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SUSTAINABLE MANAGEMENT OF URBAN HOSPITAL WASTES IN OWERRI URBAN, IMO STATE.

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ABSTRACT

This study was undertaken to investigate the level of sustainability of hospital waste management in Owerri urban. A daily waste inventory study of each hospital department was carried out for three (3) months in eighteen (18) different hospitals selected using simple random sampling out of a total of 85 hospitals in the study area. These hospitals were grouped into category A,B and C representing large, medium and small hospitals, based on the number of bed spaces. Data were collected from different sources (quantities of hospital wastes generated per day, questionnaire survey, interviews and observations, etc.). Results were analysed using descriptive statistical methods, analysis of variance and other non – parametric descriptive tools. Results obtained showed that 75.72kg of hazardous portions of hospital wastes and 222.97kg of non hazardous waste portions were generated per day by the three categories of hospitals. The study revealed that large hospitals contributes more waste of different composition as compared to medium and small hospitals in the order of LH (135.85KG/day) > MH (94.58KG/day > SH (68.26kg/day. Thus, waste composition obtained from the different hospital categories showed a positive linear relationship between and among the categories of hospitals and the wastes they generate. The study identified that inadequate training of waste handlers on disposal practices and the provision of adequate equipments are major problems militating against proper waste management practices in healthcare institutions in Owerri urban. The hospitals do not segregate wastes into marked or

colour coded containers /bins neither do they keep records of waste generated and disposed. The study further revealed the absence of institutional arrangements for the management of hospital wastes at all levels. This indicates that hospital wastes have greater potentials for adverse health and environmental impacts. Recommendations were made for the management of these wastes on a sustainable basis. Training of hospital personnel on waste handling , provision of safety gadgets and proper education on waste reduction strategies and existing guidelines on the management of hospital wastesare recommended amongst others. This process will ensure a reduction in the quantity of medical waste generated which is more expensive to manage.

KEYWORDS: Healthcare wastes, Health workers, Infectious diseases, Microbes, Waste disposal, Waste management.

1. INTRODUCTION

In Nigeria, urbanisation has generally led to enormous economic and social development, but has also created many socio - economic challenges with severe gaps in urban development investments and management capacities (Sampio, 2024). Of all these challenges, the most preoccupying, embarrassing and sometime enigmatic is the management of waste generated by healthcare institutions. It is estimated that Nigerian towns generate about 43 million tonnes of solid waste annually, with 10 to 15 percent composed of hazardous materials (Maiha and Yusuf, 2025).

According to WHO (2024), 85 percent of waste generated in institutions in most countries of the developing world are categorized as non - hazardous, the remaining 15 percent are grouped as infectious. This special waste poses a great risk to public health and could undermine environmental sustainability if not properly managed (Ezeudu et al, 2022; Janik - Karpinska et al, 2023). In response to the growing problem of wastemanagement in Nigeria, the Federal government enacted several policies, guidelines, regulations and plans guiding waste management with no clear specifications on healthcare waste (Musa et al, 2023). Besides the implementation of these policies are presently saddled with inadequate managerial capacities (Amaike et al, 2025).

Ever since the democratic dispensation in the country in 1999, a lot of health care institutions have surged in Imo State, particularly in the state capital, Owerri, offering quality healthcare to the urban and rural populations, with increased personnel. Healthcare institutions, whether

at primary, secondary or tertiary levels are service - oriented establishments that provide medicare facilities comprising observational, diagnostic, therapeutic, pharmaceutical, rehabilitation and research services. Consequently, they generate a lot of wastes, ranging from infectious, pharmaceutical, chemical to cytotoxic and radioactive wastes, including sharps, blood- contaminated items, body parts and tissues and other associated waste that commingle with the latter rendering all of them highly pathological (WHO, 2024). The incidence of COVID -19 re awakened public consciousness in many climes in making concerted efforts in properly managing these wastes (Adesi - Gyamfi et al, 2022). The problem of health care waste management has become so pervasive and pre - occupying in Imo State in general and Owerri in particular, that it has become an interesting area of study. The fundamental questions relating to this issue are as follows: How do institutions manage their waste? How does the growing number of personnel in these institutions handle the waste they generate? What is the level of awareness among the medical staff concerning the danger posed by this hospital waste? What is the quantity of waste generated by these institutions?

The first part of this paper presents the methodology used in data collection, followed by statistical analysis, presentation of results, discussion and recommendations. This study should be seen as the continuation of a process relating to an important aspect of management and improvement in understanding of healthcare waste in Imo State. The paper argues that the handling of healthcare waste problem in Owerri is indicative of how issues concerning public health are addressed in Imo State.

2.0 MATERIALS AND METHODS

2.1. Study Area.

Owerri, the capital of Imo State is located between Latitude 50.46’ and 5.57’E and longitude 70.03’ an 79.13’E at 73 meters above sea level. The urbanised area of the town constitutes parts of two other Local Government Areas (Owerri North and Owerri West) and Owerri Municipal. The area is located in the tropical rainforest region, characterized by rainy and dry seasons, with average temperature hovering around 31^0C.The area experiences high rainfall with a mean level of 214.44mm annually.

