Assessment of Solid Waste Management Practice in Port Harcourt Metropolis, Rivers State, Nigeria

H. O. Stanley[1*] and A. C. Owhor[2]

[1]*Department of Microbiology, University of Port Harcourt, P.M.B. 5323, Choba, Port Harcourt, Nigeria.*
[2]*Institute of Natural Resources, Environment and Sustainable Development, University of Port Harcourt, P.M.B. 5323, Choba, Port Harcourt, Nigeria.*

Authors' contributions

This work was carried out in collaboration between both authors. Author ACO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors ACO and HOS managed the analyses of the study. Author ACO managed the literature searches. Both authors read and approved the final manuscript.

Original Research Article

ABSTRACT

The city of Port Harcourt, an emerging mega city in the Niger Delta, is grappling with solid waste management as seen by mountains of refuse in some parts of the city. This study examined solid waste management practice in Port Harcourt, Rivers State, Nigeria. The study assessed the solid waste management practices in the city through questionnaire administered to households of sampled areas which were Borokiri, Elekahia and Ogbumnuabali. The data collected was analyzed by the use of descriptive statistical tables and multiple bar charts. Most residents dump their refuse by the road side, at common communal storage or via collection vehicles daily or at most once in two weeks. Waste management agency and contractors operate in the city but open dumping and dumping in water ways still persist. The grading of waste disposal system was considered very bad and unsafe. This study identified poor implementation, enforcement and lack of awareness of the waste management policy as the major problems confronting waste

Corresponding author: E-mail: herbert.stanley@uniport.edu.ng;

management in Port Harcourt. To attain a desired level of waste management in Port Harcourt, the right steps must be taken to create environmental awareness and implement waste management policies.

1. INTRODUCTION

It is the nature of organisms to produce waste as they consume in an unsustainable manner [1]. Urbanization and population growth have promoted wastes production and discharge into the environment thereby forcibly causing pollution [2]. The environment is constantly flooded with waste pollutants. This can lead to alteration in soil, air and water quality, with damaging consequences for plants and animals as well as aesthetic of the environment [3].

Waste materials that are not are not liquid, gaseous and insoluble are termed solid waste. Solid wastes include debris from industrial and commercial processes, construction and demolition, refuse, household garbage, plant materials, animal carcasses, abandoned vehicles and parts, bulky waste and refuse. Municipal solid waste management remains a major challenge in developing countries [2].

Port Harcourt generates approximately 2 million kg of solid waste daily [4]. It has been reported that only a fraction of this amount is collected [3]. The waste management system in the city mainly relies on open dumping. Here, generated wastes are gathered in bins or designated collection points but end up been dumped in none sanitary landfill. Residents of Port Harcourt struggle daily with the challenges of handling the waste streams generated in the city.

Waste management in Port Harcourt has not reached acceptable standard of orderly collection, transportation, processing, treatment and disposal. Waste should be properly collected and disposed in ways that wouldn't endanger human health and the environment. Proper management cannot be achieved without a well-designed waste management plan and this plan must be followed systematically [5]. The aim of the study was to assess the solid waste management practices in Port Harcourt metropolis Rivers State.

2. MATERIALS AND METHODS

2.1 Description of the Study Area

The city of Port Harcourt was established in 1912 and is now the capital city of Rivers state. The area was named Port Harcourt by British Secretary of State, Viscount Lewis Harcourt, who allegedly founded the town [6]. It is located sixty kilometers up the Bonny River, where a stretch of solid land mass rises some twenty-five kilometers to the city center. In recent times Port Harcourt has grown in stature and importance both politically and economically. The city is capital of the booming oil and gas industry in Nigeria and has attracted a lot of migrants from outside and inside the state leading to increase in its population size. The population of the city is estimated to be about 1,356,000 [4].

Port Harcourt has two seasons; the rainy and the dry periods. The wet season comes with large rainfall starting from April and ending in November. The short dry period is from December to March. The temperature condition of the city varies within 24°C and 30°C; hence it is mostly warm for a major part annually.

2.2 The Research Design

This research used the random sampling technique. The research sampled three locations in Port Harcourt City: Elehahia, Borokiri, and Ogbumnuabali.

2.3 Population and Sample Size

This study involves the population of all household members in the specific areas. The household population figure for Borokiri, Elekahia and Ogbumnuabali stood at 5009 household members. The Taro Yamane formula was used to arrive at the population size of 399 for this study (Table 1).

