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Full Length Research Paper

Healthcare Waste Disposal Options in Port Harcourt, Nigeria: A Hospital-Based Study

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This study was undertaken to identify the waste disposal options adopted by the different hospital authorities in managing wastes generated as well as determining their awareness level on hospital waste management issues. A daily waste inventory study of each hospital department was carried out for six months in five different hospitals as representative healthcare institutions in Port Harcourt, Nigeria to estimate the waste types and quantities generated. Results obtained showed that 5.53 kg of hazardous portions of hospital wastes and 20.4 kg of non-hazardous waste portions were generated per day by the three categories of hospitals. The waste composition obtained for the different hospital categories show a positive linear relationship between and among the categories of hospitals and the wastes they generate. The findings further show that all the hospitals fell below the recommended waste management practices as prescribed by the World Health Organization and other regulatory authorities. Wastes were not segregated into marked or colour coded containers/bins for the different waste streams neither do they keep records of waste generation and disposal. Recommendations are made for training of personnel on waste handling and provision of safety gadgets and proper education on waste reduction strategies. This process will ensure a reduction in the quantity of medical waste generated which is more expensive to manage.

Key words: Healthcare wastes, health workers, infectious diseases, waste disposal, waste management, hospitals.

INTRODUCTION

Port Harcourt as a fast growing capital city of Rivers State, like most developing cities, lack the infrastructural wherewithal; human and financial resources as well as the institutional capacity necessary to effectively manage hospital/medical wastes as part of the general effort to enhance the protection of human life and the general environment from health hazards arising from improper management of hospital hazardous waste. Waste management entails the process of generation, proper and effective collection, transportation, and disposal of wastes in establishments. Consequently, effective management of hospital waste does not only involve the generation/collection and removal of wastes from hospital premises. It also includes the effective and environmentally safe manner of disposing the wastes.

Management of healthcare wastes (HCW) should be considered as an integral part of hospital hygiene and infection control. The HCW generated within a healthcare facility should always follow an appropriate and well identified stream from their point of generation until their final disposal. This stream is composed of several steps that include generation, segregation, collection and onsite

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transportation, on-site storage, offsite transportation and finally on or offsite treatment and disposal. The poor segregation, handling and disposal practices of many hospitals, clinics and health centres are likely representatives of practices throughout Nigeria and pose serious health hazards to people living in the vicinity of healthcare institutions. A set of protective measures should also be developed in relation with the handling and treatment/disposal of healthcare waste. It is reported that health care institutions dispose of all wastes to municipal dumpsites without pre-treatment, leading to an unhealthy and hazardous environment around the health institutions, affecting patients, staff and the community (Ferreira and Veiga, 2003; Da Silver et al., 2005; Tudor et al., 2005; Ndidi et al., 2009; Abah and Ohimain, 2011; Ogbonna, 2011). Waste management and treatment options should first protect the healthcare workers and the patients and minimize impacts on the environment.

However, the nature and quantity of healthcare waste generated as well as the institutional practices with regards to sustainable methods of healthcare waste management including waste segregation and waste recycling are poorly examined and documented in our healthcare institutions despite the health risks posed by improper handling of healthcare wastes (Ubani, 2004; Oke, 2008; Farzadika et al., 2009; Adegbita et al., 2010).Contamination of water supply from untreated healthcare waste can also have devastating effects. If infectious stools or bodily fluids are not treated before being disposed of, they can create and extend epidemics, since sewage treatment in Africa is almost nonexistent (Rhodes et al., 2000). For example, the absence of proper sterilization procedures is believed to have increased the severity and size of cholera epidemics in Africa during the last decade.

Carl and Janis (1993) reported that most waste disposal sites are required by law to have environmental pollution prevention and control technologies. Available records on the quantity and nature of HCWs and the management techniques in our institutions, with respect to adequate disposal techniques of these wastes have remained a challenge in many developing countries of the world. However, it is reported that several hundreds of tonnes of HCWs are deposited in open dumpsites untreated alongside non hazardous solid wastes (Alagoz and Kocasay, 2007; Abah and Ohimain, 2010) which now poses health risks to health workers, cleaning staff, patients, visitors, waste collectors, disposal site staff, waste pickers, drug addicts and those who knowingly or unknowingly use “recycled” contaminated syringes and needles. Therefore, hospital wastes should be managed in such a way as to protect the health and safety of the personnel generating or transporting hospital/clinical wastes, the public and all aspects of the environment. This study was undertaken to identify the lapses or gaps associated with the handling of HCWs in our health institutions in Nigeria compared with the international best practices and current technologies to safeguard the health of the community.

MATERIALS AND METHODS

Sampling procedure

Five hospitals in Port Harcourt metropolis were randomly selected as a representative of the health care institutions in the area. Sampling was conducted for a period of 6 months to determine the effectiveness of hospital waste management practices. The hospitals were grouped into 3 categories namely large, medium and small, and due cognizance of privately and publicly/government owned hospitals were noted. In this study, the University of Port Harcourt Teaching Hospital (UPTH) represents the Teaching hospitals, Braitwaithe Memorial (BMH) hospital is government owned general hospital while St. Patrick Hospital represents a specialist home. Others were multinational company hospitals, such as the Shell Petroleum Development Company (SPDC), Agip and Elf oil companies, which were located variously in their areas of operation for their staff and host communities and finally Orogbun health Center in Ogbunabali, Port-Harcourt was classified for this study as representing primary health centers. The selected hospitals were carefully chosen to ensure geographical spread, and for adequate representation of large, medium, small sized hospitals in the survey. Also within the selected hospitals due cognizance of privately and public owned were noted. The scaling of hospitals to large, medium and small was based on bed space, bed occupancy rate, wards/units, staff strength and patients.

Sampling was carried out for each category and vital information included nature of waste generation and disposal methods for both solid and liquid wastes. Data were obtained by administering questionnaires to hospital staff such as consultants, medical officers, paramedics (matrons, nurses, cleaners, pharmacists), and administrative personnel. The questionnaires were designed in such a way as to enable respondents indicate wastes types generated and disposal methods. The questionnaire was structured to generate data on the following:

1. Various sources of wastes in the hospital
2. Type of waste collected and handled
3. Safety of personnel and personnel handling waste
4. Adequacy of the protective wear provided
5. Current waste handling methods/procedures
6. Transportation, treatment, and waste disposal methods/ procedures.
7. Existing waste management system.
8. Awareness of hospital staff on waste management.

