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Perceived Environmental Health Effects of Clinical Waste Disposal in Ahoada Local Government Area of Rivers State Nigeria

Oye Ideki[1*], Obiri Madubuchi[2], Boxe Christopher[3] and Ukpere, D.R.T[4]

[1]*Atmospheric Science program, interdisciplinary studies , Howard University Washington DC, USA*

[2]*Department of Geography and Environmental Management, Ignatius Ajuru University of Education, Port Harcourt Nigeria*

[3]*Department of Earth, Environment and Equity Howard University Washington DC, USA.*

[4]*Department of Geography and Environmental Management Ignatius Ajuru University of Education Port Harcourt Nigeria*

***Corresponding author**

Oye Ideki,
Department of Soil, Environmental and Atmospheric Sciences,
School of Natural Resources,
University of Missouri Columbia

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Abstract

The study examined the perceived health effects of clinical waste disposal in Adoada East Local Government Area of Rivers State, Nigeria on people. Purposive and random sampling techniques were employed for the collection of the data set comprising a sample size of 184 respondents selected from health/medical personnel, cleaners in health facilities, waste handlers, nurses, midwives, and doctors through structured questionnaires including basic statistical techniques using a criterion of 2.50 on the 4-point Likert scale. The result of the various analyses conducted revealed that the major types of waste generated from hospitals and medical facilities are needles, syringes scalpels, blades, and lancets, including placentas and other human tissues as well as papers, plastics, and glasses. The analysis from the returned questionnaires further indicates that the main methods of clinical waste disposal and treatment of used medical instruments/tools (autoclaving) include open burning of clinical wastes such as paper, plastic, cans, etc. The implications of the observed poor and inappropriate disposal of clinical waste in the study area include a high risk of infection among health/medical personnel and the spread of communicable diseases in the neighborhood. Given the depth of the analysis and the results generated, the study recommends the deployment of more qualified medical and para-medical personnel to the local government health facilities and the provision of modern equipment to tackle the rising cases of infectious diseases and community health associated with improper clinical waste disposal in the study area.

Keywords: Environmental Health effects, Clinical waste, Disposal Practices, Ahoada East, Rivers state, Nigeria

Introduction

Clinical wastes generated from healthcare services and activities are on the rise globally given the prevalence of diseases and the increasing number of people seeking medical attention. These medical wastes which are highly infectious constitute health hazards both to human life and the environment due to exposure (Meshram & Mhatre, 2022). The impact of poor disposal of medical and clinical waste includes environmental pollution, reduction in air quality due to unpleasant smell leading to multiplication of insects, rodents, and worms, and eventual transmission of diseases like typhoid, cholera, and hepatitis through injuries from sharp objects contaminated with blood (Babanyara et al., 2013). Arising from above, it has become important for proper handling of clinical waste and disposal to reduce the risk of public health exposure and outbreaks of epidemics. A study conducted by the United States Environmental Protection Agency (USEPA 1990 and cited in (Awad & Bajari, 2018). affirmed that medical waste incinerators are the major source of dioxin and mercury pollution in the environment and food supplies. These wastes pollute the air, water, and land which in turn causes health challenges to the public. In the same vein, studies by (Abor & Anthon, 2008). revealed that hospital waste is a potential reservoir of pathogenic micro-organisms that require appropriate, safe, and reliable handling.

Clinical waste contains infectious diseases, gene-toxic, hazardous chemicals, or pharmaceuticals, radioactive, as well as sharp instruments such as lancets, pipettes, scalpels, trocars, etc. The generation of clinical or medical wastes generally emanates from healthcare establishments which include hospitals, clinics, outpatient surgery centers, pharmacies, nursing homes as well and veterinary centers where hazardous substances are generated. In addition, substances that are produced from research and development laboratories, also constitute a part of clinical wastes. Tissues of humans and animals from healthcare services whether dental, medical,

nursing, or veterinary practices, contain pathogenic agents/ organisms in large quantities and these are infectious. Bacteria and viruses can survive in the human environment on different surfaces and portend danger to any susceptible host who may meet the surfaces (US National Institute of Health, 2007).

(Abah & Ohimain, 2011). have observed that the gap resulting from inadequate documentation on the level of awareness of the nature of healthcare waste is of serious concern. Furthermore, they assert that the nature and quantity of healthcare waste as well as institutional practices about its management especially effective disposal has not been poorly investigated and reported in several countries including Nigeria. The management of healthcare waste from both human and veterinary practices involves the effective disposal, monitoring, and coordination of several activities of healthcare establishments. A case in point was the Ebola and Lassa virus outbreak in Nigeria in 2014 which made the World Health Organization (WHO) emphasize on proper disposal of healthcare waste including pathogenic agents that threaten healthcare workers and public safety if the wastes are not handled properly.

