PRINT ISSN 1119-8362
Electronic ISSN 2659-1499

Full-text Available Online at
https://www.ajol.info/index.php/jasem
https://www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage.
Vol. 28 (4) 1211-1219 April 2024

Evaluation of Interactions between Malaria Vector Control Practices and Demographic Parameters in Selected Communities in Abia State, South-East, Nigeria

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ABSTRACT: Malaria, transmitted by *Anopheles* mosquitoes has become a debilitating and burdensome disease in Sub-Saharan Africa and conventional practices such as Long-Lasting Insecticide Treated Nets (LLITNs), and Indoor Residual Spraying (IRS) and unconventional practices are usually employed as malaria vector control measures. Hence, the objective of this paper was to evaluate the interactions that exist between these control practices and demographic parameters in selected communities across Ikwuano, Osisioma and Ohafia Local Government Areas (LGAs) of Abia State, South-East, Nigeria using multi-stage sampling technique with five hundred and ten structured questionnaires. Data obtained reveals that the predominant control practices were IRS (325; 63.7%), although it was used in combination with other control methods. This was followed by screening of windows with net (221; 43.3%), whereas only a few respondents used LLITNs. Respondent's LGA, level of education, type of dwelling structure and household size had significant relationship with most of the malaria vector control practices/perceptions ($P < 0.05$). However, gender had no significant relationship with any of the malaria vector control practices/perceptions ($P > 0.05$). Effectiveness (306; 60.0%) was the major reason behind choice of method practiced. Respondents also chose methods that were cheap (175; 34.3%) and prevented contact with mosquitoes (154; 30.2%), but attested to not being aware of any recent Government/Non-Governmental (NGO) mosquito control intervention (386; 75.7%). Considering the low ownership and usage of LLITNs in Abia, efforts should be made towards more distribution. Control programs are advised to consider LGA, level of education, household size, and type of dwelling structure during the design and deployment of interventions.

DOI: https://dx.doi.org/10.4314/jasem.v28i4.21

Cite this Article as: EKEDO, C. M; UKPAI, O. M; EHISIANYA, C. N; OKORE, O. O; AGAORU, C. G. (2024). Evaluation of Interactions between Malaria Vector Control Practices and Demographic Parameters in Selected Communities in Abia State, South-East, Nigeria. *J. Appl. Sci. Environ. Manage.* 28 (4) 1211-1219

Dates: Received: 22 January 2024; Revised: 29 February 2024; Accepted: 23 March 2024 Published: 29 April 2024

Keywords: Interactions; demography; malaria vector control practices

Malaria has grown to become a major health challenge in Africa, with a substantial part of its morbidity and mortality burden in Nigeria (Omotayo *et al*., 2021). In 2018 alone, it accounted for the death of about 400,000 persons globally, with most of the deaths within the Sub-Saharan African region (Muhammad *et al*., 2021). The principal malaria vector control methods approved by the WHO are the use of Long Lasting Insecticide Treated Nets (LLITNs) and Indoor Residual Spraying (Chukwuekezie *et al*., 2020). Other non-conventional malaria vector control practices in Nigeria, and many other sub-Saharan African countries includes the use of ordinary nets, screening of windows with nets, sleeping with windows closed, clearing of gutters, cutting grass/bush around the house, burning of repellent grass/coil, rubbing repellent creams on the body and covering the body with clothes (Omotayo *et al*., 2021).Insecticide usage has to a large extent yielded huge success (Khairy *et al*., 2017), whereas the increased usage of LLITNs in

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Ethiopia had contributed in lowering the burden of malaria (Bekele *et al*., 2012). Unfortunately, unlike ownership of LLITNs which has been reported to be on the increase IRS usage has halved by 2016 (Omotayo *et al*., 2021), whereas the grounds previously gained by these vector control methods are seriously been threatened by insecticide resistance (Chukwuekezie *et al*., 2020). The dynamics of increased malaria vector insecticide resistance is believed to be linked to constant change in mosquito behavior, population dynamics, and constant movement into new regions; hence necessitating a constant review of control methods utilized by communities for mosquito control. A people's knowledge about a situation would definitely determine how they will respond to such situation. It is therefore imperative that the knowledge, attitude and practices (KAP) of every malaria endemic community be constantly monitored and taken into consideration prior to the design and subsequent implementation of malaria vector programs within those communities (Omotayo *et al*., 2021).The improvement of a community KAP with regards to malaria vector control will in turn help to ameliorate malaria burden (Khairy *et al*., 2017). Considering a communities KAP prior to the deployment of vector control strategies is as important as taking note of the insecticide resistance status of the mosquitoes (Tyagi *et al*., 2005), and would definitely ensure a successful outing. Since a community KAP changes with time and space (Mazigo *et* al., 2020), it is therefore imperative for a constant evaluation of a community KAP to meet current needs for malaria vector control.

