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Solid Waste Management Practices and Risk Factors in Orji, Imo State, Nigeria

✉**Obinna I. OKEKE, Ayomiposi O. AKINKUOLIE, Amarachi N. UGWUJA**
Department of Biology, Adeyemi College of Education, Ondo, Ondo State, Nigeria
Corresponding Author: email: okekeoi@aceondo.edu.ng

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Abstract

The study to assess the impact of solid waste management practices and risk factors in Orji, Imo State, Nigeria was carried out to identify the solid waste management practices predominant in the area and their risk factors. Data for this study were collected using questionnaires distributed to 200 respondents and waste dumpsites were also visited. The respondents were selected using random sampling technique. The study was a cross-sectional descriptive study and the study area was categorized into groups. The questionnaire focused on information such as types of waste generated, methods for waste collection, treatment, disposal and possible impact of waste disposed on the environment and residents. The result for the type of waste generated indicated that 91.0% of the respondents identified kitchen/organic waste as the major waste generated and the least generated waste items were medical waste with 39.5%. The result for the waste management practices showed that the respondents do not sort waste, practice open dumping and do not dispose waste immediately. The result also showed that the respondents indicated that waste breeds vectors which also frequent houses. The type of diseases associated with the waste management practices according to the respondents include: malaria, food/water borne diseases, skin infections and respiratory disorder. The study concluded that wastes are not properly managed in the area and the practices have environmental and health risk implications. It is recommended that waste should be properly managed and dumpsites be properly located to minimize its effects on humans and the environment.
Keywords: Solid waste, solid waste management, risk factors.

Introduction

Solid waste can be defined as discarded solid materials from households, industries, healthcare facilities, construction sites, and agricultural ventures, commercial and institutional activities. Solid waste generated in a city is often referred to as municipal solid waste. United Nations Glossary of Environmental Statistics (1997) defined solid waste as any useless and sometimes hazardous material with low liquid content; it includes municipal garbage, industrial and commercial waste, sewage sludge, waste resulting from agricultural activities, demolition and mining waste. Organization for Economic Cooperation and Development (OECD) (2020)

defined municipal solid waste in the same vein but excluded wastes from construction and demolition as well as sludge from sewage and wastewater treatment. For this study, the solid waste characterization by OECD was adopted. Construction waste and sludge from sewage were not characterized as solid wastes because they are not disposed using the same methods as like other solid wastes. Solid or municipal solid waste management can be defined as the planning, financing and implementation of programs for solid waste collection, transportation, treatment and final disposal in an environmentally and socially acceptable manner (United Nations Glossary of Environment Statistics, 1997). Failure to comply to set standards at any of the different stages constitutes "poor solid waste management".

Solid waste management practices differ across regions, countries and even within a country (UNEP and CalRecovery Inc, 2005; Hoornweg and Bhada-Tata, 2012;). Reduced waste generation, re-use, recycling, composting, and safe disposal through landfills are encouraged in modern approaches to solid waste management; however, they are often not practiced (Ziraba *et al*., 2016). In most developing nations, a bulk of waste is not re-used. Waste sorting is rarely practiced and this makes it difficult to re-cycle. As a result, a large proportion of solid waste in developing countries is disposed of on open dump sites and many times burnt (CalRecovery Inc, 2005; Gusti, 2009; Hoornweg and Bhada-Tata, 2012; UNEP and UNEP, 2013). Differences in waste management practices are most times a reflection of existing laws and policies governing waste management and extent of their enforcement, availability of funds, composition and quantity of waste generated (Hoornweg and Bhada-Tata, 2012). Solid waste management is the responsibility of both the municipal authorities and private providers in most developing countries (UNEP and CalRecovery Inc, 2005). Solid wastes are mostly collected source or temporary dumping ground, and are disposed finally at an open dumping site on the outskirts of cities. The final dumping sites are often large open grounds where trucks deposit the waste. Dumped waste both at source and at final point of disposal are often scavenged for re-usable items and recyclable materials. Bulk of the waste are most times burnt to reduce the quantity. Solid waste composition can be complex and may contain industrial, medical, electronic, and human waste dumped on the same open grounds where all the other municipal waste is dumped (Osibanjo and Nnorom, 2007).