Each of the hospitals was provided with polythene waste bags with which waste generated were collected daily. The next day, the bags were collected, sorted into categories and the weight of various wastes were determined by using a weighing balance. This was done with the assistance of cleaners and nurses who gather all the solid wastes generated per day in a central waste bin from where the wastes were sorted into categories and weighed using the Ohaus Dail Spring Scale. The composition of the wastes from sampled hospital was estimated by sorting into five categories namely:

1. Plastics, PVC and syringes
2. Swabs, pads, gauze and absorbents
3. Paper packages and bottles
4. Sharps/needles
5. Kitchen/food wastes

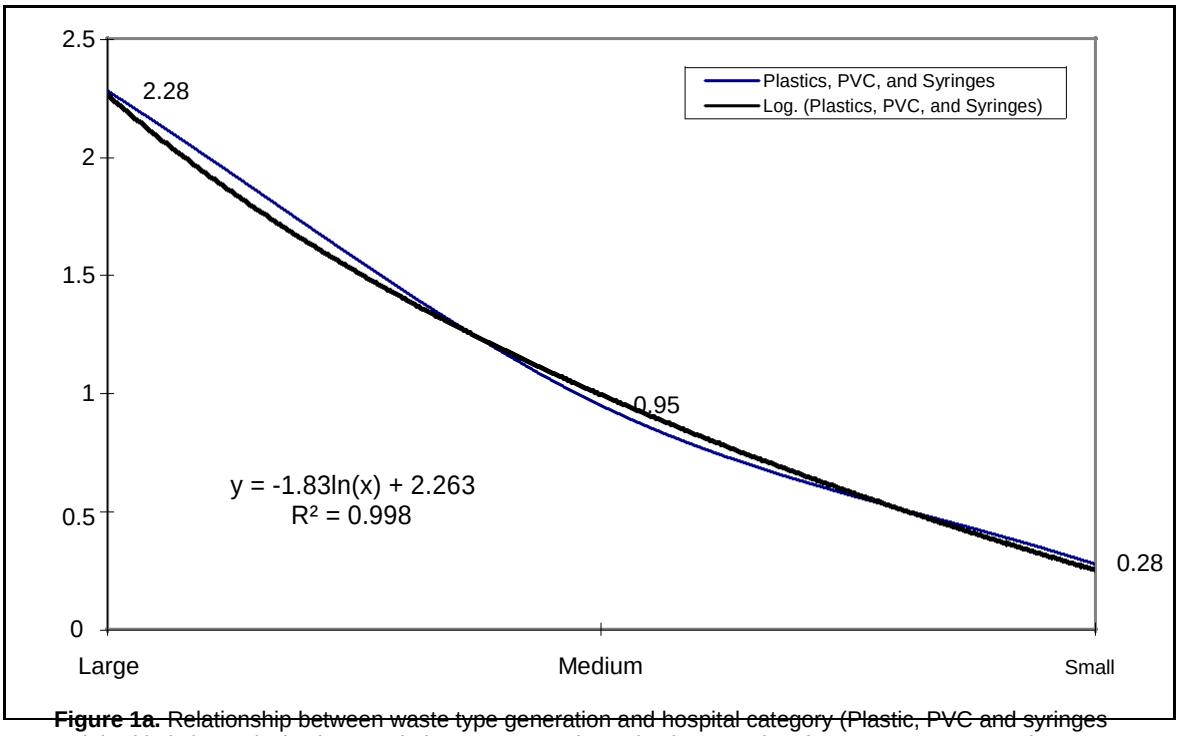

Figure 1a. Relationship between waste type generation and hospital category (Plastic, PVC and syringes weighed in kg). Vertical axis: Hospital Category; Horizontal axis: Quantity of waste type generated.

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 (WHO, 2002; UNEP/WHO, 2005).

Statistical methods were used to analyze the data generated from respondents to the structured questionnaires and direct observation was made on the waste handling at each hospitals. However, simple percentages (%) were converted to arcsines in order to remove the binomial nature of the data. Data collected were tested using analysis of variance. Tables, graphs and other non-parametric descriptive tools were equally used in interpreting the data.

RESULTS

The results obtained from the study showed that both hazardous and non hazardous wastes are generated by the three category hospitals. The result of the survey using a set of questionnaire revealed that about 5 .53 kg of solid hazardous wastes and 20.4 kg of non-hazardous wastes are generated by the three category hospitals sampled per day. 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 (Figure 1a to e). It is evident from the result that large hospital contributes more to waste of different composition as compared to medium and small size hospitals in the order of large hospital (17.66 kg/day) > medium hospital (7.89 kg/day) > small hospital (2.36 kg/day) (Table 1). Thus the quantity and composition of wastes generated followed a downward trend.

Awareness on keeping record on wastes generated

Record keeping on wastes generated in large hospitals indicated that 58% of hospitals were aware of recording waste streams from their areas of operation while 32% of the hospitals are not aware of record keeping as a management practice (Figure 2a).In the contrary, 51% of medium hospitals are not aware of keeping record of wastes generated in their facilities, whereas 39% of them are aware of keeping records of wastes generated (Figure 2b). It was also observed that a low proportion of 8% are indifferent in record keeping of wastes generated. Amongst the small hospitals, only 10% are aware of keeping record of wastes generated (Figure 2c), the greater proportion of hospitals (84%) are not aware of keeping record of wastes generated in their hospitals. 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 small 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 at 0.05 level of significance among the hospitals.

Awareness on waste segregation practice

Large hospitals were observed not to use colour-coded bags/bins to segregate and store wastes before disposal.

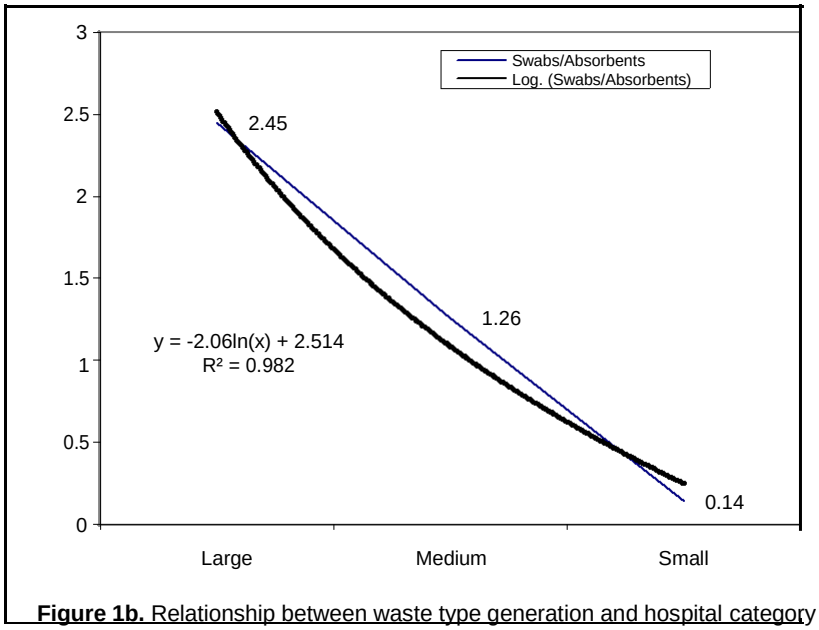

Figure 1b. Relationship between waste type generation and hospital category (Swabs and absorbents weighed in kg). Vertical axis: Hospital Category Horizontal axis: Quantity of waste type generated.