This all-encompassing definition of clinical waste provides a wider spectrum of healthcare solid waste to be included. This could be a result of technological advancement in human and animal medicine. Thus, different terms are now used to describe clinical waste but not underscoring the fact that they are highly hazardous to humans and the environment. Medical waste, healthcare waste, pathological waste, hospital waste, and clinical waste are used interchangeably. They are all hazardous because they contain substances that can cause permanent or temporary damage to human health and the environment (Marceta & Nadji, 2018). They are supposed to be disposed of in line with international best practices.

A concise definition of medical/health waste is provided by the "Basel Convention" of the United Nations Environment Program (UNEP, 1989) which categorized medical waste into hazardous waste implying that if this waste is not properly handled or disposed of could create health care concerns to medical personnel and the public the media (Mohee, 2005). The nature of medical/clinical waste and its associated disposal problems has now assumed an international dimension.

Incineration and sanitary landfills have emerged as the most common methods for medical waste management globally (Hong et al., 2018). In the United States, it was reported that more than 90% of medical waste was incinerated, which was one of the main sources (third largest) of dioxin emissions into the air according to the Environmental Protection Agency guidelines (EPA, 2020c). This unfortunate development prompted the U.S. Environmental Protection Agency (EPA) to implement stringent emission standards for medical waste incinerators under the Hospital Medical Infectious.

A recent study conducted on improper disposal of medical waste indicates that more than half of the world population is vulnerable to threats associated with environmental pollution and public health due to unsafe disposal of healthcare waste which was compounded by the COVID-19 Pandemic (Pachauri et al., 2019; Harhay et al., 2009). Furthermore, unsafe disposal of medical waste in developing countries is also considered to be a severe cause of infectious diseases responsible for 0.4-1 million deaths each year (Williams et al., 2019). According to the World Health Organization (WHO), the number of new infections of hepatitis B, hepatitis C, and HIV caused by contaminated syringes have been 21 million, 2 million, and 260,000, representing almost 32%, 40%, and 5% of all new infections, respectively (WHO, 2018). In addition, a study of 24 countries with economies in transition showed that 18% to 64% of healthcare institutions do not use proper medical waste disposal techniques. The report concluded that, on average, only 58% of the facilities from 24 low-income countries had adequate safe disposal of healthcare waste. According to (Cebe et al., (2013), the implication of improper waste disposal handling and disposal manifests serious environmental pollution. For instance, fluid contamination, human and animal tissues, sharp instruments, pharmaceutical products/ drugs clinical materials (bandages and swabs) that are left in the sewage system can have effects on the natural ecosystem and this may further contaminate water sources. Some of them smell, thus, causing air pollution. Pollutants in these wastes can be spread by insects, rodents, or winds as well as rain or flood that may lead to the leakage of these substances through clinical waste-carrying materials thereby resulting in soil or groundwater pollution. The seabed from landfills and soil may also pose a major threat to the environment and fisheries.

Infectious waste accounts for 20% of the total waste from a healthcare facility (Marceta & Nadji, 2018). Medical waste through materials and accessories poses a risk to the environment and human health through blood or secretions of infectious patients or those used in autopsy, wound healing, surgical procedures, waste from the dialysis department, gloves infusion system, tissue materials with visible blood presence, used swabs, needles syringes after parenteral drug delivery, disposable scalpels, paper, towels with traces of blood and waste containing pathogenic biological agents are of serious public health concern. (Marceta & Nadji, 2018). This view agrees with Omah, (Nazli, & Karuppannan, 2012) that 10 to 25 percent of hospital waste is regarded as hazardous and may create a variety of health risks.

In Nigeria, a couple of policies and regulations exist for the protection of public health and the environment, including the national policy on the environment as well as the national environmental sanitation policy. However, there was no national policy on healthcare waste management before September 2013 (Ezinm & Agbo, 2018). This is despite the public health risk associated with poor disposal and treatment of medical waste in the. In 2007 the national injection safety policy was developed as an outcome of the United States Agency for International Development (USAID)/ President's Emergency Plan for AIDS Relief (PEPFAR) project and the Medicaid Management Information System Injections Safe (MMIS), but the national Healthcare Waste management policy remained in

draft. The policy suffered a long bureaucratic delay before its approval in 2013.

The national healthcare waste management policy in 2013 aims at establishing efficient waste management practices across healthcare facilities in Nigeria. The policies then outlined how the government intends to manage waste generated in healthcare facilities to protect the public and the environment (Nwachukwu, et al., 2018). Since its approval, tremendous success has been recorded in the implementation of the policy across various levels of the healthcare system with emphasis on procedures of managing healthcare wastes including how they are disposed at the destination points. However, there is a dearth of research or information on the extent of implementation of this policy at the grassroots level. The focus of this study therefore is to investigate the perceived environmental effects of clinical waste disposal in Ahoada East Local Government Area of Rivers State Nigeria and this is where the research derives its relevance.