2.4 Sampling and Analytical Techniques

This research made use of random sampling for questionnaire distribution in the study areas.
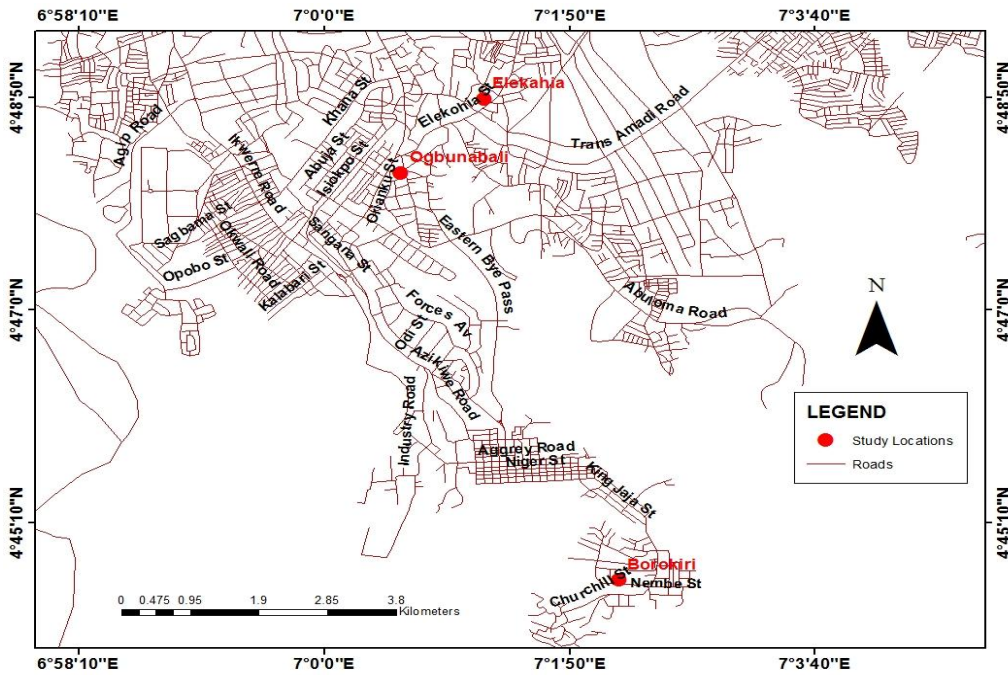
Fig. 1. Map of Port Harcourt showing the different sample locations

The questionnaires were administered between April-July, 2017. One hundred and thirty three (133) copies of the questionnaires were shared among each study location, making a total of 399 questionnaires for the three locations. The questionnaire was divided into two sections: The first (Section 1) dealt with respondents' personal data and socio-economic characteristics while Section 2 dealt with environmental conditions and services. The questionnaire formats were in both open ended format and closed format. The data collected was analyzed by the use of descriptive statistical tables and multiple bar charts.

Table 1. Study population and sample size

S/N	Communities	*Total no. of household
1	Borokiri	1902
2	Elekahia	1069
3	Ogbunabali	2038
	Total	5009 (n=N/1+N(0.05) =399

3. RESULTS

Table 2 shows the questionnaire distributions in the study area. A total of 399 questionnaires were administered but only 390 were returned.

3.1 Socioeconomic Characteristics of Respondents

Table 3 shows the socioeconomic characteristics of the respondents. Results show more females were sampled in the study. Majority of the respondents were single, had at least a technical/secondary school education, less than 70000 naira annually, reside in flats, and have lived in their resident for 12 years. Most people in a Household in this area are less than 4. Majority used plastic bin to collect waste and use children to dispose the waste.

