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Assessment of Use of Indoor Residual Spraying (IRS) Among Medical Students in Abia State University, Uturu (ABSU) Nigeria

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ABSTRACT

Background: *Malaria has remained one of the life-threatening diseases affecting Nigeria as a nation especially those living in malaria endemic region. The causative organism of malaria ii plasmodium and transmitted to man by infected female anopheles' mosquito. The clinical features of malaria vary from mild to severe and complicated according to species of parasite present and the patient's state of immunity. Students in this region are also prone to contracting the disease.*

Objective: *To determine the use of indoor residual spraying (IRS) among medical students in Abia State University, Uturu, Nigeria.*

Methods and Materials: *This descriptive cross-sectional study was carried out to assess the use of Indoor Residual Spraying (IRS) among medical students of ABSU. The study involved both preclinical and clinical students. A Simple random sampling was used in selecting participants and data was obtained using self-administered questionnaires, analyzed with Statistical Package for Social Sciences (SPSS), version 26.0 and presented in form of tables. Association between the sociodemographic variables and level of usage of IRS were determined and statistical significance was set at P<0.05.*

Result: *A total number 407 students and out which of 389 participated in this study with a response rate of 95.6% and mean age of 21.98±3.52 years, more students were in the range of 20-24, and the dominant tribe was Igbo (94.3%), more of males (50.6%) participated in this study and practice of was poor (31.9%). A high proportion of students (99.7%) had a good knowledge of malaria transmission and IRS.*

Conclusion: *The study reported a high level of knowledge of malaria preventive measures but a poor practice to its utilization, thus a need for proper health education to improve usage of Indoor residual spraying*

Keywords

Malaria, Usage, IRS, Students, ABSU, Nigeria.

Introduction

Background

Malaria infection is one of the major causes of death in African continent [1]. The causative organism of malaria is a parasite of genus Plasmodium and transmitted to man by infected female anopheles mosquito [2]. The clinical features of malaria vary from mild to severe and complicated according to species of parasite present and the patient's state of immunity.

Malaria parasite moves as sporozoites in mosquito which is injected into man during blood meal, it undergoes an exoerythrocytic

schizogony in the liver later on an erythrocytic schizogony in red blood cells, which release the merozoites that subsequently becomes the gametocytes, taken up during blood meal by the female anopheles mosquito to continue the life cycle again [3].

Malaria is endemic in many countries in sub-Saharan Africa, South East Asia and to a lesser extent in the Western Pacific and Eastern Mediterranean thus Africa accounting for 90% [3]. Despite being a high burden amongst children of under-five, pregnant women, elderly and people of low socio economic status, it remains a holo-endemic disease since it affects all ages [4]. In Nigeria, it is hyper-endemic due to certain constraints to malaria control and eradication like inadequate funding of the health sector and impact on health behaviour, lack of basic living infrastructure to malaria exposure and disease, systemic structural violence that challenges malaria eradication [5].

In 2019, six countries accounted for approximately half of all malaria death worldwide:
Nigeria (23%), Democratic Republic Of Congo (11%), United Republic of Tanzania (5%), Burkina Faso(4%), Mozambique(4%), Niger(4% each) [5]. The severity and endemic nature of this disease has thus caught the eyes of the World Health Organization as well as other bodies like UNICEF, UNDP and the World Bank, hence the initiation of "ROLL BACK Malaria Initiative" in 1998 [2].

In addition to diagnosis of malaria cases and treatment with effective and efficient anti-malaria drugs the use of Indoor Residual Spray (IRS) has been found to be a major means to tackle the vector [2]. Indoor Residual spraying (IRS) is the application of long lasting chemical insecticides on the walls and roofs of all houses and domestic stuff in a given area, in order to kill the adult mosquitoes. It is the most effective against Indoor feeding (Endophagic) and Indoor resting (Endophilic) vectors. Basically, it was the primary malaria control method used during the Global Malaria Eradication Campaign (1955-1969), the campaign did not achieve its standard objective but 37 of the 143 countries that were endemic in 1950 were free of malaria by 1978 and there was a sharp reduction in the burden of disease in other countries [6].