Aim and Objective of The Study

The study aimed to examine the perceived health effects of clinical waste disposal in Ahoada- East Local Government Area of Rivers State. Specifically, the study objectives include:

1. To determine the different types of clinical waste generated by health centers and hospitals in Ahoada- East local government area.
2. To examine the methods of disposal of clinical waste by health centers and hospitals in Ahoada East local government area.
3. To assess the common health diseases associated with poor disposal of clinical waste in Ahoada East local government area of Rivers State Nigeria.
4. To examine the agency of government saddled with the responsibility of ensuring an effective clinical waste disposal system in Ahoada East local government area.

Research Questions

The following research questions were raised to address the highlighted problems;

1. What are the types of clinical waste generated by health centers and hospitals in Ahoada East's local government area?
2. What are the methods of disposal of clinical wastes by health centers and hospitals in Ahoada East local government area?
3. What are the common health diseases associated with poor disposal of clinical waste in Ahoada East local government area?
4. How effective are the agencies concerned in managing clinical waste in the Ahoada East local government area?

Materials and Methods

The Study Area

The study was conducted in Ahoada East local government area of Rivers State, Nigeria as shown in figure 1 below. Ahoada East local government area is in the Orashi region of Rivers State, South-South Nigeria. It is one of the local government areas that constitute the Ekpeye Ethnic Nationality. The area lies between latitude 5°051 and 5°101N, and longitude 6°311 and 6°391E. It's approximately 492km2 in size. The area is bounded on the north by Ogba/Egbema/Ndoni local government area; on the East by Emuoha local government area; and in the west by Ahoada West local government area while the south is surrounded by Abua/Odual local government area shown in figure 1 below.

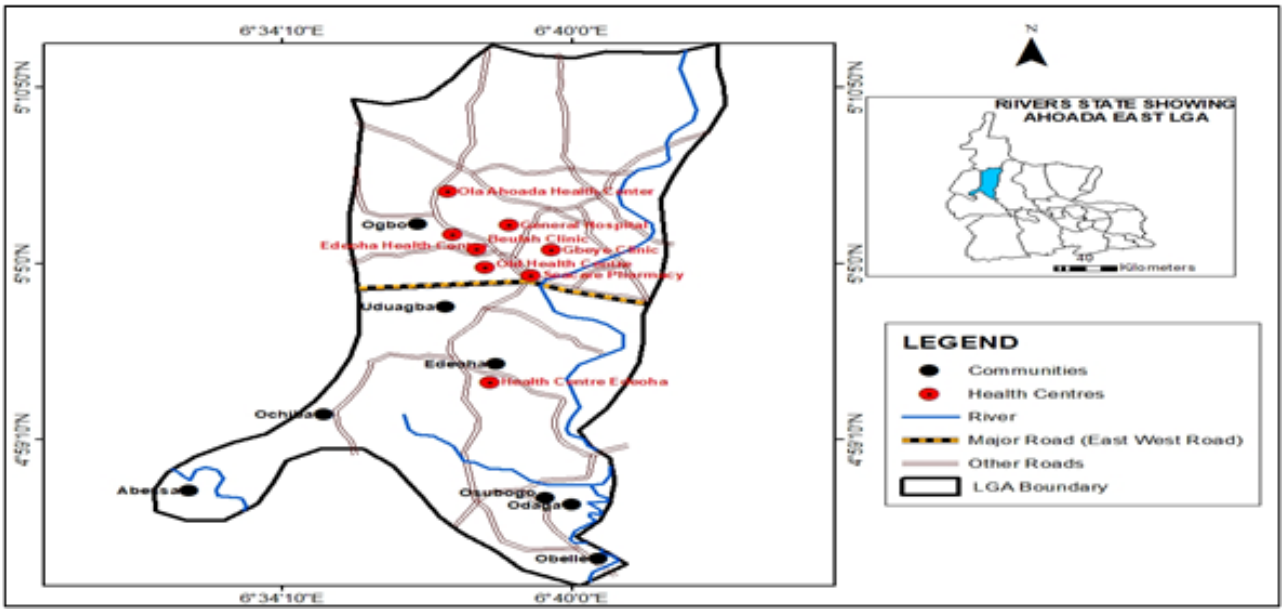

Figure 1: The Study Area (Ahoada East) showing study samples and settlements.
Source: Authors field work,2022.

Ahoada East local government area has a tropical climate characterized by heavy rainfall all year round. The rainy season in the area lasts from April to November with high relative humidity and heavy cloud cover. It experiences a short break known as "August break", a period of dryness for about two weeks. The study area is also characterized by tropical rainforest vegetation with mangrove vegetation. Important trees found here are the raffia palm, nippa palm, with woods like mahogany, ferns, and shrubs. (Izeogu & Salawu, 1985).

