

# Environmental Sanitation Practices: A Case Study of Solid Waste Management in Semi-Urban Communities in Orlu, Imo State Nigeria

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## Abstract

**Background:** Environmental sanitation is a fundamental process that is a key public health intervention which is essential for social, economic and overall health development of communities. **Objective:** To determine Knowledge, Attitude and Practices of Environmental Sanitation in Semi-Urban Communities in Orlu, Imo State, Nigeria. **Methods:** A cross sectional descriptive design using a multistage random sampling technique to select 426 participants from households and business premises in semi-urban communities in Orlu Local Government Area of Imo State. Data was collected using a pretested, semi structured, interviewer administered questionnaire. Descriptive analyses were done with frequencies and summary statistics to assess the respondents' knowledge, attitude and practices of environmental sanitation. **Results:** The results revealed that the mean age of the respondents' was  $37.0 \pm 2.2$  with a male to female ratio of 1:1.2. Despite high awareness about environmental sanitation (95.0%) reported among the respondents, proportion of them with good knowledge about environmental sanitation (22.9%), attitude (38.6%) and practice (20.8%) towards environmental sanitation was low. The mean quantity of waste generated per week per household or business premise was  $14.1 \pm 0.94$  kg with a majority of the respondents (80.0%), not separating their waste before disposal. The commonest solid waste component generated was organic/perishable materials (74.8%) and the commonest disposal practice reported was open dumping (49.8%). **Conclusion:** A lot of attention is still

required in the development of basic sanitation infrastructure and also, in the promotion of strategies or interventions that influence behavioural change towards environmental sanitation especially in developing countries like Nigeria.

### **Keywords**

Knowledge, Attitude, Practice, Environmental Sanitation, Solid Waste Management, Nigeria

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## **1. Introduction**

Environmental sanitation is a set of actions or a fundamental process of collecting and safely disposing all kinds of waste within the environment with the intention of protecting and promoting the individual health and quality of life of communities. Environmental sanitation generally includes the provision of facilities and services for the safe disposal of waste, the maintenance of hygienic conditions and the prevention of diseases [1]. So it is a key public health intervention that is essential for social and economic development especially in developing countries. This leads to the improvement of health, well-being and economic productivity and benefits the individual, household and community through the provision and practice of adequate sanitation, good hygiene and the use of safe water [2] [3].

In 2012, a study conducted by World Health Organization reported that, there was a return of 5.5 USD with respect to lower health costs, more productivity and fewer premature deaths for every 1 USD invested in sanitation [4]. Though, since 1990, there has been an improvement in sanitation with the proportion of people having access increasing from 54% to 68%, the Millennium Development Goal target by 2015 was not achieved, as up to 700 million people remaining to attain the target, were still without adequate sanitation [4].

About 10% of the global burden of disease and one third of all annual deaths in low- and middle-income countries resulting from inadequate water, sanitation, and hygiene is believed to be due to poor sanitation [3] [4]. Furthermore, a correlation has also been observed between poverty, child infancy and diseases that are associated with poor sanitation; hence, especially in developing countries with inadequate sanitation which poses a significant public health risk, children in particular are most vulnerable to ill health [5]. Therefore, interventions targeted at sanitation improvements can significantly enhance health and wellbeing of the population by preventing, reducing the severity and impact of diseases associated with poor sanitation [6].

A key culprit of poor sanitation is diarrhoeal disease which is a significant group of feco-oral diseases that has substantial impact on the mortality patterns in children especially under the age of 3 years. Consequently, a study in Brazil also concluded that, introducing interventions geared towards improving sanita-

tion and household living conditions will significantly decrease the incidence of diarrhoeal diseases and its' impact on health especially in children [7]. Poor sanitation has also been linked to acute respiratory infections [8], malnutrition [9] and in particular, neglected tropical diseases such as trachoma, soil-transmitted helminthiases and schistosomiasis; as many of these diseases can be transmitted feco-orally [3] [10].

In developing countries, majority of people in the rural communities lack sanitation and even with urbanization, the provision of improved sanitation remains a continuous challenge due to the inability to cope with the associated increase in population as communities move from rural, semi urban to urban development [3]. Also according to Daramola [11], the population growth in Nigerian cities is not accompanied by a corresponding increase in the provision of environmental sanitation facilities. So in addressing these challenges of sanitation in the semi urban and urban communities, the provision of sanitation infrastructure serves only as a means to an end, as the attitude and behaviour of the individuals, households and community as a whole, determines the end [12].

