Environmental Sanitation Practices on Malaria Control and Prevention in Abi Local Government Area, Cross River State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author SAI designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors ZU and JEE managed the analyses of the study. Author JEE managed the literature searches. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Aim: This study was conducted to determine the environmental sanitation practices on malaria prevention and control in Abi Local Government Area, Cross River State, Nigeria.
Study Design: A descriptive cross-sectional study design
Place and Duration of Study: Abi Local Government Area, Cross River State, Nigeria from June to August, 2016
Methodology: A pre-tested structured questionnaire was used to generate data from 450 adult respondents who were selected using multi-stage sampling technique. An observational checklist

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was used to assess the sanitary condition of residential dwellings and facilities. Data generated was entered into excel spread sheet and exported to Statistical Package for Social Sciences (SPSS version 20.0) software for analysis. Results were presented in frequencies, tables and charts. Chi-square was used to test for association between variables at 0.05 α level.

Results: It was revealed that 283 (62.9%) respondents exhibited poor environmental sanitation practices while 167 (37.1%) had good environmental sanitation practices. It also was observed that age (p=0.023), gender (p=0.000), educational status (p=0.000) and income (p=0.000) were found to be statistically significantly associated with environmental sanitation practices.

Conclusion: Hence, malaria intervention programmes should be redesigned or remodeled to include the core components of environmental sanitation to prevent mosquito breeding and mitigate malaria transmission in rural areas.

1. INTRODUCTION

Malaria still remains a significant public health problem especially in low and middle income countries. According to the World Health Organisation (WHO) [1], malaria transmission in Nigeria is abysmally high with over 76% of the population reporting more than 1 case per 1,000 populations annually. There was a less than 50% decrease in projected incidence of malaria from 2000–2015. Nigeria and the Democratic Republic of Congo account for more than 35% of the global total of estimated malaria deaths [2]. Malaria is principally caused by protozoa (*Plasmodium species*) and is transmitted through the bite of an infected female *Anopheles* mosquito [3]. Within the tropics and sub-tropics, human malaria is seen to be the most wide spread vector-borne disease [4]. Available statistics have documented that malaria is highly endemic in Nigeria with over 90% of the populace at risk of infection. It is the prime cause of 60% outpatient consultation for all age groups and at least half of the Nigerian populace are exposed to at least one bout of malaria attack every year [5-7].

An integrative approach has been recommended to mitigate the spread of malaria parasites. One of such strategy or approach is the Integrated Vector Management (IVM) through a combination of biological and chemical methods**.** It is aimed at improving ecological soundness and sustainability for the control of vector-borne diseases, improve efficacy and cost effectiveness [8]. Components of IVM include the use of preventive (e.g. use of mosquito repellents, long lasting insecticide-treated nets (LLINs) and wearing of protective clothing) and chemical control methods (e.g. environmental and biological control measures, outdoor spraying, larviciding and indoor residual spraying) [9]. Other malaria control strategies recommended by WHO for the control of malaria include; ITNs use, IRS and prompt management of malaria cases with Artemisinin-based Combination Therapies (ACTs) [10].

From a triad perspective which includes the agent, host and environment, researchers and scholars have encouraged the source reduction, elimination and eradication of mosquitoes breeding sites by concentrating on the environment. These tend to be essential because, the proliferation of mosquitoes continually perpetuate the transmission of malaria. So, it can be postulated that if the sources of mosquitoes breeding sites is eradicated or eliminated, malaria would be drastically reduced. This implies that good environmental sanitation practices could help mitigate malaria transmission, promote healthiness and improve quality of life of the populace.

Cross River State is situated in an area of stable malaria transmission throughout the year. This is because its surroundings are covered by mangrove vegetation and rainforest. Abi Local Government Area is a rural area which is characterized by squatter settlements or villages that lack modern facilities, good drainage and waste disposal systems, tarred road and water supply. The area is also characterized by overcrowding and poor sanitation resulting from high level of refuse generation, indiscriminate dumping of refuse, open defecation, bushy surroundings, blocked gutters, potholes creating stagnant pools of water for mosquito breeding and odour nuisance. Also, most inhabitants of Abi local Government Area are farmers; hence every available land space is converted into farmlands. All of these factors proliferates the breeding of female anopheles mosquitoes.