In terms of socioeconomic events, the people of Ahoada East local government area are predominantly subsistent farmers. Farming remains the dominant occupation, especially in rural communities. Agricultural activities ranging from food and cash crop production, aquaculture (fishing), poultry, hunting, farming, and livestock farming provide employment and the main source of livelihood to the people of the local government area (Izeogu & Salawu, 1985).

The study adopted the survey research design. This research design allows for a variety of methods to recruit participants, collect data, and make inferences about the population. The primary purpose of this type of survey research was to obtain information describing the characteristics of a large sample size and describe and explore variables and constructs of interest. (Singleton & Straits, 2009).

The study area boasts of several healthcare facilities spread across the local government. The target population was the healthcare facilities collected sample of the healthcare facilities, their status, information on clinical waste, its disposal methods, and their environmental effects in the local government area.

Two sources of data were used in the study, namely, primary and secondary sources/data. The primary data are the first-hand data and records in the study and they were collected through the use of semi-structured questionnaires and field observations while the secondary data were obtained from textbooks, magazines, journals, statutory/regulatory policies internet materials, etc.

Specifically, there are 24 healthcare facilities (one general hospital, 16 healthcare centers, 5 private hospitals, and 2 pharmacy stores) in Ahoada East Local Government. These healthcare facilities generate various types of clinical waste including chemical and pharmaceutical waste.

Purposive and simple random sampling techniques were used in selecting 8 healthcare facilities from the population size.

Data on clinical waste disposal and its health effects were collected from the waste handlers and other health / medical staff in the selected healthcare facilities as well as the 184 respondents that responded to the questionnaires. The questionnaire was divided into two sections A and B. Section A was designed to collect the demographic data/characteristics of the respondents while section B dealt with the study research variables. Under section B, data and responses were collected on; types of clinical waste generated, methods of disposal of clinical waste, effects of poor disposal of clinical waste on the environment, and agencies for supervision of clinical waste disposal. The questionnaire contains 36 items designed to answer the research questions.

The 184 copies of the semi-structured questionnaire were administered in the study area by hand. The authors used two research assistants to reach some communities in the local government area where the related healthcare facilities are located in administering and retrieving the instruments within a time interval of two weeks. However, the number of questionnaires administered was 200 of which 184 were retrieved representing more than 50% response rate as shown in Table 1.

Results

Data collected from the field survey were analyzed using the mean of the 4-point Likert scale of 2.50.

The result of the questionnaire analysis carried out is presented in tables as follows.

Gender	Number of Instruments Distributed	Number of Valid Copies(Instrument Returned)	Number of Invalid Copies
Male	77	70	6
Female	123	114	10
Total	200	184	16

Table 1: Gender of Respondents and Questionnaire Distribution

Table 1 above indicates that out of the 200 questionnaires distributed to respondents, only 184 were returned successfully representing more than 70 percent response rate. Also, in terms of gender, the result shows more women participated in the exercise than men with 114 for women as against 70 recorded for men as shown in table 2.

1 – 5 years	73
6 – 10 years	41
11 – 15 years	33
16 – 20 years	7
21 – 25 years	9
26 years and above	21
Total	184

Table 2: Working Experience of Respondents

The result of the questionnaire analysis conducted as indicated in Table 2 above on the working experience of respondents shows that 73 respondents have 1-5 years of experience followed by 41 people that have 6-10 years of experience. Those that responded with 11-15 years of experience were 33 while 7 indicated that they have 16-20 years of experience. Similarly, 9 of the respondents said they have 21-25 years of experience while those with over 26 years of experience were 21 of the total respondents.

Position being held	Number of Respondents
Waste handler	20
Nurse	87
Mid-wife	33
Cleaner	15
Doctor	29
Total	184

Table 3: Class of Work of Respondents in the Healthcare Facility

The study examined the positions of the staff of the various medical facilities and hospitals that participated in the survey and the number of those that handle waste was 20 while those that work as nurses were 87. Interestingly, 33 respondents indicated that they are Midwives followed by cleaners are 15 in number. Doctors that participated are 29 in number as shown in Table 3 above.

Type of Healthcare Establishment	Number of Respondents
Government Hospital	103
Health Centre	50
Private Hospital	26
Private Pharmacy	5

Table 4: Nature/Type of Healthcare Establishment

Table 4 above provides salient information on the nature of medical facilities and hospitals that exist in the study area. 103 of the respondents affirmed that they worked in government-owned hospitals while those that worked in health centers owned by the government were 50 in number. Similarly, those who worked in private hospitals were 26 in number followed by 5 that are staff of private pharmacies. However, table 5 provides the analysis carried out on the frequency and percentage of waste generated by health centers.