Now, the trend in the promotion of sanitation is progressively moving from the emphasis on centrally planned sanitation infrastructure to a demand led approach that empowers people to change behaviour and improve their own sanitation [3]. In this regard, simple health interventions such as hygiene and sanitation promotion in the prevention of diarrhoea have been central to the demand led approaches such as sanitation marketing, community led total sanitation and community health clubs; which begins with, and it is based on influencing peoples' attitude, what they know, do and want [13]. These interventions have also been successful and cost effective globally with respect to the cost of averting occurrences of morbidity and mortality [14].

Hence, the foundation for a successful demand led approach will be achieved mainly through strategies that improve knowledge, attitude and motivate the practice of safe sanitation by the individual; which is an important and effective approach in attaining better and sustainable sanitation within the households and communities. So this study sets out to determine the knowledge, attitude and practices of environmental sanitation in semi-urban communities with a view to designing specific strategies that targets behavioural change by improving their knowledge and attitude towards sanitation.

## **2. Methodology**

### **2.1. Study Area**

The study was conducted within semi-urban communities in Orlu Local Government Area (LGA) which is one of the twenty seven LGAs of Imo State in the South Eastern zone of Nigeria. Orlu LGA which is made up of 10 autonomous communities, is predominantly a semi-urban area covering 133 sq km with an estimated population of 142,792 and a population density of about 1074 persons per square kilometre according to the 2006 national census [15].

## 2.2. Study Population/Study Design/Selection Criteria

The study population comprised households and business premises within the semi-urban communities in Orlu LGA. The study was a descriptive cross sectional type. The criteria for selection was any individual aged 20 years and above from a household or business premise within the selected communities and had lived in the study area for at least one year. The selected individual was subsequently enrolled after informed consents were given. Any individual selected, that was unable to participate due to health issues was excluded.

## 2.3. Sample Size Estimation

The minimum sample size was calculated using the Cochran formula [16]

$$n = \frac{Z^2 pq}{d^2}$$

When  $n$  = minimum sample size,  $Z$  = Standard normal deviate corresponding to 5% significance level,  $p$  = proportion of the target population that had a moderate to good standard of practice relating to environmental sanitation (49%) [17],  $q = 1 - p$  ( $1 - 0.49 = 0.51$ ),  $d$  = tolerable error of margin set at 0.05,  $Z = 1.96$ . Applying the formula above, and adjusting for incomplete and non-response rate, a sample size of 426 participants were studied.

## 2.4. Sampling Technique

The sampling technique used to select the participants for this study was the multistage random sampling technique. The first stage involved the selection of the communities that were studied. This was done using simple random sampling by balloting of which 3 semi-urban communities were selected from a list of 6 semi-urban autonomous communities that are part of the 10 communities (rural and semi-urban) that make up Orlu LGA. The second stage involved using simple random sampling by balloting to select two enumeration areas from each of the 3 selected semi-urban autonomous communities based on the Nigerian 2006 census enumeration area delineation. The third stage involved the selection of one participant from the individual household or business premise within the selected enumeration areas in the respective communities.

In each enumeration area within a particular community, a prominent location was identified and moving in a particular direction, each consecutive household or business premise was enrolled until 71 households and or business premises were selected. A total of 426 households and business premises were selected from the six enumeration areas within the respective communities. If there were more than one individual aged 20 years and above present in any household or business premise, balloting was done to select and enrol one eligible individual after an informed consent. Any household or business premise without an eligible individual present after two repeat visits or had only one adult individual present, who had not lived in the area for at least one year was

skipped.

## 2.5. Data Collection and Analysis

Data was collected within a two month period from February to March 2016 using a pretested, semi structured, interviewer administered questionnaire. The questionnaire was developed by the researchers and pretested in another community in the LGA not selected for the study. The content validity was established qualitatively assessing each question against the intended construct. The questionnaire comprised 4 sections; section one: the socio-demographic and household characteristics; section two: the awareness and knowledge of environmental sanitation; section three: attitude towards environmental sanitation and section four: environmental sanitation practices and self-assessment of community sanitation.