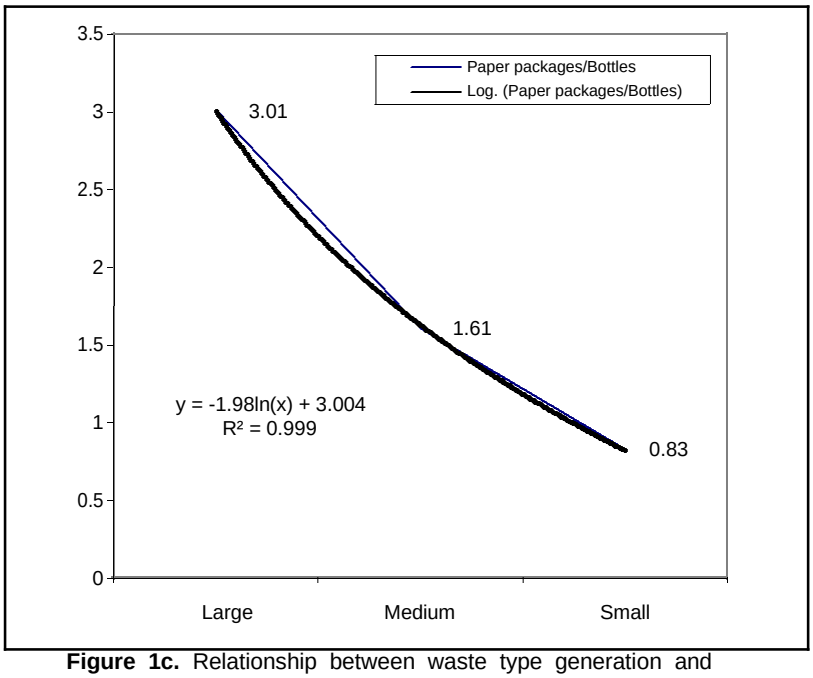

Figure 1c. Relationship between waste type generation and hospital category (Paper packages and Bottles weighed in kg). Vertical axis: Hospital Category; Horizontal axis: Quantity of waste type generated.

This is evident from the larger proportion of respondents (53%) that do not use colour-coded bags to segregate and store wastes. It was also observed that 26% of respondents are aware of the use of color- coded bags/bins, while 21% of respondents are indifferent on the use of color-coded bags/bins in waste management (Figure 3a). Medium hospitals (52%) were observed to show similar respondent pattern as observed with the large hospitals (Figure 3b). Only 14% of respondents indicated awareness on the use of colour-coded bags/bins for wastes segregation, while 34% of respondents are 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 hospital exhibited obvious low

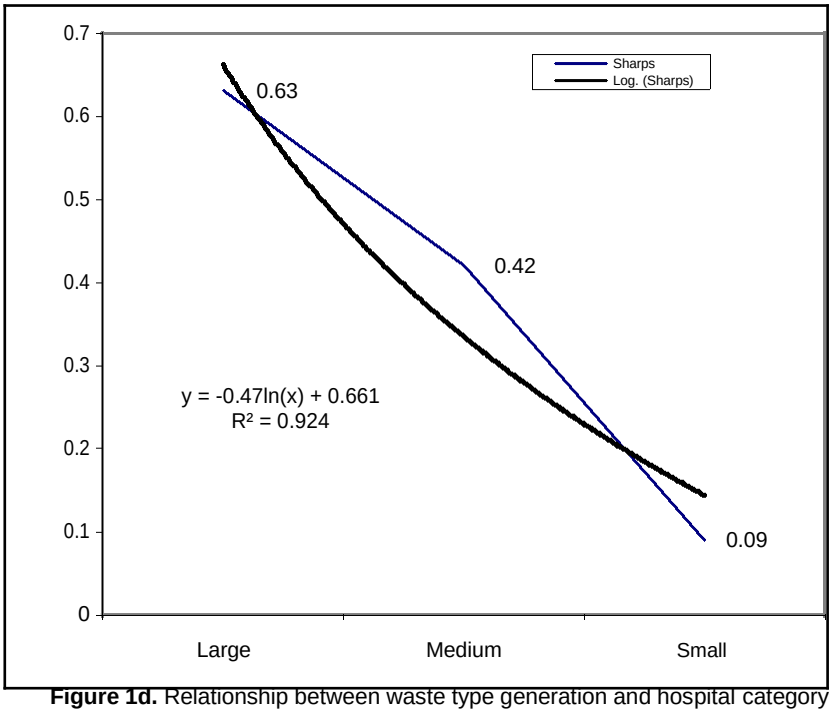

Figure 1d. Relationship between waste type generation and hospital category (Sharps weighed in kg). Vertical axis: Hospital Category Horizontal axis: Quantity of waste type generated.

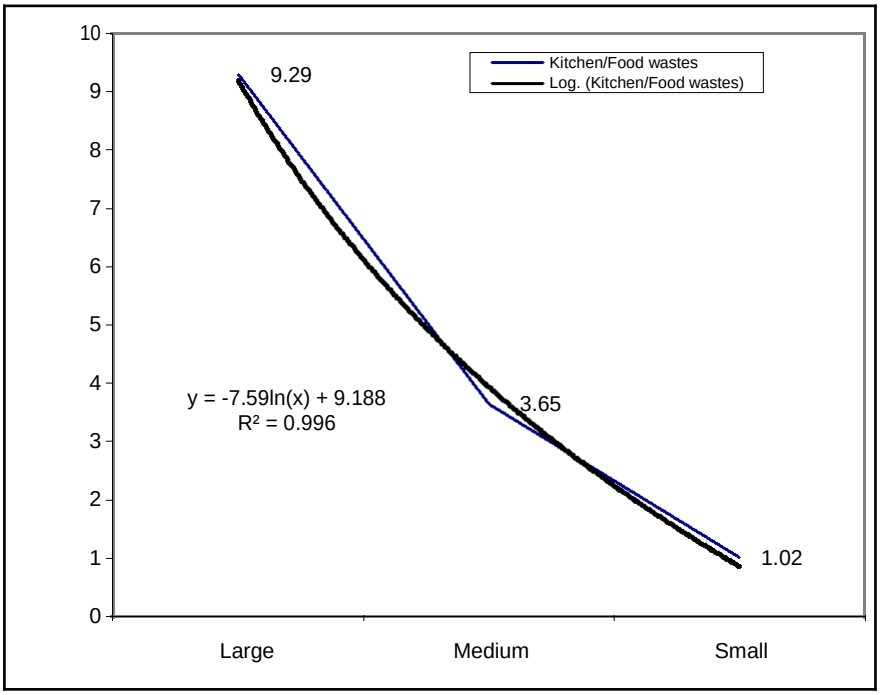

Figure 1e. Relationship between waste type generation and hospital category (Kitchen and Food weighed in kg). Vertical axis: Hospital Category Horizontal axis: Quantity of waste type generated