Hence, the objective of this paper was to evaluate the interactions that exist between these control practices and demographic parameters in selected communities across Ikwuano, Osisioma and Ohafia Local Government Areas (LGAs) of Abia State, South-East, Nigeria

MATERIALS AND METHODS

Study Area: Abia State is situated in Southeastern Nigeria, with 17 Local Government Areas distributed in an area of 5,234.7km^2 (Ogbuewu *et al*., 2016). Towards the south Abia shares boundary with Rivers and AkwaIbom States, by the west with Imo State, by the North Anambra, Enugu and Ebonyi State, and Cross River State by the east (Fig 1). Geographically, the State lies between $5^0 25^1$- $5^0 42^1$N latitude and $7^0 30^1$ - $7^0 50^1$E (Ogbuewu *et al*., 2016). The state stands at about 223m above sea level, with its average temperature, humidity and annual rainfall range as 26.7^{0}C, 75.5% and 2500mm/year respectively. The rainy season is between April and October (Ogbuewu *et al*., 2016).

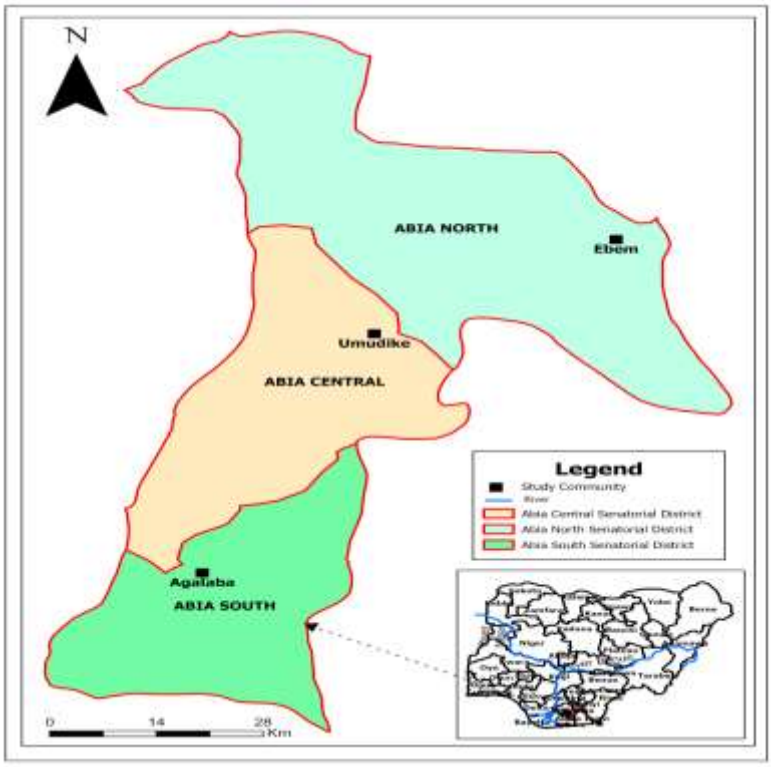

Fig 1: A Map of Abia State indicating the study sites

Questionnaire sampling procedures: This study was conducted from August 2022 to February 2023. Using a multi-stage sampling technique, Abia was divided into its three senatorial zones (Abia North, Abia Central, and Abia South). A LGA was then picked from each zone: Ohafia from Abia North, Ikwuano from Abia Central, and Osisioma from Abia South. Finally, households were randomly chosen from four selected communities from each of the three LGA's. Consent was sought from necessary authorities, and was then followed by the administration of a questionnaire to the selected households. Although 384 was the calculated minimum sample size (Lemershow, *et al*., 1990), 510 questionnaires were equitably administered to the three LGAs after an initial pretest.

