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# Impact of Environmental Sanitation in Curbing the Proliferation of Mosquito Breeding Sites in Jaba Local Government area of Kaduna State.

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## ABSTRACT

*This study was carried out on Impacts of environmental sanitation in curbing the proliferation of mosquito breeding sites in Jaba Local Government. A descriptive cross-sectional study design 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 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. 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. 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. 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. Government, Stake holders and non-governmental organizations should redesign a plan of action to sensitize the households about the importance of proper waste disposal so as to maintain their positive attitude in Jaba Local Government.*

***Keywords:*** **Impact, Environmental, Sanitation, Curbing, Proliferation, Mosquito, Breeding Sites.**

## 1. INTRODUCTION

Mosquitoes are among the most important insect pests affecting the health of people and animals. Female anopheles mosquitoes not only irritate people and animals, but they can also transmit disease [1]. Annoying populations of mosquitoes can occur anywhere in Texas because there are habitats favorable for mosquito species almost everywhere in the state. To control mosquitoes effectively, it helps to understand their life cycle, to be able to identify the various kinds of mosquitoes, and to know what steps work best for the different species and specific locations [3].

Malaria still remains a significant public health problem especially in low- and middle-income countries. According to the World Health Organisation [12], 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.

Malaria is principally caused by protozoa (Plasmodium species) and is transmitted through the bite of an infected female Anopheles mosquito [8]. Within the tropics and sub-tropics, human malaria is seen to be the widest spread vector-borne disease. 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.

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 [15]. 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.

In its modern concept, environment includes not only water, air and soil but also the social and economic conditions under which we live. The key to man's health lies largely in his environment. In fact, much of man's ill-health can be traced to adverse environmental factors such as water, soil and air pollution, poor housing conditions, presence of animal reservoir and insect vectors of diseases which pose threats to man's health. Often, man is responsible for the pollution of his environment through urbanization, industrialization and other human activities.

According to the National Sanitation Foundation of USA, the word sanitation is defined as a way of life that is expressed in the clean home, farm, business, neighborhoods and community. Also, World Health Organization (WHO) defines sanitation as the provision of facilities and services for the safe disposal of human urine and faeces [13].

Environmental hazards are responsible for about a quarter of the total burden of disease worldwide and as much as 30% in regions such as sub-Saharan Africa. As many as 13 million deaths can be prevented every year by making our environments healthier. These facts and figures highlight the impact of environmental factors on public health. More than 2.4 billion people in the world currently lack access to adequate sanitation and are forced to dispose of their excreta in unimproved and unsanitary conditions. Those who suffer from this, lack most basic human needs and also tend to be victims of poverty, ill health and an overall poor quality of life [12].

In developing countries like Nigeria, the main diseases of the environment are diarrhoeal disease, lower respiratory infections, unintentional injuries, and malaria. In children under the age of five, one third of all disease is caused by the environmental factors such as unsafe water and air pollution [14]. The poor state of food sanitation in the country has been shown to play a significant role in the etiology of food borne diseases. One of the most significant diseases that arise from poor sanitation is diarrhea. Deaths resulting from diarrhea are estimated to be between 1.6 and 2.5

million every year [12]. National records show that every year, about six hundred thousand (600,000) episodes of diarrhoea occur in children under the age of five.

Similarly, there have been increasing numbers of cases of cholera over the years. From January to December 2010, Nigeria reported 41,787 cases including 1,716 deaths from 222 Local Government Areas (LGAs) in 18 States of the country. The most affected states were Borno, Bauchi and Katsina. In addition to the disease burden, Nigeria loses about N455 billion annually which is equivalent to 1.3% of Gross Domestic Product (GDP), due to poor sanitation as reported by water and sanitation program of the World Bank. Most of the affected are young children below the ages of five. Other diseases that are caused by poor sanitation include schistosomiasis, trachoma, soil transmitted helminthiases, and malaria [12].

One of the essential public health care elements is provision of safe drinking water and sanitation. However, deposition of faecal matter near homes, contamination of sources of drinking water (sometimes caused by poorly designed or maintained sewage system), dumping of refuse and sweeping into the gutters, defecating and disposing of faeces by the street corners and waterways and selling of food stuffs and cooked food by the road side are all unwholesome practices that pose potential risk to the development of diseases. Water quantity is as important as water quality. Washing of hands after defecation and before preparing food is of particular importance in reducing disease transmission, as has been demonstrated by Nigeria's recent control over Ebola Viral Disease. Poor housing also contributes to poor environment health and its consequent input in the health of the urban dwellers. Measures for the prevention of cholera mostly consist of providing clean water and proper sanitation to populations who do not yet have access to basic services. Health education and good food hygiene are equally important.

The environmental sanitation-related diseases exacer-bate poverty by diminishing productivity and household income. In addition, the national cost of lost productivity, reduced educational potential and huge curative health costs constitute a major drain on the local and national economy. Besides, a dirty environment with its attendant health consequences, prevailing in most of our cities, can discourage tourists/investors and undermine the economic benefit of tourism to the country. Consequently, wide-ranging actions are required to solve Environmental Sanitation problems in order to reduce and avert their adverse health, economic and developmental effects.

## 2.0 RESEARCH DESIGN

A research design is the structure of research. It holds all the elements in a research project together. It shows how all the major parts of the research project work together to try to address the central research question. A descriptive cross- sectional study design was used for the study.