Table 2. Questionnaire distributions in the study area

Study location	Total copies distributed	Total copies received	Percentage %
Elekahia	133	129	32.3
Borokiri	133	130	32.6
Ogbumnuabali	133	131	32.8
Total	399	390	97.7

Table 3. Socioeconomic characteristics of respondents

Variable	Percentage (%)
Gender	
Male	34.1%
Female	65.9%
Marital status	
Single	55.6%
Married	39
Divorced	5.4
Educational status	
Nursing/College of education	58.7
Technical/secondary school	23.3
Polytechnic/University	17.9
Type of living unit	
Flat	46.2
Bungalow	24.1
Duplex	16.2
Room	13.6
Duration of residence	
12 years and above	48.5
6 to 12	44.3
Less than 6 years	7.2
Number in a household	
Less than 4	68.2
4 to 7	26.4
8 and above	5.4
Average income of respondent	
Less than 70000 annually	47.7
71000 to 80000	35.4
81000 to 90000	16.9
Type of waste storage bin used	
Plastic bin	35.1
Polyethylene bags	23.3
Metal bin	11
Carton	8.7
Broken bucket	21.8
Who disposes the refuse	
Children	27.2
Respondent	25.4
Hired labor	22.8
Housemaid	20
Neighbor	4.6

Result in Fig. 1 showed that most of the residents in Elekahia and Ogbumnuabali dispose their rubbish everyday while residents in Borokiri dispose theirs twice in a week.

Fig. 2. showed that most of the residents in Elekahia and Borokiri dispose their refuse by the road/street side, while residents in Ogbumnuabali dispose theirs by the collection vehicle.

Fig. 3. showed that most residents in Port Harcourt are aware that the Rivers State Waste Management Agency come to collect their waste. Contractors come to collect refuse in some places as well. Scavengers only account for a small part and in certain areas in Ogbumnuabali do not have collectors.

Fig. 4 showed that most of the residents feel that the waste they dispose either by using a contractor or directly are collected daily which is represented as 36.9%, while a few (7.4%) insist that nobody comes to collect their refuse.

Fig. 5 showed that the residents in Port Harcourt are aware that most of their waste goes to the open dumps as represented as by 36.9%, while 26.4% have no idea where the refuse they dispose goes to, some residents feel their refuse is being taken to a landfill represented as 23.3%.

Table 4 showed that most of the residents in Port Harcourt feel the disposal method of their waste is very unsafe as represented by 46.9% while 37.9% have no idea about the safety of the final disposal, while a small fraction thinks the final disposal is very safe represented as 15.1%.

Table 5 revealed that the waste management in Port Harcourt was said to be very bad which is represented as 30.3%, closely followed by bad represented as 24.6% and average represented as 22.1%.

Table 6 showed that most of the residents in Port Harcourt are not aware that there is an existing policy on waste management as represented.

From Table 7 by the response from the residents, a higher percentage of the people felt that the policy on waste management is very ineffective represented as 56.4%, some of the residents said although they are not aware of any policy in place, but if there was a policy then it is confusing as to why waste management is still a major issue in the state, while 43.6% said its effective.

The Table 8 tells us that waste management is still a problem because of the poor implementation of the policy thereby making it ineffective represented as 42.8%, while 28.7% of the reason why this policy is ineffective is because it is not made known to the residents. 18.5% had no idea why the policy was not effective and 10% felt the policy was too rigid.
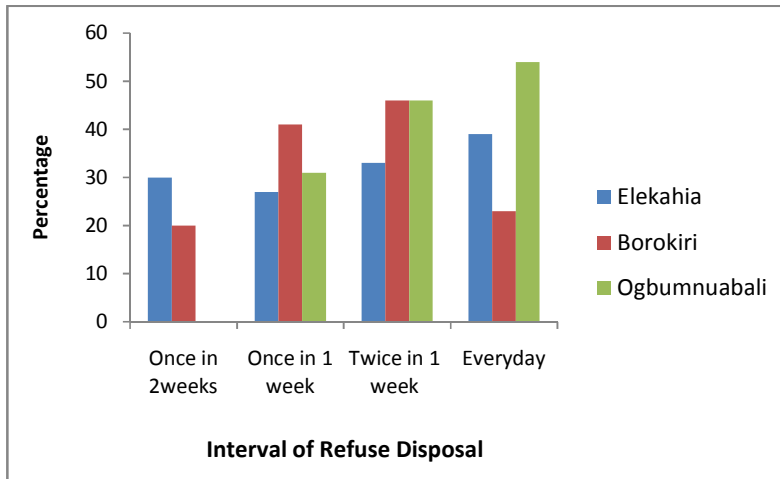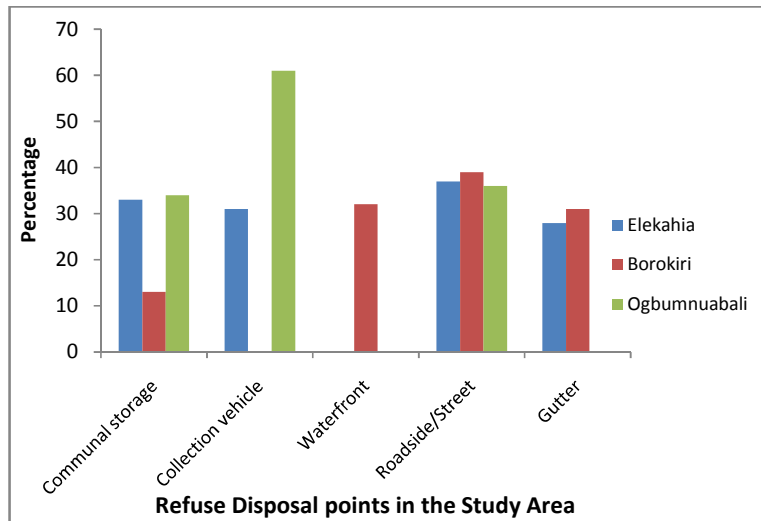
Fig. 1. Interval of refuse disposal

