Original Research Article

Factors InfluencingUtilization of Insecticide-Treated Nets among Pregnant Women and Children in Bayelsa and Rivers States, Nigeria

ABSTRACT

Aim: Globally, Pregnant women and under five years children are the most vulnerable group in malaria zones. This studyaimed toassessedfactors influencing utilization of ITNs among pregnant women and care givers of children in Bayelsa and Rivers States, Nigeria.
Methodology:A pretest-posttest descriptive cross-sectional survey of 330 pregnant women and caregivers of children was conducted in Bayelsa and Rivers Statesusing multi-stage random sampling technique.Pretest questionnairewas administered to sampled respondents.Health education intervention was doneto motivate behavioral change wheel (BCW) of respondents. Posttest questionnaire was administeredtwo (2) months after health education intervention.
Results: Two hundred and eight (63.0%) of pre and292(88.5%) of post intervention respondents strongly agreed that using ITNs was the best way to prevent malaria. Findings showed that educated respondents were 4 times more knowledgeable than their uneducated counterparts (O.R.: 4.300, 95% C.I.: 0.838-22.064; p-value: 0.058). Low proportion of post interventionrespondents 131(39.7%) slept in the ITNs previous nightwhen temperature was between 26 -24^{0}C compared to 224 (67.9%) pre intervention respondents when temperature was between 24 – 25^{0}C.Public health education on use of ITNs was statistically significan (t-test: 31.026; *P*< .05).Being harmful and intolerance due to heat were the negative reasons for not using ITNs.
Conclusion: The factor 'heat'during dry season stands as barrier in use of ITNs irrespective of health education intervention. It is recommended that Government policies on ventilated buildings be enforced, as well as improve on quality of the ITNs for hot weather tolerance.

Keywords: Malaria, Insecticide Treated Nets, Vulnerable Population, Heat, Campaign

1. INTRODUCTION

Despite progress in world malaria control, the disease remains a constant cause of sickness and death(1). Global malaria report in 2019 approximates 405 000 mortality and 228 million morbidities as a result of malaria in 2018(2). Sub-Saharan Africa is responsible for 95% of global morbidities (3). Nigeria is responsible for 25% of world malaria cases (4). Preventing malaria infection is by utilization of ITNs and indoor residual insecticide(1).In 2018 the prevalence of malaria infection among pregnant women in West Africa Sub-region and Nigeria has about 39%(4).The high rate of ITNs possession and good knowledge did not translate into overwhelming usage and this impact negatively on the prevention of malaria among vulnerable populations (5). Findings fromOdoko*et al.*among pregnant women in Bayelsa State of Nigeria(6) revealed 20% of respondents lack ITNs, those who owns ITNs only 31% utilized it every day. Previous work revealed that ITNs are reliable tool at decreasing child mortality, malaria parasite prevalence. Although, there have been a rise in the resistance to pyrethroids ITNs affecting the impact of ITNs on malaria transmission (7).

Malaria prevention and control in pregnant women in Africa rests on three pillars: ITNs, IPTp with sulphadoxine - pyrimethamine and effective case management of malaria illness (8). Studies on malaria during pregnancies indicate pregnancy complications: miscarriage, maternal anemia, stillbirth, low birth weight and prematurity (9). Study have revealed that in some countries irrespective of scaling-up of intermittent preventive treatment (IPTp) and delivery of nets, there is increase in malaria infection among pregnant women, which necessitate the need to investigate women at risks of further interventions (10). Increase in drug resistant malaria parasites in Ghana has favored the use of ITNs as an effective strategy in the prevention of malaria (11). A study in Ugandan for children under five years revealed an increase in use of nets from 8% in 2001 to 74% in 2014, this improvement still fell short of the Millennium Development Goal (MDG) target of 80% (12).

Information to behavioral change connected to malaria brought about high use of ITNs in several African nations (13). The phase iv expanded program linked malaria vaccine implementation in 2019 was disrupted by a novel pneumonia condition termed coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (14). COVID-19, the disease may have result to more than 200 million people to be infected with malaria and almost 500,000 people may die, mostly young children in each year (8). The efficacy on the use of ITNs to prevent malaria is approximately 50% in highly endemic area of African and 63% reduction of malaria mortality among children (15). Studies in many Africa settings indicate that malaria immunization with the RTS, S/AS01(RTS,S) vaccine efficacy wanes over time. (16).Malaria being caused by mosquitos are transferred through feeding two times on a person exposed to it (17). The cost effectiveness of ITNshas boost the coverage of ITNs in Nigeria to 69% in 2016 (18).Despite the effort by both governmental and non-governmental organizations to roll back malaria, it is estimated that Nigeria is

among 10 countries in Sub-Saharan Africa out of 11 countries that account for 70% of the global malaria infection (19).To remarkably decrease the effect of malaria which could have been frustrated by COVID-19 Pandemic (20) as well as to sustained the achievement of malaria control during post COVID -19 Pandemic (21), health education intervention study is inevitable in order to identify factors influencing utilization of ITNs among pregnant women and care givers of children in Bayelsa and Rivers States, Nigeria.

2. MATERIAL AND METHODS

2.1 Study Design

A pretest-posttest descriptive cross-sectional survey of 330 pregnant women and caregivers of children was conducted in Sagbama, Kolokuma/OpokumaLocal Government Area (Bayelsa State) and Ahoada-West Local Government Area (Rivers State)using multi-stage random sampling technique.