Statistical Analysis: All data from the questionnaire were sorted, imputed, and analyzed with SPSS Version 21.0(SPSS Inc., Chicago, IL). Frequencies, percentages, mean, and range were generated using descriptive analysis, whereas Chi-square analysis was used to measure the influence of age, gender, marital status, level of education, household size, Local Government Area, and type of dwelling structure on respondents' KAP to malaria vector control.

RESULTS AND DISCUSSION

Socio-demographic characteristics of study respondents: Out of the 510 questions analyzed 170 (33.3%) were from each of the three Local Government areas sampled (Ikwuano, Osisioma and Ohafia). The mean age of respondents in years was 32.3 ± 10.2, whereas the median was 30.0. The majority of the respondents were in the youthful (18-30yrs) (206; 40.4%) and single (198; 38.8%) categories. More of the respondents had post-secondary education (272; 53.3%), whereas those with primary education alone, were the least (29; 5.7%). The mean number of inhabitants in a household was 4.3 ± 2.3, while the median was 4.0. Most of the respondents lived in a single family house (123; 24.1%), however, the least number of them lived in a mini-flat (33; 6.5%). The socio-demographic characteristic of respondents is summarized in Table 1.

Knowledge and practices related to mosquito control: From Table 2 below it can be seen that the majority of the respondents use more than one method to control mosquitoes. The most common methods utilized by respondents are 'use of insecticide's (325; 63.7%), 'Screening of windows with net' (221; 43.3%), 'Cutting bushes and grasses around the house' (192; 37.6%) and 'sleeping with closed windows' (83; 16.3%).Respondents preferred the various control methods for different reasons, but effectiveness (306; 60.0%) was the most pronounced reason for choice and use of methods. A substantial number of respondents used methods 'because they are cheap' (175; 34.3%). Others preferred methods that 'prevent contact with mosquitoes' (154; 30.2%), whereas a handful of respondents were particular about the 'negative impacts of insecticides' (60; 11.8%) (Table 2). The Majority of the respondents (386; 75.7%) were not aware of any recent government/NGO mosquito control intervention within Abia State.

Table 1: Socio-demographic characteristics of respondents in Abia State, Nigeria

Characteristics	*n* = 510(%)
LGA	
Ikwuano	170 (33.3)
Osisioma	170 (33.3)
Ohafia	170 (33.3)
Age	
Mean ± SD (Range)	32.3 ± 10.2 (18 -
Median	61)
Age group (yr)	30
18-30	
31-40	206 (40.4)
41-50	139 (27.3)
51-60	94 (18.4)
>60	36 (7.0)
	35 (6.9)
Gender	
Male	238 (46.7)
Female	272 (53.3)
Marital Status	
Single	198 (38.8)
Married	268 (52.5)
Divorced	15 (2.9)
Widowed	29 (5.7)
Level of Education	
Primary	29 (5.7)
Secondary	177 (34.7)
Post-secondary	272 (53.3)
No formal education	32 (6.3)
Type of dwelling structure	
Single family house	123 (24.1)
Duplex	93 (18.2)
Two/three-bedroom flat	106 (20.8)
Mini flat	33 (6.5)
Room and parlor	42 (8.2)
Single room	113 (22.2)
Number of household members	4.3 ± 2.3
Mean ± SD (Range)	4.0
Median	43 (8.4)
1	89 (17.5)
2	86 (16.9)
3	71 (13.9)
4	68 (13.3)
5	70 (13.7)
6	40 (7.8)
7	25 (4.9)
8	7 (1.4)
9	7 (1.4)
10	(0.2)
11	(0.4)
12	1 (0.2)
13	