## 2.1 DATA COLLECTION PROCEDURE

For the purpose of this research work, the researcher used the questionnaire, which is a structured series of questions in written form meant to be answered by respondents. The question forms are to be either ticked or choose by those concerned.

The researcher issued questions to staffs of different organization, the questionnaire for staffs were mainly issued to obtained information.

## 2.2 TARGET POPULATION

A study population is a group of elements or individuals as the case may be, who share similar characteristics. These similar features can include location, gender, age, sex or specific interest. The emphasis on study population is that it constitutes of individuals or elements that are homogeneous in description. The population of this present covered residents in Jaba Local Government Area, Kaduna state, Nigeria. 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 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.

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 Jaba 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 Jaba 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.

## 2.3 METHOD OF DATA ANALYSIS

The data for this study were generated from two main sources; Primary sources and secondary sources. The primary sources include questionnaire, interviews and observation. The secondary sources include journals, bulletins, textbooks and the internet.

## 2.4 RESEARCH INSTRUMENTATION

This is a tool or method used in getting data from respondents. In this study, questionnaires and interview are research instruments used. Questionnaire is the main research instrument used for the study to gather necessary data from the sample respondents. The questionnaire is structured type and provides answers to the research questions therein.

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.

## 2.5 SAMPLING TECHNIQUE

The technique used in this research work is Random sampling technique. This method enabled the researcher to select a sample from population so that each member has equal chances of being selected. This technique simply uses a sample from the population.

## 2.6 ANALYTICAL TOOL

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 Kaduna State Ministry of Health 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 maintain anonymity and information obtained were kept confidential throughout the period of research.

## 3. 0 Results and Discussion

### Environmental Sanitation Practices for Malaria Control and Prevention

Table 1. 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 |

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. 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 |

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. 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 | 16 daily | 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 |

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.

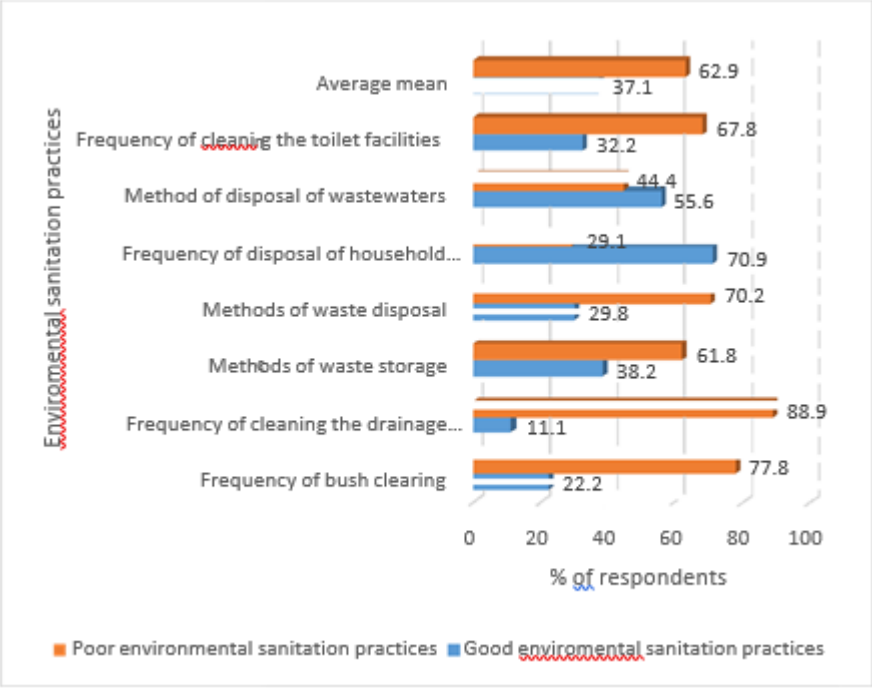


**Figure 3. 1 Environmental sanitation practices among respondents**

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).

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

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

**Number of respondents (Percentage) Chi-square**

| | **Good environmental sanitation practice (n = 167)** | **Poor environmental sanitation practice (n = 283)** | **Total (n = 450)** | **(P-value)** |
|---|---|---|---|---|
| **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) | |

From the table, it was observed that age ($\chi 2 = 11.90$; P= 0.023), gender ($\chi 2 = 20.27$; P= 0.000),

Educational status ($\chi 2$ = 25.45; P= 0.000) and income level ($\chi 2$ = 69.13; P= 0.000) were statistically significantly associated with environmental sanitation practice among respondents.

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. 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 [4]. 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.

While 188 (41.8%) respondents claimed that they had drainage system around their houses, 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 [2] 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 [5], 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 [6]. 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 [7], 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 [9], in which the use of ITNs was rated low, but agrees with that of [10], 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 [10]. 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.

**CONCLUSION**

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.

The Government should intensify the campaign against the mosquito borne diseases through different public sectors or advertisement in news papers or TV channels and should take proper action in regular cleaning of polluted water. The spraying of suitable chemical adulticide or larvicide as well as the introduction of biocontrol agents such as application of larvivorous fishes in the temporary or permanent water body can reduce the frequency and prevalence of mosquito borne diseases in this peri-urban area. Active participation of stakeholders, community volunteers and self-help group members are necessary to maximize community awareness and can improve the quality of life in this area.

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