awareness level in the use of colour- coded bags/bins in waste management (Figure 3c).The analysis of variance of awareness on waste segregation by the three hospital categories shows a significant difference at 0.05 level of significance among the hospitals.

Use of trained personnel in handling waste

The use of trained personnel in waste handling varied between the hospitals categories. Greater proportion of hospital waste was handled by trained personnel in the

Table 1. Average solid daily waste generation rates (kg) from selected hospitals in Port Harcourt metropolis.

Waste description	Hospital category		
	Large	Medium	Small
Plastics, PVC, and syringes (kg/day)	2.28	0.95	0.28
Swabs/absorbents (kg/day)	2.45	1.26	0.14
Paper packages/bottles (kg/day)	3.01	1.61	0.83
Sharps (kg/day)	0.63	0.42	0.09
Kitchen/food wastes (kg/day)	9.29	3.65	1.02
Total waste stream (kg)	17.66	7.89	2.36

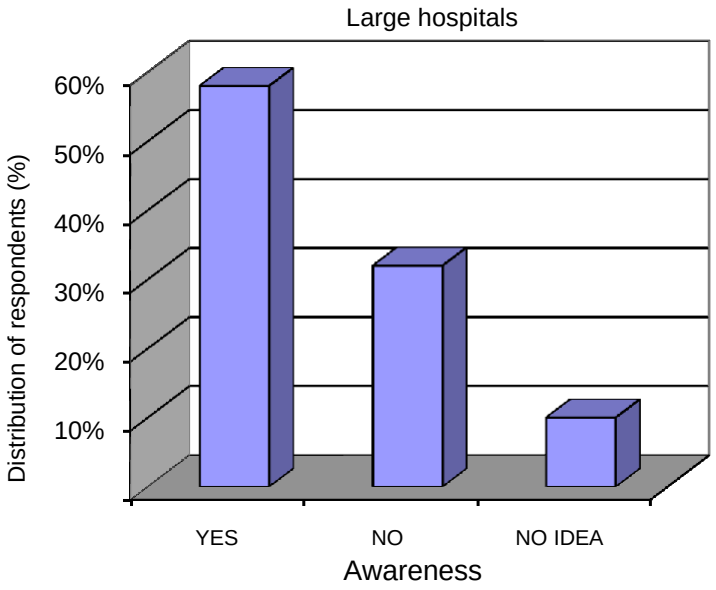

Figure 2a. Relative awareness by large hospitals on keeping record of wastes generated.

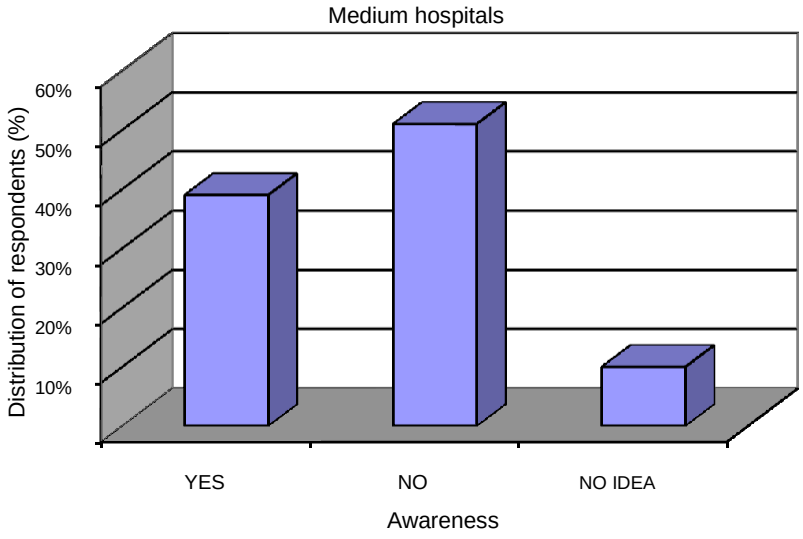

Figure 2b. Relative awareness by medium hospitals on keeping record of wastes generated.

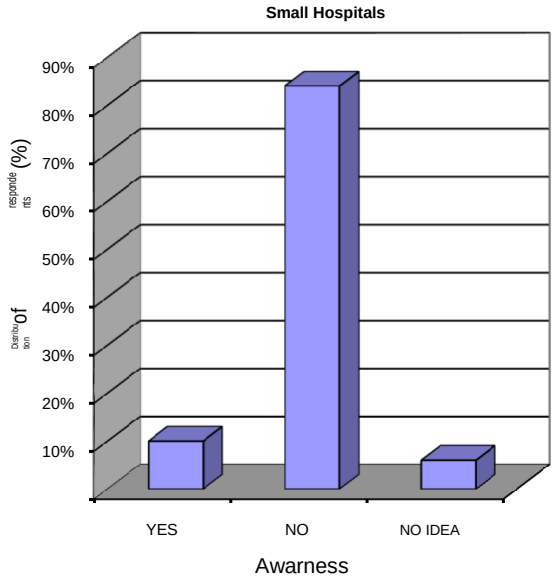

Figure 2c. Relative awareness by small hospitals on keeping record of wastes generated.

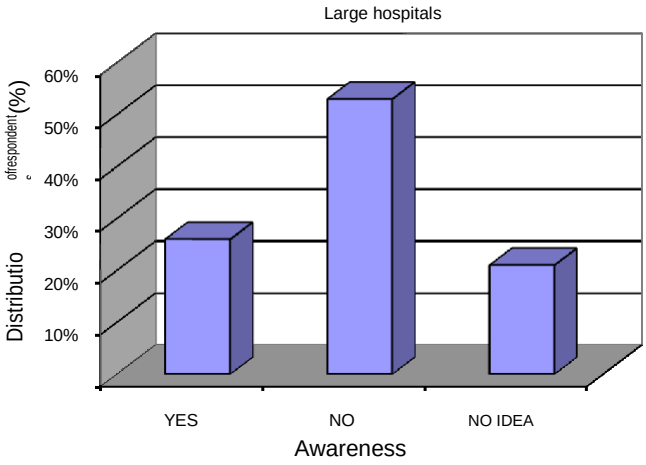

Figure 3a. Relative awareness on waste segregation by large hospitals.