Repelling, irritation and killing of the mosquito are the main actions of IRS. A good Indoor Residual Spray has long lasting effect on a given surface and high toxicity to mosquitoes, mosquitoes must be susceptible to it, requires a correct formulation, should be stable during transportation, storage and minimal ventilation, it should pose no damage to the household and must be acceptable and affordable [6].

Malaria is a global public health problem that causes massive morbidity and mortality and poses a higher burden of disease especially in the sub-Saharan Africa region [9]. It is known to affect all ages and sexes with some population groups considered as having a higher risk of malaria contact and developing severe disease than others. These include infants, children under 5 years of age, pregnant women and patients with HIV/AIDS, as well as non-immune migrants, mobile populations and travelers [5].

According to Centre for Disease Control CDC, pregnant women lose some of their immunity and are prone to malaria infection because of the changes in women's immune systems during pregnancy and the presence of placenta with new places for parasites to bind [10]. Also, it is known to cause significant economic losses and can decrease the gross domestic profit (GDP) by as much as 1.3% in countries with high levels of transmission [10].

Despite decades of control activities, malaria continues to cause more deaths than any other parasitic disease worldwide [11]. Over 219 million cases and 435,000 malaria-related deaths are estimated to have occurred globally in 2017, and approximately half of the global population is believed to be at risk of malaria [12]. According to the recent malaria report released on 30th November 2020, an estimated number of malaria deaths stood at 409,000 in 2019, compared with 411,000 deaths in 2018 with children less than 5 years accounting for 67% (274,000) deaths in 2019 [5].

The aim of this study is to access the use of IRS and other malaria vector control measures among medical students at Abia State University, Uturu in using indoor residual sprays and other malaria vector control measures. Since malaria is endemic in Nigeria, any study or research that aids in the understanding of how to prevent its transmission is important. Malaria has contributed to the reduction in the general and physical wellbeing of students and also has a significant financial and human resource effect too. This research will most importantly access each student's awareness on the various symptoms of malaria as well as the strategies they use to avoid malaria transmission. Awareness campaigns may be designed based on the findings from this study thus potentiating a reduction in the morbidity and mortality rates of malaria among medical students and the general population at large.

This study was conducted in Abia State University, Uturu, (ABSU) located in the northern part of Abia State in Isuikwuato Local Government Area, south East Nigeria. It is popularly known as ABSU. The inception of the university was in 1981 in the former Imo State under the name of Imo State University, Etiti. Following the creation of Abia State in August 1991, the Uturu campus of the University was ceded to Abia State, and is now known as Abia State University Uturu. ABSU is a government-owned institution, which has ten faculties with about seventy-eight departments and over 20,000 students which comprises of the undergraduates, postgraduates and doctoral students.13 It has three campuses- its main campus in Uturu, College of Law and College of Agriculture in Umuahia and College of Medicine and Health Sciences in Aba. The school's colours are Yellow and Blue. They are known with the motto "Excellence and Service".

Abia State has its capital in Umuahia and its major commercial city at Aba. It is also the fifth most industrialized state in the country and has the 4th highest index of human development in the country, with numerous economic activities and fast-growing

populations. It accounts for 2.0% of Nigeria's total population. The state derives its name from the first letters in Aba, Bende, Isuikwuato, and Afikpo. Its citizens are predominantly Igbos making up 95% of the population. It covers an area of 4,796km^2. It lies at latitude 5° 25' North and longitude 7° 30' East. It has a population of 3,727,300[2016] and a population density of 777.1/km^2[2016] [14].

Study Design
This was a descriptive cross-sectional study using self-administered questionnaire to obtain information from the students.

Study Population
The study population includes all Medical students of the University.

Inclusion Criteria
Male and female pre-clinical and clinical students of the University.

Exclusion Criteria
1. Male and female non-medical students of the University.
2. Medical students who did not give their consent for the study.