2.2 Study Area

This study was conducted at three LocalGovernment Areas (LGAs): Sagbama, Kolokuma/ Opokuma LGA (Bayelsa State) and Ahoada -West (Rivers State). The total of fifteen (15) Communities where randomly selected from the three LGAs at five communities per each LGAs. In Sagbama LGAs the following communities were randomly selected as study area: Sagbama, Adagbabiri, Tungbo, Toru-Angiama, andAgbere. They are made up of riverine communities in Bayelsa, predominantly farmers and fisher men/women.The study areas for Kolokum/Opokuma Local Government Area were made up of five Communities: Kaiama, Odi, Sampou, Sabagreia andOpokuma. The main occupation of the inhabitants is farming, trading, civil servant, fisher men/women and craft men/women. They have a common boundary with Sagbama and Yenagoa LGA in Bayelsa State. The communities along the East-West Road which is a major Road Network that link Sagbama LGA, Kolokuma/ Opokuma LGA Yenagoa LGA and Ahaoda West LGA. Distribution of primary health care centers and various category of health workers are located in each community. In Ahaoda West LGA (River State), the five communities involved in the study are Akinima, Mbiama, Okaki, Okubie and Ohahi.

2.3 Scope of Study

This pre and post intervention study covers only women of reproductive age 15-49 years, pregnant women and care givers of under five years children in Sagbama, Kolokuma/ Opokuma LGAs (Bayelsa State) and Ahoada -West (Rivers State).

2.4Study Population

The study population consist of pregnant mothers and care givers of under-five years children in Sagbama, Kolokuma/ Opokuma LGAs (Bayelsa State) and Ahoada -West (Rivers State).

2.5 Sample Techniques/Sample Size

2.5.1 Sampling Techniques

Multi-stage random sampling method was used to obtain the sample size of 330 respondents in the study area.

2.5.1.1 Stage I: identification of cluster LGAs to select Sagbama, Kolokuma/Opokuma and Ahoada -West LGAs in the study area.

***2.5.1.2 Stage II*:** line listing of each political wards in the three (3) LGA (22).

2.5.1.3 Stage III:Five (5)communities/settlements were randomly selected from wards in each LGA to determine the utilization of ITNs

2.5.1.4 Stage IV:identification of twenty-two (22) pregnant wome care givers of under five years children randomly selected from households in each of the fifteen (15) communities in the three (3) LGA making a total of 330 respondents.

2.6 Method and Instrument for Data Collection

A well structure questionnaire approved by research supervisors was adopted for both pre and post intervention.

The adopted questionnaire inquired about knowledge, attitude and practice (KAP) on ITNs that could be translated into capacity, motivation and opportunities (CMO), which follow the methods of similar studies as used in Sagbama and Shashogo District, study.(6).(23).

The pre tested questionnaire was divided into sections to addressed variables such as demographic information: age, educational level, occupation, religion, marital status; Ownership of ITNs, knowledge on awareness of malaria in pregnancy and in under five years children, knowledge on best way to prevent malaria; attitude towards the use of ITNs among respondents ; Practice(actual utilization of ITNs among those who own ITNs).

The pre- tested questionnaire for pre- intervention was administered randomly sampled houses of respondents between August, September and October 2021 and the subsequent post intervention questionnaire in November to December 2021 after utilizing systemic approach to conduct stakeholders'health education meeting with respondents.

Twelve (12) research assistants were trained on the content understanding of the questionnaire and procedure for data administration.

2.7 Reliabilityof Study

A test- retest approach (pilot study) was carried out on forty (40) pregnant women and care givers of children under five years randomly selected outside the study area.

2.8 Validityof Study

The instrument was presented to my supervisors for content validity, face validity, construct validity, internal validity and external validity. Twelve (12) research content was trained on the content understanding of the questionnaire and procedure for data administration.

2.9 Limitation of Study

There was nationwide flooding with more devasting effects in Bayelsa and Rivers State within the study period

2.10 Method for Data Analysis

Statistical data were analyzed using the Statistical Package for Social Sciences (SPSS for window versions 20.0 SPSS. Descriptive statistic was performed and presented in tables, figures, frequency and percentages.Statistical test to test difference in pre and post parameters was the t test statistic. It assessed the individual scores for knowledge and attitude. All p- values reported were two tailed and statistical significances was defined as *P*= .05.

3. RESULTS AND DISCUSSION

3.1 RESULTS

In this study, a total of 330 respondents were involved. 119 (36.1%) were from Ahoada LGA, 117 (35.5%) were from Sagbama LGA and 94 (28.5%) were from Kolokuma/Opokuma LGA. The highest proportion of the respondents were aged between 26 and 35 years 153 (46.4%) and were traders 142 (43.0%). The majority of the respondents had also received secondary school education 200 (60.6%), were Christians 307 (93.0%) and were married 270 (81.8%). These details are shown in Table 1**.**

Table 1: Demographic/socio-economic details of respondents

Variable	Variable Categories	Frequency (330)	Percentage (%)
LGA	Ahoada	119	36.1
	Sagbama	117	35.5
	Kolokuma/Opokuma	94	28.5
Age (years)	16-25	59	17.9
	26-35	153	46.4
	36-45	94	28.5
	45 and above	24	7.3
Educational attainment	Primary	26	7.9
	Secondary	200	60.6
	Tertiary	82	24.8
	Informal	22	6.7
Occupation	Civil servant	69	20.9
	Trader	142	43.0
	Farmer	65	19.7
	Others	54	16.4
Religion	Christianity	307	93.0
	Islam	9	2.7
	Traditional	8	2.4
	Others	6	1.8
Marital status	Married	270	81.8
	Separated	17	5.2
	Single	33	10.0
	Widow(er)	10	3.0