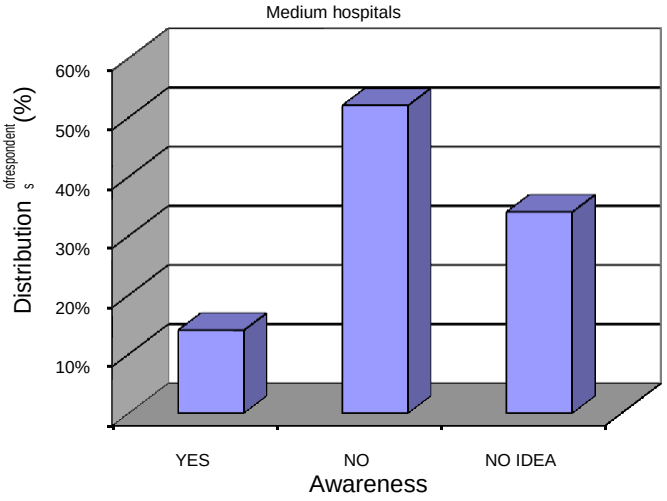

Figure 3b. Relative awareness on waste segregation by medium hospitals.

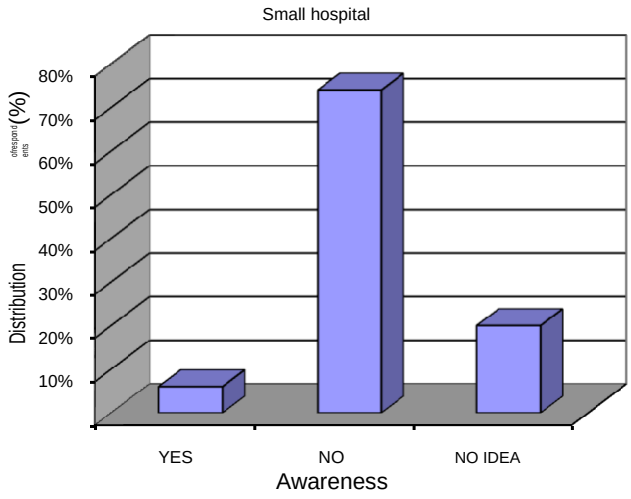

Figure 3c. Relative awareness on waste segregation by small hospitals.

large hospitals (Figure 4a). The proportion that felt otherwise (28%) was double fold less than those who are aware (55%). In the medium and small scaled hospitals (Figure 4b and c), the revise pattern was observed. In the same way, the analysis of variance of awareness on the use of trained personnel in waste handling by the three hospital categories shows no significant difference at 0.05 level of significance.

Awareness on existing guidelines/legislations on waste management and compliance

The three categories of hospitals showed high level of awareness of some existing guidelines/legislations for industrial hazardous and medical wastes handling. Awareness level on the existence of Harmful Wastes Act, Cap 165 LFN 1990, was in the decreasing order of large hospitals greater than the medium hospitals greater than the small hospitals (LH > MH > SH) (Figure 5). The statistical test for awareness level on existing guidelines/ legislations on waste management and compliance among the three category hospitals shows no significant difference, at 0.05 level of significance.

Provision of safety gadgets to staff in waste handling

It was observed that in large hospitals, safety gadgets

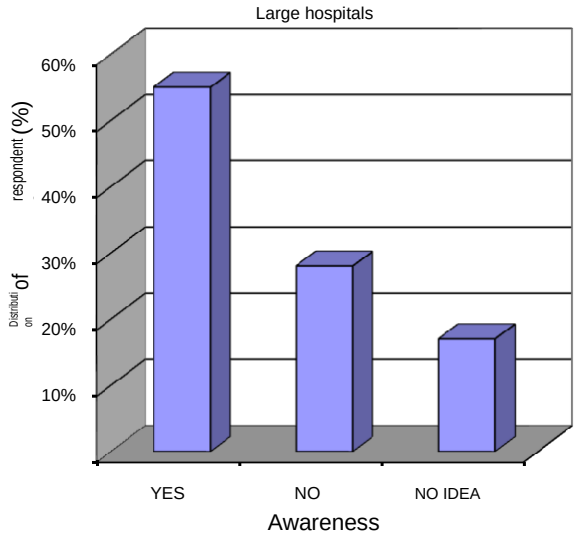

Figure 4a. Awareness by large hospitals on the use of trained personnel in waste handling.

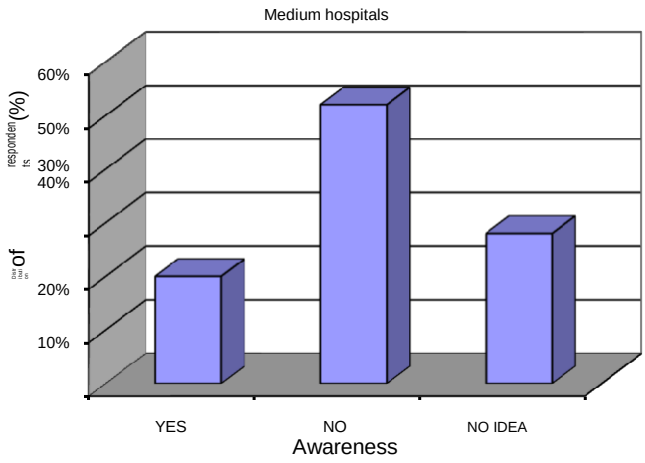

Figure 4b. Relative awareness by medium hospitals on the use of trained personnel in waste handling.

were provided and in the ordering magnitude of hand gloves (48%), coverall (27%), safety boots (12%), with 33% of respondents indicating the provision of all safety gadgets listed for waste handling (Figure 6a). In the medium hospitals (Figure 6b), provision of safety gadgets to staff in waste handling is in the decreasing order of coverall (35%) greater than hand gloves (31%), greater than safety boots (10%), greater than nose mask (0%), and eye goggles (0%). It was observed that nose mask and eye goggles are not used in waste handling by medium hospitals. Small scale hospitals (Figure 6c) also had provision of safety gadgets in the decreasing order of hand gloves (59%), coverall (14%), and nose mask (9%). 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 hospital 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 show a significant difference in the provision of safety gadgets to staff in the three categories of hospitals.