Hence, considering the significant of the environment on the control and prevention of malaria, this study was aimed at assessing environmental sanitation practices on malaria prevention and control in Abi Local Government Area, Cross River State, Nigeria.

2. METHODOLOGY

The study was carried out in Abi Local Government Area of Cross River State, Nigeria. It is situated in the Central Senatorial District of Cross River State and has boundary with Yakurr Local Government Area to the South, Biase Local Government Area to the West, Obubra Local Government Area to the East, and Ikwo and Onitcha Local Government Areas of Ebonyi State in the North. The area has 10 political wards with a population of 218, 734 persons covering a landmass of approximately 334.43 square kilometres [11]. Most inhabitants of the areas are mainly commercial farmers, petty traders and civil servants. A descriptive cross-sectional study design was used for the study. Multi-stage sampling technique was used to select 450 respondents who were available and expressed enthusiasm to participate in the study. Firstly, five council wards were used for the study. Simple random sampling technique (take-a-pick lottery method) was used to select five (5) wards out of the ten council wards in Abi Local Government Area (LGA). Numbers were assigned to each ward, folded in pieces of papers, put in a container and mixed thoroughly. Then, the research assistants were asked to pick a piece of the folded paper each. Names of wards written on the paper picked were considered for the study. Secondly, out of the selected five (5) wards, simple random sampling technique (take-a-pick lottery method) was also used to select five (5) villages from each ward(i.e. 5 x 5 = 25 villages). Thirdly, the primary health center (PHC) house-enumeration list for Abi L.G.A. was used as the sample frame and systematic random sampling technique was utilized to select eighteen (18) households in each selected village. The sample interval was obtained by dividing the total number of households in each village by the sample size (households to be sampled) depending on the total number of households in each village. Lastly, in each of the randomly selected households, an adult, either male or female was selected by simple random sampling to participate in the study. The total number of respondents recruited for the study was 450. A total of 450 copies of the questionnaire were administered to 450 households in 25 villages in the selected 5 wards of the study area. A pre-tested structured questionnaire developed by the researcher was used to collect quantitative data from eligible respondents (18 years and above). The rationale for considering individuals who were 18 years and above is based on the fact that data needed to draw inference and generalization should constitute reliable data which these category of individuals can provide. Also, the target population for this study were adults which are usually from 18 years and above by Nigerian standard. An observational checklist designed by Federal Ministry of Environment [12] was also used to assess residential houses and their surroundings sampled for the study. Items assessed with the checklist were basically type of house, household size, window/door screening, outside surroundings and waste disposal methods. Data generated was entered into excel spread sheet and exported to Statistical Package for Social Sciences (SPSS version 20.0) software for analysis. Results were presented in frequencies, tables and charts. Chi-square was used to test for association between variables at 0.05 α level. Ethical approval was obtained from the Cross River State Health Research Ethics Committee (CRS-HREC) to carry out the study. Respondents gave their informed consent verbally before participating in the study. No names were required during the process of data collection to maintian anonymity and information obtained were kept confidential throughout the period of research.

3. RESULTS

3.1 Socio-demographic Characteristics of the Respondents

The results obtained in this study shows that 120 (26.7%), 110 (24.4%) and 101 (22.4%) of the respondents were between the ages 28-37, 38-47 and 18-27 years of age respectively. Male respondents were 243 (54.0%) while 207 (46.0%) were female respondents. Most respondents 237 (52.7%) were married, 159 (35.3%) were farmers, 415 (92.2%) were Christians, 167 (37.1%) had attained secondary level of education, 353 (78.4%) earned a monthly income of less than N20,000, 182 (40.4%) live in mud houses with zinc roof and 181 (40.2%) have a household size of between 4-6 persons (Table 1).