Baseline ownership of Insecticide-Treated-Nets (ITNs) enquiry of the ownership of ITNs among the respondents showed that majority of the respondents 272 (82.4%) owned these nets. This is shown in Table 2. Post-intervention ownership of ITNs enquiry of the ownership of ITNs among the respondents after the intervention showed that majority of the respondents 304 (92.1%) owned these nets. This is shown in Table 2

Table 2: Ownership of Insecticide Treated Nets

Variable	Options	Baseline		Post intervention	
		Frequency (330)	**Percentage (%)**	**Frequency (330)**	**Percentage (%)**
Ownership of ITNs	Yes	272	82.4	304	92.1
	No	58	17.6	26	7.9

Table 3. showed that at baseline, majority of them 237 (71.8%) had moderate knowledge that using ITNs was the best way to prevent malaria in pregnancy and under-five children. In post intervention from Table 3. showed that majority of them 227 (68.8%) had moderate knowledge that using ITNs was the best way to prevent malaria in pregnancy and under-five children.

Table 3: Baseline knowledge of the best way to prevent malaria in pregnancy and under-five children among the respondents

Variables	Knowledge options	Baseline		Post intervention	
		Frequency (330)	Percentage (%)	Frequency (330)	Percentage (%)
knowledge of preventive measure	Good	18	5.5	90	27.3
	Moderate	237	71.8	227	68.8
	Poor	75	22.7	13	3.9
Taking of drugs from a chemist	Strongly Agree	61	18.5	12	3.6
	Agree	117	35.5	9	2.7
	Undecided	17	5.2	2	0.6
	Disagree	101	3.6	247	74.8
	Strongly disagree	34	10.3	60	18.2
To attend clinic for treatment	Strongly agree	168	50.9	17	5.2
	Agree	117	35.5	34	10.3
	Undecided	10	3.0	0	0.0
	Disagree	26	7.9	221	67.0
	Strongly disagree	9	2.7	58	17.6
To always sleep in ITNs (ITNS)	Strongly agree	208	63.0	292	88.5
	Agree	85	25.8	19	5.8
	Undecided	8	2.4	0	0.0
	Disagree	21	6.4	18	5.5
	Strongly disagree	8	2.4	1	0.3
To use mosquito coils	Strongly agree	58	17.6	14	4.2
	Agree	108	32.7	124	37.6
	Undecided	18	5.5	0	0.0
	Disagree	95	28.8	145	43.9
	Strongly disagree	51	15.5	47	14.2
To use	Strongly agree	65	19.7	21	6.4

spray/repellants	Agree	118	35.8	263	79.7
	Undecided	23	7.0	0	0.0
	Disagree	86	26.1	36	10.9
	Strongly disagree	38	11.5	10	3.0
To clean the environment	Strongly agree	168	50.9	16	4.8
	Agree	100	30.3	257	77.9
	Undecided	13	3.9	0	0.0
	Disagree	30	9.1	46	13.9
	Strongly disagree	19	5.8	11	3.3

Table 4. showed that from the baseline, the largest proportion of them 157 (47.6%) had good attitude towards the use of ITNs. In post intervention, it showed an increase that most of them 321 (97.3%) had good attitude towards the use of ITNs. This is shown in Table 4.

Table 4: attitude of the respondents towards the use of ITNs

Variables	**Attitude options**	**Baseline**		**Post intervention**	
		Frequency (330)	**Percentage (%)**	**Frequency (330)**	**Percentage (%)**
Overall attitude	Good	**157**	**47.6**	**321**	**97.3**
	Moderate	**120**	**36.4**	**5**	**1.5**
	Poor	**53**	**16.1**	**4**	**1.2**
I personally do not like using ITNs	Strongly agree	**66**	**20.0**	**3**	**0.9**
	Agree	**62**	**18.8**	**6**	**1.8**
	Undecided	**11**	**3.3**	**1**	**0.3**
	Disagree	**115**	**34.8**	**254**	**77.0**
	Strongly disagree	**76**	**23.0**	**66**	**20.0**
Using those nets is very uncomfortable	Strongly agree	**43**	**13.0**	**4**	**1.2**
	Agree	**70**	**21.2**	**2**	**0.6**
	Undecided	**10**	**3.0**	**0**	**0.0**
	Disagree	**125**	**37.9**	**210**	**63.6**
	Strongly disagree	**82**	**24.8**	**114**	**34.5**

I will not encourage anyone to use those nets	Strongly agree	**26**	**7.9**	**3**	**0.9**
	Agree	**38**	**11.5**	**1**	**0.3**
	Undecided	**17**	**5.2**	**1**	**0.3**
	Disagree	**137**	**41.5**	**167**	**50.6**
	Strongly disagree	**112**	**33.9**	**158**	**47.9**
Use of ITNs can be harmful to the lungs, thus I don't use them	Strongly agree	**34**	**10.3**	**3**	**0.9**
	Agree	**36**	**10.9**	**2**	**0.6**
	Undecided	**18**	**5.5**	**0**	**0.0**
	Disagree	**133**	**40.3**	**148**	**44.8**
	Strongly disagree	**109**	**33.0**	**177**	**53.6**
I am always against the use of ITNs	Strongly agree	**29**	**8.8**	**3**	**0.9**
	Agree	**48**	**14.5**	**4**	**1.2**
	Undecided	**15**	**4.5**	**0**	**0.0**
	Disagree	**121**	**36.7**	**151**	**45.8**
	Strongly disagree	**117**	**35.5**	**172**	**52.1**