Table 2: Knowledge and practices on mosquito control among respondents

Methods employed for protection against mosquito	*n* = 510 (%)
Use of insecticides	325 (63.7)
Sleeping under ordinary net	56 (11.0)
Sleeping under LLITNs	69 (13.5)
Sleeping with windows closed	83 (16.3)
Screening of windows with net	221 (43.3)
Burning coil/grass as repellents	54 (10.6)
Cutting bushes and grasses around the house	192 (37.6)
Draining stagnant water	48 (9.4)
Clearing gutters	57 (11.2)
Covering the body with clothes	75 (14.7)
Rub repellent cream on the body	21 (4.1)
Reasons for method's preference among respondents	
Because of the negative impact of insecticides	60 (11.8)
Because it is very effective	306 (60.0)
Because it prevent contact with mosquito	154 (30.2)
Because it is cheap	175 (34.3)
Because it is easy to use and time saving	40 (7.8)
Because it was recommended	100 (19.6)
Because it is readily available	109 (21.4)
No reason	21 (4.1)
Because I have no alternative	57 (11.2)
Are you aware of any NGO/Gov. Intervention?	
Yes (Net distribution)	124 (24.3)
No	386 (75.7)

Interactions between demographic parameters and malaria vector control practices: Chi-square analysis for the test of relationship showed that level of education, type of dwelling structure, household size, and Local Government Area had a significant relationship with most of the vector control methods practiced in Abia State ($P < 0.05$) (Table 3). Whereas age and marital status had a significant relationship with only 'burning of coil/grass as repellent' and 'use of insecticides' ($P < 0.05$) respectively. On the other hand, Gender had no significant relationship with any of the malaria vector control methods practiced in the State ($P > 0.05$) (Table 3).In the same vein, level of education, type of dwelling structure, household size and Local Government Area had a significant relationship with most of the reasons for which respondents practiced various malaria vector control methods in Abia State ($P < 0.05$) (Table 4). Age had a significant relationship only with the reason 'because it is very effective', whereas marital status had a significant relationship with the reasons 'because it is very effective' and 'because it is cheap' ($P < 0.05$). However, gender had no significant relationship with any of the reasons for practicing malaria vector control methods ($P > 0.05$) (Table 4). Furthermore, it can be seen from Table 5 that some significant interactions existed between the various malaria vector control methods, and the reasons for their use. Screening of windows with nets had a significant relationship with the highest number of respondent's reasons for practicing malaria vector control methods ($P < 0.05$). This was followed by use of insecticides and cutting of bushes and grass, whereas 'burning of coil and grass as repellent' had no significant relationship with any of the reasons ($P > 0.05$) (Table 5).

Vector control is one of the primary means recommended for the control of malaria, and the two conventional methods approved by WHO are indoor residual spraying (IRS) and the use of Long Lasting Insecticide Treated Nets (LLITNS). The enormous reduction of malaria within Sub-Saharan Africa has been accredited to these two methods. To ensure a steady increase in the coverage of these vector control strategies, sufficient understanding of the Knowledge, Attitude and practices of communities is very necessary. This component of this research provides baseline information on the socio-economic demography of communities within Abia State, and their interactions with various malaria vector control methods employed by respondents, to aid prioritization of options for maximum results.

Table 3: Relationship between demography and malaria vector control methods employed by respondents in Abia State

	Use of insecticides	Sleeps under ordinary nets	Sleeps under LLITNs	Sleeps under closed windows	Screening of window with nets	Burning coil/grass as repellents	Cutting of bushes and grass	Draining stagnant water	Clearing gutters	Covering the body with clothes	Rub repellent creams on the body
Age	0.122	0.416	0.757	0.153	0.082	*0.000	0.434	0.085	0.360	*0.042	0.605
Gender	0.325	0.241	0.276	0.105	0.358	0.526	0.164	0.903	0.910	0.210	0.592
Marital Status	*0.001	0.296	0.068	0.375	0.779	0.382	0.211	0.443	0.578	0.088	0.857
Level of education	*0.000	*0.006	0.078	*0.002	*0.000	0.379	*0.000	*0.029	*0.048	0.011	0.882
Type of dwelling structure	*0.000	0.826	*0.002	0.072	*0.000	*0.018	*0.000	*0.008	0.446	0.060	0.119
Household size	*0.000	0.695	0.2114	*0.023	*0.000	0.658	0.016*	*0.028	0.052	*0.022	*0.000
Local Government Area	0.525	*0.038	*0.000	*0.000	*0.000	0.830	*0.000	*0.000	*0.000	*0.000	*0.001