Owerri urban currently has an estimated population of 640,899 inhabitants. The rapid population growth within the area has led to the provision of numerous health facilities to meet the growing healthcare needs of the people. At present, Owerri urban counts more than 85 health facilities of different sizes (hospitals, clinics, community health centres etc)

generating different types of wastes, which have to be collected ,treated and disposed of in the most hygienic manner in order to protect public health and environment. The aim of this study is therefore focused on how to achieve a sustainable management of these wastes. The study is limited to wastes generated by hospitals in the area and does not include primary health care, laboratory and research centres.

2.2 Sampling and Sampling procedures.

The study was carried out in 18 hospitals of different sizes and bed spaces within Owerri urban for a period of three months. The hospitals are public and private - owned located within the urban territory. As a matter of convenience, these hospitals were grouped into three according to the number of bed spaces available in each of them. Those with 30 beds and above were grouped Class A, those with 15 to 30 beds were Class B, and those having less than 15 beds are grouped as Class C corresponding to large, medium and small hospitals respectively. After grouping these hospitals, they were now selected through a simple random method. The selection was carried out to ensure geographic spread and adequate representation of large, medium and small - sized hospitals in the survey.

Sampling was carried out in each of the 18 hospitals with the use of a well structured questionnaire that was administered among the staff of these hospitals. The questionnaire was designed to enable respondents provide requisite information on the variables contained in the questions such as sources of wastes, types of wastes, level of safety of personnel, adequacy of protection, frequency of collection, method of disposal, level of awareness among staff on management of these wastes etc.

In order to generate data on the quantity of waste generated, each of these hospitals selected was provided with plastic bags for the collection of different wastes generated daily. This activity was carried out with the assistance of hospital cleaners, health assistants and our research staff. The waste is then weighed using a weighing balance before the components were carefully separated into five categories namely; Plastics/syringes, Swabs, pads, gauze, absorbents Paper packages and bottles Sharps, needles Food wastes.

Calculations of the average quantity of waste per bed per day were then carried out by dividing the quantity of waste by the number of beds in the unit (UNEP, 2018: WHO, 2020).

Statistical methods were used for data analysis. The statistical package for social science (SPSS V. 20) was used for processing data. Descriptive analysis made use of percentages, line graphs, bars and cross tabulations to interpret the data.

3. RESULTS

The results obtained from the study showed that both hazardous and non hazardous wastes are generated by the three categories of hospitals. The result of the survey revealed that about 75.72 kg of solid hazardous wastes and 222.97kg of non-hazardous wastes were generated by the three category hospitals sampled per day. The result of the survey indicated that large hospital categorised as Class A generated the highest quantity of waste per day, accounting for 135.85kg or 45.1% of the total waste generated in all the hospitals surveyed. A medium hospital follows this, with 94.58kg or 31.7%. The small hospitals classified as Class C generated the smallest quantity of wastes, accounting for 68.36kg per day (22.9%).

The relatively small quantity of wastes generated by the small hospitals is partly explained by its isolated location from many residential areas and its relatively small bed spaces. The large quantity of waste generated by large hospitals is an indicative that they are general purpose hospitals with specialist in different areas for patients with all kinds of ailments as shown in fig.1.

The survey report revealed that hospital workers (sweepers and waste collectors) go round the wards to collect wastes from bins once every day (usually in the mornings). They empty them into larger bins placed at strategic positions in the hospital premises for easy access to contractors who collect them and transport them to public dump sites.

Observations also show that most of these hospitals do not sort their wastes as they are lumped together. With the exception of some pathological wastes containing human tissues (placenta and fluids) that are buried in placenta pits, the rest are assimilated into the domestic waste streams before their final disposal.

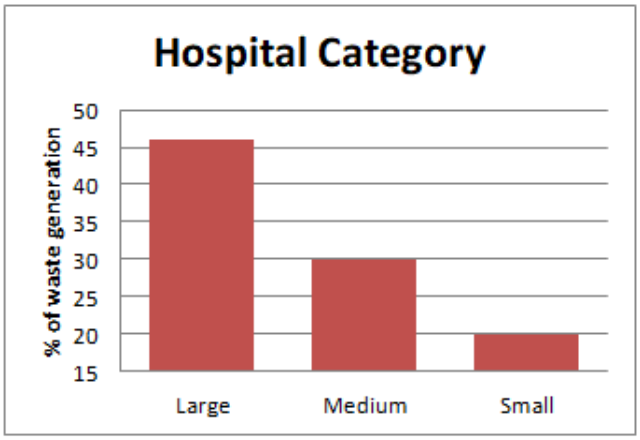

Figure 1: Showing % waste generated in the three category of hospital.