In epidemiology, a risk factor is a variable associated with an increased risk of disease or infection (Parritz, 2017). Health and wellbeing are affected by many factors, those linked to poor health, disability, disease or death, are known as risk factors. A risk factor is anything that increases the likelihood of getting a disease or injury. In general, risk factors can be categorized into the following: behavioural, physiological, demographic, environmental and genetic (WHO, 2009). Behavioural risk factors are related to actions that individuals or group of individuals take and can be eliminated or reduced through lifestyle or behavioural choices. Environmental risk factors include physical, chemical and biological factors as well as, social, economic, cultural and political factors (WHO, 2009).

The inter-linkage between poor solid waste management which is associated with behavioural and environmental risk factors and adverse health outcomes may be overt and direct but may also be indirect and not obviously linkable to poor health outcomes of a population. Inappropriate solid waste management practices pose health and environmental risks and dangers to persons or group of people. Decomposition of solid waste in dumpsites release methane which

has a green house effect and contributes to climate change (Alam and Ahmade, 2013). The group at risk from the unsanitary disposals of waste include – the population in areas where there is no proper waste disposal method, especially the pre-school children; waste workers; and workers in facilities producing toxic and infectious materials. Other high-risk group includes population living close to a dumpsite and those, whose water supply has become contaminated either due to waste dumping or leachates from landfill sites (Vrijheid, 2000). The health effects of poor waste management are well known and the people are ready to pay for improvements towards proper waste management and a cleaner environment (Rathi, 2006). Some risk-factors of indiscriminate solid waste disposal include: breeding of rodents and insects that are disease vectors as well as; outbreak of food and water-borne diseases. Refuse dumps give rise to smog and air pollution when burnt openly. Leachates from refuse dumps can also contaminate underground water (Chadar and Keerti, 2017). Indiscriminate dumping of refuse along drainages, streams and river courses pollute water bodies, poison aquatic life and cause environmental degradation.

There are difficulties associated with assessing health impacts related to waste management practices including the complex composition of wastes, interactions between hazards during waste management and latency between exposure to waste and onset of symptoms of some diseases. Furthermore, epidemiological studies of the impact of waste management practices on health typically rely on indirect exposure data, including emissions data or household proximity to waste management facilities, and are unable to make accurate exposure assessments which are required to determine causation (Rushton, 2003; Saffron *et al.*, 2003). Notwithstanding the difficulties in demonstrating a causal link between waste management practices and health conditions, potential health issues associated with the handling, treatment and disposal of waste have been identified (Giusti, 2009). Studies in different parts of Nigeria have centered on impact of solid waste management only, while some have also determined their public health implications. Aguoru and Alu (2015) studied waste management practices in Makurdi, North Central Nigeria. The findings of the study showed that wastes were disposed using inappropriate methods like littering on the streets, gutters, underdeveloped plots, or dumped into water bodies by riverine communities. The propensity to throw collected solid waste away from the point of generation as reported by Aguoru and Alu (2015) showed that people generally exhibit the Not-in-my-Backyard (NIMBY) syndrome reported by Olokesusi and Adeagbo (2004) in the survey carried out in rural communities in Ibadan. According to Nabegu (2010) households accounted for more than 50% of solid waste generated in Kano State. The finding of the study further revealed the presence of bacterial isolates in the waste samples (Nabegu, 2010). The presence of bacterial species on wastes was also shown in Achudume and Olawale (2007) who observed *Pseudonomas, Micrococcus, Actinomyces, Neisseria, Bacillus* and *Klebsiella* species of bacteria in the waste dumpsites studied. Infectious diseases associated with poor waste management are malaria, cholera, typhoid fever and skin infections (Badejo and Badejo, 2019; Suleman *et al*., 2015). It was also revealed that people residing around waste dumpsites are susceptible to these diseases (Badejo and Badejo, 2019). In Sierra Leone, a study by Sankoh *et al*., (2013) revealed that many residents living around dumpsites know that these dumpsites not only cause diseases, but are also breeding ground for vectors of diseases as well as reduce the aesthetic quality of their surroundings. Improper solid waste management practices have adverse effect on human health and the environment. Proper handling of waste especially from the point of generation to the location of disposal involves steps and processes and if not carefully followed can lead to perilous situations.