**Level of significance < 0.05*

Table 4: Relationship between demography and reasons for the malaria vector control methods employed by respondents in Abia State

	Because of negative impact of insecticides	Because it prevents contacts with mosquitoes	Because it is very effective	Because it is cheap	Because it is easy to use and time saving	Because it was recommended	Because it is readily available	No reason	Because I have no alternative
Age	0.307	0.087	*0.049	0.117	0.826	0.723	0.835	0.363	0.431
Gender	0.054	0.827	0.346	0.493	0.582	0.709	0.535	0.592	0.338
Marital Status	0.095	0.380	*0.012	*0.026	0.702	0.272	0.174	0.243	0.819
Level of education	0.070	*0.034	*0.000	*0.000	0.176	0.002	*0.000	*0.016	0.954
Type of dwelling structure	*0.049	*0.002	*0.000	*0.000	0.111	0.050	*0.000	0.574	*0.022
Household size	0.134	*0.034	*0.000	*0.000	0.059	0.061	*0.009	0.933	0.091
Local Government Area	0.066	*0.000	*0.003	*0.000	*0.000	*0.040	*0.000	*0.004	*0.004

**Level of significance < 0.05*

Table 5: Relationship between the malaria vector control methods of respondents and their reasons for using those control methods in Abia State

	Use of insecticides	Sleeps under ordinary nets	Sleeps under LLITNs	Sleeps under closed windows	Screening of window with nets	Burning coil/grass as repellents	Cutting of bushes and grass	Draining stagnant water	Clearing gutters	Covering the body with clothes	Rub repellent creams on the body
Because of negative impact of insecticides	0.226	0.134	0.723	0.076	*0.000	0.052	0.062	0.524	0.758	0.945	0.309
Because it prevents contacts with mosquitoes	*0.015	0.060	*0.001	0.121	*0.004	0.398	*0.001	0.622	0.076	0.084	0.076
Because it is very effective	*0.000	*0.000	0.369	*0.002	*0.000	0.060	*0.000	0.710	0.731	*0.005	0.101
Because it is cheap	*0.000	*0.002	*0.001	0.059	*0.000	0.285	*0.000	0.639	0.117	0.325	0.571
Because it is easy to use and time saving	0.390	0.208	0.444	*0.001	0.912	0.345	*0.043	0.486	*0.000	*0.000	*0.005
Because it was recommended	*0.004	*0.013	*0.015	0.322	*0.000	0.382	*0.000	*0.004	*0.006	0.176	0.947
Because it is readily available	*0.000	0.086	0.237	0.829	*0.000	0.111	*0.000	0.784	0.334	*0.006	0.781
No reason	*0.042	0.055	0.450	*0.006	0.065	0.376	0.381	0.456	*0.010	0.229	0.203
Because I have no alternative	0.283	0.056	0.127	0.072	*0.000	0.070	0.058	*0.007	0.779	*0.009	0.242

**Level of significance < 0.05*

The majority of the respondents were youths aged 18-30 years (206; 40.4%), mostly having post-secondary education (272; 53.3%) (Table 1). All of the respondents practiced more than one malaria vector control method (Table 2), and this agrees with the study of Obembe *et al.* (2014) which reported the use of insecticides, LLITNs and coils as the major vector control method in Ilorin. In the same vein, Omotayo *et al*. (2021) reported that the majority (77.0%) of the respondents from three Local Government Areas of Lagos state utilized insecticides alongside other vector control methods. The aforementioned studies agree with this present study, as most of the respondents across the three L.G.As, of Abia State sampled practiced the use of insecticides mostly (325; 63.7%), followed by 'screening of windows with nets' (221; 43.3%) in combination with other control methods (Table 2). This could be attributed to the age-long acceptability of insecticides and portrays hope for future use of insecticides for indoor residual spraying.