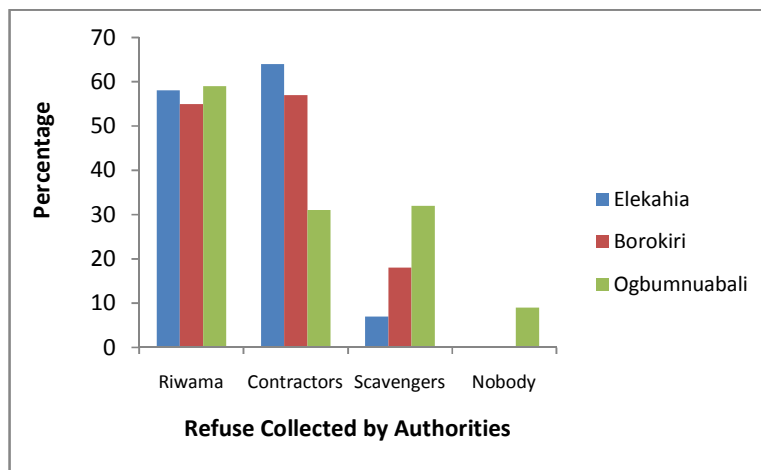**Fig. 2. Refuse disposal points in the study area**
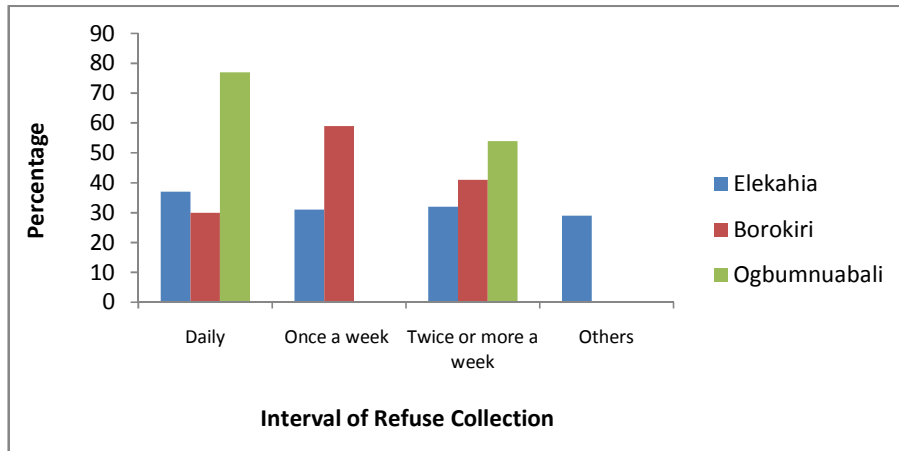

