination & Phytomedicine Research, University of Port Harcourt that collected the data. All authors read and approved the final manuscript.

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ABSTRACT

Background: Malaria is a life threatening protozoan infection and children under 5 years are one of the most vulnerable group. Good malaria preventive practices among these group is key to reducing malaria burden and its associated mortality.

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Objective: The aim of the study was to assess malaria preventive practices among under-five children in Rivers State, Nigeria.
Materials and Methods: This was a cross sectional study carried out in public and private health facilities in Rivers state. Ethical approval for the study was obtained from the Research and Ethics committee of the University of Port Harcourt Teaching Hospital, while an informed written consent was obtained from the parents or caregivers of the participants. Stratified sampling method was used to select the health facilities and the subjects for the study. A pretested interviewer administered questionnaire was used to harvest relevant information on socio demographic characteristics of the subjects and informants and malaria preventive practices. Obtained data was analysed using SPSS version 22 and results are presented in prose and tables.
Results: A total of 1138 children participated in the study constituting of 613 (53.9%) male and 525(46.1%) female giving a male: female ratio of 1.2:1. Mean age of participants was 1.74±1.08 years. Mothers, accounted for majority 1012 (88.9%) of the informants. Most of the informants had tertiary degree; 605 (53.4%) and 697 (61.8%) among mothers and fathers respectively. Among the occupations of fathers, public servants, civil servants and the self-employed were more represented, constituting 242 (21.4%), 200 (17.7%) and 149 (13.2%) respectively. Traders/ business women, the self-employed and civil servants were most represented among the occupations of mothers in the study and these accounted for 444 (39.7%), 181 (16.2%) and 137 (12.3%) respectively. Malaria preventive practices included use of Insecticide-treated bed nets (ITNs), Indoor spraying of insecticide (modified IRS), use of antimalarial drugs, clearing of bushes/ disposal of containers where mosquitoes breed and use of mosquito repellent creams which constituted 605 (53.2%), 483 (42.4%), 133 (11.7%), 4 (0.4%) and 2 (0.2%) respectively; there were 512 (45.0%) children who slept under ITNs the previous night. Also, 970 (85.2%) had window nets installed in their homes. Protective window nets was also in place in the homes of 970 (85.2%) of the study participants. Among families that practiced use of ITNs, 110 (61.8%) were from the middle social class and 62 (34.8%) were from the upper social class, while 316 (52.2%) and 276 (45.6%) were from the upper and middle social class respectively among those that practised Indoor spraying of insecticide (IRS).
Conclusion: Use of ITNs, modified IRS and use of anti malarials were the common malaria preventive practices among under-fives in Rivers state and these methods were more practiced among the middle and upper social class. Education on the integrated approach to malaria prevention which advocates the use of several malaria prevention methods in a holistic manner should be intensified.

Keywords: Malaria preventive; child health; protozoan infection; anti-malaria.

1. INTRODUCTION

Malaria is a vector-borne infectious disease caused by plasmodium. It is a life threatening protozoan infection and children under 5 years are one of the most vulnerable group. It is widespread in tropical and subtropical regions in a broad band around the equator. Despite the fact that it is both preventable and treatable, and effective preventive and treatment tools have been developed, it has continued to be a leading cause of morbidity and mortality in many tropical regions of the world with more than 20% of humanity being affected by malaria [1]. In sub-Saharan Africa, where over 90% of the world's malaria occurs, about 500 million cases are recorded annually with hundreds of thousands of child deaths and a child under the age of 5 years dies from this illness every 2 minute [2].

In Nigeria, it is estimated that over 50% of Nigerians suffer at least one bout of malaria every year [3]. It accounts for 20% of under-five mortality and 25% of childhood mortality [4]. The burden of malaria is well documented and has been shown to be a big contributor to the economic burden of disease and is responsible for annual economic loss to the tune of 132 billion Naira [5]. The human and economic costs associated with declining quality of life, consultations, treatments, hospitalisation and other events related to malaria are enormous and often lead to low productivity and lost incomes [6].

Experiences with malaria have shown that prevention is better and cheaper than cure; however, the practice of malaria preventive measures has been related to the knowledge and belief of people [7]. Many studies have been

carried out on malaria-related knowledge, attitudes and practices in many rural and partly urban multi-ethnic populations in Africa [8-11]. Within Nigeria, surveys of residents of the Atlantic coast revealed a lack of knowledge and many misconceptions about the transmission and treatment of malaria, which could adversely affect malaria preventive measures and treatment [12].