Sample Size Determination
Sample size was statistically determined using this formula [15],

$$n=\frac{90}{384}\times 100$$

Where n= minimum sample size
Z= normal deviate which corresponds to 1.96
P= desired proportion i.e. 50%
Q= 1.0$\frac{90}{384}\times 100$P
D= 0.05 (Level of Precision)

$$n=\frac{90}{384}\times 100 = 384$$

Adjustment for non-response:

$$=\frac{90}{384}\times 100\ 100$$

$$=\frac{90}{384}\times 100$$

= 23 i.e. more questionnaires to be added.
=407

Sample Technique
There are 17 Local Government Areas in Abia State; Isuikwuato was selected by simple random sampling method of balloting. The institution, Abia State University was selected by simple random sampling from the two Universities in the state that train medical students (ABSU and Gregory University, Uturu). The questionnaire was then administered to consenting medical students till the sample size was reached.

Study Instruments
Self-administered questionnaires, computers, calculators, statistical table, International Business Machine Statistical Package for Social Studies Software. (IBM SPSS).

Data Collection Method
Data was collected using self-administered questionnaires given to voluntary participants till the sample size was reached. The questionnaire was made up of five sections; socio-demographic data, knowledge of the students on malaria transmission and control, attitude of students towards the use of IRS as a means to control the malaria vector, other methods of malaria vector control used by the students and the factors influencing the choice of IRS and other malaria vector control measures among the students.

Data Managements
Measurement of Variables
Selected variables were duly measured.

Statistical Analysis
Data collected were entered into and analyzed using Statistical Package for Social Science [SPSS], Version 26.0. Continuous/numerical variables were summarized using mean and standard deviation, categorical variables were summarized using frequency and proportions. The Chi square test of association or the Fisher's exact test was performed to determine associations between knowledge of malaria transmission/control and other variables. Level of statistical significance was set at a predetermined p-value of <0.05.

Ethical Consideration
Ethical approval for the study was sought for and given by the Ethics and Research Committee of Abia State University Teaching Hospital, Aba while a written and signed consent was duly obtained from all volunteered participants. Participants were also assured of confidentiality and anonymity.

Study Limitations
During the exercise. there was difficulty retrieving some of the questionnaires from study participants, some students were not willing to participate in the study, gathering of participants, and collecting their responses were of great challenges, Some participants did not fully understand some of the questions and as such did not respond appropriately but we ensured we had a successful field work by following up the students and adequate explanations where made.

Results
A total of 407 questionnaires were distributed to the study participants but 389 participants returned their questionnaires giving 95.6% recovery which was the response rate and the findings are presented below in tables. Mean age of the respondents was 21.98 ± 3.52.

Table 1: Socio-demographic characteristics of the students.

Variables	Frequency (N=389)	Percent
Age group (in years)		
<20	91	23.4
20-24	214	55.0
25-29	75	19.3
30+	9	2.3
Sex		
Male	197	50.6
Female	192	49.4

Marital status		
Single	375	96.4
Married	11	2.8
Divorced	3	0.8
Tribe		
Igbo	367	94.3
Yoruba	13	3.3
Hausa	1	0.3
Others	8	2.1
State of origin		
Abia	229	58.9
Imo	95	24.4
Others	65	16.7
Religion		
Christianity	382	98.2
Others	7	1.8
Place of residence		
School hostel	151	38.8
Off Campus	238	61.2
Level of study		
Pre-med	45	11.6
PC1	70	18.0
PC2	128	32.9
C1	52	13.4
C2	72	18.5
C3	22	5.7

Mean age=21.98 ± 3.52

Table 1 above shows the socio-demographic characteristics of the respondents. 389 students participated in this study with a mean age of 21.98±3.52 years. Majority (55%) were in the age group 20-24 years with a slightly higher proportion of males (50.6%). Nearly all were single (96.4%), of the Igbo tribe (94.3%) and Christians (98.2%). Over two-thirds (61%) of the students reside off campus and a higher proportion were in the Preclinical Class (PC2) class (32.9%).

Table 2: Knowledge on malaria transmission and control.