Source: Field Survey.

3.2: Composition of hospital wastes in the surveyed sample.

A detailed breakdown of the composition of these wastes in large hospitals indicated that kitchen and food wastes were the most predominant waste accounting for 23.7% of the total waste generated. They comprised mainly food and food items (from hospital kitchen, patients, workers and visitors) as these large hospitals have kitchen where they prepare food for patients with different ailments. This is followed by sharp objects (needles, surgical blades, scapels) which were the second largest fraction by weight of all categories of wastes accounting for 22.5% of the total wastes. Plastics, PVC and syringes contributed only 20.9%. Papers, wrappers and bottles accounted for 14.8% only. These are mainly wastes from surgical/ emergency unit and non - degradable components such as nylon and wrappers collected from sweepings within the Swabs/absorbent and paper packages/bottles, each accounted for 18.03% respectively.

Composition of wastes in medium sized hospitals indicated that plastics, PVC, and syringes contributed 25.6%% of the total wastes. Swabs and absorbents accounted for 21.2%.Paper packages, bottles, nylon and wrappers contributed 15.9%. Kitchen and food wastes were quite small and contributed only 10.6%. Other wastes made up of sharp objects (needles, surgical blades, scapels) were the largest fraction by weight of all categories of wastes accounting for 26.5% of the total wastes.

Plastics, PVC, and syringes contributed 29.3% of the total wastes stream in small sized hospitals. Swabs and absorbent recorded 23.1% while paper, packaging, wrappers and nylon contributed 14.8%. However, sharp objects - needles, blades, broken bottles etc were the largest, accounting for 29.4% while kitchen/food wastes accounted for the remaining 3.04% of the total wastes generated.

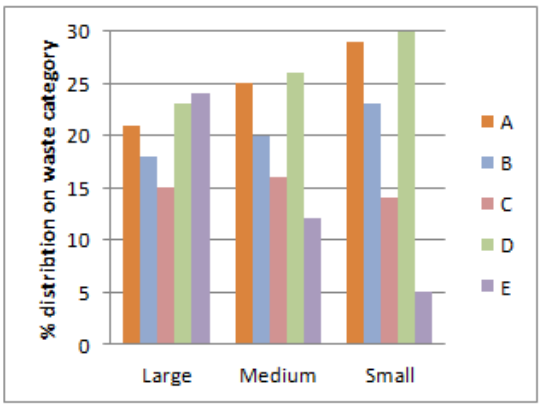

Fig.2: Showing % composition of wastes.

Source: Field Survey.

Legend:

A = Plastics/Syringes

B= Swabs/Absorbent

C= Paper/wrappers/bottles

D= Sharp objects/needles

E= Food wastes

Statistical (natural log) analysis of the hospital waste types and quantity showed a positive linear relationship between and among the three categories of hospitals and the wastes they generate (Fig.2a - e). It is evident from the result that large hospital contributes more waste of different composition as compared to medium and small size hospitals in the order of LH (135.85kg/day)> MH (94.58kg/day) > SH (68.26kg/day)(Table 1). Thus the quantity and composition of wastes generated followed a downward trend.

3.3 Awareness on RecordKeeping on Wastes Generated.

It is also surprising that data on waste hardly exist in any of the hospitals, as no record keeping is done for lack of monitoring and surveillance on the part of the hospital. Record keeping on wastes generated in large hospitals indicated that 18% of hospitals were aware of recording waste streams from their areas of operation while 82% of the hospitals are not aware of record keeping as a management practice. In the contrary, 88% of Medium hospitals are not aware of keeping record of wastes generated in their facilities, whereas 12% of them are aware of keeping records of wastes generated.

Amongst the Small hospitals, only 4% are aware of keeping record of wastes generated. The greater proportions of hospitals (96%) are not aware of keeping record of wastes generated in their hospitals. (Fig.4). This scenario makes it difficult to track hazardous wastes content in the waste generated in this category of hospitals. It is therefore obvious that awareness on keeping record of wastes generated by the three categories of hospitals is low. The two-factor analysis of variance of awareness on keeping record of wastes generated by the three hospital categories shows no significant difference.

Table 1. Daily Solid waste composition and generation rates (kg) from selected Hospitals in Owerri urban.