The level of knowledge and practice of environmental sanitation was determined by scoring the questions that assessed knowledge or practice. For a single response question, an appropriate answer was scored 2; an inappropriate answer was scored 0. For a multiple response question, up to 2 appropriate answers was scored 1; from 3 to 5 appropriate answers was scored 3 and greater than 5 appropriate answers was scored 5. In assessing the level of attitude towards environmental sanitation, a Likert scale was used. For a positive question, a response from strongly agree to strongly disagree, a score from 5 to 1 was allocated accordingly and for a negative question, a response of “strongly disagree” to “strongly agree”, a score from 5 to 1 was allocated accordingly. The aggregate scores for each respondent according to the level of knowledge, attitude and practice of environmental sanitation were translated to a percentage and assessed against a scale of less than 60% for poor, 60% - 80% for moderate and greater than 80% for good. For the self-assessment of community sanitation, each respondent was asked to rate the level of environmental sanitation in their respective communities as good, moderate or poor.

Data was cleaned and validated manually, then using Software Package for Social Sciences (IBM-SPSS) version 22, descriptive statistics (frequency tables and summary indices) were generated to assess the respondents' knowledge, attitude and practices of environmental sanitation.

## 2.6. Ethical Considerations

Ethical approval was obtained from the Ethics Committee of Imo State University Teaching Hospital Orlu. Informed consents were obtained from the participants. All authors hereby declare that the study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

## 3. Results

Four hundred and twenty six copies of the questionnaire were administered but 420 copies were completely and correctly filled with a response rate of 98.6%.

### 3.1. Socio-Demographic and Household Characteristics of Respondents in Semi-Urban Communities in Orlu LGA

The mean age of the respondents was  $37.0 \pm 2.2$  years with most of them being of Igbo extraction (93.6%). Majority of the respondents were females (55.2%), married or separated (58.8%), having either no education or a primary level of education (51.9%) and half of the respondents were of the Christian catholic faith (50.0%). Majority of the respondents were living in either a one, two or three bedroom flat (60.0%) with 6 or more household occupants (59.5%) and having a borehole as their main source of water supply (55.7%). A sizable proportion of the households (35.5%) practice open defecation (Table 1).

### 3.2. Awareness and Knowledge of Environmental Sanitation among Respondents in Semi-Urban Communities in Orlu LGA

Most of respondents were aware about environmental sanitation (95.0%) and majority of them, got their information about sanitation from the mass media such as the television (59.1%) and the radio (56.6%); and next, from community meetings (41.4%). While a majority of the respondents (73.7%) indicated that the objective of environmental sanitation was to promote health, close to 10% indicated that it was to avoid contact with people. Also, while a majority of the respondents indicated that waste disposal (83.7%) and hand washing (74.2%) constitutes appropriate environmental sanitation, less than half indicated that sewage disposal (46.4%) and the provision of safe water (35.8%) constitutes appropriate environmental sanitation. Similarly, while a majority of respondents regarded open dumping as an appropriate waste disposal method (68.9%), only less than half regarded sanitary land fill (41.3%) and incineration (37.4%) as appropriate methods. Though, infection was reported as a result of inappropriate sanitation practices by a majority of the respondents (72.7%), providing a place for criminal hideouts was also reported by as high as 21% of the respondents (Table 2).

Generally, a majority of the respondents (60.0%) had an overall moderate level of knowledge about environmental sanitation with only less than one quarter (22.9%) having an overall good level of knowledge (Figure 1).

### 3.3. Attitude towards Environmental Sanitation among Respondents in Semi-Urban Communities in Orlu LGA

A majority of the respondents either agreed or strongly agreed that surfaces and floors should be washed with clean water regularly (77.6%), that it is necessary to dig pit toilets at a distance away from wells (69.0%), that factories should be located outside the populated communities (65.0%), that solid waste should be disposed daily (61.2%), that all communities should have a day for general clean-up (85.0%) and that community sanitation should be taught in schools (80.2%). As high as 17% - 30% of the respondents were either undecided, agreed or strongly agreed that solid waste could be thrown into the stream (21.4%), that

**Table 1.** Socio-demographic and household characteristics of respondents in semi-urban communities in Orlu.

Variable	Category	Frequency (%) n = 420
Age (years) Mean age (37.0 ± 2.2)	20 - 30	105 (25.0)
	31 - 40	126 (30.0)
	>40	189 (45.0)
Gender	Female	232 (55.2)
	Male	188 (44.8)
Tribe	Igbo	393 (93.6)
	Non-Igbo	27 (6.4)
Religion	Catholic	210 (50.0)
	Pentecostal	147 (35.0)
	Orthodox	57 (13.5)
	Others	6 (1.5)
Marital status	Married	209 (49.8)
	Single	173 (41.2)
	Separated	38 (9.0)
Educational level	Tertiary	159 (37.9)
	Secondary	43 (10.2)
	Primary	201 (47.9)
	None	17 (4.0)
Type of House	Duplex	61 (14.5)
	Bungalow	107 (25.5)
	3 bed room flat	103 (24.5)
	2 bed room flat	84 (20.0)
	1 bed room flat	65 (15.5)
Household size	1 - 5	170 (40.5)
	6 - 10	145 (34.5)
	>10	105 (25.0)
	Borehole	234 (55.7)
Main source of water	Stream and rivers	105 (25.0)
	Tanker supply	41 (9.8)
	Public supply	22 (5.2)
	Rain water	18 (4.3)
	Water closet	252 (60.0)
Toilet facilities	Open defecation	149 (35.5)
	Pit toilet	19 (4.5)