Types of Clinical Waste Generated	N	SA	A	D	SD	Mean	Cut off Mean	Standard Deviation	Decision
Papers, plastics, cans or glasses	184	74(40.2%)	67(36.4%)	23(12.5%)	20(10.9%)	3.06	2.5	0.98	Agree
Leftover(remain) of food or grasses	184	40(21.7%)	97(52.7%)	27(14.7%)	20(10.9%)	2.85	2.5	0.88	Agree
Placenta and other tissues	184	104(56.5%)	33(17.9%)	20(10.9%)	27(14.7%)	3.16	2.5	1.11	Agree
medical instrument/ tools-needle, syringe, scapes, blades, lancets	184	110(59.8%)	47(25.5%)	14(7.6%)	13(7.1%)	3.38	2.5	0.90	Agree
Chemical waste from diagnosis	184	47(25.5%)	77(41.8%)	43(23.4%)	17(9.2%)	2.84	2.5	0.91	Agree
Chemical waste as drugs	184	80(43.5%)	60(32.6%)	14(7.6%)	30(16.3%)	3.03	2.5	1.08	Agree
Liquid waste from blood and body fluid	184	87(47.3%)	50(27.2%)	17(9.2%)	30(16.3%)	3.05	2.5	1.10	Agree
Grand total	184	542	431	158	157	18.32	-	5.86	Agree
Grand mean	184	77	62	23	22	2.63	2.5	0.84	

Table 5: Frequency, percentage, mean, and standard deviation of clinical waste generated by health centers and hospitals.

In Table 5 above, 40.2% of the respondents strongly agree that plastics, papers, and glasses are the most common wastes generated in hospitals and medical facilities followed by 36.2% of the respondents who simply answered agreed while 23 and 10 percent of respondents answered strongly disagree and disagree respectively.

Similarly, 21,7% of the respondents strongly agree that leftover food and glasses are the dominant waste 52% only agreed to the question while 14.7% and 10.9% disagreed and strongly disagreed respectively. On placenta and other human tissues as waste in the hospital, 56.5% of the respondents strongly agreed to the question while 17.9% only agreed. Those that strongly disagreed were 14.7% while 10.9% responded disagreed.

Medical instruments and tools as medical waste in hospitals were supported by 59.8% who strongly agreed another 25.5% simply responded agree while 7.6% responded disagree and 7.1% strongly disagreed. Chemical waste generated from medical diagnosis 25.5% who responded strongly agree while 42.8% responded agree. In the same vein, 23.4% of the respondents disagreed while 9.7% strongly disagreed. Chemical waste from drugs 43.5% who responded strongly agreed while 60% only agreed. 14% of the respondents disagreed while 16.3% of the respondents strongly disagreed. Liquid waste from blood and body fluid,47.3% of the respondents who indicated agreed while 27.2% strongly agreed. 9.2% disagreed and another 16.3% strongly disagreed. The table below highlights the result of the method of waste disposal used in the study.

Methods of Disposal of Clinical Waste	N	SA	A	D	SD	Mean	Cut off Mean	Standard Deviation	Decision
Recycling of papers, plastics, can or glasses	184	23(12.5%)	37(20.1%)	84(45.7%)	40(21.7%)	2.23	2.5	0.93	Disagree
Recycling of leftover (remains) of foods and grasses as compost	184	7(3.8%)	40(21.7%)	90(48.9%)	47(25.5%)	2.04	2.5	0.78	Disagree
Burning of papers plastic, cans etc.	184	74(40.2%)	60(32.6%)	43(23.4%)	7(3.8%)	3.09	2.5	0.88	Agree
Dumping at waste collection centres for papers, plastics, can glasses, foods and grasses	184	43(23.4%)	64(34.8%)	64(34.8%)	13(7.1%)	2.74	2.5	0.90	Agree
Burying of placenta and other human parts	184	60(32.6%)	77(41.8%)	27(14.7%)	20(10.9%)	2.96	2.5	0.95	Agree
Dumping at waste collection centres for placenta and other human parts	184	23(12.5%)	27(14.7%)	50(27.2%)	84(45.7%)	1.94	2.5	1.05	Disagree
Treatment of medical instrument/tools within health centres and hospitals	184	94(51.1%)	57(31.0%)	17(9.2%)	16(8.7%)	3.24	2.5	0.95	Agree
Treatment of medical instrument/tools outside health centres and hospitals	184	23(12.5%)	27(14.7%)	91(49.5%)	43(23.4%)	2.16	2.5	0.93	Disagree
Burying of medical instrument/tools	184	13(7.1%)	37(20.1%)	64(34.8%)	70(38.0%)	1.96	2.5	0.93	Disagree
Dumping at waste collection centre for medical instrument/ tools	184	50(27.2%)	40(21.7%)	40(21.7%)	27(14.7%)	2.61	2.5	1.04	Agree
Special treatment and disposal of chemical waste by authorized staff	184	54(29.3%)	80(43.5%)	40(21.7%)	10(5.4%)	2.97	2.5	0.85	Agree
Special treatment and disposal of left over drugs by authorized staff	184	64(34.8%)	57(31.0%)	50(27.2%)	13(7.1%)	2.93	2.5	0.94	Agree
Underground sewage tank/system for liquid waste from human body	184	47(25.5%)	54(29.3%)	57(31.0%)	26(14.1%)	2.66	2.5	1.01	Agree
Bagged and disposed outside health centre and hospital liquid waste from human body	184	13(7.1%)	33(17.9%)	74(40.2%)	64(34.8%)	1.97	2.5	0.90	Disagree