WASTE COMPOSITION	HOSPITAL CATEGORIES		
	Large	**Medium**	**Small**
Plastics, PVC, and Syringes (kg/day)	28.46	24.17	20.01
Swabs/Absorbents (kg/day)	25.50	20.06	16.04
Paper packages/Bottles (kg/day)	20.15	15.07	10.07
Sharps (kg/day)	30.58	25.08	20.06
Kitchen/Food wastes (kg/day)	32.16	10.02	2.08
Total Waste Stream	**135.85kg**	**94.58kg**	**68.26kg**

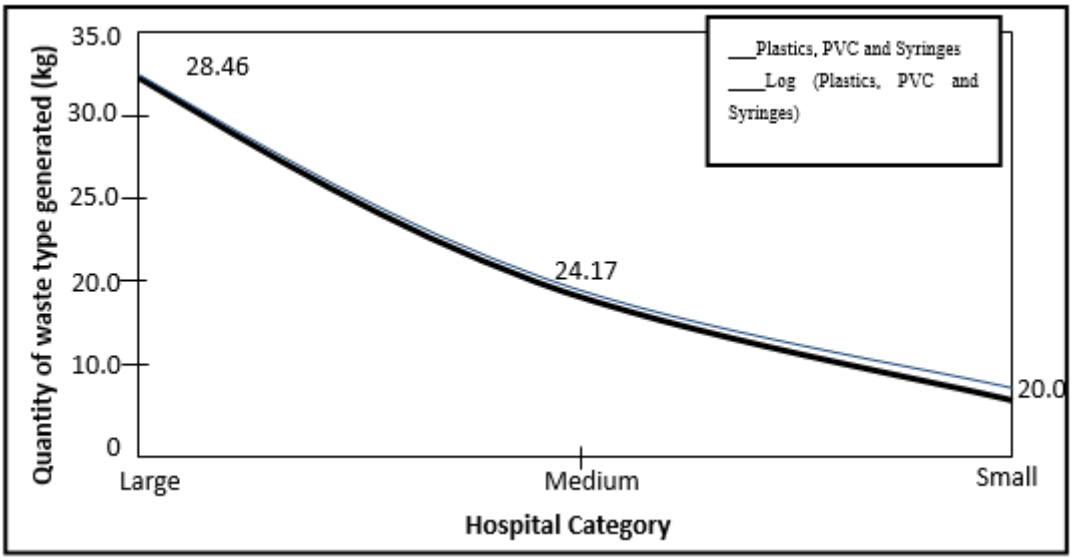

Figure2a. Relationship between waste type generation and hospital category (Plastic, PVC and Syringes weighed in kg)

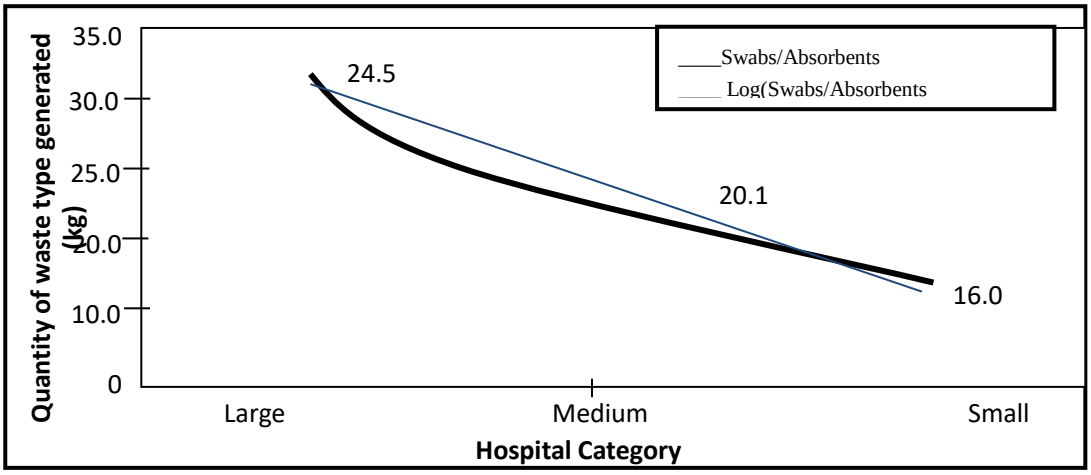

Figure2b. Relationship between waste type generation and hospital category (Swabs and Absorbents weighed in kg)

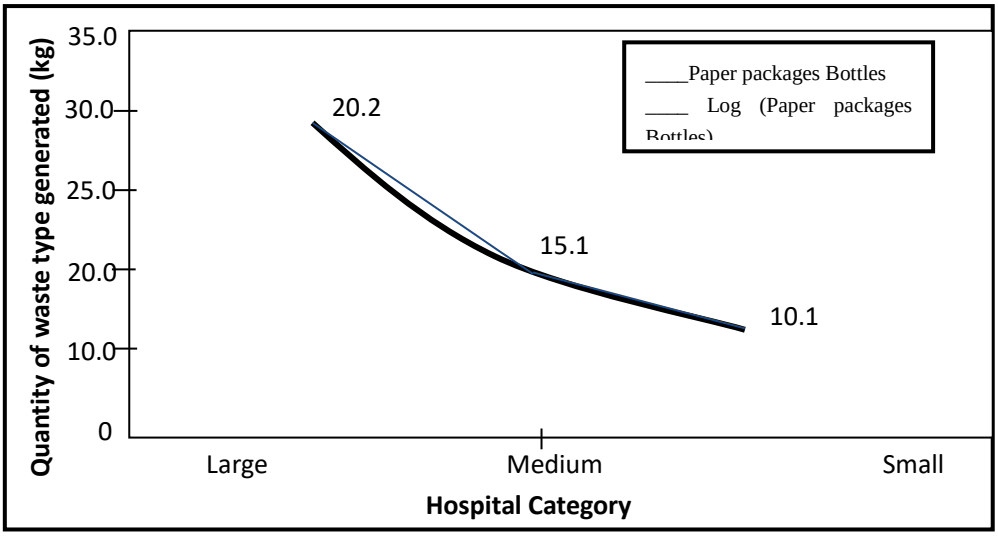

Figure2c.Relationship between waste type generation and hospital category (Paper packages and Bottles weighed in kg)