urination and defecation could be done near wells (17.1%), that sewage could be discharged into the stream (30.0%) and that solid waste could be spread around the compound to decay naturally (30.0%). A majority of the respondents were undecided, disagreed or strongly disagreed that all waste bins should have covers (55.0%). Also a majority of the respondents were undecided, agreed or strongly agreed that open waste bins could be kept in the kitchen (60.0%) and that it is unnecessary to separate waste before disposal (80.0%) (**Table 3**).

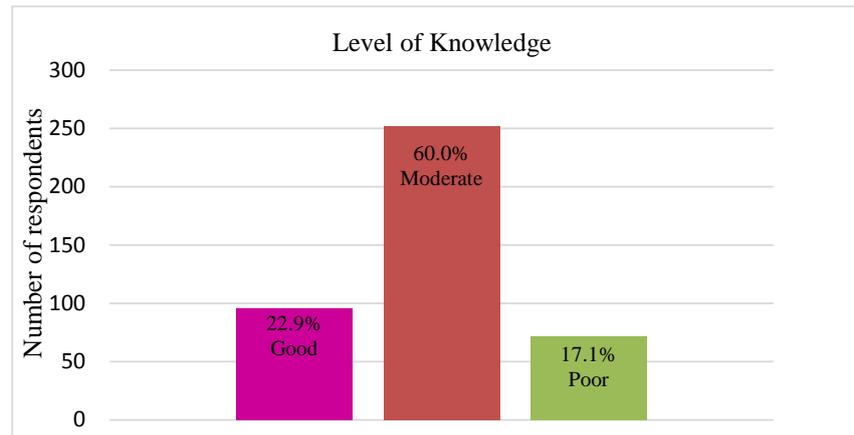
**Table 2.** Awareness and knowledge of environmental sanitation among respondents in semi-urban communities in Orlu.

Variable	Category	Frequency (%)
Have you heard about environmental sanitation (n = 420)	Yes	399 (95.0)
	No	21 (5.0)
*Sources of information (n = 399)	Television	236 (59.1)
	Radio	226 (56.6)
	Community meetings	165 (41.4)
	Health personnel	129 (32.3)
	Market	109 (27.3)
	Newspaper	101 (25.3)
	Neighbours	91 (22.8)
	Friends/relatives	77 (19.3)
	Poster/sign boards	62 (15.5)
	internet	43 (10.8)
*What is the objective of Environmental Sanitation? (n = 399)	Sanitation agencies	20 (5.0)
	Promoting health	294 (73.7)
	Preventing diseases	189 (47.4)
	Personal cleanliness	46 (11.5)
	Avoid contact with people	38 (9.5)
*What constitutes appropriate Environmental Sanitation? (n = 399)	Waste disposal	334 (83.7)
	Hand washing	296 (74.2)
	Safe guarding food	256 (64.2)
	Sewage disposal	185 (46.4)
	Provision of safe water	143 (35.8)
*Types of appropriate waste disposal methods known (n = 334)	Provision of good housing	25 (6.3)
	Open dumping	230 (68.9)
	Sanitary land fill	138 (41.3)
	Incineration/burning	125 (37.4)
	Recycling	99 (29.6)
	Hog feeding	68 (20.4)
*Consequences of inappropriate sanitation practices (n = 399)	Composting	62 (18.6)
	Causes infection	290 (72.7)
	Unhealthy living conditions	277 (69.4)
	Blocks drainages	269 (67.4)
	Pollutes water bodies	254 (63.7)
	Provides breeding sites	229 (57.4)
	Causes injuries	228 (57.1)
Provides criminal hideouts	83 (20.8)	