Table 1. Socio-demographic characteristics of the respondents (n=450)

Variables	Number of respondents	Percentage
Age (in years)		
18-27	101	22.4
28-37	120	26.7
38-47	110	24.4
48-57	86	19.1
58 and above	33	7.3
Sex		
Male	243	54.0
Female	207	46.0
Marital status		
Married	237	52.7
Single	73	16.2
Divorced	33	7.3
Widowed/widower	67	14.9
Co-habiting	40	8.9
Household size		
1-3	180	40.0
4-6	181	40.2
7-9	76	16.9
10 and above	13	2.9
Occupation		
Farmer	159	35.3
Trader	90	20.0
Civil servant	103	22.9
Fulltime housewife	17	3.8
Artisan	10	2.2
Student	51	11.3
Unemployed	20	4.4
Religion		
Christianity	415	92.2
Islam	0	0.0
Traditional religion	35	7.8
Educational status		
No formal education	103	22.9
Primary	111	24.7
Secondary	167	37.1
Tertiary	69	15.3
Monthly income		
Less than N20,000	353	78.4
N20,000-N50,000	61	13.6
Above N50,000	36	8.0
House type		
Mud house with bamboo roof	85	18.9
Mud house with Zinc roof	182	40.4
Block house with Zinc roof/asbestos roofing sheets	177	39.3
Uncompleted building	6	1.3
Wooden made house	0	0.0

3.2 Environmental Sanitation Practices for Malaria Control and Prevention

Most respondents 306 (68.0%) admitted that there were bushes and grasses in their premises, out of which 128 (41.8%) respondents cleared their surrounding of bushes and grasses monthly, 100 (32.7%) cleared weekly and 45 (14.7%) cleared their surroundings whenever they like or expect visitors. Out of 450

respondents, 188 (41.8%) claimed that they had drainage system in their houses; out of which 96 (51.1%) clean the drainage on weekly basis, 50 (26.6%) clean on daily basis while 26 (13.8%) clean their drainage every six months. On methods of solid waste storage, 172 (38.2%) of the respondents claimed that they store their solid wastes in close plastic containers, 116 (25.8%) stored in open containers while 87 (19.3%) of respondents practice open dumping behind their houses (Table 2).

The methods of waste disposal adopted by the respondents were predominantly open dumping 276 (61.3%) and burning 116 (25.8%). A reasonable proportion of the respondents 319 (70.9%) claimed that they dispose their household generated solid waste on daily basis, 46 (10.2%) once a week while 31 (6.9%) disposed their waste only when the waste bin is filled. Similarly, majority of the respondents 174 (38.7%) disposed their wastewater by pouring in the drain, 111 (24.7%) by pouring anywhere while 84 (18.7%) by throwing on the road. On method of household water storage, 292 (64.9%) of the respondents claimed to store their water in covered containers to avoid contamination while 106 (23.6%) stored in open containers (Table 3).

The types of toilet facilities used by majority of the respondents was pit latrine with cover 149 (33.1%) while 137 (30.4%) used pit latrine without cover. A larger proportion of the respondents 145 (36.7%) claimed that they cleaned their toilets on daily basis, 101 (25.6%) said they cleaned once a week while 89 (22.5%) claimed that they cleaned their toilets only when it is dirty. On methods employed by respondents in preventing mosquito from entering the house, more than half of the respondents 248 (52.1%) admitted that they close their doors and windows especially at night,117 (24.6%) screened doors and windows with nets while 69 (14.5%) used insecticide spray. On methods of preventing mosquito bites inside the house, most respondents 359 (75.7%) claimed using bed nets or ITNs, 41 (8.6%) said they covered their bodies with clothes while 32 (6.7%) used insecticide spray. Majority of the respondents 299 (66.4%) admitted that they have a small farmland of crops in their area of residence (Table 4).

Averagely, a greater proportion of the respondents 283 (62.9%) recorded poor environmental sanitation practices while 167 (37.1%) recorded good environmental sanitation practices (Fig. 1).

Table 2. Environmental sanitation practices for malaria control and prevention (Bush clearing and cleaning of drainage system)

Variables	Number of respondents	Percentage
Presence of bushes in the surroundings (n=450)		
Present	306	68.0
Absent	144	32.0
Frequency of cleaning the surroundings of bushes and grasses (n=306)		
Weekly	100	32.7
Monthly	128	41.8
Every 2-3 months	23	7.5
Every six months	10	3.3
Whenever I like/expect visitors	45	14.7
Availability of drainage system around the house (n=450)		
Available	188	41.8
Not available	262	58.2
Frequency of cleaning the drainage system (n=188)		
Daily	50	26.6
Weekly	96	51.1
Monthly	13	6.9
Every 2-3 months	0	0.0
Every six months	26	13.8
Not at all	3	1.6
Method of solid waste storage (n=450)		
Open container	116	25.8
Polythene bag	75	16.7
Closed plastic container	172	38.2
Open dumping behind the houses	87	19.3