Variables	Frequency	Percent
Heard about malaria		
Yes	388	99.7
No	1	0.3
If Yes, source of information		
Poster	41	9.1
Internet	100	22.1
TV/Radio	54	11.9
School	185	40.9
Seminar	33	7.3
Others	39	8.6
Malaria is a		
Bacteria	81	20.8
Parasite	254	65.3
Fungi	8	2.1
Life threatening infection	45	11.6
STD	1	0.3
Malaria is spread through		
Coughing	28	7.2
Vector	334	85.9
Contact with an infected person	6	1.5
No idea	21	5.4
Malaria is transmitted through		
Female anopheles mosquito	377	96.9
Housefly	4	1.0
Cockroach	3	0.8
Bed bugs	4	1.0
Sand fly	1	0.3
Signs & symptoms of malaria	**n=1428***	
Elevated temperature	336	23.5
Headache	282	19.7
Dizziness	182	12.7
Nausea & vomiting	189	13.2
Chills	213	14.9
Body pains	226	15.8
Vector is found in	**n=509***	
Stagnant waters	346	68.1
Fresh water	25	4.9
Clear vegetation	23	4.5
Waste materials	95	16.7
No idea	20	3.9
Time vector bites		
Morning	19	4.8
Day	25	6.4
Night	196	50.0
Anytime	137	34.9
No idea	15	3.8
Malaria transmission can be prevented		
Yes	366	94.1
No	12	3.1
I don't think so	11	2.8
If Yes, mention at least 3 measures		
Up to 3 measures	21	5.6
<3 measures	351	94.4

***Multiple responses**

Table 2 is on the knowledge of malaria transmission and control among the students. Nearly all the students 388 (99.7%) have heard about Malaria. Their major source of information was the school 185 (40.9%) followed by the Internet 100 (22.1%). Majority of the participants knew that malaria is a parasite 254 (65.3%), spread through a vector 334 (85.9%). Three hundred and seventy-seven (96.9%) of them knew that malaria was transmitted through a female Anopheles mosquito, most of the signs and symptoms were known by the students and 346 (68.1%) knew that the vector could be found in stagnant waters. The time the vector bites is known by half of the students. Three hundred and sixty-six (94.1%) knew that malaria transmission can be prevented though only 21 (5.6%) could mention 3 measures of malaria prevention.

Table 3: Attitude of students towards IRS use.

Variables	SA (%)	A (%)	SD (%)	D (%)	N (%)
Malaria is a serious health problem	256(65.8)	119(30.6)	1(0.3)	2(0.5)	11(2.8)
Best way to prevent malaria is by avoiding mosquito bites	225(57.8)	115(29.6)	17(4.4)	18(4.6)	14(3.6)
IRS is a common means of malaria vector control	193(49.6)	156(40.1)	11(2.8)	9(2.3)	20(5.1)
IRS use could be harmful to one's health	173(44.5)	160(41.1)	9(2.3)	11(2.8)	36(9.3)
IRS should be recommended for use in the community	140(36.0)	156(40.9)	18(4.6)	17(4.4)	55(14.1)

***SA=Strongly agree; A=Agree; SD=Strongly disagree; D=Disagree; N=Neutral**

Table 3 above is on the attitude of the respondents towards IRS use. 65.8% of the respondents strongly agreed that Malaria is a serious

health problem while 30.6% of them agreed to the statement. 57.8% of the participants strongly agreed that the best way to prevent malaria is by avoiding mosquito bites while about 29.6% of them agreed to it. In regards to IRS as a means for controlling the malaria vector, 49.6% and 40.1% of the respondents strongly agreed and agreed respectively. 44.5% of the participants strongly agreed that IRS use could be harmful to one's health. Approximately 41% of the respondents agreed to IRS recommendation for use in the community.

Table 4: Methods of malaria vector control used.