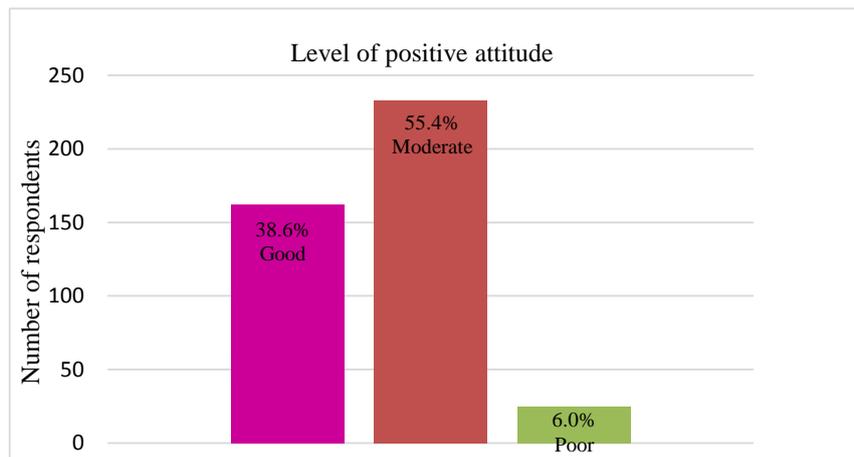
Generally, a majority of the respondents (55.4%) had an overall moderate level of positive attitude towards environmental sanitation with only above one third having an overall good level of positive attitude (38.6%) (**Figure 2**).

### 3.4. Environmental Sanitation Practices among Respondents in Semi-Urban Communities in Orlu LGA

About three quarters of the respondents mainly generate, organic and perishable solid waste (74.8%) and a majority of the respondents generate 5 - 20 kg of solid



**Figure 1.** Overall level of knowledge of Sanitation among respondents in semi-urban Communities in Orlu.



**Figure 2.** Overall level of positive attitude towards Sanitation among respondents in semi-urban communities in Orlu.

waste per household or business premise per week (71.4%) with an average waste generated per person per week of 2.69 kg. Even though a majority of the respondents store their waste using covered bins (55.0%), as high as 22% - 30% of the respondents still store their waste either by dumping openly (30.2%) or by using uncovered bins (27.6%) or baskets (22.6%) with close to half of the respondents disposing their waste 2 - 3 times per week (48.1%). A majority of the respondents use wheel barrows and head pans (73.8%) to transport their waste to the dump site and do not pay any form of dues for waste disposal (80.2%). A majority of the respondents either reported that the community did not have a designated central area for waste disposal or did not know of its existence in the community (65.3%) and commonest form of waste disposal practiced by household was open dumping, (49.8%). A majority of the respondents reported not having public toilets in their communities (59.8%) but close to half of the respondents reported having a health committee (50.7%). A majority of the respondents reported either not being visited by sanitary inspectors or not knowing

**Table 3.** Attitude towards environmental sanitation among respondents in Semi-urban communities in Orlu.

Variable	Category	Frequency (%) (n = 420)
Surfaces and floors should be washed with clean water regularly?	Strongly Agree	210 (50.0)
	Agree	116 (27.6)
	Undecided	79 (18.8)
	Disagree	10 (2.4)
	Strongly disagree	5 (1.2)
Solid waste could be thrown into the stream	Strongly Agree	6 (1.4)
	Agree	62 (14.8)
	Undecided	22 (5.2)
	Disagree	160 (38.1)
	Strongly disagree	170 (40.5)
Urination and defecation could be done near wells	Strongly Agree	5 (1.2)
	Agree	8 (1.9)
	Undecided	59 (14.0)
	Disagree	188 (44.8)
	Strongly disagree	160 (38.1)
Sewage could be discharged into the stream	Strongly Agree	3 (0.7)
	Agree	60 (14.3)
	Undecided	63 (15.0)
	Disagree	105 (25.0)
	Strongly disagree	189 (45.0)
It is necessary to dig pit toilets at a distance away from wells	Strongly Agree	126 (30.0)
	Agree	164 (39.0)
	Undecided	25 (6.0)
	Disagree	63 (15.0)
	Strongly disagree	42 (10.0)
Factories should be located outside the populated communities	Strongly Agree	83 (19.8)
	Agree	190 (45.2)
	Undecided	61 (14.5)
	Disagree	62 (14.8)
	Strongly disagree	24 (5.7)
Solid waste should be disposed daily	Strongly Agree	40 (9.5)
	Agree	217 (51.7)
	Undecided	150 (35.7)
	Disagree	4 (1.0)
	Strongly disagree	9 (2.1)
Solid waste could be spread around the compound to decay naturally	Strongly Agree	0 (0.0)
	Agree	21 (5.0)
	Undecided	105 (25.0)
	Disagree	63 (15.0)
	Strongly disagree	231 (55.0)
All waste bins should have covers	Strongly Agree	129 (30.7)
	Agree	60 (14.3)
	Undecided	162 (38.6)
	Disagree	48 (11.4)
	Strongly disagree	21 (5.0)