Fig. 3. Refuse collection by authorities

Stanley and Owhor; JGEESI, 16(2): 1-10, 2018; Article no.JGEESI.42325

Fig. 4. Interval of refuse collection
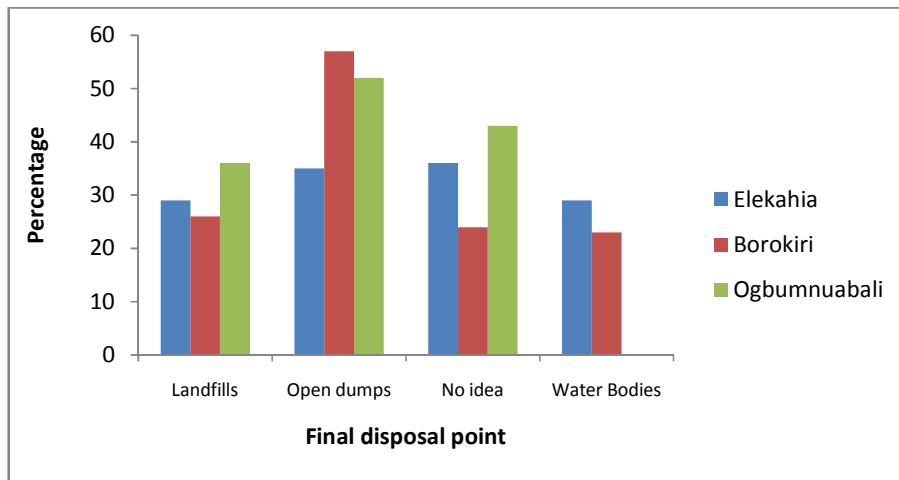
Fig. 5. Final disposal point

Table 4. Safety of final disposal

S/NO	Response	Elekahia	Borokiri	Ogbumnuabali	TOTAL	%
1	Very safe	8		51	59	15.1
2	Not safe	65	74	44	183	46.9
3	No idea	56	56	36	148	37.9
	Total	129	130	131	390	99.9

Table 5. Grading of waste disposal system

S/NO	Grade	Elekahia	Borokiri	Ogbumnuabali	Total	%
1	Good	-	13	28	41	10.5
2	Very good	-	15	19	34	8.7
3	Average	40	13	33	86	22.1
4	Bad	43	25	28	96	24.6
5	Very bad	46	49	23	118	30.3
6	Others	-	15	-	15	3.8
	Total	129	130	131	390	100

Table 6. Knowledge of waste management policy

S/NO	Responses	Elekahia	Borokiri	Ogbumnuabali	Total	%
1	Yes	58	47	80	185	47.4
2	No	71	83	51	205	52.6
	Total	129	130	131	390	100

Table 7. Effectiveness of the solid waste management policy

S/NO	Response	Elekahia	Borokiri	Ogbumnuabali	Total	%
1	Yes	54	48	58	160	41.0
2	No	75	82	73	230	59.0
	Total	129	130	131	390	100

Table 8. Ineffectiveness of solid waste management policy

S/NO	Response	Elekahia	Borokiri	Ogbumnuabali	Total	%
1	Poor implementation	48	65	54	167	42.8
2	It's too rigid	-	-	39	39	10
3	Lack of awareness	42	32	38	112	28.7
4	No idea	39	33	-	72	18.5
	Total	129	130	131	390	100

4. DISCUSSION

The present study looked at the problem of poor waste management in Port Harcourt metropolis. Results showed that more females were sampled in the study. The dominance of female respondents in this study is a reflective of their role in handling domestic affairs which are considered gender centered. Women are commonly reported to perform the jobs of mowing the lawn or taking out the refuse better than their partners, and as a result, taken the responsibility of finishing these projects themselves [7]. A study conducted on the nexus between gender, education and health, recognized the pivotal role of women in household cleanliness and sanitation [8].

The study also revealed that a sizeable number of the respondents numbering two hundred and twenty-nine (58.7%), attended college of education or nursing school, while those that attended secondary school education were 91 (23.3%), and those that attended university 70 (17.9%). Formal education is an indication of a high level of awareness of oneself and the environment. This should translate to willingness to implement waste management policies in a given society. The results indicated otherwise. In work reported by Banga [9] household knowledge of solid waste segregation in Urban Kampala showed that only about 17.5% of the

respondents had gained tertiary education and 43.8% gained secondary education, while 30.5% had primary education. Surprisingly, even with the huge number (205) of respondents with tertiary education (52.6%) were not aware that there was a policy on waste management while 185(47.4%) said they knew about the policy but are not so sure what it entails. Binafeigha and Enwin [3] in their appraisal of solid waste management practices in Enugu City, reported that 69% of the respondents knew nothing about waste management policy. This is worrisome again because Enugu like Port Harcourt is a major city in Nigeria. Adeyemo and Gboyesola [10] however reported on knowledge, attitude, and method of managing waste for people living in Ogbomoso town and found that the respondent knew enough about management of waste and its policy. The fact that majority of respondent in the study have adequate knowledge of waste management policies did not translate to better compliance. This goes to show that beyond knowledge of waste management policies, attitudinal change and responsiveness to matters relating to environmental health could push for better waste management practices among individuals.