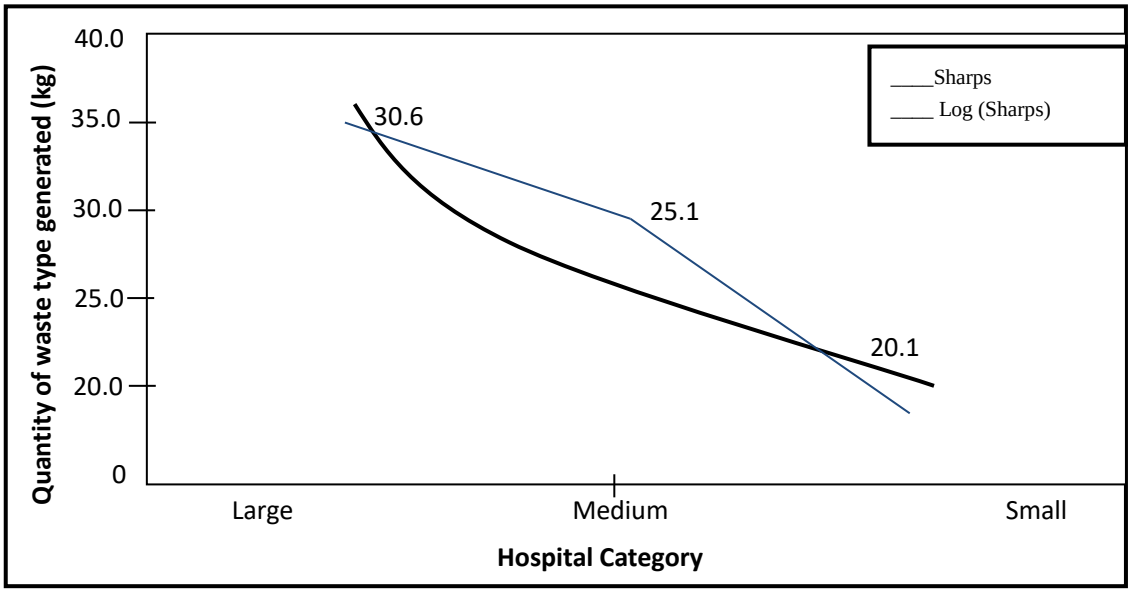

Figure2d. Relationship between waste type generation and hospital category (Sharps weighed in kg)

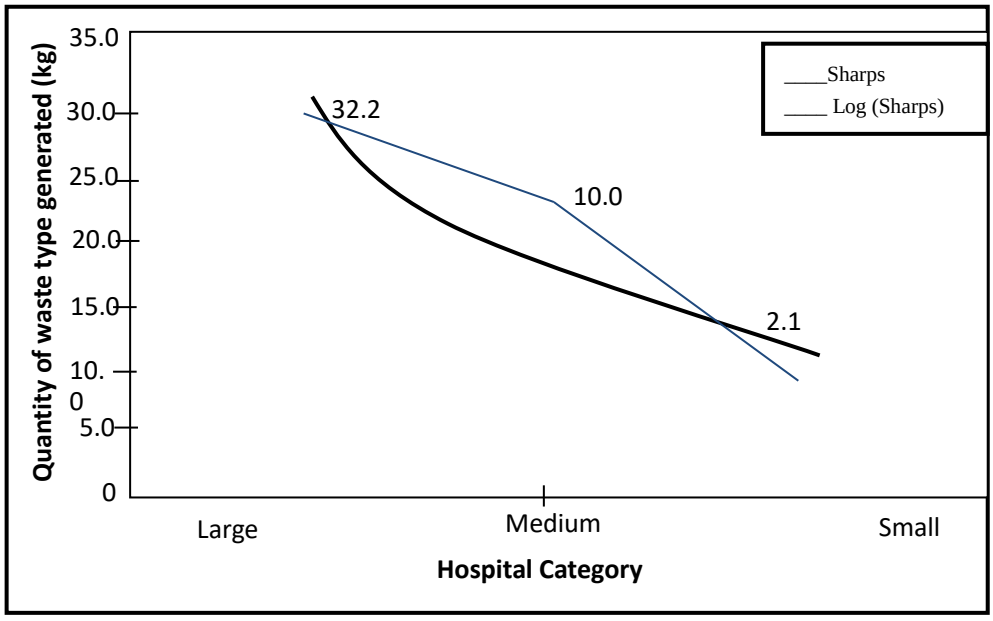

Figure2e. Relationship between waste type generation and hospital category (Kitchen and Food weighed in kg)