The current global malaria control and preventive interventions are use of long lasting insecticidal nets (LLINs), indoor residual spraying (IRS), preventive chemotherapy including intermittent preventive treatment among pregnant women, and prompt diagnosis and treatment [13].

In addition to the use of LLINs and IRS, other measures can be implemented at household level to reduce mosquitoes that transmit the disease. These measures include use of protective nets in windows and doors, ventilators, and eaves to prevent access of mosquitoes; removing mosquito breeding sites like stagnant water for instance through filling with soil; larviciding; and clearing vegetation around houses where mosquitoes habour [14-16]. Malaria-intervention goals in endemic areas should be to prevent mortality and reduce morbidity, as well as associated socio-economic losses. This requires the progressive creation of capacities for assessing the local malaria situation and selecting appropriate control measures [17]. Correct knowledge of a health problem, when combined with the right attitude, can lead to healthy behaviour and practice [17].

This study therefore is aimed at looking at the malaria preventive practices among the under five children in Rivers State.

2. METHODOLOGY

This was a cross sectional study carried out in public health facilities in Rivers state. Stratified sampling method was used to select the health facilities and the subjects for the study. Health facilities involved in the care of children were selected from each of the 3 senatorial district. A total of twelve health facilities (four from each senatorial district) were selected. In each study centre, the study was carried out in the Department of Paediatrics within one to two weeks. The first 100 consecutive children who are less than 5 years and whose parents or guardian gave consent for the study were selected. Ethical approval for the study was obtained from the Research and Ethics committee of the University of Port Harcourt Teaching Hospital, Notification and permission to carry out the study was obtained from the hospital administration of selected hospitals while an informed written consent was obtained from the parents or caregivers of the participants. A pretested interviewer administered questionnaire was used to harvest relevant information on socio demographic characteristics of the subjects and informants (age, sex, education, weight, height, occupation, tribe), and malaria preventive practices (bed net use, window nets, and medicine use). Obtained data was analysed using SPSS version 22 and results are presented in prose and Tables.

3. RESULTS

One thousand two hundred children were interviewed from the twelve selected health facilities. Sixty two questionnaires were excluded from the analysis because of incomplete and inconsistent data and data from 1138 children were included in the final analysis. Out of these, 613 (53.9%) were males and 525 (46.1%) were females giving a male: female ratio of 1.2:1 and the mean age of the study participants was 1.74±1.08 years (Table 1). The modal informant in the study were the mothers, accounting for 1012 (88.9%) of the total participants (Table 2). Among the occupations of fathers, public servants, civil servants and the self-employed were more represented, constituting 242 (21.4%), 200 (17.7%) and 149 (13.2%) respectively. Traders/business women, the self-employed and civil servants were most represented among the occupations of mothers in the study, these accounted for 444 (39.7%), 181 (16.2%) and 137 (12.3%) respectively (Table 3). Table 4 shows that most of the participants had obtained tertiary degree; among fathers, there were 697 (61.8%) and 605 (53.4%) among mothers. Distribution of respondents by social class reveals that the upper and middle social class were most represented, constituting 560 (49.4%) and 548 (48.3%) respectively (Table 5). The median (average) family income was 50,000 Naira; families that earned above average constituted 275 (27.4%) and 270 (26.9%) of the total study participants. (Table 6). The techniques employed in preventing malaria included use of Insecticide-treated bed nets (ITNs), Indoor spraying of insecticide, use of antimalarial drugs, Clearing of bushes/ disposal of containers where mosquitoes breed and use of mosquito repellent creams which constituted 605 (53.2%), 483 (42.4%), 133 (11.7%), 4 (0.4%)

Table 1. Sex and age distribution of the children

Variable	Frequency (n)	Per cent (%)
Sex of child		
Male	613	53.9
Female	525	46.1
Age of Child		
< 2 years	879	77.2
>2 < 5 years	259	22.8
Mean age	1.74±1.08 years	

Table 2. Survey informant (Respondent)