Solid waste management and disposal is a challenge that successive government agencies in Imo State have tried to surmount. Existing facilities like street bins, collection trucks and landfills seem inadequate to serve the ever increasing populace. The solid waste generated within Owerri Metropolis is enormous. Authorities encounter many difficulties like increase in waste generation due to rural-urban migration and urbanization, town planning deficit and poor road network in their quest to properly manage solid waste within the Metropolis. This has made many residents to lose confidence in the capacity of authorities to adequate manage waste. People now resort to open dumping in abandoned plots, pavements/road demarcations and street junctions. Designated waste collectors in many areas are overflowing and residents dump refuse on the ground around the collectors (Fig. 1). This study thereby seeks to assess the impact of solid waste management practices and risk factors in Orji, Owerri North, Imo State, Nigeria.

A **B**

Fig 1: Waste dumpsites; A - Refuse receptacle filled to the brim at Nkwo, Orji market; B - Refuse dump site close to student hostels in Ama-wire.

Methodology

Study area

The study was carried out in Orji, Owerri North, Imo State, South-Eastern Nigeria from June to September, 2017. Orji is located within 5.4682^{o}N and 7.0176^{o}E and has an average temperature of 26.4 °C. It is a sub-urban area, with many dwellers from all parts of the country. Orji is a semi commercial area with a popular central market called Nkwo Orji market. There are a high concentration of residential buildings, churches, schools, hospitals, clinics, pharmacies and maternities, shops, restaurants, eateries, bars and automobile workshops in the study area.

Preliminary Visits

Preliminary visits were carried out for a period of two weeks (23rd June, 2017 to 7th July, 2017). Five (5) major dumpsites within the study area were visited. The assessment of waste generated around the study area was done from 23rd to 28th June. Permission was also obtained from the respondents in form of consent. The visits were carried out to ascertain the reliability of the research instrument of data collection.

Study design

The study design was a cross-sectional descriptive study. The various categories/sections of the study area were visited on a weekly basis. The categories were grouped as:

1. Residential buildings and schools (Group A)
2. Eateries (bars and restaurants) (Group B)
3. Mechanic Workshops (Group C)
4. Hospitals and Clinics (Group D)
5. Markets and Stores (Group E)

Sample and Sampling Technique
The samples for the study were 200 residents and business operators staying around dumpsites using a systematic random sampling technique. Respondents were randomly selected 500m radius equidistance from each dumpsite.

Data collection
The data was collected by the use of questionnaires, surveys, observations and also interviews. The questionnaire was administered to a total of 200 respondents. Questionnaires were designed to obtain information such as types of waste generated, methods for waste collection, treatment, disposal and utilization, possible impact of waste disposed on the environment and residents.
The questionnaires were administered using the contact and collect method in which the researchers personally delivers and collects the questionnaires. The questionnaires were administered in English language only. Key informant interviews and participant observations were also conducted to complement the questionnaire technique.

Data Presentation and Analysis
The data was analyzed using quantitative and qualitative methods to discuss the findings of the study. Quantitative data were derived from the structured questionnaires and were presented using tables and simple percentages. Qualitative data included data from dumpsite visits, observations and interviews of some residents.

Results and Discussion

The result for the type of waste generated by the respondents in the different groups showed that 91% of the respondents indicated that they generate kitchen/organic waste, 84% generate plastics while 81.5% generate nylon/polythene bags. The least generated waste items by the respondents is used cloths/shoes (40.5%) and medical waste (39.5%) as presented in Table 1. This result agrees with the findings of UNEP (2013) that kitchen waste, plastics and polythene are the most generated household waste materials. Alam and Ahmade (2013) observed that the decomposition of the organic wastes by the anaerobic activities of some bacterial species produces an unpleasant smell and can release high quantity of methane (CH_4) into the environment. The high occurrence of kitchen/organic wastes, plastics and polythene in the visited dumpsites also collaborate the response of the respondents. Decomposing wastes in the form of food remnants and discarded fruits and vegetables were noticeable in the dumpsites, with its attendant pungent and repulsive smell.

Group A, B and E contributed more than 80% of the plastic, nylon and polythene waste. This can be attributed to the constant purchase and subsequent discarding of consumables in plastic containers and the packaging of goods in polythene or nylon bags after purchase. Used shoes and

clothes are not readily discarded as waste, while medical wastes are discarded by specialized entities like those in Group D and A.