Table 3. Environmental sanitation practices for malaria control and prevention (Waste management and water storage)

Variables	Number of respondents	Percentage
Methods of waste disposal (n=450)		
Burning	116	25.8
Open refuse dumpsite	276	61.3
Dump waste in drains/gutters	40	8.9
Burying	18	4.0
Frequency of disposal of household generated solid waste (n=450)		
Daily	319	70.9
Once a week	46	10.2
2-4 times a week	30	6.7
Only when it fills the waste bin	31	6.9
Only when the waste emits offensive odour	16	3.6
1-3 times a month	8	1.8
Method of disposal of wastewater (n=450)		
Pour in the drain	174	38.7
Throw on the road	84	18.7
Pouring anywhere	111	24.7
In an open pit	76	16.9
Stored in the house	5	1.1
Method of household water storage (n=450)		
Open water container	106	23.6
Open surface water tanks	35	7.8
Underground cover containers	17	3.8
Covered water containers	292	64.9
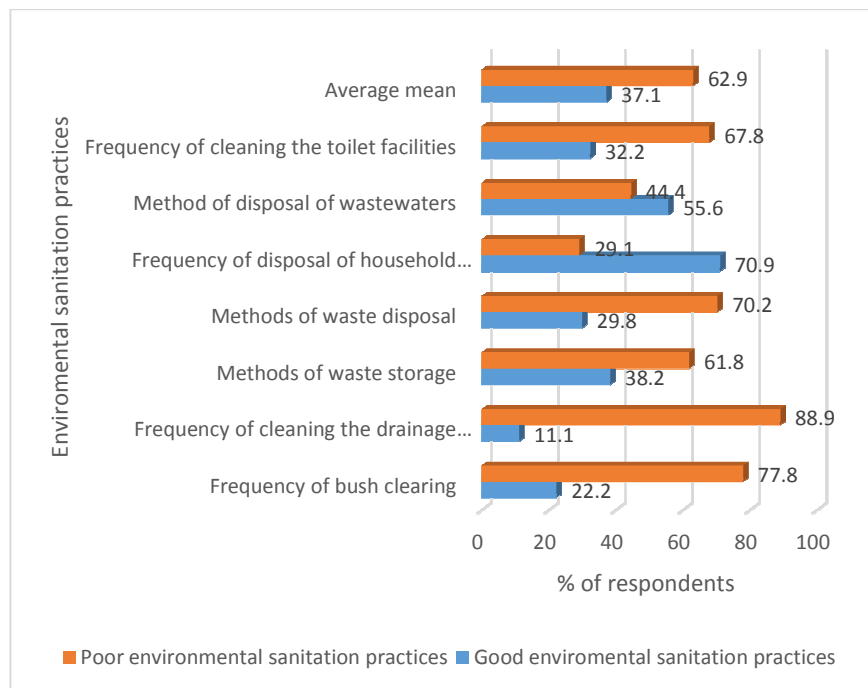
Fig. 1. Environmental sanitation practices among respondents

Table 4. Environmental sanitation practices for malaria control and prevention (sanitary facilities and indoor malaria control

Variables	Number of respondents	Percentage
Type of toilet facility currently in use (n=450)		
Pit latrine without cover	137	30.4
Pit latrine with cover	149	33.1
Water system closet without cover	20	4.4
Water system closet with cover	89	19.8
Bush	51	11.3
In polythene bags	4	0.9
Frequency of cleaning the toilet facility (n=395)		
Daily	145	36.7
Once a week	101	25.6
2-4 times a week	43	10.9
Only when it is dirty	89	22.5
1-3 times a month	17	4.3
Methods of preventing mosquitoes from entering the house (n=476)		
Closing door and windows regularly	248	52.1
Screening doors and windows with nets	117	24.6
Use of insecticide spray	69	14.5
Using insect mosquito coil	7	1.5
None at all	35	7.4
Method of preventing mosquito bites inside the house (n=474)*		
Using bed nets	359	75.7
Using insecticide spray	32	6.7
Rubbing repellant cream before going to bed daily	16	3.4
Covering body with clothes	41	8.6
None at all	26	5.5
Presence of small farmland of crops in area of residence (n=450)		
Present	299	66.4
Absent	151	33.6

Multiple responses

3.3 Test of Relationship between Socio-demographic Characteristics of Respondents and Environmental Sanitation Practices using Chi-square Analysis

From the table, it was observed that age (x^2 = 11.90; P= 0.023), gender (x^2 = 20.27; P= 0.000), educational status (x^2 = 25.45; P= 0.000) and income level (x^2 = 69.13; P= 0.000) were statistically significantly associated with environmental sanitation practice among respondents (Table 5).