Assessment of the practice of ITNs in baseline among the respondents showed that majority of them 224 (67.9%) had used the ITNs the previous night as shown in Table 5. Also,172(52.1%) hung and tucked-in the net when they were about to sleep which was the correct method of use. These details are shown in Table 5. In post-intervention usage of ITNS among the respondentshowed that majority of them 199 (60.3%) had used the ITNs two nights ago, a minority number 131(39.7%) slept in the ITNs the previous night as seen in Table 5. Enquiry about how they used the nets showed that majority were of the opinion that they hung and tucked-in the net when they were about to sleep 284 (86.1%) which was the correct method of use. These details are shown in Table 5.

Table 5. Practice of ITN use among the respondents at baseline

Variables	**Knowledge options**	**Baseline**		**Post intervention**	
		Frequency (330)	**Percentage (%)**	**Frequency (330)**	**Percentage (%)**
When last	Previous night	224	67.9	131	39.7
	Two days ago	86	26.1	199	60.3
	Three days ago	4	1.2		
	Cannot Yes	239	72.4	326	98.8

used ITNs	No	91	27.6	4	1.2
Method of use of ITNs	Hung and tucked-in the net when about to sleep	172	52.1	284	86.1
	Slept under hanged net without dropping	326	98.8		
	Sleep halfway and later drop the hanged ITN Yes	66	20.0	175	53.0
	No	264	80.0	155	47.0
Frequency of net washing	Based on manufacturer's instructions	89	27.0	9	2.7
	Once in a year	102	30.9	13	3.9
	Twice a year	134	40.6	308	93.3
	Monthly	5	1.	0	0.0
Present condition of the ITNs	Torn	172	52.1	32	9.7
	Not torn	158	47.9	298	90.3
Outcome of ITNs use	Reduction in malaria treatment	37	11.2	325	98.5
	No reduction of malaria treatment	293	88.8	5	1.5

Table 6. showed that their education had a borderline statistically significant association with their attitude towards ITN use. It was found that educated respondents were 4 times more knowledgeable than their uneducated counterparts (O.R.: 4.300, 95% C.I.: 0.838-22.064; p-value: 0.058).

Table 6: Association between attitude towards ITN use and socio-economic factors post-intervention

Factors	Factors Categories	Attitude towards ITN use			X^2 (p-value)	OR (95% CI)
		Good	Poor	Total		
Education	Educated	301 (97.7)	7 (2.3)	308 (100.0)	3.598 (0.058)	4.300 (0.838-22.064)
	Not educated	20 (90.9)	2 (9.1)	22 (100.0)		
	Total	321 (97.3)	9 (2.7)	330 (100.0)		
Age (years)	≤ 35	206 (97.2)	6 (2.8)	212 (100.0)	0.024 (0.878)	0.896(0.220-3.649)
	> 35	115 (97.5)	3 (2.5)	118 (100.0)		
	Total	321 (97.3)	9 (2.7)	330 (100.0)		
Occupation	Skilled	67 (97.1)	2 (2.9)	69 (100.0)	0.010 (0.922)	0.923(0.187-4.547)
	Unskilled	254 (97.3)	7 (2.7)	261 (100.0)		
	Total	321 (97.3)	9 (2.7)	330 (100.0)		
Religion	Christian	299 (97.4)	8 (2.6)	307 (100.0)	0.245 (0.621)	1.699(0.203-14.203)
	Non-Christians	22 (95.7)	1 (4.3)	23 (100.0)		
	Total	321 (97.3)	9 (2.7)	330 (100.0)		
Marital status	Married	263 (97.4)	7 (2.6)	270 (100.0)	0.102 (0.750)	1.296(0.262-6.398)
	Not married	58 (96.7)	2 (3.3)	60 (100.0)		
	Total	321 (97.3)	9 (2.7)	330 (100.0)		

Assessment of the difference in the means of the pre-intervention and post-intervention knowledge scores of the respondents regarding: the cause of malaria in pregnancy and in under-5-year-old children showed a statistically significant difference between both categories (t-test statistic: 31.026; P=.05); effect of malaria in pregnancy and in under-5-year-old children showed statistically significant differences between both categories (t-test statistic: 10P=.05; t-test statistic: 8.397, P=.05 respectively); the best way to prevent malaria in pregnancy and in under-5-year-old children showed a statistically significant difference between both categories (t-test statistic:14.460; P=.05);finally, attitude scores

of the respondents towards the use of ITNs showed a statistically significant difference between both categories (t-test statistic: 12.027; P=.05). These are shown in Table 7.