The low usage of LLITNs (69; 13.5%) in this study disagrees with the other studies in Nigeria (Omotayo *et al*., 2021; Singh *et al*., 2014) Malawi (Masangw *et al*., 2012), and Ethiopia (Abate *et al*., 2012).From Table 2 other methods used by respondents in the control of mosquitoes includes: 'sleeping with windows closed' (83; 16.3%), 'burning of coil and grass as repellents' (54; 10.6%), 'cutting of bushes and grass' (192; 37.6%), 'draining stagnant water' (48; 9.4%), 'clearing gutters' (57; 11.2%), 'covering the body with clothes' (75; 14.7, 'cutting bushes and grass around the house' (192; 37.6%) and 'rubbing repellent creams on the body' (21; 4.1%). The second most used control method after use of insecticides was 'screening windows with net' (221; 43.3%), and this could probably be responsible for the low usage of LLITNs. Many studies have reported some level of discomfort reported by respondents who used LLITNs, and this could have made them resort to putting LLITNs on their windows rather than sleeping with them (Atkinson *et al*., 2009; Oguonu *et al*., 2005; Aina *et al*., 2013). Although just a few respondents attested to burning coil and grass as repellents, some other studies have reported it to be a major mosquito control method (Oladepo *et al*., 2010; Aïkpon *et al*., 2013).

Respondents from Abia State showed that they had some knowledge of the impact of environmental management on mosquito population control, hence an integrated pest management program for mosquito control in Abia State, will probably enjoy community support. This assertion is evident from the increased practice of 'cutting bushes and grass around the house' (192; 37.6%) as a malaria vector control method (Table 2). However, only a few of the respondents attested to 'draining stagnant water' (48; 9.4%) and clearing gutters (57; 11.2%): this equally suggests the need for more sensitization as to the massive impact of these two practices in keeping down malaria vector population and subsequently malaria transmission in Abia State (Table 2). More than half of the respondents may be exposed to outdoor mosquito bites since they did not subscribe to covering the body with cloths.

As to the reasons why the respondents employed various malaria vector control methods, it will be seen from Table 2 that just a few respondents (60; 11.8) in Abia State used non-insecticide based methods because of the negative impact of insecticides, showing that a majority of the respondents didn't agree that insecticides had any negative impact. These few reports on insecticide rejection could have been due to nasal and ocular irritations, which can be taken care of by the use of non-irritating insecticides (Omotayo *et al*, 2021). This also means that insecticide based interventions would be accepted in Abia State, Nigeria, and agrees with the study of Omotayo, *et al* (2021). A good number of the respondents from the study sample practiced control methods because they 'prevent contact with mosquitoes' (154; 30.2%), whereas a similar number of respondents used control methods because they were cheap (175; 34.3%) (Table 2). The most reported reason for the use of vector control methods was 'because of its effectiveness' (306; 60%), and this agrees perfectly with the study of Omotayo *et al* (2021). Control interventions must be made available bearing in mind that people within the state would generally tilt towards effective control measures first, even before considering the cost.

Table 2 shows that there has not been any recent Government/non-Governmental intervention with regard to LLITNs in Abia State, Nigeria as attested by a majority of the respondents (386; 75.7%), and it agrees with the study of Omotayo *et al*. (2021). The free distribution of nets carried out around the year 2010-2012 in the South Eastern states of Nigeria might have been the last done within the study area. This is sad and calls for action from relevant authorities, as families or individuals might not be able to buy nets in these economically challenging times. This therefore might have contributed to the few ownership and utilization of LLITNs in Abia State (69; 13.5%) (Table 2).

Very importantly, the relationship between the demographic parameters of respondents and their reasons for employing various malaria vector control methods was analyzed. Age had no significant relationship with most of the malaria vector control methods practiced by respondents in Abia State ($P > 0.05$) (Table 4.3). It only had a significant relationship with 'burning coil and grass as repellents' ($P=0.000$) and 'covering the body with clothes' ($P= 0.042$). It therefore means that as IRS and LLITNs intervention based programs are being planned, age may not be factored in as a key consideration. This agrees with the study of Tula *et al*. (2023), which showed no significant association between age and use of LLITNs amongst tertiary institution students in the Northeastern Nigeria. Similarly, Gender had no significant relationship with any of the malaria vector control practices in Abia State ($P> 0.05$) (Table 3), and should hence not be considered by vector control programs during the planning and deployment of interventions.