4. DISCUSSION OF FINDINGS

More than half of the respondents admitted that there were bushes and overgrown weeds/grasses in their surroundings; out of which 128 (41.8%) clean their surrounding monthly, 100 (32.7%) clean weekly and 45 (14.7%) only clean the surrounding whenever they choose or expect visitors. This result clearly indicates poor environmental sanitation practice despite the fact that the respondents reported that they clear their surrounding bushes to prevent malaria (Table 3). The low frequency in bush clearing exhibited by the respondents in this study predisposes them to the risk of contracting malaria. This fact is supported by a Cameroonian study in which malaria prevalence was higher among school children who had bushes around their homes [13]. This is a clear indication that bushes around residential areas poses substantial health risk to humans. Even though it is a common fact that rural people reside in areas surrounded by bushes and undeveloped plots, it is also consequential that they should be aware of the danger of not clearing their surrounding bushes at least on weekly basis. This approach would increase the awareness level as well as suppress the spread of malaria.

Table 5. Test of relationship between socio-demographic characteristics of respondents and environmental sanitation practices using chi-square analysis

Variables	Number of respondents (Percentage)			Chi-square (P-value)
	Good environmental sanitation practice (n = 167)	Poor environmental sanitation practice (n = 283)	Total (n = 450)	
Age (in years)				11.90 (0.023)*
18-27	43 (9.6)	58 (12.9)	101 (22.4)	
28-37	51 (11.3)	69 (15.3)	120 (26.7)	
38-47	36 (8.0)	74 (16.4)	110 (24.4)	
48-57	21 (4.7)	65 (14.4)	86 (19.1)	
58 and above	16 (3.6)	17 (3.8)	33 (7.3)	
Gender				20.27 (0.000)*
Male	67 (14.9)	176 (39.1)	243 (54.0)	
Female	100 (22.2)	107 (23.8)	207 (46.0)	
Education				25.45 (0.000)*
No formal education	26 (21.3)	77 (17.1)	103 (22.9)	
Primary	38 (8.4)	73 (16.2)	111 (24.7)	
Secondary	45 (10.0)	122 (27.1)	167 (37.1)	
Tertiary	58 (12.9)	11 (2.4)	69 (15.3)	
Monthly income				69.13 (0.000)*
<N20,000	96 (21.3)	257 (57.1)	353 (78.4)	
N20,000-N50,000	46 (10.2)	15 (3.3)	61 (13.6)	
>N50,000	25 (5.6)	11 (2.4)	36 (8.0)	

While 188 (41.8%) respondents claimed that they had drainage system around their houses, (Table 5), it was discovered from observation that only 136 (30.2%) had drainage system around their homes; out of which 41 (30.1%) drains were in sanitary condition. The poor environmental sanitation practice observed in this study may be linked to the fact that the drains were probably used as refuse dumpsite for residents in the area. It is common practice that during heavy rainfall, people dump their refuse in the drains and gutters so that run-off water or storm will carry the waste away. During this process, some waste materials are flushed away as expected while others may remain as nuisance, causing offensive odour and providing breeding sites for the female *Anopheles* mosquitoes. Hence, the poor sanitary condition of most drainage systems observed in most homes presents significant level of health risks to the people residing in such environments as exposure to malaria is inevitable. Thus, rural dwellers need to be properly informed of the need to clean their drains on daily basis.