Table 7: Comparison of knowledge and attitude scores of respondents pre- and post-intervention

Variables		N	Mean	Standard deviation	T-test statistic	p-value	95% C.I.
Knowledge of causes of malaria	Pre-Intervention	330	21.39	1.999	31.026	< 0.05	6.997 – 7.942
	Post-Intervention	330	13.92	3.890			
Knowledge of effect of malaria in pregnancy	Pre-Intervention	330	17.62	2.365	10.940	< 0.05	2.099 – 3.017
	Post-Intervention	330	15.06	3.528			
Knowledge of effect of malaria in children	Pre-Intervention	330	18.23	1.998	8.397	< 0.05	1.207 – 1.944
	Post-Intervention	330	16.65	2.762			
Knowledge of prevention of malaria	Pre-Intervention	330	20.38	3.168	14.460	< 0.05	3.352 – 4.405
	Post-Intervention	330	16.50	3.703			
Attitude towards use of ITNs	Pre-Intervention	330	21.78	2.775	12.027	< 0.05	3.205 – 4.456
	Post-Intervention	330	17.95	5.076			

95% C.I.: 95% confidence interval

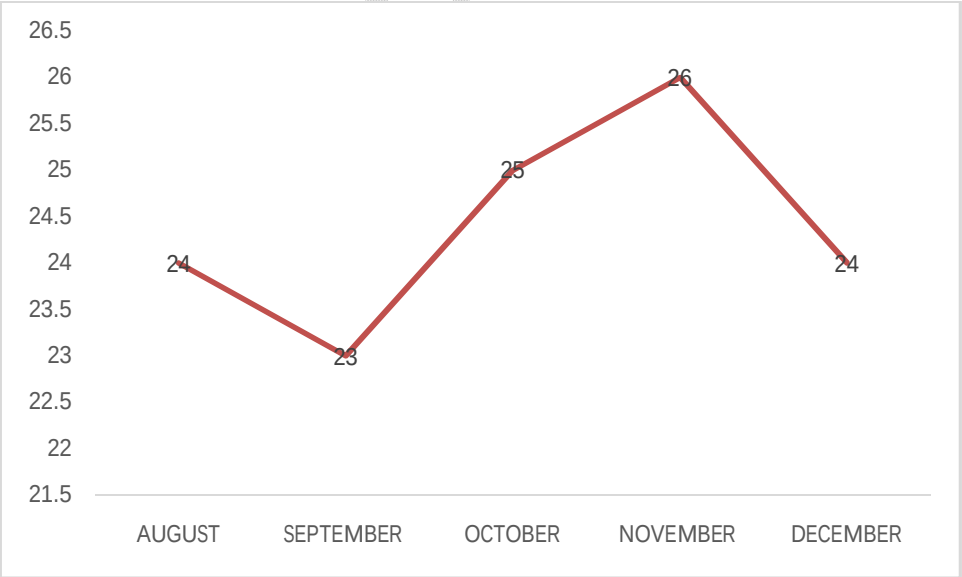

Figure 1: Weather Forecast for Sagbama and Kolokuma/Opokuma LGA (Bayelsa State) from August to December 2021 (Nigerian Meteorologically Agency, 2021).

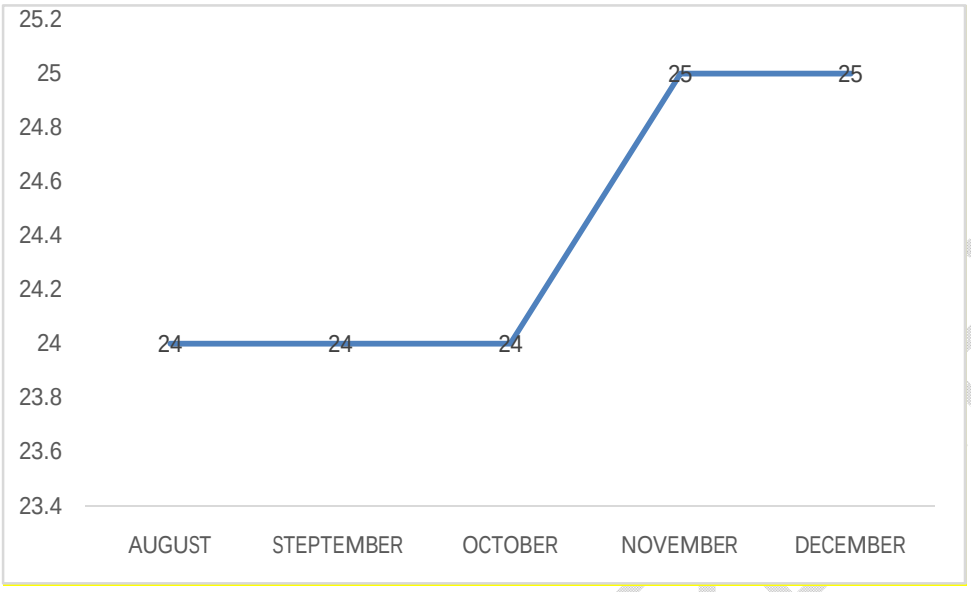

Figure 2 Meteorologically Agency,2021)

Comparing the night temperature in the use of ITNs to a standard ambient room temperature 20 -25^{0}C (24)