Marital status had significant relationship with 'use of insecticides alone, but had no significant relationship with other control measures examined in Abia State ($P <0.05$) (Table 3), and hence should not necessarily be considered during design and deployment of non-insecticide based malaria vector control interventions in Abia State. Level of education had significant relationship with most of the malaria vector control practices employed by respondents in Abia State ($P <0.05$), but had no significant relationship with use of LLITNs ($P>0.05$) (Table 3). This particularly agrees with the study of Omotayo *et al.* (2021) that found level of education to be significantly related to use of insecticides in Lagos State, but disagrees with their report on its significant relationship with LLITNs.

In the same vein, the type of dwelling structure had a significant relationship with most of the malaria vector control practices in Abia State, Nigeria ($P< 0.05$) (Table 3). This significant relationship between the type of dwelling structure and the various vector control method is in agreement with the report of Omotayo *et al*.(2021) which reported a very significant relationship between the 'type of dwelling structure' and the use of the various control methods surveyed in Lagos State. It also supports the suggestion of Curtis and Mnzava (2000) that type of dwelling structure should be of major concern in deployment of mosquito control strategies. Similarly, household size of respondents had significant

relationship with most of the malaria vector control methods (P <0.05), although it had no significant relationship with LLITNs usage (P >0.05). Household size should therefore be considered during indoor residual sprayings in communities within Abia State.

The Local Government Area (L.G.A) of respondents from Abia State, had a significant relationship with most of the malaria vector control measures examined (P <0.05), although it very importantly did not have a significant relationship with insecticide usage (P >0.05) (Table 3). This partly disagrees with the report of Omotayo *et al.* (2021) on no significant relationship between L.G.A. and LLITNs, but agrees with their report on no significant relationship between L.G.A. and IRS in Lagos. This significant relationship between L.GA and use of different malaria vector control methods in Abia State, makes it necessary to put into considerations the peculiarities of each L.G.A. before deployment of vector control methods, with particular emphasis on level of education. Information on ownership and usage of LLITNs from different L.G.As should be considered prior to LLITNs distribution. A probe to determine the relationship between demographic parameters and respondent's reasons for using the various control methods showed that age had significant relationship with the reason 'because it is very effective' only (P < 0.05), but had no relationship with all the other reasons (P > 0.05) (Table 4). On the other hand, there was no relationship between gender, and all the reasons for practicing the control methods by respondents (P > 0.05) (Table 4). Marital status however had a significant relationship with the reasons 'because it is very effective' and 'because it is cheap' (P < 0.05), but had no significant relationship with all the other reasons (P > 0.05) (Table 4). Level of education had a significant relationship with most of the respondent's reasons for practicing the various malaria vector control methods (P > 0.05), except 'because of the negative impact of insecticides', 'because it is easy to use and time saving', 'because it was recommended and 'because I have no alternative' (Table 4). In the same vein, type of dwelling structure had significant relationship with majority of the respondents reasons for practicing different malaria vector control methods (P > 0.05), except 'because it is easy to use and time-saving, and 'because it was recommended(Table 4). Similarly, respondents in Local Government Areas had a very a significant relationship with all of their reasons for practicing different malaria vector control methods (P <0.05), except the reason 'because of the negative impact of insecticides' (Table 4). It greatly shows that vector control methods being designed for different localities must put into consideration most of these reasons that influenced respondents into practicing the different malaria vector control methods.