Variables	Frequency	Percent
Methods of vector control you know	**n=1404***	
ITNs	353	25.1
Window & door netting	300	21.4
Wearing long sleeved clothes	198	14.1
IRS	238	17.0
Mosquito coil	261	18.6
Herbs	45	3.2
Others	9	0.6
Which of the methods do you use	**n=927***	
ITNs	249	26.9
Window & door netting	225	24.3
Wearing long sleeved clothes	154	16.6
IRS	165	17.8
Mosquito coil	117	12.6
Herbs	12	1.3
Others	5	0.5
How often do you use IRS		
Daily	44	11.3
Weekly	96	24.7
Monthly	47	12.1
Yearly	24	6.2
When I see the need	178	45.8
ITN gives a better protection than IRS		
Yes	163	41.9
No	39	10.0
No idea	187	48.1
RTS, S/ASOI vaccine is now used to prevent malaria transmission		
Yes	119	30.6
No	58	14.9
No idea	212	54.5

***Multiple responses**

Table 4 is on the methods of malaria vector control used by the students. A quarter of respondents knew ITN as a method of vector control for malaria (25.1%). Other methods known by the respondents were window and door netting (21.4%), mosquito coil (18.6%) and IRS (17.0%). On the method used by the respondents, 26.9% use ITN, 24.3% use window and door netting, 17.8% use IRS while 16.6% use long sleeved clothing. 45.8% of the respondents make use of IRS when they see the need with about 48% having no idea if ITN offers a better protection than IRS. 54.5% of the respondents have no idea that RTS, S/ASOI is a vaccine now used to prevent malaria transmission.

The reason for choosing a vector control method was dependent on its effectiveness (33.6%), availability (20.2%), toxicity (17.8%), smell (15.8%), and cost (12.5%).

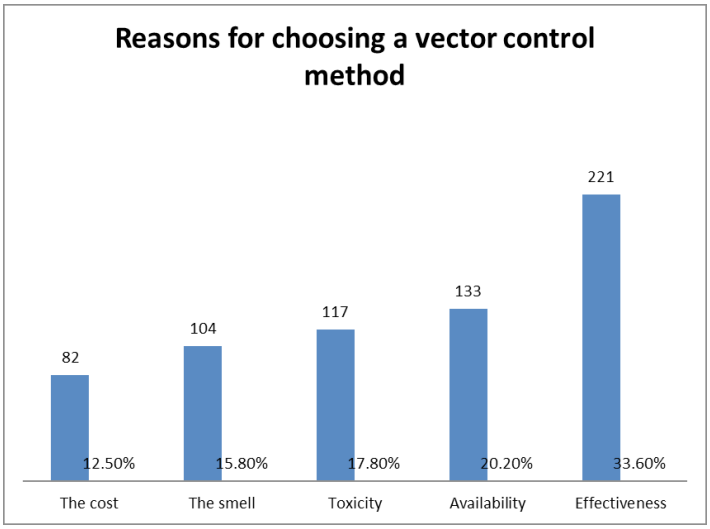

Figure 1: Reasons for choosing a vector control method.

Table 5: Factors influencing choice of IRS and other malaria vector control measures.

Variables	Frequency	Percent
Monthly income spent on vector control		
A small percent	130	33.4
More than I should be spending	34	8.7
I don't spend any money on that	60	15.4
It depends	165	42.4
Experienced any adverse effects from using malaria vector control measures?		
Yes	233	59.9
No	156	40.1
If Yes, what kind?	**n=274***	
Rashes	50	18.2
Cough & sneezing	106	38.7
Watery eyes	40	14.6
Itchy eyes	44	16.1
Others	34	12.4

***Multiple responses**

Table 5 above is on the factors affecting the choice of IRS and other malaria vector control measures. Two hundred and thirty-three (59.9%) of the participants have experienced a side effect from using a vector control measure. Side effect mostly experienced included cough and sneezing 106 (38.7%), rashes 50 (18.2%) and itchy eyes 44 (16.1%).

Table 6: Practice of malaria vector control.

Practice	Frequency (N)	Percent (%)
Good practice (5-10points)	124	31.9
Poor practice (0-4points)	265	68.1

Table 6 shows the practice of malaria vector control among the respondents. The five (5) practice questions were assigned 2 points for each correct response. Respondents who scored 5-10 points were said to have good practice of malaria vector control (31.9%) while those with 0-4 points had poor practice (68.1%).