Out of the 450 respondents, only 172 (38.2%) respondents reported that they store wastes in

plastic containers with cover. The remaining 278 (61.8%) respondents store wastes in open containers, polythene bags while 87 (19.3%) practice open dumping behind their houses. It was also observed that half of the households surveyed 229 (50.9%) had waste storage facility; out of which only 77 (33.6%) used sanitary waste storage facilities. As reported in the current study, only 38.2% practice the proper method of waste storage while 61.8% practice the improper methods. The ultimate aim of proper waste storage is to prevent the emission of obnoxious odour, flies/rodent infestation and maintain environmental hygiene. According to Pat-Mbano and Ezirim [14], where proper waste storage is not practiced, individuals resident in such households are at risk of malaria infection. The health risk becomes higher for households without any waste storage facilities. This is because absence of waste storage facilities would lead to littering of wastes around the surroundings which is hazardous to human health. It is therefore pertinent to emphasize proper storage of household solid wastes (i.e. storage of waste in a closed plastic container) with the aim of maintaining environmental hygiene and healthiness.

A reasonable proportion of the respondents 276 (61.3%) practiced open refuse dumping as the method of waste disposal, 116 (25.8%) practiced burning, 40 (8.9%) dumped their waste in drains/gutters while 18 (4.0%) buried their waste. This result is comparable to that of Warunasinghe and Yapa [15], whereby the respondents practiced burning, burying, compositing and incineration as methods of waste disposal. In most rural areas, open dumping of solid wastes is the most widely practiced method of waste disposal probably because of its cost-effectiveness and convenience. It is also common practice that households dispose wastes in open pits and cover with earth once it is filled. Nevertheless, open waste dumping has its negative impact on health as it encourages flies/rodent infestation, breeding of mosquitoes and emit offensive odour all of which are hazards to human health. Open dumping also destroys the aesthetic beauty of the environment. Thus, public enlightenment should be directed towards acceptable methods of waste disposal such as burning, burying, incineration, compositing, etc.

Two-third of the respondents 319 (70.9%) claimed that they dispose their wastes on daily basis while 46 (10.2%) dispose wastes once a week. The daily disposal of wastes by the respondents in this study may be linked to their knowledge level and personal experience of the consequences of prolonged wastes storage before disposal. If such waste consist things like empty cans, discarded plastics, etc., it can facilitate mosquito breeding. Hence, there is need to intensify awareness to abolish such practice. While 200 (44.4%) of the respondents practice indiscriminate disposal of wastewater such as pouring anywhere, throwing on the road and storing in the house, 250 (55.6%) respondents on the other hand dispose wastewater by pouring in the drains or in an open pit. This result clearly suggests that most respondents knew the implication of indiscriminate disposal of wastewater especially water from the kitchen. Lack of drainage systems around homes may encourage the indiscriminate disposal of wastewater in the surrounding. For example, in households where bathroom facilities are constructed without a good drainage system, the wastewater accumulates causing breeding sites for mosquitoes. In such practical instance, malaria control becomes very difficult.

Most respondents 292 (64.9%) practice the acceptable method of storing their water in covered water containers to avoid contamination whereas 106 (23.6%) store water in open water containers and 35 (7.8%) in surface water tanks. This observation is supported by a similar study carried out in Akwa Ibom State, Nigeria where 81.2% respondents reported that they store water in close containers [16]. Lack of appropriate storage facilities with cover could predispose to water-borne diseases. A greater proportion of the respondents 286 (63.5%) had pit latrine; out of which 145 (36.7%) clean once a week. This finding is contrary to the findings by Ekong [16], in which 52.8% of the subjects used flush toilets and washed them on daily basis. This result concurs with what was observed, where 283 (62.9%) households used pit latrine; out of which 140 (37.6%) households maintained their toilets in sanitary condition. This is a clear indication that most rural households still patronize the pit latrine probably because of its cost-effectiveness and less complexity in maintenance than the water system closet. Routine and daily cleaning of toilet facilities should be highly emphasized to maintain hygiene standards as well as protect the health of household members from infectious diseases that may arise from unsanitary facilities.

On methods used by the respondents to prevent mosquito from entering the house, majority of respondents 248 (52.1%) claimed to close their doors and windows regularly, 117 (24.6%) said they screened their doors and windows with nets, 69 (14.5%) used insecticide spray. Three-quarter of respondents 359 (75.7%) claimed they used bed nets for preventing mosquito bites inside the house. This finding contradicts that of Bamidele, Ntaji, Oladele, and Bamimore [17], in which the use of ITNs was rated low, but agrees with that of Olayemi et al. [18], in which high usage of bed nets was reported. This result clearly indicates that respondents acknowledge the high endemicity of malaria infection and adopt multi-dimensional approaches to its effective control. Existing literature has clearly highlighted that no one single strategy is capable of combating malaria effectively. Currently, integrated vector management (IVM) is the recommended strategy to combat malaria. The high usage of bed nets may be attributed to the fact that it is widely advertised, readily available and cost-effective. This evaluates the efficacy of malaria intervention programmes especially as it concerns the distribution of ITNs to rural households. Two-third of the respondents 299 (66.4%) acknowledged that they have a small