All the demographic parameters except gender had a significant relationship with the reason 'because it is very effective' across Abia State (Tables 4) (P <0.05). This goes to show that irrespective of age, marital status, level of education, type of dwelling structure and even L.G.A. of residence, people are primarily interested in control interventions that will be very effective for mosquito control. Apart from age and gender, all other demographic parameters had a significant relationship with the reason 'because it is cheap' (Tables 4) (P <0.05), signifying the need for vector control methods to be cheap. Meanwhile level of education, type of dwelling structure, household size and local government area of respondents had a very significant relationship with the reasons 'because it prevents contact with mosquitoes' and 'because it is readily available(Tables 4)(P <0.05). This shows that respondents irrespective of these demographic factors will tilt towards control methods that reduce contact with mosquitoes, especially when they are readily available. Analysis to ascertain the relationship between the various malaria vector control methods practiced by respondents and their reasons for using those methods showed that a significant relationship existed between the use of insecticides and the following reasons: 'because it prevents contact with mosquitoes'(P=0.015); 'because it is very effective' (P=0.000); 'because it is cheap'(P=0.000); 'because it was recommended'(P=0.004); 'because it is readily available'(P=0.000): and 'for no reason'(P=0.042) (Table 5). This clearly shows that respondents used insecticides more obviously for these reasons. The most significant among these reasons for using insecticides were that they were adjudged to be very effective, cheap, readily available and easy to use (P=0.000 in each)(Table 5): this contributed to insecticides being the most used malaria vector control method in Abia State (Table 4).The fact that a very significant (P value = 0.000) relationship in reasons such as because it is very effective, 'because it is cheap' and 'because it is readily available' translates to more use of vector control method can be seen with the 'screening of windows with the net', which was the second most used malaria vector control method in Abia State. Screening of windows with the net was the only control method that had a significant relationship (P=0.000) with the reason 'because of the negative impact of insecticides', indicating that a large number of those who did not use insecticides due to their perceived negative impacts had to screen their windows with net. Screening of windows with the net also had a significant relationship with other reasons such as the following: 'because it was recommended'

(*P*=0.000), 'because I have no alternative' (*P*=0.000) and 'because it prevents contact with mosquitoes' (*P*=0.004) (Table 5).Furthermore, some significant relationship was found to exist between sleeping under LLITNs and just three of the reason examined: 'because it prevents contact with mosquitoes' (*P*=0.001); 'because it is cheap' (*P*=0.001); and 'because it was recommended (*P*=0.015)(Table 5). This possibly could have informed the low usage of LLITNs in Abia State, considering that the few who used it did so majorly because it prevented contact with mosquitoes, and was cheap for them, probably because they had the LLITNs already. This calls for more efforts to ensure scale up of delivery of LLITNs within Abia State. Those who slept with closed windows did so majorly because they found it effective, easy to use and time-saving: this is demonstrated by the significant relationship sleeping under closed windows had with the reasons 'because it is effective'(*P*=0.002) and 'because it is easy to use and time-saving'(*P*=0.001)(Table 5). On the contrary, there was no significant relationship between the burning of coil/grass as repellents and any of the reasons examined (*P* >0.05) (Table 5), hence the very low usage recorded. Cutting of bushes and grass was practiced by respondents probably 'because it was able to reduce contact with mosquitoes', 'because it was effective', 'because it is cheap', 'because it is easy to use and time-saving', 'because it was recommended', and 'because it is readily available' adjudged from the significant relationships that it had with these reasons (*P* < 0.05) (Table 5). However, respondents who practiced draining of stagnant waters as a malaria vector control method, did so only 'because it was recommended' and 'because they had no alternative', whereas a significant relationship existed between clearing of gutters and 'because it is easy to use and time saving (*P*= 0.000), and 'because it was recommended (*P*= 0.000), (Table 5). On the other hand, covering of the body with clothes had significant relationship with reason such as: 'because it is very effective (*P*= 0.005); 'because it is easy to use and time-saving' (*P*= 0.000); 'because it was recommended' (*P*= 0.006); and 'because I have no alternative' (*P*= 0.009) (Table 4). Meanwhile, those that applied repellent creams on their bodies did so primarily because they found it easy to use and time-saving. It is recommended that the level of education, type of dwelling structure, household size, and Local Government Area is very importantly considered before the design and deployment of vector control programs. Further studies are recommended to seek more detailed information with regards to the usage of IRS and LLITNS, which is particularly a limitation of this study.

Conclusion: The study revealed that level of education, type of dwelling structure, household size, and Local Government Area had a significant relationship with most of the vector control methods practiced in Abia State. These demographic factors, especially Local Government Area and level of education should therefore be considered in policy making and implementation of vector control interventions. The Use of insecticides was the most prominent vector control method for communities; however, usage of LLITNs was low. Surprisingly the majority of the respondents had never benefited from the Government/NGO distribution of LLITNs. Some of the prominent reasons why respondents in Abia used the various control methods were because of their effectiveness, ability to prevent contact with mosquitoes and cost-effectiveness. Finally, there is a need for intervention programs and vector control researchers to think out outdoor control methods that could drastically reduce contact with mosquitoes while putting in mind the cost.

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