**Continued**

All communities should have a day for general clean up	Strongly Agree	189 (45.0)
	Agree	168 (40.0)
	Undecided	26 (6.2)
	Disagree	21 (5.0)
	Strongly disagree	16 (3.8)
Open waste bins could be kept in the kitchen	Strongly Agree	42 (10.0)
	Agree	105 (25.0)
	Undecided	105 (25.0)
	Disagree	84 (20.0)
	Strongly disagree	84 (20.0)
It is not necessary to separate waste before disposal	Strongly Agree	42 (10.0)
	Agree	42 (10.0)
	Undecided	252 (60.0)
	Disagree	40 (9.5)
	Strongly disagree	44 (10.5)
Community sanitation should be taught in school	Strongly Agree	126 (30.0)
	Agree	211 (50.2)
	Undecided	81 (19.3)
	Disagree	2 (0.5)
	Strongly disagree	0 (0.0)

at all, if they visited their communities (80.4%). Of those that reported being visited by sanitary inspectors, a majority reported that the frequency of visits were either monthly or yearly (78.0%). Similarly, a majority of the respondents reported that their communities observe a monthly environmental sanitation day (70.2%) but close to half of the respondents (49.5%) either reported that, it was of no benefit or did not know if observing the environmental sanitation day benefited the community. Close to 45% of the respondents reported having communal bush clearing and gutter cleaning activities, of which, a majority (78.1%) reported having the communal activities every month (Table 4). Furthermore, though a majority of the respondents (52.9%) had an overall poor level of environmental sanitation practice, most of the respondents (87.2%) rated their level of community sanitation as moderate to good (Figure 3 and Figure 4).

#### 4. Discussion

This study assessed the knowledge, attitude and practice of environmental sanitation in semi-urban communities in a developing country. Though it was revealed that most of the respondents were aware of environmental sanitation mainly through the mass media which was similarly reported by Adogu *et al.*, from a previous study [18], only about 23%, 39% and 21% of the respondents had a good level of environmental sanitation knowledge attitude and practice respectively.

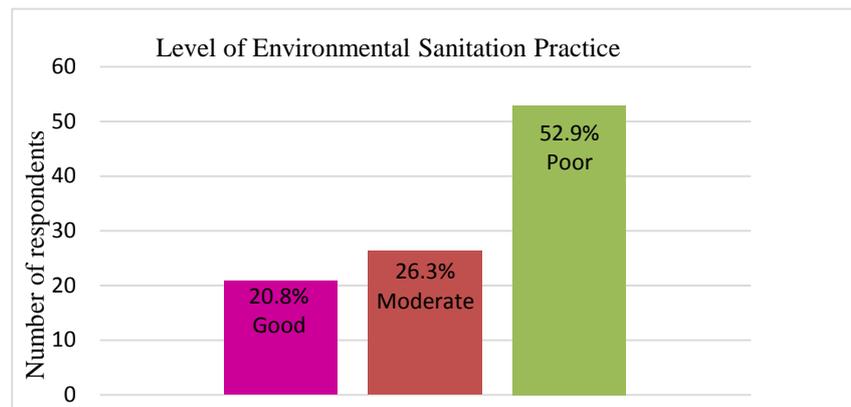
In spite of the fact that, most of the respondents' self-assessment of their level of community sanitation was graded as moderate to good, their actual level of practice for a majority of the respondents was poor to moderate. As a result,