DISCUSSION

A major issue confronting the management of healthcare waste is perhaps the fact that it is generally viewed mainly from an environmental and less from a public health perspective. In Nigeria, liability for any pollution occurring as a result of unauthorized waste management activities rests with the waste generator in accordance with Article 20(1) of Decree No 58/88. The Public Health Act 1958 and various state edicts on environmental sanitation 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 healthcare as an Integral part of the existing environmental protection framework should be considered.

The current disposal method of hazardous wastes in the healthcare institutions studied, that is dumping and opens burning within the premises of hospitals poses health risk to patients and people residing close to healthcare facilities (Kuroiwa et al., 2004). The HCW may contain a large proportion of plastics (as recorded in this study), when burnt emits dioxin which is a major air pollutant of concern from chlorinated polymer (WHO, 2004). Improperly disposed hazardous HCW (like syringes and needles in the absence of sterilization) can cause infectious of Hepatitis B, C and HIV (WHO, 2002) and poses indirect risks to humans through direct environmental effects by contaminating soil and ground-water (Abah and Ohimain, 2011). This observation is consistent with several studies (Allsopp et al., 2001; Echegaray et al., 2002; Ndidi et al., 2009 Ogbonna, 2011). This is orchestrated by the fact that when untreated wastes are beaten by rain are washed into the drainages, rivers, streams and other waters thus endangering human and aquatic lives (Ogbonna et al., 2007). The concern about hazardous wastes may differ or have similar outcomes. This is because the harmful effects of some wastes may not be obvious while being used and /or before they are discarded. For instance, people could get exposed during a product manufacturing process, transportation, distribution and/ or usage. Most chemicals and cytotoxic drugs are good examples of products that are harmful throughout their lives' cycle and disposal.

From the results on record keeping on waste generated

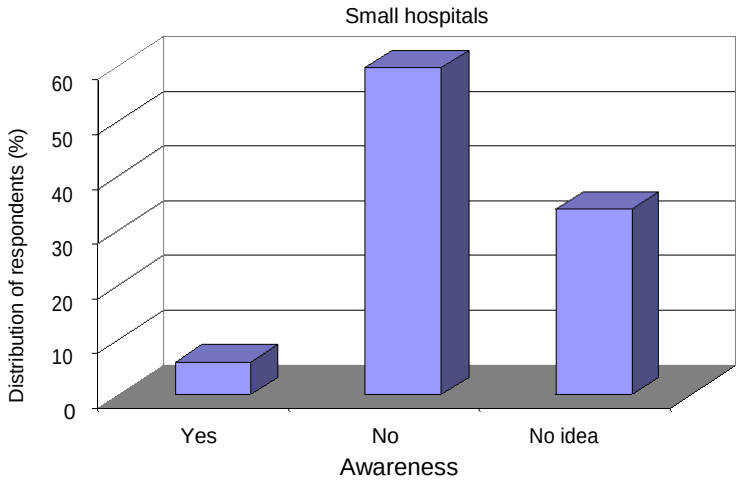

Figure 4c. Relative awareness by small hospitals on the use of trained personnel in waste handling.

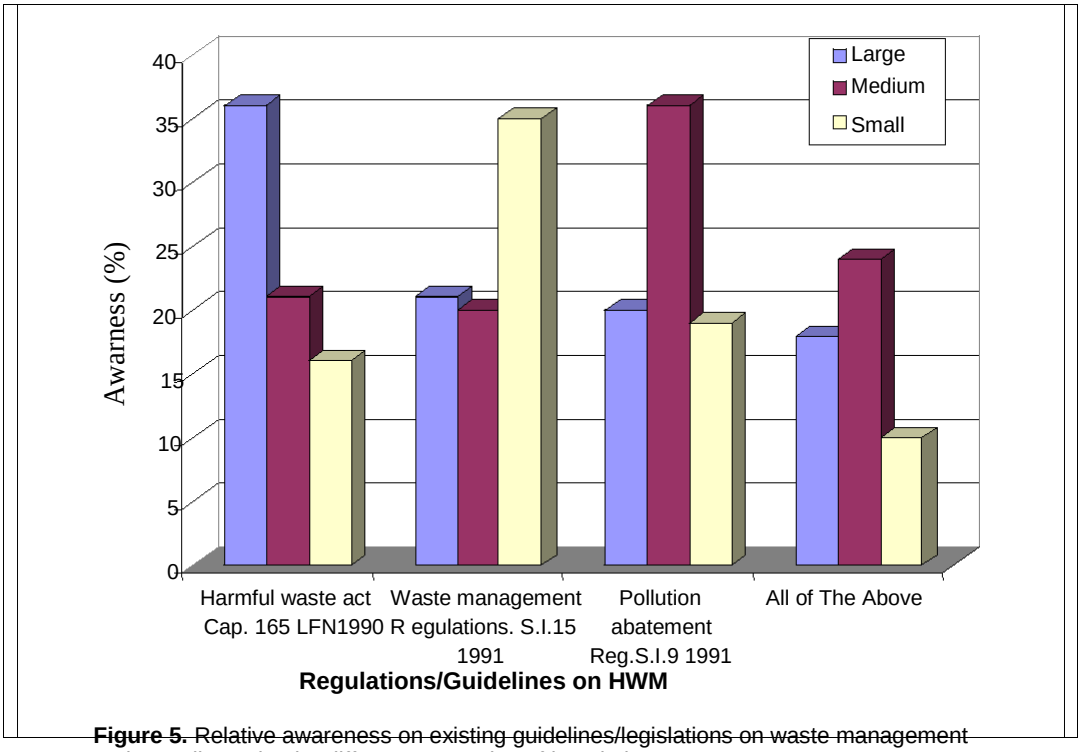

Figure 5. Relative awareness on existing guidelines/legislations on waste management and compliance by the different categories of hospitals.

by large, medium and small hospitals, it is not surprising to observe that the awareness is more in large hospitals than in the other category hospitals. It could be part of clients' requirement as a matter of policy especially for those hospitals doing business with oil and gas industries such as SPDC, Agip and Elf oil companies. These multi-nationals have an organized hospital waste management system that meets international standards. In addition, it may be that large hospitals have waste managers or 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 not only to get a good approximation of waste generation data and more difficult to track hazardous wastes components in the waste generated in these hospitals.