Table 1: Categories (Groups) and type of waste generated

VARIABLES	Group A (N=40)	Group B (N=40)	Group C (N=40)	Group D (N=40)	Group E (N=40)	TOTAL (N=200)
PAPER	40 (100)	25 (62.5)	11 (27.5)	32 (80)	40 (100)	148 (74)
METALS/TINS	38 (95)	5 (12.5)	40 (100)	23 (57.5)	20 (50)	126 (63)
PLASTICS	38 (95)	35 (87.5)	24 (60)	31 (77.5)	40 (100)	168 (84)
KITCHEN/ORGANIC WASTE	40 (100)	40 (100)	32 (87.5)	30 (75)	40 (100)	182 (91)
USED CLOTHES AND SHOES	28 (70)	9 (22.5)	21 (52.5)	15 (37.5)	8 (20)	81 (40.5)
NYLON AND POLYTHENE	38 (95)	33 (82.5)	22 (55)	30 (75)	40 (100)	163 (81.5)
MEDICAL WASTE	22 (55)	0 (0)	5 (12)	40 (100)	12 (30)	79 (39.5)

The result for the predominant waste management practice in the area showed that 98% of the respondents practice open dumping as a means of refuse disposal, while 2% indicated that they incinerate their waste (Table 2). This agrees to the findings of Aguoru and Alu (2015), UNEP, (2013) and Isu (2005) that majority of the inhabitants of cities and towns in developing countries and third world countries practice open dumping as a means of waste disposal. It is common practice among people to always dump waste away from point of generation like houses and shops and was also observed by Aguoru and Alu, (2015). Wastes were seen dumped on road demarcations, street junctions and abandoned plots. This shows clearly the Not-in-my-Backyard Syndrome reported by Olokesusi and Adeagbo (2004). Over 90% of the respondents indicated lack of satisfaction with the dumpsite location. It was observed by Rathi (2006) that people are readily willing to pay the price for proper waste management and a cleaner surrounding. Dumpsites when not properly sited and managed, cause dissatisfaction and reduces the aesthetic outlook of the environment.

Waste as shown by the findings of Isu (2005) encourages the breeding of vectors (insects, rodents, etc). The result of this study shows that all the respondents indicated that waste encourages the breeding of vectors (Table 3). The result also shows that houseflies, mosquitoes, cockroaches are vectors that breed on and around waste dumps. The implication of this is that with the breeding of these insects in the dumpsites close to human dwellings, there is a very high tendency for the outbreak of diseases associated with the insects since they frequent human settlements as indicated by 99% of the respondents (Table 3). The dumping of wastes around densely populated areas has serious epidemiological implications and was also reported by Sankoh *et al*., (2013).

Table 2: Waste management practices of the groups.

Waste Management Practices	Group A (N=40)	Group B (N=40)	Group C (N=40)	Group D (N=40)	Group E (N=40)	TOTAL (N=200)	Percentage (%)
Waste Sorted Before Disposal							
Yes	0	0	0	2	0	2	1
No	40	40	40	38	40	198	99
Method Of Waste Disposal							
Open Dumping	40	40	38	38	40	196	98
Incineration	0	0	2	2	0	4	2
Land filling	0	0	0	0	0	0	0
Satisfaction With Location Of Dumpsite							
Yes	0	0	11	5	0	16	8
No	40	40	29	35	40	184	92
Waste Disposed Immediately (Daily)							
Yes	2	22	0	35	0	59	29.5
No	38	18	40	5	40	141	70.5
Storage Of Waste	Group A (N=38)	Group B (N=18)	Group C (N =40)	Group D (N=10)	Group E (N=40)	Total (N=141)	
Waste Bin Inside the House	20	10	15	5	29	79	56.0
Waste Bin Outside	18	8	25	0	11	62	44.0
Dumpsite Distance From Residence							
100m	13	0	31	7	10	61	30.5
200m	10	12	6	9	13	50	25
300m	0	10	1	20	1	32	16
500m	9	10	1	4	10	34	17
More Than 500m	8	8	1	0	6	23	11.5

This study has also revealed that children of 36.5% of respondents play on or around the waste dumpsite (Table 3). Though the number is not up to 50%, it is nonetheless of public health importance as various types of diseases and ailments can be contacted by the children and which can be spread around the area. Injuries can also be inflicted on the children by sharp and improperly disposed and infected medical waste. The vulnerability of children to harm from improper waste management practices was also reported by Vrijheid (2000).