**Table 4.** Environmental sanitation practices among respondents in semi-urban communities in Orlu.

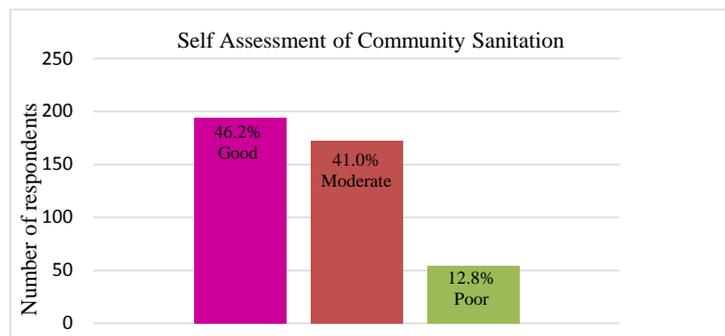
Variable	Category	Frequency (%)
*Major types of solid waste generated (n = 420)	Organic/perishables	314 (74.8)
	Paper/cartons/glass	232 (55.2)
	Plastic/polythene bags	165 (39.3)
	Clothing/leather	106 (25.2)
	Stationery	64 (15.2)
	Electronic waste	43 (10.2)
	Construction materials	25 (6.0)
Estimated quantity of solid waste generated per household or business premise per week (n = 420) Mean waste generated = 14.1 ± 0.94 kg. Average waste generated per person/week = 2.69 kg	1 - 2 buckets (5 - 10 kg)	173 (41.2)
	3 - 4 buckets (11 - 20 kg)	127 (30.2)
	5 - 10 buckets (21 - 40 kg)	59 (14.0)
	Can't estimate	61 (14.5)
*How is waste stored? (n = 420)	Use of cover bins	231 (55.0)
	Bags/sacs/nylon bags	169 (40.2)
	Open dumping	127 (30.2)
	Use of uncovered bins	116 (27.6)
	Use of baskets	95 (22.6)
How frequently do you dispose waste? (n = 420)	2 - 3 times per week	202 (48.1)
	Once per week	116 (27.6)
	Daily	102 (24.3)
How do you transport waste to dump site? (n = 420)	Wheel barrows	166 (39.5)
	Head pans	144 (34.3)
	Private closed carriers	69 (16.4)
	Dragging on the floor	41 (9.8)
Do you pay any dues for waste disposal? (n = 420)	Yes	83 (19.8)
	No	337 (80.2)
Does your community have a designated central area for waste disposal? (n = 420)	Yes	146 (34.8)
	No	207 (49.3)
	Don't know	67 (16.0)
What is the major waste disposal method practiced? (n = 420)	Open dumping	209 (49.8)
	Burning	61 (14.5)
	Composting	55 (13.1)
	Recycling	23 (5.5)
	Hog feeding	19 (4.5)
	Sanitary land fill	5 (1.2)
	Not sure	48 (11.4)
Are there public toilets in the community? (n = 420)	Yes	169 (40.2)
	No	251 (59.8)
Does the community have a health committee? (n = 420)	Yes	213 (50.7)
	No	106 (25.2)
	Don't know	101 (24.0)
Do sanitary inspectors visit your community? (n = 420)	Yes	82 (19.5)
	No	287 (68.3)
	Don't know	51 (12.1)

**Continued**

If yes, how frequently? (n = 82)	Yearly	33 (40.2)
	Monthly	31 (37.8)
	Weekly	18 (22.0)
Does your community observe a monthly environmental sanitation day? (n = 420)	Yes	295 (70.2)
	No	43 (10.2)
	Don't know	82 (19.5)
Has monthly environmental sanitation day benefited the community? (n = 295)	Yes	149 (50.5)
	No	83 (28.1)
	Don't know	63 (21.4)
Are there any communal bush clearing and gutter cleaning activities? (n = 420)	Yes	187 (44.5)
	No	107 (25.5)
	Don't know	126 (30.0)
How frequently is the bush clearing and gutter cleaning activities? (n = 187)	Monthly	146 (78.1)
	Weekly	27 (14.4)
	Yearly	14 (7.5)



**Figure 3.** Overall level of environmental sanitation practice among respondents in semi-urban communities in Orlu.



**Figure 4.** Self-assessment of community sanitation among respondents in Semi-urban communities in Orlu.

there seems to be a gap between their level of practice of sanitation and the perception of the level of sanitation they practice. In order words, they appear not to appreciate the inadequacy and inappropriateness of the environmental sanita-

tion they actually practice. This may be attributed to the level of knowledge and attitude observed among the respondents in the present study. This level of knowledge and attitude observed could also be attributed to their level of education, as more than half of the respondents either had no education or had a primary level of education.

Previous studies have observed significant relationships between knowledge of sanitation and education, with higher levels of education being associated with better knowledge, as formal education provides the foundation for better understanding which invariably, improves the level of knowledge [19] [20] [21] [22]. Also, according to Agbola [23] and supported by George [24], it was suggested that attitude is a response that is learned and as such, can be influenced by education; so education, could therefore be a tool for changing or modifying the way people perceive events or actions. This was further highlighted in a study among Nigerian teachers [25], where it was reported that, most of the teachers had a positive attitude towards environmental issues which was a consequence of their level of education.