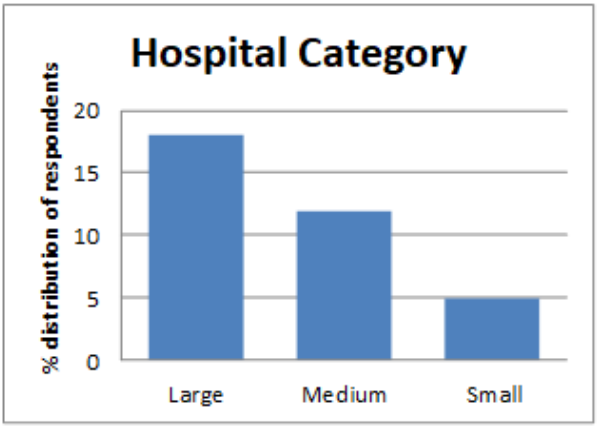

Figure3.Relative Awareness by hospitals categories on keeping Record of wastes generated.

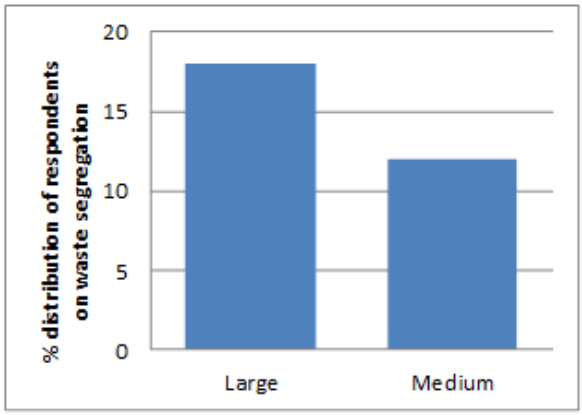

Fig 4: Bar-chart showing waste segregation in the three categories of hospital.

3.4. Waste Segregation Practice

The result of this inventory exercise showed that waste segregation is hardly practiced in the three categories of Hospitals. In large hospitals we observed that they do not use colour-coded bags/bins to segregate and store wastes before disposal. This is evident from the larger proportion of respondents (73%). It was also observed that 6% of respondents are aware of the use of colour- coded bags/bins, while 21% of respondents are indifferent on the use of colour-coded bags/bins in waste management.

Similar observation was made in medium hospitals where only 4% of respondents indicated awareness on the use of colour-coded bags/bins for wastes segregation, while 14% of respondents were indifferent on the use of colour- coded bags/bins.

Small hospitals also showed no awareness on the use of colour-coded bags/bins in waste management.

Thus the three categories of hospitals exhibited obvious low awareness level in the use of colour- coded bags/bins in waste management (Fig. 5).The analysis of variance of awareness on waste segregation by the three hospital categories showed no significant difference among the hospitals at 0.05 level of significance.

3.5. Provision of Safety Gadgets to Staff in Waste Handling

It was observed that in large hospitals, safety gadgets were provided and in the ordering magnitude of hand gloves and nose masks (57%), coverall (7%), safety boots (0%), with 36% of respondents indicating non provision of all Safety gadgets listed for waste handling.

In the medium hospitals,provision of safety gadgets to staff in waste handling is in the decreasing order of overall (3%) hand gloves and nose masks (31%), safety boots (0%), and eye goggles (0%) while 66% respondents indicated non provision of all the safety gadgets**.** It was observed that safety boots and eye goggles are not used in waste handling by large and medium hospitals.

Small hospitals also had provision of safety gadgets in the decreasing order of hand gloves (19%), nose mask (9%) and safety boots (0%) with 72% of respondents indicating non provision of all safety gadgets listed for waste handling. Small hospitals were also observed to show similar respondent pattern as observed with medium hospitals in the use of safety boots and eye goggles in waste handling. Generally, results from the three categories of hospitals showed that eye goggle as a safety gadget, was not used in waste handling. The statistical test for comparing provision of safety gadgets to staff, among the three categories

of hospitals shows a significant difference in the provision of safety gadgets to staff among the hospitals.