3.2 DISCUSSION

Socio-demographic details revealed highest proportion of the respondents in this study were aged between 26-35 years unlike other studiesin Cameroon were most of the respondents aged were 14- 24 years.Similarly, majority (81.8%) of this study are married similar tomajority (84.4%) ofpregnant women who participated in the use of ITNs in Cameroon were married.Also, majority (93.0%) of the respondents in this present study were Christians(25). This issimilar to other studies in Cameroon were majority (87.3%) of the respondents were Muslims.Furthermore,majority (60.6%) of the respondents had also received secondary education similar to studies in Cameroon on use of ITNs reported highest percentage (69.8%) of respondents are with secondary level education (25). This study was carried out from August to December, 2021which covered both raining season and dry season unlike other study done from April to July 2018 that covers only dry season (25).The study showed that the respondents 330(100%) are mainly pregnant women and caregivers of under-five yearschildren. This is contrary to studies carried out in Rivers State where majority of the respondents (57.2%) were males (26). Baseline intervention showed that majority of the respondents 272 (82.4%) owned nets. Comparing to post intervention, increaseownerships of ITNs 304 (92.1%). This finding is in agreement with a similar studies in southern Nigeria (27).(28).A large proportion 157 (47.6%) had good attitude towards the use of ITNs at baseline while in post intervention result it showed an increase 321 (97.3%) who had good attitude on use of ITNs. This result therefore agreed with a similar study done in Ethiopia (29). It was observed that in baseline, majority of the respondents 224 (67.9%) had

used the ITNs the previous night, majority 172(52.1%) hung and tucked-in the net when they were about to sleep, which was the correct method of use. Behavioral change after health education post intervention, indicate low proportion of respondents 131(39.7%) slept in the ITNs the previous night. The low usage of ITNs in the dry season, was observed to be contributed by the variation of the temperature in the study areas. As indicated in figure 1 and figure 2, where temperatureat night in Bayelsa State between August and October 2021 was in the range 24-25^{0}C and between November and December 2021, temperature at nightwas between 26- 24^{0}C.This findings is similar to seasonal variation of climatic temperature in raining and dry seasons of Rivers State between February to December (30).High ownership of ITNs and low utilization is similar to study conducted in Ho municipality, Ghana (11). Current study revealed baseline attitude of respondents that 43(13.0%) strongly agree and 70(21.2%) agreed that using ITNs is very uncomfortable during dry season period.Heat therefore was identified as a main barrier which negatively influence poor attitude on the use of ITNs, and this finding is similar to study done in Isingiro district (5).

A critical assessment of this survey revealed that majority of the respondents (60.6%) are of secondary educational background and are part of (82.4%) ownership of ITNs. This is similar to studies in Southern Nigeria, and contrary to other studies where tertiary education was the highest(27).(31). In post intervention, findings indicate that majority 304 (92.1%) of the respondents with secondary education has an increase of ownership of ITNs. The increase in ownership of ITNs is considered to be significant as a result of effective public health awareness campaign on free distribution of ITNs during the study period by Bayelsa State Government under maternal and child health week to all pregnant women and caregivers of children under-five years at various LGAs.Likewise,in Rivers State maternal and child health care programs in various health centers were rendered to pregnant women and under-five years children by health care providers. On the other hand, on use of ITNs the previous night after post intervention it shows that 131(39.7%) slept under ITNs. This is short of the 80% National and Global Target on ownership and use of ITNs which is stated in similar study done in Nigeria (32). Also, the short fall in use of ITNs despite educational background is similar to studies in tertiary hospital in Bayelsa State on ITNs (33). In this study, it was found that their education had a borderline statistically significant association with their attitude towards ITN use. It was found that educated respondents were 4 times more knowledgeable than their uneducated counterparts (O.R.: 4.300, 95% C.I.: 0.838-22.064; *P*=.058). This is similar to study conducted in Enugu State (34). The role of education and access to tools for malaria prevention played a key factor in the attitude on use of ITNs, this is in agreement with similar studies in Ondo, Lagos and Ekiti States (35).(36).

Assessment of the difference in the means of the pre-intervention and post-intervention knowledge scores of the respondents regarding the cause of malaria in pregnancy and in under-5-year-old children showed a statistically

significant difference between both categories (t-test statistic: 31.026; *P*=.05).Effect of malaria in pregnancy and in under-5-year-old children showed statistically significant differences between both categories (t-test statistic: 10.940, *P*=.05; t-test statistic: 8.397 *P*=.05 respectively). This is in agreement with similar study in sub-Saharan Africa on ownership of ITNs which varied from as low as 3% to greater than 80% (37)(35). The impact of the public health education shows 67.9% on use of ITNs in the previous night during the baseline, in post intervention there was a drastic fall on those who use the ITNs the previous night 39.7%. Some of the negative reasons attributed for not using the ITNs include being harmful, do not like to use, and uncomfortable. This is in agreement to studies in Nigeria .(38)(26).

Other findings shows that 94.5% had good knowledge on causes of malaria which is significant to utilization of ITNs with T- test statistics 31.026; P-value < 0.05 this is similar to a pre and post intervention findings in Lagos State, Nigeria (39).Similarly, low percentage of utilization of ITNs in the post-intervention despite influence of knowledge on ITNs through education, this agree with reasons given for non- utilization of ITNs in a similar study were respondents (10.6% vs. 18.9%) indicated it was hotter to sleep under LLIN (39). It was found in this study that their marital status was a statistically significant factor associated with use of ITNs (O.R.:0.424;95%C.I.:0.237-0.760; *P*=.033).

4. CONCLUSION

Poor utilization of ITNs by the vulnerable group is of public health concern. Despite the large proportion of ownership and having good knowledge of use of ITNs in prevention of malaria, majority of the respondents do not make use of the nets. It was found that educated respondents were 4 times more knowledgeable than their uneducated counterparts.This study also showed that malaria have statistically significant effects in pregnancy and in under-5-year-old children.Public health education did not improve the usage of ITNs in the dry season due to variation of temperature at night in the study areas. It is therefore, recommended thatCommunity Health Practitioners and other public health practitioners should pay regular home visits to health educate pregnant mothers and care givers on the need to use ITNs in order to improve and promote good attitude on use of ITNs at all weather.