Table 3: Risk factors of the waste management practices

Risk Factors	Group A (N=40)	Group B (N=40)	Group C (N=40)	Group D (N=40)	Group E (N=40)	TOTAL (N=200)	Percentage (%)
Waste Breeds Vectors							
Yes	40	40	40	40	40	200	100
No	0	0	0	0	0	0	0
Total	40	40	40	40	40	200	100
Type Of Animal/Insect							
Mosquitoes	40	32	28	40	40	180	90
Houseflies	40	40	40	40	40	200	100
Cockroaches	40	40	26	25	30	161	80.5
Rats	33	40	31	22	28	154	77
Vectors Frequent Your House							
Yes	40	40	40	38	40	198	99
No	0	0	0	2	0	2	1
Total	40	40	40	40	40	200	100
Children Play On The Dumpsite							
Yes	23	13	12	5	20	73	36.5
No	17	27	28	35	20	127	63.5
Total	40	40	40	40	40	200	100
Domestic And Farm Animal Graze Around The Dumpsite							
Yes	35	38	33	32	34	172	86
No	5	2	7	8	6	28	14
Total	40	40	40	40	40	200	100
Foul Smell Emanates From The Dumpsite							
Yes	40	40	40	40	40	200	100
No	0	0	0	0	0	0	0
Total	40	40	40	40	40	200	100

The danger in the transfer of zoonotic diseases can be seen from the result in Table 3, where it was indicated by 86% of the respondents that both domestic and farm animals graze and move around the dumpsites. Gusti (2009) reckoned that food chains can be contaminated when waste

is not properly disposed. Consuming contaminated animal carcass can lead to food poisoning, Lassa fever, gastro-intestinal infections, to mention a few.
The diseases and ailments associated with the waste management practice of the area are malaria, skin infections, food and water borne diseases, respiratory disorders and gastro-intestinal helminth infections, as seen in Table 4. This is consistent with the findings of Boardi and Kuitunen (2005), Achudume and Olawale (2007) and Sankoh *et al*., (2013), which confirmed that different diseases and infections are associated with waste and waste management practices as well as other environmental pollutants. Disease vectors like mosquitoes and houseflies use dumpsites as breeding grounds and they transmit diseases such as malaria and dysentery to people living around waste dumpsites.

Water sources (both surface and underground) can be contaminated or polluted through runoffs and leachates. Food can be contaminated by houseflies, cockroaches and even rodents. Food and water borne diseases like Typhoid, Lassa fever and gastro intestinal disorders can be transmitted by drinking unclean water and eating contaminated food. Suleman *et al*. (2015) and Badejo and Badejo (2019) also reported that dumpsites are associated with the spread of diseases. Malaria, typhoid fever, skin infections and cholera are the diseases associated with poor solid waste management in the tropics (Suleman *et al*., 2015).

Table 4: Disease associated with waste management practices

Diseases and mode of transmission	Frequency	Percentage (%)
Diseases		
Malaria/other insect borne infections	178	89
Food/Water Borne Diseases	102	51
Lassa Fever	98	49
Helminth Diseases	76	38
Allergies	45	22.5
Skin Infections	105	52.5
Respiratory Disorders	130	65
Mode Of Transmission		
Vector Bite	170	85
Contact with Waste/Contaminated Animal	86	43
Food/Water Contamination	154	77
Airborne Particles	78	39

This study concludes that solid wastes are not properly managed in Orji, Owerri. Open dumping of waste around residential and commercial buildings is still predominantly employed. The improper waste management practice of residents in the area has serious human health effects

and environmental implications. It is against this backdrop that the following recommendations are made;

- Dumpsites be properly located and managed to minimize its effects on humans and the environment.
- Government agencies saddled with the responsibility of waste management should be consistent and diligent in evacuating and proper clearing of dumpsites located in residential areas.
- Waste bins and larger containers should be covered with lids. This will mitigate the risk of disease transmissions through insects and other vectors.
- Efforts to provide low-cost houses situated in a clean environment is a priority that the government must pursue vigorously to enable the poor to live in affordable yet clean environment.
- People need to be educated by Sanitation and Environmental Health Officers on the effects of poor waste management practices on their health and the environment.
- Proper sorting of waste should be encouraged at the source of generation. This will help in isolating reusable items like plastic containers and others that can be recycled.
- Open burning of waste containing hazardous materials which can release dangerous chemicals and particles that can pollute the atmosphere should be minimized. This will help in reducing the risks of respiratory infections.

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