A total of 137(35.1%) respondents collected their waste in plastic cans and all of them do not split their waste before disposing it. This is in congruence with the study conducted by Modebe

and Ezeama [11] which reported that eighty-five percent of residences in Awka keep their waste in closed bins outside the house and most of the respondents (87.8%) did not bother to separate their waste before disposing. In the study conducted by Adogu et al. [12], 51.4% collected their waste in containers with cover and majority (88.3%) did not separate also. A large volume of waste collected in Africa is not sorted before disposal [13]. Sorting of waste ensures that recyclable material are separated and reused.

A major part of the residents in Port Harcourt dispose their waste twice a week 123(31.5%) the reason being due to convenience, however accumulating of waste for a long time leads to susceptibility to infections and diseases, also a large number of the residents get rid of their waste by the road side and in street corners 112(28.7%). Most of the residents get rid of their waste through the Rivers State waste management agency 172(44.1%). This outcome agrees with Modebe and Ezema [11], which reported that most of the inhabitants in Awka (73%) get rid of their waste through government waste management agency.

The most popular method of waste disposal known to the respondents 144(36.9%) was open dumping. This was followed by 103(26.4%) of the respondents who had no idea where their refuse was disposed, while those that thought their refuse was disposed on a Landfill were 91(23.3%). This outcome is in congruence with the findings in other research, as open dumping is still the easiest and the most ordinarily used approach for solid waste disposal in areas with low to medium income especially the third world countries [14]. Adogu et al. [12] reported that 66.3% of respondents in Owerri municipality use open dumping as their preferred method of waste disposal in spite of the fact that the same study reported that 90% of respondent were aware of waste management practices. While wastes are deposited in open dumps in developing countries; these have become obsolete in the developed countries. Sanitary landfills which are well engineered facilities (with liners, leachate collection/ treatment system, and gas collection system) are currently used to safeguard human health and protect the environment. In the present study, 23.3% of the reported final disposal method for waste ended up in landfills. In some parts of Nigeria, where landfills are available they are usually the unsanitary type which are not subject to regulations, created from

sand mining activities into which waste could be deposited [15]. Aderemi and Falade [14] posited that landfills in Nigeria are better categorized as open dumps, sited for convenience and usually involve the pitching of waste in pre-existing pits. In Lagos Nigeria largest city, some of these open pits are situated near residential buildings, hospitals and hence pose a threat to human health and the environment. Also a South African research discovered that out of the five million tons of waste produced annually; only five percent is gotten rid of in an appropriate location, which means that majority of the waste generated in that country is gotten rid of in an unsuitable environmentally unsafe location [13].

A great percentage of the respondents had a negative perception on the safety of the final waste disposal system as 183(46.9%) felt the final disposal point was not safe while 37.9% had no idea about the safety of the final disposal point. Also respondents agreed that if disposal of waste is done properly it can help improve their standard of living and 118(30.3%) graded the current waste disposal system as very bad while 86(22.1%) felt it was average, all the respondents acknowledged that properly disposed waste and collection system can promote good health and create a serine surrounding and that the current system need major improvement. This is similar to the research of Adeyemo and Gboyesola [10] which revealed that respondents around the University of Ogbomso had a hope towards improved waste management, as 82% agreed that improper waste disposal can impact on their health. Similarly, 97.5% of respondents in Owerri municipality agreed that proper waste management can better their lives [12]. Again studies have shown that having the right attitude among a few person does not generally lead to improved waste management or that knowing that the final waste disposal system is not safe does not stop bad waste management practices.

Majority of the respondent in this study do not have Knowledge of the Waste Management Policy and considered it ineffective. In a similar study conducted by Elenwo [16] it was observed that solid waste management in the city of Port Harcourt was ineffective and unskilled manpower, lack of finance, inadequate enlightenment on the policy, and ambiguity of the environmental laws were identified as impediments.