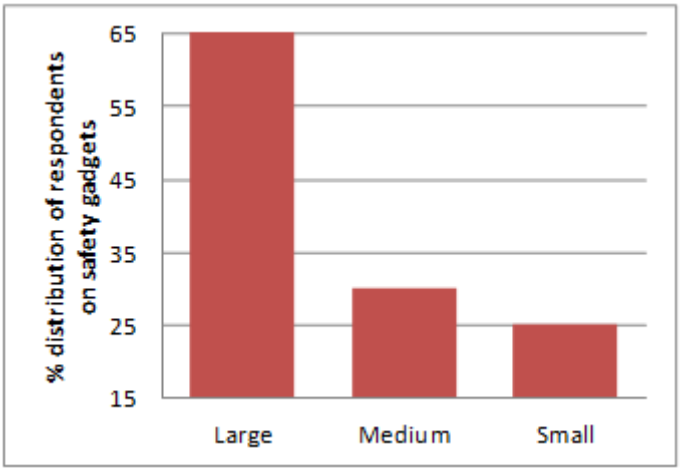

Fig 5: Bar-chart showing safety gadgets in three categories of hospitals.

3.6: Use of Trained Personnel in Handling Waste.

The use of trained personnel in waste handling varied between the hospital categories. Few proportion of respondents claimed that hospital wastes were handled by trained personnel in some large hospitals (28%). The proportion that felt otherwise was double fold of respondents that have trained personnel (72%).

In the medium and small hospitals, no respondent indicated that they have trained personnels for handling of wastes.

In the same way, the analysis of variance on the use of trained personnel in waste handling by the three hospital categories shows no significant difference at significance level of 0.05.

4.0 DISCUSSION

Results of this survey report revealed that hospital waste in Owerri urban is poorly managed. In Nigeria, liability for any pollution occurring as a result of unauthorized waste management activities rests with the waste generator in accordance with National Environmental (Sanitation and waste control) Regulations, S.I. NO. 28. (Abah and Ohimain, 2020). The NESREA Act2018 and various state edicts on environmental sanitation (The Nigerian Health Act of 2014: National Municipal Waste Management Policy, 2020: Imo state waste management Agency law, 2020) also provide regulation on the management of solid waste, particularly non hazardous, general (municipal) waste. These laws however do not adequately address the important aspects of healthcare waste. A mechanism to regulate and enforce sustainable management of wastes generated from health facilities as an integral part of the

existing environmental protection framework should be considered. This then, indicates that a major problem confronting the management of health care waste is perhaps the fact that it is generally viewed mainly from an environmental and less from a public health perspective.

The current disposal method of hazardous wastes in the healthcare institutions studied (dumping and open burning) within the premises of hospitals poses health risk to patients and people residing close to healthcare facilities (Kuroiwa, Suzuki, Yamaji and Miyoshi, 2014).Moreso,some waste components with lowcalorific value are hardly incinerated as none of the hospitals surveyed houses any incinerator (Incinerator at FMC broke done since 2002). These wastes may contain a large proportion of plastics (as recorded in this study), when burnt it emits dioxin which is a major air pollutant of concern from chlorinated polymer (WHO, 2021). Improperly disposed hazardous hospital wastes like syringes and needlesin the absence of sterilization (as seen in the health care institutions

surveyed) can cause infectious Hepatitis B, C and HIV (WHO, 2020) and poses indirect risks to humans through direct environmental effects by contaminating soil and groundwater (Abah and Ohimain, 2020) . This is orchestrated by the fact that when untreated wastes are exposed to rain they are washed into the drainages, rivers, streams and other water bodies thus endangering human and aquatic lives (Ogbonna, 2017).

From the results on record keeping on waste generated by large, medium and small hospitals it was observed that the awareness is more in large hospitals than in the other category of hospitals. It could be that large hospitals have an organized system of waste handling hence this level of awareness. It could be deduced that awareness on keeping record of wastes generated is a function of hospital category (LH>MH>SH). Secondly, it could also be as a result of the fact that health care facilities/institutions have no enforceable legal or environmental obligation to keep record of wastes generated. No matter how it is viewed, this scenario has made it difficult to get a good approximation of waste generation data and therefore more difficult to track thesewastes . This assertion lends credence to the assertion of Coker and Sangodoyin (2020) that the management of health facilities is hampered by lack of basic waste generation data. Moreso, tracking of hazardous wastes in hospitals is often complicated by lack of available records on waste generation. It is therefore suggested that improved management oversight, tracking, and inventory control should be put in place to effectively monitor waste generation. Such data collected in this process can be used to produce a hospital waste data bank on which further researches on hospital waste management could hinge upon.

The study on waste segregation showed that the three category of hospitals are not aware of waste segregation as a management practice. It was revealed that wastes were hardly segregated into marked or colour- coded containers for the different waste streams as physical visits to various hospitals confirmed a heterogeneous mixture of wastes in the same waste bin kept at a considerable distance from waste generation source. Non-separation of hospital wastes endangers scavengers and waste handlers in addition to the exposure of wild animals such as birds, flies and rodents that facilitate the spreading of germs frommedical wastes to nearby environments. This is confirmed by the findings of the study in Lagos by Olubukola (2019) that hospital waste management practices is marred by poor waste segregation practices as well as lack of instructive posters on waste segregation and disposal. Segregation of wastes according to Ndidi*et al* (2019) and Abah and Ohimain (2020) would result in a clean solid waste stream which could be easily, safely and cost effectively managed. The nature and quantity of medical wastes generated in these hospitals makes it very imperative to employ waste segregation because of the health risks posed by them. This is because the hospital wastes contain materials that may be harmful and can cause ill health to those exposed to them especially health workers who may be directly exposed and to people near health facilities, particularly children and scavengers who may become exposed to higher risk of diseases like hepatitis, HIV/AIDS (Path, 2019; WHO, 2020).This practice is characterized by lack of proper education on waste minimization or waste reduction strategies in healthcare institutions. Therefore good segregation practice will ensure a reduction in the quantity medical waste which is more expensive to manage.