Incineration of liquid waste from human body	184	13(7.1%)	23(12.5%)	74(40.2%)	74(40.2%)	1.86	2.5	0.89	Disagree
Grand total Grand mean	184	601 40	713 48	892 59	554 37	37.36 2.49	 2.5	13.93 0.93	Agree

Table 6: Frequency, percentage, mean, and standard deviation of the methods of disposal of clinical waste by health centers and hospitals

The result of the questionnaire analysis on the method of disposal of waste by medical and hospital waste indicates that recycling papers, plastics, cans, or glasses have not been considered a method of waste disposal in hospital and medical facilities in the study area as respondents simply disagreed as shown in table 6. Most of the respondents disagreed that recycling leftover (remains) of foods and grasses as compost waste is also not practiced as evidenced by their overall decision.

Burning papers, plastics, and cans as a waste disposal method has received an overwhelming majority who responded they agreed with the decision 40.2% and 32.6% respectively. Dumping wastes at waste collection centers as a method of waste disposal also has most of the respondents who agreed with the decision. Regarding the question of burying the placenta and other human parts, most of the respondents agreed with the decision. Respondents also agreed with the question of the treatment of medical instruments/tools in health centers and hospitals as a method of waste disposal. Underground sewage tank/system for liquid waste from the human body as a method of waste disposal has the support of respondents who responded in the affirmative (agreed). However, respondents disagreed with the issue of bagging and disposing of outside health centers and hospital liquid waste from humans. On the question of incineration of liquid waste generated from patients, respondents were firm in their overall decision by disagreeing with the question knowing fully well that such method is not practiced in the study area.

Diseases of improper disposal of clinical waste	N	SA	A	D	SD	Mean	Cut off Mean	Standard Deviation	Decision
Respiratory diseases	184	43(23.4%)	57(31.0%)	60(32.6%)	24(13.0%)	2.65	2.5	0.98	Agree
Eye diseases	184	21(11.4%)	23(12.5%)	110(59.8%)	30(16.3%)	2.19	2.5	0.84	Disagree
Skin diseases	184	28(15.2%)	69(37.5%)	76(41.3%)	11(6.0%)	2.62	2.5	0.81	Agree
HIV/AIDS	184	27(14.7%)	23(12.5%)	80(43.5%)	54(29.3%)	2.13	2.5	1.00	Disagree
Hepatitis	184	23(12.5%)	30(16.3%)	84(45.7%)	47(25.5%)	2.16	2.5	0.95	Disagree
Meningitis	184	10(5.4%)	20(10.9%)	114(62.0%)	40(21.7%)	2.00	2.5	0.74	Disagree
Blood disease	184	20(10.9%)	23(12.5%)	104(56.5%)	37(20.1%)	2.14	2.5	0.86	Disagree
Gastrointestinal diseases	184	27(14.7%)	67(36.4%)	67(36.4%)	23(12.5%)	2.53	2.5	0.89	Agree
Fever	184	27(14.7%)	40(21.7%)	70(38.0%)	47(25.5%)	2.26	2.5	1.00	Disagree
Grand total Grand mean	184	226 25	352 39	765 85	313 35	20.68 2.30	 2.5	8.07 0.90	Disagree

Table 7: Frequency, percentage mean, and standard deviation of diseases from improper disposal of clinical waste

The result of the questionnaire analysis on the health effects of improper waste disposal in the study domain is shown in Table 7 above with most of the respondents agreeing in the affirmative that people could contract respiratory diseases through improper disposal of medical waste. However, the question on residents contracting eye diseases from improper medical waste disposal received overwhelming rejection as respondents disagreed with the question while skin diseases were accepted as something that could easily be contracted through improper waste disposal as respondents simply agreed. Questions were asked on the chances of HIV/AIDS being contracted from medical waste disposal and respondents simply answered disagreed. This was the same response supplied by respondents on Hepatitis, Meningitis, blood diseases, and Fever, while gastrointestinal diseases had respondents who supported the question with an agreed response.