Variable	Frequency (n)	Per cent (%)
Survey informant		
Father	86	7.6
Mother	1012	88.9
Sister	7	0.6
Grand Mother	12	1.1
Aunty	14	1.2
Others	7	0.6

Table 3. Parents' Occupation

Variable	Frequency (n)	Per cent (%)
Fathers' occupation		
Trader/Business man	367	32.5
Public servant	242	21.4
Civil servant	200	17.7
Self-employed	149	13.2
Engineer	45	4.0
Teacher	34	3.0
Farmer	24	2.1
Artisan	16	1.4
Driver	14	1.2
Unemployed	13	1.2
Electrician	10	0.9
Student	8	0.7
Others	5	0.4
Welder	2	0.2
Mothers' occupation		
Trader/Business woman	444	39.7
Self-employed	181	16.2
Civil servant	137	12.3
Teacher	110	9.8
Unemployed	88	7.9
Public servant	74	6.6
Student	33	3.0
Farmer	26	2.3
Artisan	17	1.5
Others	6	0.5
Engineer	1	0.1

and 2 (0.2%) respectively; there were 512 (45.0%) children who slept under ITNs the previous night (Table 7). Also, 970 (85.2%) had window nets installed in their homes. Among families that practiced use of ITNs, 110 (61.8%) were from the middle social class and 62 (34.8%) were from the upper social class, while 316 (52.2%) and 276 (45.6%) were from the upper

and middle social class respectively among those that practised Indoor spraying of insecticide (IRS). Over half of the families that practiced use of bed nets (51.0%) and antimalarial drugs (51.2%) had an average monthly income of 10,000.00 – 50,000.00 naira. Apart from families with average monthly income of less than 10,000.00 naira, Insecticide use rate was near 30% in the other families (Table 8).

Table 4. Parents' educational level

Variable	Frequency (n)	Per cent (%)
Fathers' education level		
None	6	0.5
Primary	20	1.8
Secondary	405	35.9
Tertiary	697	61.8
Mothers' education level		
None	4	0.4
Primary	35	3.1
Secondary	489	43.2
Tertiary	605	53.4

Table 5. Social class (Oyedele's Social class classification)

Variable	Frequency (n)	Per cent (%)
Social Class		
Upper Class	560	49.4
Middle Class	548	48.3
Low Class	26	2.3

Table 6. Family's monthly income

Variable	Frequency (n)	Per cent (%)
Family monthly income (Naira)		
< 10000	95	9.5
10000 – 50000	364	36.3
50000 – 100000	275	27.4
>100000	270	26.9
Median family income	50,000 Naira	

Table 7. Malaria prevention techniques

Prevention technique employed (Multiple response, n= 1409)	Frequency (n)	Percent (%)
Use of bed net	605	53.2
Use insecticide	483	42.4
None	182	16.0
Use of drugs - antimalarial	133	11.7
Others (Clearing of nearby bushes, disposal of mosquito breeding cans)	4	0.4
Repellent	2	0.2
Child slept under bed net last night		
No	626	55.0
Yes	512	45.0
Have window nets		
No	168	14.8
Yes	970	85.2

Table 8. Relationship between prevention technique, social status and family income

Variable	Test of difference						
	None	Bed net	Drugs	Insecticide	Repellent	Others	Fishers' exact
Social Status							
Upper class	62 (34.1)	316 (52.2)	50 (37.6)	287 (59.4)	0 (0.0)	0 (0.0)	
Middle class	110 (60.4)	276 (45.6)	75 (56.4)	191 (39.5)	2 (100.0)	4 100.0)	
Low class	10 (5.5)	13 (2.1)	8 (6.0)	5 (1.0)	0 (0.0)	0 (0.0)	
Family income (N)							
<10,000	21 (13.9)	44 (8.1)	24 (19.8)	19 (4.5)	0 (0.0)	0 (0.0)	
10,000 – 50,000	77 (51.0)	178 (32.8)	62 (51.2)	119 (27.9)	2 (100.0)	2 (50.0)	
50,000 – 100,000	26 (17.2)	167 (30.8)	23 (19.0)	135 (31.7)	0 (0.0)	2 (50.0)	
>100,000	27 (17.9)	153 (28.2)	12 (9.9)	153 (35.9)	0 (0.0)	0 (0.0)	

4. DISCUSSION

This study looked at the malaria preventive practices among under five children in Rivers State. The commonly practiced malaria preventive methods include, use of Insecticide-treated mosquito bed nets (ITNs), indoor spraying of insecticide (modified IRS), use of anti-malarial drugs and protective window nets. Other less common methods practiced in this area include, clearing of nearby bushes/disposal of mosquito breeding containers and use of mosquito repellents.