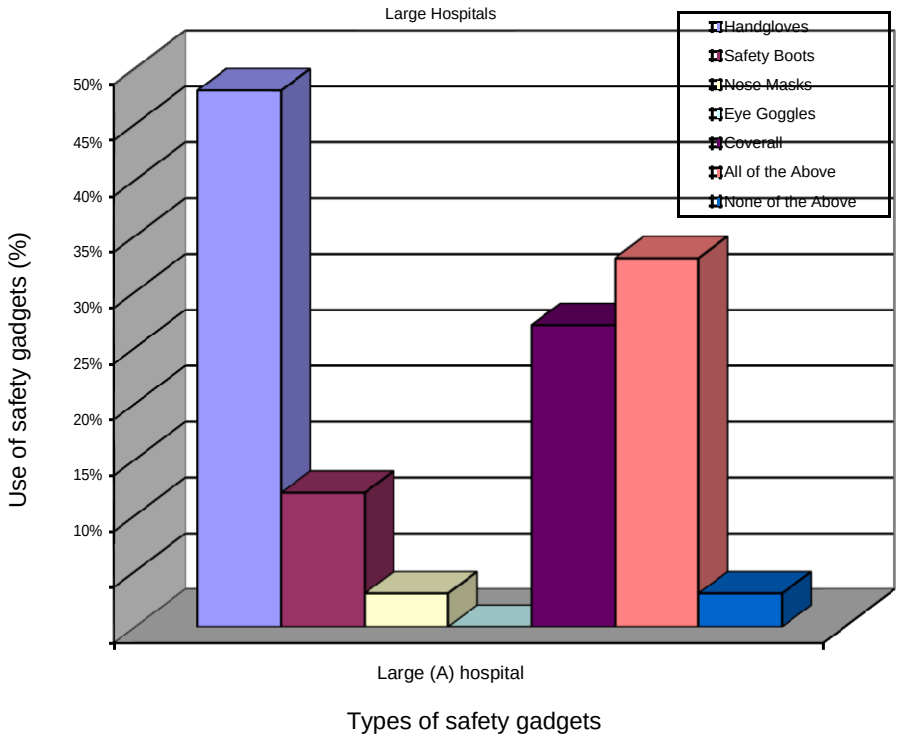

Figure 6a. Provision of safety gadgets to staff in waste handling by large hospitals.

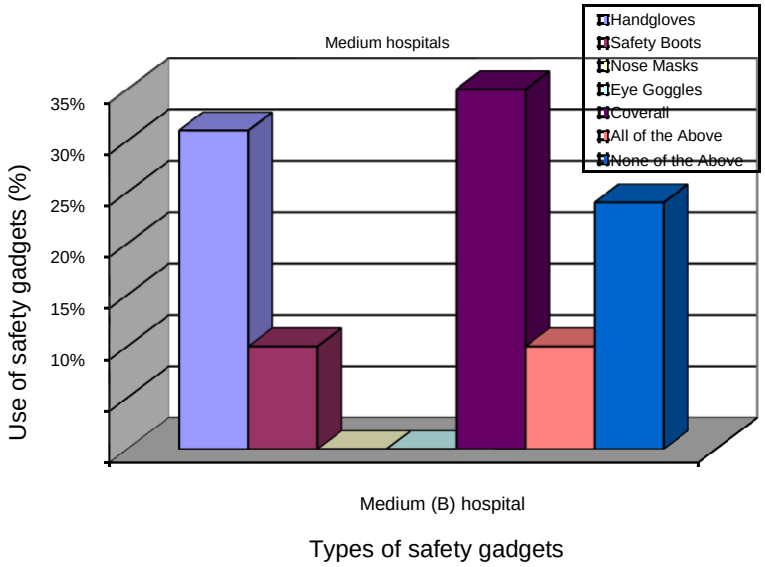

Figure 6b. Provision of safety gadgets to staff in waste handling by medium hospitals.

This assertion lends credence to the assertion of Coker and Sangodoyin (2000) that the management of health facilities is hampered by lack of basic waste generation data. Furthermore, it was observed that 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 reduce waste generation. Such data collected by this process can be used to produce a hospital waste bank on which further researches on hospital waste management could hinge upon.

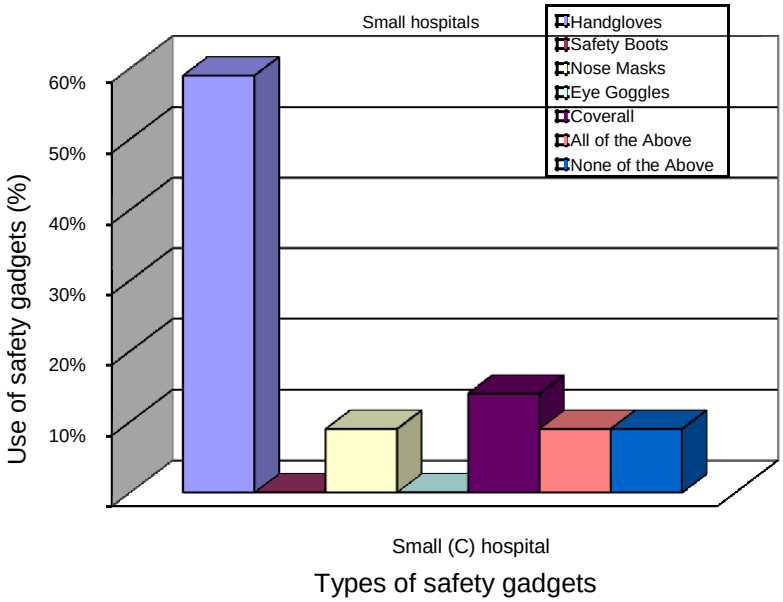

Figure 6c. Provision of safety gadgets to staff in waste handling by small hospitals.

The study on waste segregation showed that the three category hospitals are not aware of waste segregation as a management practice. It was revealed that wastes were hardly segregated into marked or colour-coded con-tainers for the different waste streams as physical visits to various category 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 from infectious medical wastes to nearby environments. This is confirmed by the findings of the study in Lagos by Olubukola (2009) that HCW management practices is marred by poor waste segre-gation practices as well as lack of instructive posters on waste segregation and disposal of general wastes. Segregation of wastes according to Ndidi et al. (2009) and Abah and Ohimain (2011) would result in a clean solid waste stream which could be easily, safely and cost effectively managed through recycling, composting and land filling. The nature and quantity of HCW generated in these hospitals makes it very imperative to employ waste segregation because of the health risks posed by the improper handling of HCW (Oke, 2008; Farzadika et al., 2009; Abah and Ohimain, 2011; Ogbonna, 2011). This is because the HCW contain materials that may be harmful and can cause ill health to those exposed to it; especially health workers who may be directly exposed and to people near health facilities, particularly children and scavengers who may become exposed to infectious wastes and a higher risk of diseases like hepatitis, HIV/AIDS (WHO, 1999; 2002; Oke, 2008; PATH, 2009; Coker, 2009; Adegbita et al., 2010). Further reports also indicate that several hundreds of tonnes of HCW are deposited openly in waste dumps alongside non-hazardous solid wastes around surrounding environ-ments without segregation (Alagoz and Kocasay, 2007; Abah and Ohimain, 2010). 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. The absence of waste segregation according to Abah and Ohimain (2011) imply that the estimates of the various waste categories may not be precise; nonetheless it provides a useful guide for the assessment of the different waste streams generated by many of which are hazardous in nature requiring special handling to avoid health consequences.