This study observed inadequate, training of waste handlers on disposal practices and provision of adequate equipment as a problem militating against proper waste management practice in healthcare institutions in Owerri urban. If indeed they were being trained, the exercise did not impact on theirappropriateskills and knowledgefor proper waste management process. In large hospitals few proportion of hospital wastes is claimed to be handled by trained personnel (28%), implying that it could be attributed to national policy which often follows the international best practices and guidelines.The implication of a large proportion of unawareness in large, medium and small hospital categories is predicated on the fact that these hospitals patronize the waste disposal outfits and therefore has no trained staff on waste management process. On the spot assessment of waste disposal agents in Owerri urban showed that they treat the wastes they handle as normal domestic wastes and dispose them as such, thus confirming the findings of Fleming ,Danits, Benan, Englehardt, John and Rogers

(2020) that solid waste workers are exposed to significant levels of physical, chemical and biological toxins.

The findings from the study also shows that training and retraining programmes should be organized for all workers (with no exceptions) in the hospitals, thereby creating awareness of wastes, its effects, importance of guidelines and the implementation of the waste management options for the different categories of waste.

Thus these observations are in agreement with the observation of Louis (Louis, 2021) that even though Nigeria has waste management regulations, the awareness level among waste generators regarding current or impending environmental legislation is unclear hence firms were not motivated to prevent or reduce waste by regulatory reasons. Furtherance to this, the survey showed that health institutions treat their wastes as normal domestic wastes and dump them without appropriate handling procedure. Louis (2021) reported that environmental regulations in Nigeria do not play any important role in encouraging firms to improve their environmental performance or reduce waste.Although awareness seems to have increased in the three hospitals as they claimed regarding the need for proper management and disposal of medical waste. Yet it has no impact on the way hospitals handle their wastes.

With regard to the provision of safety gadgets to staff in handling waste,the result showed that the safety gadgets provided by these hospitals were inadequate. It was also observed that eye goggles and safety boots were not provided by the three category of hospitals surveyed. It was equally observed from oral interviews of personnel in the various hospitals as well as waste disposal agents' personnel that on the average, they were merely provided with protective wears such as overalls, hand gloves and safety boots to ensure adequate protection. This observation confirms reports by other workers (Adusei - Gyamfi, Boateng, Sulemana, Hogarth, (2022). Flemming et al, 2020) that a high proportion of waste handlers are highly exposed to the risks associated with medical waste handling. This also confirms Blackman (2013) reported that the health impact of direct and indirect exposure to hazardous wastes includes: carcinogenic, mutagenic and tetratogenic effects, reproductive systems damage, respiratory effects etc. Fleming *et al* (2020) lamented that this situation was particularly worsened by gross lack of protective wears in practically all the sampled health facilities.

5. CONCLUSIONS

The management of healthcare wastes has become one of the critical concerns in developing countries especially Nigeria.

Hospital wastes is dangerous and if handled, treated or disposed off incorrectly, can spread diseases, poison people, livestock, wild animals, plants and ecosystems.

The case of Owerri is a clear testimony of how hospital waste is managed in urban areas of Nigeria. One could imagine the magnitude of this problem in bigger towns and cities (Abuja, Lagos Kano etc.) , and the likely consequences on human health. The study identified that inadequate training of waste handlers on disposal practices and provision of adequate equipment are major problems militating against proper waste management practice in healthcare institutions in Owerri urban. The hospitals do not segregate wastes neither do they keep records of waste generation and disposed. The study further revealed the absence of institutional arrangements for the management of hospital wastes at all levels. It is therefore recommended that staff training becomes imperative to create awareness on wastes, their effects, importance of existing guidelines and the implementation of the waste management options for the different categories of wastes so that hospitals do not become infection centres that contribute to the damage of both the environment and human health. To achieve this, healthcare institutions must utilize the most practical options to achieve acceptable standards and practices for hospital wastes management using available technologies. The choice of waste treatment technology should be tailored to urban or rural health facilities. Waste segregation therefore, should be employed as a critical step to achieve waste minimization, cost reduction and sustainable waste management practice.

Moreso, financing healthcare programs should also consider funding for the management of the generated waste. To achieve this , there is a need for a waste management committee to be formed in Owerri to facilitate the proper use of these funds for oversight of healthcare waste disposal.

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