ITNs have been shown to be highly effective in malaria prevention and control. Proper and consistent use of ITNs can reduce malaria transmission by up to 90% and prevent up to 44% of all-cause mortality among under five children [18-20]. ITNs use rate (53.2%) in this study was low compared to other African studies [21-25] but higher than some studies in Nigeria among physicians and adolescents where it ranged from 25-34% [26,27] The reported ITNs use rate in this study had a close corroboration with the number of children who slept under the nets in the previous nights (45.0%). Considering the degree of awareness that has been created and the amount of fund that the federal and state Government have invested into free distribution of ITNs into the local and urban communities in the state one expected a higher use rate. However, it has been reported that bed net distribution programs fall short of ensuring that the nets are used, kept appropriately, and sometimes, the most vulnerable members of the households do not benefit from the use of the nets [28]. A systematic investigation may be required to differentiate ITNs ownership and its use rate as ownership will have little impact on the burden of malaria except people consistently sleep under them [29-31].

Many reasons have been given for the low use rate including especially the fact that the net is too hot to sleep under, [32] considering the paucity of electricity in this part of the world. While not disputing this fact, when one considers the health, economic and social burden associated with malaria disease, the benefits of ITNs use far outweigh any 'demerit'.

Other reason for low ITNs use rate include that it is 'no longer effective' [33]. It is possible that an ITN's diminishing effectiveness over time was perceived as a sign of ineffectiveness, or possibly prior messages about the importance of re-treating nets have buttressed the idea that effectiveness of nets is temporary. Whether the perceived loss in effectiveness is in fact true is unknown, but studies in other settings have shown that loss of insecticide can occur over time following regular handling or exposure to environmental factors such as dirt and soot [33]. It may be useful to conduct bioassays of ITNs and adjust the frequency of ITN distribution or disseminate messages concerning washing if necessary.

Similarly, field observations from another study help explain the finding that conical ITNs were much more likely to be used than rectangular ITNs [33]. Conical ITNs use a single hanging point for hanging, whereas rectangular ITNs require four hanging points and sometimes extra rope for reaching an attachment point. It is often difficult to find attachment points in some houses, and purchase of nails add extra cost and inconvenience as they often easily pull out of wooden and soft walls.

This study found that more families from the middle (61.8%) and upper (34.8%) social class practiced the use of ITNs. This is in tandem with another study where ITNs use rate had a positive correlation with educational status of the study participants [25]. Despite the fact that ITNs are often given out free or at minimal cost, its ownership and use was mainly by the middle and upper class. A low representation of lower social class in this study would have contributed to this. However, this may also be due to the fact that distribution of these nets mostly take place in hospitals which is often less patronised by individuals from the lower class who prefer patronage of quacks due to the huge costs in out of pocket expenditure on health bills. Refocussing of distribution centres and strategy by using schools, markets and other community gatherings may change this dynamics. More use of ITNs by the middle social class than the upper may be due to the fact that it is free or cheap.

Use of Indoor spraying of insecticide (IRS) constituted a significant proportion (42.4%) in the study population. This is a modified type of Indoor Residual Spraying (mIRS) where unit households who can afford it use approved and effective insecticide sprays in their homes in the evenings and nights to checkmate or kill malaria vectors in the homes. The rooms are subsequently aired for about thirty minutes to one hour to reduce or eliminate the harmful effects of the insecticides before residents sleep in the room. The effect of these insecticides

depends on the type and the vector susceptibility but it is usually short lived and so have to be used very frequently or on daily basis in some homes. Families that practice regular use of indoor spraying of insecticide have better vector control than where it is used irregularly. There is paucity of study in this form of insecticide use to show its effectiveness in vector control.