This study observed inadequate, relevant training of waste handlers on disposal practices and provision of adequate equipment as a problem militating against proper waste management practice in healthcare institu-tions in Port Harcourt. If indeed they were being trained, the exercise did not impact on them skills and knowledge of the recommended measures for proper waste management process. In large hospitals, greater propor-tion of hospital wastes is known to be handled by trained personnel (55%), implying that it could be part of client requirement as a matter of policy especially for those large hospitals doing business with oil and gas industries in Port Harcourt. The fact that oil Companies require retainer clinics to meet up with their HSE standards could be responsible for this practice. In any case, the practice is not good enough which is an indication of the generally

poor attitude towards hospital waste management in Port Harcourt municipality. The implication of a large proportion of unawareness in 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 Port Harcourt showed that they treat the wastes they handle as normal domestic wastes and dispose them as such, thus confirming the findings of Fleming et al. (2002) that solid waste workers are exposed to significant levels of physical, chemical and biological toxins. This revelation was further strengthened by the results of the survey of garbage collectors regarding health and safety aspect of their jobs by Rogers et al. (2002), in which it was observed that 75% of the collectors were reported to have being injured in the process. The study also observed that waste disposal agents carry out partial sorting/scavenging during loading of wastes. 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.

This general perception is contrary to physical observations at some of the hospitals as there is little or no institutional arrangement for the management of hospitals medical wastes in all hospitals studied. This indicates that these hospitals have no specific policy to guide medical waste management. The available guidelines/legislations as corroborated by Coker and Sangodoyin (2000) are broad and focused more on solid wastes especially those covering toxic /industrial hazar-dous wastes. Thus these observations are in agreement with the observation of Louis (2001) 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. It is assumed that having been aware of the relevant legislations on wastes, hospitals' management should follow the appropriate procedure in disposal of these wastes. Contrary to this, the survey showed that health institutions treat their wastes as normal domestic wastes and dump them without appropriate handling procedure. Louis (2001) reported that environmental regulations in Nigeria do not play any important role in encouraging firms to improve their environmental performance or reduce waste. Despite the fact that there is no existing hospital waste policy to guide medical waste handling and disposal, in Nigeria (Coker and Sangodoyin, 2000; Louis, 2001), the individual hospitals do not have any guiding policy on hospital wastes generation, handling and disposal. This observation supports Melanen et al. (2001) and Townend and Cheeseman (2005) position that administrative instruments are still needed in order to control the use of harmful and dangerous substances and the management of hazardous wastes. Although awareness seems to have increased in the three hospitals as they claimed regarding the need for proper management and disposal of medical waste, it had no impact on the way hospitals handle wastes. One possible reason for this observation could be attributed to the general carefree attitude of Nigerians towards hospital waste management. Another argument could be hinged on the fact that environmental regulations in the country do not play any important role in encouraging hospitals improve their waste manage-ment; reason being lack of political will to enforce the existing regulations/guidelines on general waste management. This tend to agree with the report of Mato and Kaseava (1999) that many countries especially the developed nations have legal provisions with regard to proper management of hazardous wastes unlike developing countries where hazardous wastes are still handled and disposed together with normal domestic wastes thus posing a great health risks to municipal health workers, the public and the environment at large. For instance more than twenty (20) ordinances on waste have been issued in Finland since the National Waste Act came into force in 1994 and also as a requirement from European Union, Finland also has a National Waste management Plan (Melanen et al., 2001). This was not the case in Port Harcourt hospitals which showed that all the different categories of hospitals visited do not follow any procedural guideline in the management of harmful/dangerous/medical wastes as enshrined in the Federal Environmental Protection Agency Decree No 58 of 1988. To say the least decree No 58, of 1988 as amended by Harmful Wastes Act Cap 165 LFN 1990 and Waste Management Regulations S.I.15 1991 are defective as it did not encapsulate any broad policy framework that has direct influence on medical waste management neither did it take cognizance of the fact the scope of medical waste incineration processes should include monitoring of emissions and standards as it is done elsewhere (CDHS,1988; Mato and Kaseava, 1999; Melanen et al., 2001).

With regard to the provision of safety gadgets to staff in handling waste, the result showed that the three category hospitals provide safety gadgets to staff involved in waste handling. It was observed that the use of eye goggles as a safety gadget for waste handling seems not to be required by the various hospitals. It was also observed that Nose mask is not used in waste handling by medium hospitals. 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 coveralls, hand gloves and safety boots that do not ensure adequate protection. This observation confirms reports by other workers (Coker et al., 1998, 1999; Fleming et al., 2002; Rogers et al., 2002) that a high

proportion of waste handlers are highly exposed to the risks associated with medical waste handling. This also confirms Blackman (1993) 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. (2002) revealed that injuries as well as acute and chronic musculo-skeletal, dermal, and respiratory health effects were well documented among solid waste workers. They lamented that this situation was particularly worsened by gross lack of protective wears in practically all the sampled health facilities. This was further supported by the observations of Mato and Kaseava (1999) that staff in charge of handling medical wastes, usually have no protective gear or sufficient knowledge of potential hazards of the wastes they handle.

Conclusion

Management of healthcare wastes has become one of the critical concerns in developing countries especially Nigeria. Healthcare waste is dangerous, if handled, treated or disposed off incorrectly can spread diseases, and poison people, livestock, wild animals, plants and ecosystems.

The study identifies inadequate relevant 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 Port Harcourt. The hospitals do not segregate wastes neither do they keep records of waste generation and disposal. The study further revealed the absence of institutional arrangements for the manage-ment 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 infections centres that contribute to the damage of both the environment and human health (Ndidi et al., 2009). To achieve this, healthcare institutions must utilize the most practical options to achieve acceptable standards and practices for HCW management using available tech-nologies. The choice of waste treatment technology according to Abah and Ohimain (2011) should be tailored to urban or rural health facility. Waste segregation therefore, should be employed as a critical step to achieve waste minimization, cost reduction and sustainable waste management practice.

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