Table 7: Association between knowledge and the use of Indoor Residual Spraying.

Variable	Good Knowledge (N%)	Poor Knowledge (N%)	χ^2	P-value
Age group (in years)				
<20	25 (20.2)	66 (24.9)	8.676 (FT)	0.031*
20-24	64 (51.6)	150 (56.6)		
25-29	34 (27.4)	41 (15.5)		
30+	1 (0.8)	8 (3.0)		
Sex				
Male	60 (48.8)	137 (51.7)	0.370	0.587
Female	64 (51.6)	128 (48.3)		
Tribe				
Igbo	119 (96.0)	248 (93.6)	2.203 (FT)	0.548
Yoruba	2 (1.6)	11 (4.2)		
Hausa	0 (0.0)	1 (0.4)		
Others	3 (2.4)	5 (1.9)		
Level of study				
Pre-Clinicals	66 (53.2)	199 (75.1)	18.603	<0.0001*
Clinicals	58 (46.8)	66 (24.9)		
Place of residence				
School hostel	58 (46.8)	93 (35.1)	4.852	0.034*
Off-campus	66 (53.2)	172 (64.9)		
Adverse effects				
Yes	83 (66.9)	150 (56.6)	3.754	0.059
No	41 (33.1)	115 (43.4)		

***Statistical significance FT=Fisher's exact test**

Table 7 shows the relationship between knowledge and the use of indoor residual spraying. From the table, age, level of study and place of residence of the students showed statistically significant association with their use of malaria vector control measures [P=0.031; P<0.001 and P=0.034] respectively while the association between sex, tribe and adverse effects was not statistically significant with the use of malaria vector control [P = 0.587; P = 0.548; P = 0.059] respectively.

Discussion

Most of the respondents in this study were between 20 and 24 years. The age distribution of the respondents in this study was found to share similarity with a study conducted among non-medical students of a tertiary institution in Nsukka, Enugu State, Nigeria [16]. Our finding differs with that of the study carried out in Nasarawa state [17], Nigeria where the age range of the respondent were between 20 and 39. The mean age of our study is 21.98 ± 3.52 and it is lower than that of the study in Nasarawa State [17] the reason for the low mean age may be because the respondents in our study were younger than that of Nasarawa state. Out of the 389 respondents, there was slightly higher proportion of males than the females which is similar to a study conducted among students of Hamelmalo Agricultural College, Anseba Eritrea [18] but both findings were lower than the study in Nasarawa State [17] where male proportion were higher with a value of 79.9%.

This study observed IRS coverage of 31.9% and this is not in agreement with the World Health Organization recommendation of more than 80% coverage in targeted community [19]. Our finding was lower to 98.7% documented in the end of spray report of spray report of the African Indoor Residual Spraying (AIRS) Project [20]. It is also lower to 95.3% observed by West et al., in Tanzania in a survey conducted following a round of IRS [21] The high coverage observed in these areas could imply high acceptability among their household in this areas, prior to the spraying, following the initial advocacy, communization and social mobilization embarked upon by AIRS. There is high acceptability of IRS to the findings of studies in Mexico and Tanzania where majority of the households welcomed future spraying [21,23].

However, studies have reported less than a third coverage in Ethiopia and about 41% in Mozambique [24,25]. Their finding is higher than that of our studies and the low level may be due to low acceptability in these areas. Choice of vector control method was determined by the effectiveness of IRS as effectiveness was rated higher than other methods of vector control with 33.6%. This is keeping with other studies in Nasarawa state [17] and Uganda [26] This is not unexpected because, generally an intervention is more likely to be accepted by persons involved where they perceive it to be effective and of benefit to their health. Our study observed that spending small percentage of their monthly income is important factor that influences the choice of IRS [27] Moreover, economic studies have shown that resources are limited, and any activity that would lead to lower cost and lower spending would almost always be expressly welcome [28,19].