Indoor residual spraying (IRS) on the other hand is considered an effective means of mosquito (vector) control and is recommended by World Health Organisation (WHO) [34]. It involves spraying of internal walls and ceilings of dwellings by skilled men using insecticides with residual action (i.e. insecticides that remain on the surface for a long time) to kill mosquito thereby interrupting malaria transmission.34 The effectiveness of this control method also depends to a large extent on the vector's sensitivity to the insecticide used and how much they like to rest indoors. Most vectors in Africa do prefer to rest indoors. The aim of IRS is to kill potentially infected Anopheles mosquitoes before the parasite they carry develops into an infective stage. Mosquitoes spend at least two days on the wall after they have fed on blood before they are ready to lay eggs. The probability that an infected mosquito comes in contact with a sprayed surface at least once is, therefore, high during its frequent feeding-resting-egg-laying cycle which takes place every 2-3 days. The parasite in the blood takes about 12 days at 25^{o}C (or longer in cooler environments) to develop before it is ready to be transmitted by the mosquito. During this period, the mosquito has to feed about 4-6 times. There is a high probability that the mosquito will rest on a sprayed wall during this time; if it dies then the parasite will not have been transmitted.

When insecticide use was compared with social class, 52.2% of the upper social class as against 45.6% in the middle social class uses insecticide spray as malaria control measures. This finding is not surprising considering the cost implication of regular use of insecticide and will only be affordable by this class of citizens. ITNs reduces malaria prevalence, however free net distribution does not guarantee the appropriate use and utilization by the most vulnerable members of the households [35]. A combination of ITNs and IRS to reduce mosquito-host contact would therefore be an efficient malaria control tool.

Use of anti-malarial drug in the prevention of malaria was practiced by 133 (11.7%) in this study. Anti-malarial drugs can make a significant contribution to the control of malaria in endemic areas when used for prevention as well as for treatment [36]. Chemoprophylaxis is effective in preventing deaths and morbidity from malaria, but it is difficult to sustain for prolonged periods, may interfere with the development of naturally acquired immunity and will facilitate the emergence and spread of drug resistant strains if applied to a whole community. However, chemoprophylaxis targeted to groups at high risk, such as pregnant women, or to periods of the year when the risk from malaria is greatest, can be an effective and cost effective malaria control tool and has fewer drawbacks. Intermittent preventive treatment, which involves administration of anti-malarials at fixed time points, usually when a subject is already in contact with the health services, for example attendance at an antenatal or vaccination clinic, is less demanding of resources than chemoprophylaxis and is now recommended for the prevention of malaria in pregnant women and infants resident in areas with medium or high levels of malaria transmission [36]. However, this practice in infants and children is uncommon in the researcher's area of practice hence poorly represented in this population. The common indication for chemoprophylaxis in children in malaria endemic area include children with sickle cell anaemia, non-immune travellers into malaria endemic areas and children who have had splenectomy. It is probable that children that practiced this method of malaria prevention have sickle cell anaemia which is quite prevalent in Nigeria.

One hundred and eighty two (16.0%) did not actively practice any preventive method except that some had window nets installed in their homes, among these 62 (34.1%) and 110 (60.4%) were from the upper and middle class respectively. Therefore, education on malaria control practices must be all inclusive irrespective of one's social or economic status.

A significant proportion of individuals (85.2% have window nets installed in their homes. Window nets are a good vector control measure as it limits entry of mosquitoes into homes, however the quality and calibre of these nets vary as evidence show that these vector have access into homes despite their presence. Clearing of bushes, emptying and disposal of containers where mosquitoes breed and use of mosquito repellent creams are part of malaria control measures and was practiced by a small

proportion (0.6%) of the study participants. Consistent application of these creams by all members of a household or community cannot be guaranteed or sustained and so limits its effectiveness as a community control measure.

5. CONCLUSION AND RECOMMENDATION

In conclusion, use of ITNs, modified IRS and use of anti-malaria drugs were the common malaria preventive practices among under-fives in Rivers state and these methods were more practiced among the middle and upper social class with an above average monthly income. ITNs use rate in Rivers state is high but lower than what obtains in other African countries.

It is recommended that ITNs distribution methods and education on its use should target all citizens including those with low monthly income and low social class. Also, education on the integrated approach to malaria prevention which advocates the use of several malaria prevention methods in a holistic manner should be intensified.

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CONSENT

Informed written consent was obtained from the parents or caregivers of the participants.

ETHICAL APPROVAL

Ethical approval for the study was obtained from the Research and Ethics committee of the University of Port Harcourt Teaching Hospital.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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