Agency Responsible for Disposal of Clinical Waste	N	SA	A	D	SD	Mean	Cut off Mean	Standard Deviation	Decision
Only the local government area	184	21(11.4%)	23(12.5%)	70(38.0%)	70(38.0%)	1.97	2.5	0.98	Disagree
Only the state government	184	13(7.1%)	17(9.2%)	94(51.1%)	60(32.6%)	1.91	2.5	0.83	Disagree
Ministry of Health	184	43(23.4%)	60(32.6%)	54(29.3%)	27(14.7%)	2.65	2.5	0.99	Agree
Ministry of Environment	184	74(40.2%)	60(32.6%)	30(16.3%)	20(10.9%)	3.02	2.5	1.00	Agree
Rivers State Waste Management Agency	184	80(43.5%)	70(38.0%)	20(10.9%)	14(7.6%)	3.17	2.5	0.90	Agree
Communities where health facilities are located	184	47(25.5%)	30(16.3%)	57(31.0%)	50(27.2%)	2.40	2.5	1.02	Disagree
Grand total Grand mean	184	278 46	260 43	325 54	241 40	15.12 2.52	2.5	5.72 0.95	Agree

Table 8: Frequency, percentage, mean and standard deviation of agency of government saddled with the responsibility of ensuring an effective clinical waste disposal system.

The outcome of the analysis on the government agency that is most effective in clinical waste disposal, the majority disagreed on the efficacy of the local government authorities in the management of medical waste disposal is shown in table 8. The same response of disagreed was supplied on the effectiveness of only the state government in the management and disposal of waste generated from medical and health facilities.

However, respondents agree that the ministries of Health and Environment in the state as the most effective government agencies in tackling the issue of proper disposal of medical waste while respondents disagreed on communities with medical and hospital facilities in assisting in the disposal of waste generated as shown in table 8 above.

Discussion

The result of the analysis conducted above clearly revealed that the main types of clinical waste generated by health centers and hospitals in Ahoada East Local Government Area are as follows; medical instruments/tools used for patients such as needles, syringes, scalpels, blades, lancets, recyclable paper, plastics, cans or glasses; and liquid type of waste from the human body like blood and other body fluid. Findings revealed that chemical waste in the form of drugs that expired or left during diagnosis carried out on patients constitutes part of the clinical waste

Hospital/medical instruments top the list of clinical waste since they are widely used in diagnosis and treatment, and most times the handy ones are used for one patient at a time and do not need to be stored for use by other patients. It is worth mentioning that during the collection of samples for diagnosis, most of them contain some form of fluid/liquid that can be disposed of after use. Papers, plastic, or glasses used in the hospital and other medical facilities that can be recycled are classified as non-health risk.

While it is true that there are methods of handling or disposing of instruments/tools, the recycled materials are not recycled in the health facilities in the area, and this is consistent with the findings of (Adeoye et al., 2018) that there is no appreciable recycling. This situation often leads to the accumulation of huge waste given the fact that it cannot be recycled. This view was also supported by (Omar et al., 2012) that there are many deficiencies in the management of clinical waste in healthcare facilities.

The study established the main methods of disposal of clinical waste among healthcare facilities in the area; treatment of medical instruments/tools used in health/medical processes in the facilities through a process of autoclaving, burning for clinical waste such as papers, plastics, can or glasses, remains of food and grasses, as well as special treatment and disposal of chemical waste produced during diagnosis by authorized staff. The result of the study further indicates that healthcare facilities in the area bury the placenta and other human parts/tissues; especially during treatment and these materials are subsequently disposed of. Others include chemical waste like expired and leftover drugs used by medical personnel, dumping of plastic, instruments, and paper waste in unauthorized waste dumping sites, and the attitude of medical personnel flushing liquid waste from the human body into the underground sewage tank/system. It was therefore appalling from the data analysis that all the healthcare facilities considered in this study in Ahoada East local government area of Rivers state Nigeria do not practice modern clinical waste disposal methods expected of healthcare facilities.

The outcome of the analysis further revealed that waste recycling is not a waste disposal method practiced by healthcare providers in the area. They do not dump placentas and other human parts at public waste collection centers, nor do they bury medical instruments/tools. They do not bag

or incinerate liquid waste from the human body but choose to flush it into the underground sewage tank/system. This is an indication that health facilities in the area have their own method of disposing of medical instruments/tools which are (autoclaving); burning for recyclable waste, special treatment for chemical waste (from diagnosis), and flushing liquid waste into the underground sewage tank/system.

Those referred to as authorized staff are those waste handlers designated to handle special kinds of waste as revealed in the study. This finding lends credence to previous studies by (Ezirim & Agbo, 2018) that health facilities have designated persons or units handling healthcare waste. In terms of burning some types of clinical waste, controlled measures of burning waste were not followed which can lead to environmental pollution. (Omar et al., 2012) also agreed that the method of disposal of clinical waste is similar among health facilities in Ahoada East Local Government Area, and the act of burning waste incinerators amounts to deficiencies in clinical waste management.