In the study on assessment of knowledge of students on Malaria among students of Hamelmalo Agricultural College, it shows that almost all of the students have heard about malaria, which is consistent with our study [18]. In regards to their major source of information, majority of our participants had stated that school (40.9%) was their major source, which was in contrast to a study conducted at Layyah Punjab where TV was their major source of information [30]. In a study done among students in Kwara state, Nigeria, a great number of students were aware that malaria is transmitted through the bite of a vector called The Female Anopheles mosquito however very few had other perceptions [31]. Also, most of the signs and symptoms were known by the students with majority of the students knowing that the vector can be found mostly in stagnant waters [30]. All these were consistent with our study. Regarding the students' knowledge on prevention of malaria, majority (94%) knew that malaria transmission could be prevented though only 5.6% were able to mention up to 3 malaria preventive measures. This was similar to a study done in Namibia [32].

Majority of our study participants, 65.8% strongly agreed that malaria is a serious health problem, which is similar to a study done amongst students of Hamelmalo College [18]. Majority of our study participants strongly agreed that the best way to prevent malaria is by avoiding mosquito bites, which is similar to study done in Namibia [32]. Regarding IRS as a means of vector control, approximately 50% of our study participants strongly agreed to this statement, which is similar to a study done in Nsukka among non-medical students [16]. Majority of our respondents agreed to IRS recommendation for use in community, which was similar to

a study done in Haryana [33].

On preventive strategies for vector control known by the students, various studies showed different measures known by the students which varied from the use of Insecticide Treated Nets (ITN), window and door netting, Indoor Residual Spray, mosquito coil, Herbs etc. of which Insecticide Treated Nets was majorly known by our participants with majority of them utilizing it. This was in contrast to a study done amongst students in Lagos State where Insecticide spray was the commonly used [34]. In a study done in Mozambique, the study participants were of the opinion that ITN gives a better protection than IRS, which was in contrast with our study where most participants had no idea, which could give a better protection [35].

In our study, a lot of factors influenced the participants' choice of a vector control method with the effectiveness of the vector control method being the major reason cited. This was similar to a study done in Nasarawa State, Nigeria [17]. Majority of our respondents experienced cough and sneezing (38.7%) as the most common side effect which is in contrast with a study done in Anambra, South east, Nigeria, where the most common side effect experienced was skin allergies [36]. In a study done among midwifery students in Plateau State, majority of the study participants had a good practice of malaria prevention which was in contrast with our study where our participants had a poor practice [37]. In our study, there is statistically significant association between knowledge and age, level of study and place of residence in the use of indoor residual spraying and this is similar to the findings of a study in Uganda where respondents with secondary education and above were more likely to accept IRS [21].

Also in a study carried out at Hamelmalo, the use of a vector control measure(ITN) showed to be significantly associated with the age and place of residence which is similar to our study [18]. This association of use with age can be due to the common age grade commonly seen in Tertiary Institutions and also, they are more enlightened on malaria prevention practices yet the poor practice could be due to financial constraints amongst students.

Conclusions

This study revealed that the students had a good knowledge about malaria transmission and its preventive measures, though with a low practice of malaria vector control. The attitude of the students towards IRS use was generally satisfactory. This was evidenced by majority of the respondents agreeing to the recommendation of IRS use in the community. However, the knowledge and attitudes of the students did not reflect in the students' utilization of IRS which revealed that approximately 31.9% of the respondents make use of IRS when they see the need which may be in part due to its effectiveness, availability, toxicity or cost. The age, level of study and place of residence of the students showed statistically significant association with their use of malaria vector control measures.

Recommendations

Creation of more awareness on malaria preventive measures. Promoting ITN and IRS utilization among students to help achieve the desired protection against mosquito bites. School authorities should provide a mosquito free environment by clearing of bushes, removal of stagnant waters to eliminate breeding sites for the vector and installation of window nettings on school hostels. Government should make available effective and affordable vector control measures for the community including schools to reduce the spread of the infection especially the use of ITN and IRS. Schools should organize spraying programs especially during vacations to minimize the students' coming in contact with the toxic effects of the chemical.

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