ACKNOWLEDGEMENT

I owe a debt of gratitude to the following authors: Joseph O. Odoko; John E. Moyegbone; Emmanuel A. Agege; Omatseye A. Akuirene; Charles C. Ofili; Samuel D. Nwajei; Ezekiel U. Nwose& Ephraim E. Benson for their effective supervision and peer review over the work.

CONSENT

Ethical principle guiding the use of human participation in research was adopted. The consent of respondents to the part of the study was derived through the use of health talk in local language and Pidgin English during stakeholder meeting and immunization program.

ETHICAL APPROVAL

Ethical approval was requested from the ethical committee from the Department of Public Health, Novena University, Ogume, Delta State and from the authorities of Sagbama LGA, Kolokuma/ Opokuma LGA and Ahoada- West LGA respectively. The study followed the ethical principles guiding the use of human participation in research.

REFERENCES

[1] Fullman N, Burstein R, Lim SS, Medlin C, and Gakidou E, "Nets, spray or both? the effectiveness of insecticide-treated nets and indoor residual spraying in reducing malaria morbidity and child mortality in sub-Saharan Africa," Malar. J. 2013;12(1):1-10. doi: 10.1186/1475-2875-12-62.

[2] World Health Organization, WHO technical brief for countries preparing malaria funding requests for the Global Fund (2020–2022). 2020.

[3] Makenga G. "Prevalence of malaria parasitaemia in school-aged children and pregnant women in endemic settings of sub-Saharan Africa: A systematic review and meta-analysis," Parasite Epidemiol. Control. 2020;11:e00188. doi: 10.1016/j.parepi.2020.e00188.

[4] WHO, "World malaria report 2019," no. 4 December 2019 | Meeting report, pp. 978-92-4-156572–1, 2019.

[5] Taremwa IM, Ashaba, S., Adrama, H.O. et al. "Knowledge, attitude and behaviour towards the use of insecticide treated mosquito nets among pregnant women and children in rural Southwestern Uganda," BMC Public Health. 2017;17:794-801. doi: 10.1186/s12889-017-4824-4.

[6] Odoko JO, Nwose EU, and Igumbor EO. "Evaluation of utilization of insecticide treated nets among pregnant women in Bayelsa State of Nigeria: a case study of Sagbama community," Int. J. Res. Med. Sci.2018;6(8):2571-2577. doi: 10.18203/2320-6012.ijrms20183234.

[7] Gibson K, Samuels G, and Pryce J. "Authors of accountability: Paperwork and social work in contemporary child welfare practice," Child. Youth Serv. Rev. 2017;85:43–52. doi: 10.1016/j.childyouth.2017.12.010.

[8] Rogerson SJ. "Identifying and combating the impacts of COVID-19 on malaria," BMC Med. 2020;18(1):1–7. doi: 10.1186/s12916-020-01710-x.

[9] Yitayew AE, Enyew HD, and Goshu YA. “Utilization and Associated Factors of Insecticide Treated Bed Net among Pregnant Women Attending Antenatal Clinic of Addis Zemen Hospital, North-Western Ethiopia: An Institutional Based Study,” Malar. Res. Treat. 2018; 2018:1-9. doi: 10.1155/2018/3647184.

[10] Berry I. “Seasonal dynamics of malaria in pregnancy in West Africa: Evidence for carriage of infections acquired before pregnancy until first contact with antenatal care,” Am. J. Trop. Med. Hyg. 2018;98(2):534–42. doi: 10.4269/ajtmh.17-0620.

[11] Konlan KD, Japiong M, K. Konlan KD, Afaya A, Salia SM, and Kombat JM. “Utilization of Insecticide Treated Bed Nets (ITNs) among Caregivers of Children under Five Years in the Ho Municipality,” Interdiscip. Perspect. Infect. Dis. 2019:1-7. doi: 10.1155/2019/3693450.

[12] Andinda M, Mulogo E, Turyakira E, and Batwala V, “Predictors of sleeping under cost-free mosquito bed nets among children under-five years in Mbarara, Uganda: A household survey,” Afr. Health Sci.2019;19(1):1353–60. doi: 10.4314/ahs.v19i1.7.

[13] Babalola S. “Ideational factors associated with consistent use of insecticide-treated nets: a multi-country, multilevel analysis,” Malar. J. 2022;21(1):1–14. doi: 10.1186/s12936-022-04384-3.

[14] Nghochuzie NN, Olwal CO, Udoakang AJ, Amenga-Etego LNK, and Amambua-Ngwa A. “Pausing the Fight Against Malaria to Combat the COVID-19 Pandemic in Africa: Is the Future of Malaria Bleak?,” Front. Microbiol. 2020; 11:1–5. doi: 10.3389/fmicb.2020.01476.

[15] Ins D, Coe O, and Beb N. “Perceptions on Use the of ITNs in the Imo River Basin African Journal of Reproductive Health,” Reprod Heal. 2010;14(1): 117-28.

[16] Olotu A, Fegan G, Wambua J, et al., “Seven-Year Efficacy of RTS, S/AS01 Malaria Vaccine among Young African Children new england journal. 2016; 374(26):2519–29, 2016, doi: 10.1056/NEJMoa1515257.