farmland of crops near their residential areas. While agricultural productivity propels food availability, food security, economic benefits and maintenance of good health via intake of nutritious food products, its benefits are not without trade-offs. Some agricultural practices such as the use of irrigation for crop cultivation, ponds for fish farming and storage of water in tanks for livestock provides suitable breeding sites for the female *Anopheles* mosquito to strive, proliferate and infect their hosts [19]. Residents near these farmlands are susceptible to high malaria transmission. It can be inferred that farming activities should be done far from residential areas if healthiness is to be maintained.

From the results, it was observed that age was significantly associated with environmental sanitation practice (P<0.05). Younger ages were found to engage in good and standard environmental sanitation practices than their older counterparts. This is strongly associated to the fact that, in most homes, the younger adults and teenagers take responsibility of bush clearing, disposal of household solid wastes, wastewaters and cleaning of sanitary facilities. Secondly, the younger respondents may be more aware of the implications of good environmental sanitation practices than their older counterparts even though in some cases the older adults can be an impetus to proper environmental sanitation practices. In a typical African family setting, while parents are saddled with the responsibility of providing basic household needs, their offspring on the other hand are in charge of the chores in the house which clearly explains the disparity in environmental sanitation practices among age groups.

Females were found to be more engaged in good environmental sanitation practices than their males counterparts (P<0.05). This may be attributed to the fact that females are seen to be home builders, home managers and organizers. They usually ensure the environment is kept tidy and clean. The males on the other hand, engage in day-to-day activities with the aim of providing for their families. As a result, maintaining good environmental sanitation may probably be of less concern. Educational status was also found to be associated with environmental sanitation practice (P<0.05). This means that the higher the educational status, the higher the standard of environmental sanitation practice and vice versa. Adequate access to health information and high

awareness level on the implication of proper environmental sanitation practice may largely account for good environmental sanitation practices among respondents with higher educational status.

Income level was also observed to be significantly associated with environmental sanitation practice (P<0.05). This means that income greatly influence the standard of environmental sanitation practice to a reasonable extent. Arguably, the desire to maintain clean and safe environment is highly dependent on the availability of materials and equipment such as rakes, hoes, cutlasses, durable waste bins, disinfectants and detergents. However, it was observed that lower income earners were found to be more engaged in good environmental sanitation practices than the higher income earners. Aside the fact that they constitute more than two-third of the respondents in the current study, they may largely constitute the unemployed or self-employed categories of persons which enables them create the time to maintain their surroundings. The higher income earners may be government or private employees or large-scale business owners who may only attend to their environment about 2-4 times a month probably because of their busy schedules.

5. CONCLUSION AND RECOMMENDA-TIONS

Poor environmental sanitation practice has been strongly linked to high malaria transmission, morbidity and mortality rates especially in low and middle income countries**.** In Nigeria, malaria remains a major public health problem with higher endemicity in rural and semi-urban settings. Findings in the current study showed that most respondents recorded poor environmental sanitation practices. Hence, the government at all levels in conjunction with the local communities should provide basic sanitation facilities such as good channeling of drainage systems for proper disposal of wastewater and waste collection services for proper disposal of household generated solid wastes, etc. This is critical to the prevention and control of mosquitoes and malaria transmission. Agricultural activities such as the use of bamboo in the construction of yam barns and the planting of water-bearing crops that encourage the breeding of mosquitoes should be restricted to places outside residential areas. This would also minimize

mosquito breeding and exposure to malaria transmission.

CONSENT

All authors declare informed consent was duly sought and obtained from the respondents that took part in the study. Participation in this study was strictly voluntary and confidentiality of information provided was maintained (or other approved parties) for publication of this paper.

ETHICAL APPROVAL

Ethical approval was obtained from the Cross River State Health Research Ethics Committee (CRS-HREC) to carry out the study. Respondents gave their informed consent verbally before participating in the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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