The outcome of the analysis in the study is that diseases such as respiratory diseases, skin diseases, and gastrointestinal diseases are the major diseases from poor disposal of clinical waste in Ahoada East Local Government Area. These diseases are possibly the ones that infect both the health/medical staff and the public who work closely with waste or pathogens that carry the waste; and are predominant in the area. However, cases of other diseases such as eye diseases, HIV/AIDS, hepatitis, meningitis, blood diseases, and fever have lesser chances of being caused by poor clinical waste disposal as revealed in the study. Generally, the data analysis revealed the possibility of getting infected by other diseases apart from respiratory, skin, and gastrointestinal diseases is very slim. This finding failed to agree with that of (Cebe et al., 2013) that the possibility of contracting diseases in the hospital is high, especially hepatitis and human immunodeficiency virus HIV.

Finally, results showed that the Rivers State Waste Management Agency, Ministry of Environment, and Ministry of Health are the most concerned/effective government agencies in managing clinical waste in the Ahoada East Local government area. Perhaps their presence is always felt during sanitation exercises as they evacuated huge dumps of waste at the waste collection centers around the area. Findings further show that the eventual disposal and the destination of the collected waste is not the responsibility of one agency but a collective effort of the Rivers State Waste Management Agency, the Ministry of Environment, and the Ministry of Health. It is therefore obvious from the data analysis that all the waste management agencies saddled with the responsibility of waste management, have been playing their role effectively. The local government authority has little or no influence over waste management except the staff of ministries of environment and health posted to the local government councils; they do routine inspections of the clinical waste management of health facilities in the area.

In line with the findings of (Marceta & Nadj, 2018) the Ministry of Health and the Ministry of Environmental Protection are to take responsibility for the safe management of medical waste. This suggests a need for collaboration as it is not the responsibility of one ministry or agency. Sridhar et al., (2017) also underscored the need for collaborative effort and harmonization in waste management in Nigeria in terms of waste management policy and implementation.

Conclusion

The clinical wastes generated by the health centers and hospitals in Ahoada East Local Government Area are mainly composed of medical instruments/tools, particularly the ones that are of small sizes and used by health/medical personnel during treatment. However, the nature of activities in the healthcare facilities are the same, consequently, placenta and human tissues, and papers, plastics, cans or glasses constitute another huge part of the clinical waste. Childbirth rate is high in the area thus placenta and other human parts are ranked second after medical instruments/tools. The study revealed that the hospitals and medical facilities in the study area are confronted with the problem of proper waste disposal mechanisms as huge amounts of various types of clinical waste are generated on regular basis.

Autoclaving is a practice in healthcare facilities where certain equipment is sterilized under air-tight pressurized steam. Expensive instruments/tools are treated by this method such that the contaminants in them are made ineffective, but each of the facilities has its policy on treatment of chemical waste of which the method may include flushing them into the sewage tank. It was observed that healthcare facilities are ignorant of the effects of uncontrolled burning of waste products. Clinical waste like placentas are never disposed of publicly in the healthcare facilities in Ahoada East Local Government Area.

The medical/health personnel are exposed to both pathogenic and chemical hazards because of the nature of their job in the area. Children and adults who go on barefoot and perhaps put their feet in running water whenever it rains are exposed to contaminated objects. The burning of certain clinical waste like papers, and plastics which is commonly practiced in the study area is environmentally unfriendly and unacceptable as it has implications on air quality in the neighborhood where medical facilities are located.

There is a likelihood that respiratory diseases will affect health/medical personnel and residents in some places where clinical wastes are not properly disposed. This is because of the attitude and practices of healthcare facilities in the area to engage in uncontrolled burning of certain clinical waste instead of using the incinerator.

Recommendation

Arising from the findings and conclusions above, the study therefore recommends that,

1. The management of healthcare facilities should adopt the recommended waste container color, and labeling during healthcare waste segregation as specified by WHO and Basel Convention to reduce the risk of infectious diseases among health workers and also for easy identification.
2. The Ministry of Health should enforce all protective measures that will reduce the exposure of medical/ health personnel to hazards during treatment or handling pathogenic and chemical emanating from healthcare provision, and it's the position of the Ministry to sanction facilities that do have these measures in place.
3. Healthcare workers should be regularly trained on the methods of handling clinical waste in terms of container colors, coding, and labeling from time to time to reduce the high risk of infection.

Conflict of Interest

The authors declare no conflict of interest.

Authors Contribution

All the authors contributed significantly to the manuscript from conception, analysis initial draft, and final review before submission. Oye Ideki revised the final manuscript after acceptance by the journal.

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