Inadequate sanitation can charge the environment with overload of wastes which can make humans susceptible to disease, particularly when waste is not properly managed to check breeding of disease vectors [10]. One of the limiting factors in the environmental and waste management policies in this country has been the lack of implementation. Reasons ranging from ignorance to negligence had been adduced for this attitude. The problem must be tackled head-on to create an environment relatively free from waste pollution and degradation.

5. CONCLUSION

In the government policy document on waste management, it is stated that no person shall dispose waste in a manner that is likely to have adverse impact on the environment or be harmful to health. As clear as this sound, the manner of waste disposal in the city of Port Harcourt does not appear to give consideration to the impact it has on health and environment. Waste management in Port Harcourt has not reached acceptable standard of orderly collection, transportation, processing, treatment and disposal as shown in this study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Almquist S, Barnsley K. Biodegradable municipal solid waste in Santo Domingo de Heredia. Worcester Polytechnic Institute. 2008;1.
2. Amalu TE, Ajake AO. Appraisal of solid waste management practices in Enugu City. Journal of Environment and Earth Science. 2014;4(1):97-105.
3. Binafeigha TR, Enwin A. The state of solid waste management in Port Harcourt City, Nigeria. American Journal of Civil Engineering and Architecture. 2017;5(4): 160-166.
   DOI: 10.12691/ajcea-5-4-4
4. Igoni AH, Ayotamuno MJ, Ogaji SOT, Probert SD. Municipal solid-waste in Port Harcourt, Nigeria. Appl. Energy. 2007;84: 664-670.
5. Buclet N. Municipal waste management in Europe: European policy between harmonisation and subsidiarity. Waste Management. 2002;33(1): 220-232.
6. Ajie UE, Dienye A. Spatial data analysis of solid waste management system in Port Harcourt metropolis after 100 years of its existence. XXX International Federation of Surveyors Congress, Kuala Lumpur Malaysia; 2004 (16-21 June).
7. Hewitt B, Baxter J, Givans S, Murphy M, Myers P, Meiklejohn C. Final report on "men's engagement in shared care and domestic work in Australia". The Social Research Centre and the Institute for Social Science Research, University of Queensland Office for Women, Department of Families, Housing, Community Services and Indigenous Affairs, 15 October, 7 November 2010, 4-82.
   Available:http://www.environmentalistsever yday.org/issues-solid-waste-technologies-regulations/landfills-garbage-disposal/index.php
8. Mattos TV, MacKinnon MA, Boorse DF. The intersection of gender, education, and health: A community-level survey of education and health outcomes for women in Southeastern Togo Gordon College. BIO381Public Health Research. 2012;1-22.
9. Banga M. Household knowledge attitudes and practices in solid waste segregation and recycling: The case of Urban Kampala. Zambia Social Science Journal. 2013;2:27-39.
10. Adeyemo FO, Gboyesola GO. Knowledge, attitude and practices on waste management of people livingin the University Area of Ogbomso, Nigerian. International Journal of Environment Ecology, Family and Urban. 2013;3:51-56.
11. Modebe I, Ezeama NN. Public Health Implication of Household Solid Waste Management in Awka South East Nigerian. The Journal of Public Health. 2011;1.
    DOI: 10.5580/265d
12. Adogu POO, Uwakwe KA, Egenti NB, Okwuoha AP, Nkwocha IB. Assessment of waste management practices among residents of Owerri municipal Imo State Nigeria. Journal of Environmental Protection. 2015;65:10-18.
13. Ogola JS, Chimuka L, Tshivhase S. Management of municipal solid wastes: A case study in Limpopo Province, South Africa, Integrated Waste Management. 2011;I.

Available:http://www.intechopen.com/book s/integrated-waste-management-volume-i/management-of-municipal-solid-wastes-a-case-study-in-limpopo-province-south-africa

14. Aderemi AO, Falade TC. Environmental and health concerns associated with the open dumping ofmunicipal solid waste: A Lagos, Nigeria Experience. American Journal of Environmental Engineering. 2012;2:160-165.
Available:http://dx.doi.org/10.5923/j.ajee.2 0120206.03

15. Taylor R, Allen A. Waste disposal and landfill: Potential hazards and information needs. In: WHO, World Health Organization (Eds.), Protecting Groundwater for Health: Managing the Quality of Drinking Water Resources. 2006;339-360.

16. Elenwo EI. Solid waste management practices in Port Harcourt Metropolis: Problems and prospects. Journal of Geographic Thought & Environmental Studies. 2015;13(1):60–81.