Even with the high level of environmental sanitation awareness observed in most of the respondents, it was still obvious that the depth of sanitation knowledge was lacking *i.e.* inadequate and inappropriate knowledge content. For example, where more than half of the respondents in the present study did not know that sewage disposal and more so, that the provision of safe water constitutes appropriate environmental sanitation; or where a majority of the respondents regarded open dumping as an appropriate waste disposal method or did not know that sanitary land fill and incineration as appropriate methods; or where up to one quarter to one third of the respondents either did not know that infections, unhealthy living conditions or blocked drainages were consequences of inappropriate environmental sanitation.

Similarly, their level of attitude also compounded the level of inadequacy and inappropriateness of their knowledge, where as high as 17% - 30% of the respondents were either undecided or were of the opinion that solid waste could be thrown or sewage discharged into the streams; or that you could urinate and defecate near wells; or that solid waste could be spread around the compound to decay naturally into the soil; or that all waste bins need not have covers and could be kept without covers in the kitchen. This level of knowledge and attitude among the respondents in the present study was not similarly observed in other studies, where it was reported that, a majority of the respondents were knowledgeable; and or, had a positive attitude towards environmental sanitation [25] [26] [27].

The practice of environmental sanitation in the present study was poor to moderate in a majority of the respondents. This could have been influenced by their level of education, knowledge and attitude towards environmental sanitation; as it was observed in a study by Iwu *et al.*, [28] among traders in Imo State, where it was reported that, the level of knowledge, attitude and education were significantly associated with waste management practice. Arora *et al.*, [19] also

suggested that, people with good knowledge that is usually associated with good practice, are more capable of properly managing waste. Furthermore, previous studies have reported the association of education, and or knowledge with the practice of environmental sanitation [17] [20] [21] [29]; and according to Olofsson *et al.* [30], the environment is more of a concern to people that are educated, who consequently act on preserving it.

The storage of waste using covered bins within the household or business premise environment was observed in a higher proportion of the respondents in the present study which was similarly observed in other studies done Owerri and Awka cities in Nigeria [18] [31]. Also, the practice of subsequently disposing these wastes by open dumping was the most common practice by about half of the respondents in the present study. This practice still appears to be prevalent in Nigeria, as was observed in previous Nigerian studies [18] [31] [32]. The practice of open dumping observed in the present study, is further compounded by the fact that three quarters of the respondents either did not know or did not have a designated central area for waste disposal and as such, probably dumped their waste indiscriminately.

So it appears that, even if the people are willing to practice proper sanitation, they are constrained by the lack of, or inadequacy of existing sanitation infrastructure including sanitation governance. This is further highlighted in the present study, where about half of the respondents either did not know of, or did not have a health sanitation committee; or where more than three quarters of the respondents either did not know of, or have visits by sanitary inspectors; or where more than half of the respondents either did not know of, or organize communal sanitation activities like bush clearing and gutter cleaning in their respective communities. Therefore, a demand led approach in sanitation that borders on behavioural change especially in our environment, cannot be fully effective unless adequate basic sanitation infrastructure is first established.

Finally, it was also observed that, the attitude towards waste segregation among the respondents in the present study was poor as more than three quarters of the respondents felt it unnecessary to separate waste before disposal. The lack of practice and appreciation for the need to separate waste before disposal seems to be a common trend especially in African countries [18] [28] [33] [34]. A study in Zambia, [35] reported that participation in solid waste separation depended on the level of awareness and educational status. Furthermore, Iwu *et al.*, [28] was of the opinion that the people do not see the necessity and benefits to segregate their waste and this is probably due to the lack of appropriate education on its benefits, the perception that waste segregation is the sole responsibility of sanitation employees and the burden of the cost associated with purchasing and maintaining separate disposal receptacles.

## 5. Conclusion

This study established that the levels of sanitation knowledge, attitude and practice was poor to moderate; as a good level of knowledge and practice of envi-

ronmental sanitation was only observed in less than one quarter of the respondents with just above one third of them having a good level of attitude and close to half having an erroneous perception that their level of environmental sanitation is good. A lot of attention is still required in the area of environmental sanitation especially in developing countries like Nigeria, with respect to not only employing and promoting strategies that influence behavioural change through effective regular education and awareness campaigns that are targeted, appropriate and consistent; but also, by advocating for increased public sector investments in basic sanitation infrastructures that is sustainable, well planned and coordinated. This will form the basis for adopting demand led approaches that will further empower people to improve their own sanitation.

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### Authors' Contributions

All the authors participated in the study.

### Competing Interest

The authors hereby declare that there are no competing interests.

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