[17] Mckay G and Parker M. Epidemics. In: Allen, T; MacDonald, A; Radice, H, (eds.) Humanitarianism A Dictionary of Concepts. Routledge, Abingdon, Oxon; New York, NY, 2018. DOI: https://doi.org/10.1108/IJHRH-04-2018-0033

[18] Blessed AK and Victor OB. “The Challenges of Using Insecticides Treated Nets (ITNs) in Curbing Malaria in Nigeria: A 2000-2018 Systematic Review,” J. Infect. Dis. Epidemiol. 2020;6(4):1–8. doi: 10.23937/2474-3658/1510140.

[19] Ngondi J, Reacher M, Matthews F, Brayne C, and Emerson P. “Trachoma survey methods: A literature review,” Bull. World Health Organ. 2009;87(2):143–51. doi: 10.2471/BLT.07.046326.

[20] Fuge TG, Ayanto SY, and Gurmamo FL. “Assessment of knowledge, attitude and practice about malaria and ITNs

utilization among pregnant women in Shashogo District, Southern Ethiopia," Malar. J. 2015;14(1):1–9. doi: 10.1186/s12936-015-0755-7.

[21] Sidiki NNA, Payne VK, Cedric Y, and Nadia NAC, "Effect of Impregnated Mosquito Bed Nets on the Prevalence of Malaria among Pregnant Women in Foumban Subdivision, West Region of Cameroon," J. Parasitol. Res. 2020:1-10. doi: 10.1155/2020/7438317.

[22] Albert C, Isife B, Jaja G. "Adoption of Insecticide Treated Nets By Rural Dwellers in Rivers State , Nigeria," J econs and sustainable devt.2015;6(16):8–14. https://www.semanticscholar.org/paper/Adoption-of-Insecticide-Treated-Nets-By-Rural-in-Albert-Isife/b3c6c9d6a36e19bfca0d07cf9cfcba3a39c2abe2

[23] Odoko JO, Nwose EU, and Igumbor EO. "Utilization of insecticide treated nets against malaria among pregnant women in Southern Nigeria," Int. J. Res. Med. Sci. 2017;5(11) 4661-66. doi: 10.18203/2320-6012.ijrms20174913.

[24] Tobin-West C and Kanu E. "Factors influencing the use of malaria prevention methods among women of reproductive age in peri-urban communities of Port harcourt city, Nigeria," Niger. Postgrad. Med. J. 2016;23(1):1-1. doi: 10.4103/1117-1936.180114.

[25] Kebede BZY, Abebe L, Alemayehu G, Sudhakar M, "No TitleSchool-based social and behavior change communication (SBCC) advances community exposure to malaria messages, acceptance, and preventive practices in Ethiopia: A pre-posttest study," Ethiop. a pre-posttest study. PLoS One. 2020;25(6):e0235189., 2020.

[26] Wali E. "Flood Vulnerability Assessment on Selected Communities in Ikwerre Local Government Area of Rivers State, Nigeria, Using Remote Sensing and GIS Techniques," J. Geogr. Environ. Earth Sci. Int. 2021;25:46–57. doi: 10.9734/jgeesi/2021/v25i930308.

[27] Mohamed MH, Mohamed H, and Hassan A, "Factors Affecting Utilisation of Insecticide Treated Net among Household with Children Less than Five Years in Hodan District, " Journal of Biosciences and Medicines. 2020;8:194–204. doi: 10.4236/jbm.2020.88017.

[28] A. Andrada, S. Herrera, U. Inyang, A. B. Mohammed, P. Uhomoibhi, and Y. Yé, "A subnational profiling analysis reveals regional differences as the main predictor of ITN ownership and use in Nigeria," Malar. J. 2019;18(1)1–16. doi: 10.1186/s12936-019-2816-9.

[29] Ibegu MI, Hamza KL, Umeokonkwo CD, Numbere TW, Ndoreraho A, and Dahiru T. "Use of long-lasting insecticidal nets among women attending antenatal clinic at a tertiary hospital in Bayelsa State, Nigeria 2019," Malar. J. 2020;19:455-60. Doi: 10.1186/s12936-020-03531-y.

[30] Ugwu EO, Ezechukwu PC, Obi SN, Ugwu AO, and Okeke TC. "Utilization of insecticide-treated nets among pregnant women in Enugu, South Eastern Nigeria," 2013;16(3):292-6.

[31] Adetunji AA, Ademuyiwa AJ, Alo GN. “Geo-additive modelling of children under-five sleeping under Insecticide-treated nets in Nigeria,” 2021;87:2479–90.

[32] Sharma RK. “Socio-economic determinants of malaria in tribal-dominated Mandla district enrolled in Malaria Elimination Demonstration Project in Madhya Pradesh,” Malar. J. 2021;20:1–13. doi: 10.1186/s12936-020-03540-x.

[33] Singh SRM, Brown G. “Ownership and use of insecticide-treated nets during pregnancy in sub-Saharan Africa : a review,” Malar. J. 2013;12:268-77.

[34] Amâncio FF. “Dengue virus serotype 4 in a highly susceptible population in Southeast Brazil,” J. Infect. Public Health. 2014;7(6):547–52. doi: 10.1016/j.jiph.2014.07.016.

[35] Fagbohun IK, Idowu ET, Onafuwa AO et al. “Knowledge, attitudes and perception of communities on mosquitoes and its control practices in Lagos state, Nigeria,” Pan Afr. Med. J. 2021;38:1–9. doi: 10.11604/pamj.2021.38.44.22572.