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Full Length Research Paper

Characteristics and waste management practices of medical wastes in healthcare institutions in Port Harcourt, Nigeria

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The study was undertaken to investigate the medical waste categories and its management practices in five different hospitals as representative health care institutions in Port Harcourt city, Nigeria. Sampling was conducted by grouping the representative hospitals into large, medium and small categories based on bed space, average bed occupancy rate, ward units, staff strength and patients. Data were obtained by administering questionnaire to hospital staff. Results obtained showed that the average waste types generated in the three categories of hospitals for both hazardous and non-hazardous wastes were in the order of 17.66, 7.89 and 2.36 kg/day for large, medium and small hospitals respectively. The percentage waste generation for the large hospitals show that 41% of the waste type are hazardous, 33% are non hazardous while in the medium size hospitals, 35% of the waste generated are hazardous and non hazardous had 35% and the small scale hospitals had combined waste types as the dominant waste type with 51% followed by non hazardous with 31% and hazardous had the least with 18% of waste types. Solid waste disposal method adopted by the health institutions showed that open dumpsites are most preferred to other disposal methods while liquid wastes are mostly disposed of by flushing through drains/sinks. However, disposal of solid waste by incineration is recommended except for the environmental problems which have a tendency to pollute the sub-soil and groundwater due to their leaching as well as the health risks it pose to the general public.

Key words: Hospital, medical wastes, hazardous waste, waste type, disposal method, environment.

INTRODUCTION

Hospital wastes constitutes a problem because of the epidemiological and political considerations associated with increase in the incidences of viral blood infections such as the AIDS and Hepatitis B and C that was linked to discarded syringes (Coker and Sangodoyin, 2000). This is because stakeholders in the Hospital Waste Management sector did not see the subject matter as a component of hospital hygiene intended to control nosocomial infections among patients and hospital personnel. It is pertinent to note that Medical wastes are still being handled and disposed of together with normal domestic wastes, thus posing a great health risks to dumpsite scavengers, municipal workers, the public and the entire environment. These wastes are generated as a result of patient's diagnosis, treatment or immunization of human beings or animals (MEF, 1998; US EPA, 2004). Many hospitals simply dump all their wastes together from reception area trash to operating room waste without any form of segregation while in most cases, some hospitals use incinerators. However, in the recent times, these medical waste treatment technologies have not been cost-effective enough to render the wastes safer, cleaner and harmless in the environment (Jang et al., 2006).

Management of medical wastes therefore work to eliminate the dangerous practice of incineration as well as to minimize the amount and toxicity of all waste streams generated by the hospitals. Despite the high level of waste generation from the hospital sources and the health implication, emphasis on waste generation and

management have been on domestic sources (Ogbonna et al., 2007) and industrial sectors (FEPA, 1991; Louis. 2001). Information on the amount of hospital waste and its management practices is rather nonexistent in spite of the hazards and epidemiological implications (Coker and Sangodoyin, 2000). The infectious waste stream must then be treated to prevent the spread of disease. This study was therefore undertaken to assess the medical waste categories and management practices in hospitals in Port Harcourt, Nigeria as a baseline to ascertain medical waste generation rates and further identify possible waste disposal methods used in the various hospitals. This will enable stakeholders in the health care sector control and eliminate the illicit handling of toxic wastes generated in various hospitals.

METHODOLOGY

Sampling procedure

Five hospitals in Port Harcourt were randomly selected as a representative of the health care institution 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 the SPDC hospitals, 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 health centers. The scaling of hospitals to large, medium and small was based on bed space, average 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, matrons, nurses, cleaners, pharmacists, and administrative personnel. The questionnaires were designed in such a way as to enable respondents indicate the kind of wastes they generate and their disposal methods.

The hospitals were provided with polythene bags with which they collected their daily waste. The next day the bags were collected, sorted into categories and the weight of various wastes were determined by using a weighing balance. Statistical methods were used to analyze the data generated from both respondents to the structured questionnaires and the participant's observation from the various hospitals. Simple percentages (%) were converted to arcsines in order to remove the bionomical nature of the data (Zar, 1984). The hypothesis was tested using analysis of variance (ANOVA). Also standard deviation statistical analysis was employed to determine the relationship between the waste types, which were classified into categories.

Description of the study area

The study area is situated within the geographical locations of 4° 44/ to 4°59/ N and 6° 75/ to 7° 05/ E. It is located in a tropical rain forest area with climatic conditions classified as humid, semi-hot equatorial type (Padaki, 1961) from March to October. The mean annual rainfall is about 2,405.2 mm. The dry season experienced in the area is between November to February with occasional rainfall (Gobo, 1990). The study area includes Obio/Akpor and Port Harcourt city Local Government Areas of Rivers State and it occupies an estimated area of 180,000 hectares (Port-Harcourt Master Plan, 1975) (Figure 1). Port Harcourt city and Obio Akpor population is 440,399 and 263,017 in 1991 with a projected figure of 521,199 and 311,272 respectively in 1996 (NPC, 1992). The municipal area has a population growth rate at 5% and by the year 2003, it is estimated to have a one million mark (Ogionwo, 1979). This anticipated population growth will continue as the pace of urbanization continues, modern living standard increases.

The rate at which wastes are generated will also increase thereby constituting much greater burden. In which ever way one looks at the future, there is no doubt that the magnitude of wastes likely to be generated in Port-Harcourt is bound to be tremendous giving the changes taking place in the economy of the state.

RESULTS

Average solid waste generation rate per day (kg) from selected hospitals in Port-Harcourt metropolis show that large hospitals contribute more to medical waste stream of different composition when compared to medium and small size hospitals in the order of 17.66> 7.89 > 2.36 kg/day respectively (Table 1). The waste generation of large hospitals indicates that 41% of the waste type is hazardous, 33% are non-hazardous and 26% are combined waste type (Figure 2). The medium hospitals had 35% of waste generated as hazardous and non-hazardous 35% while 30% is of combined type (Figure 3); while in the small scale hospitals the combined waste type constituted the dominant waste types with 51% followed by non-hazardous 31% and hazardous waste type having the least with 18% (Figure 4). The hazardous waste include used needles and syringes, surgical blades, human tissues or fluids, genotoxic chemicals, x-ray materials, gloves, gauze radioactive wastes etc while non-hazardous wastes include linens, papers, food material, vegetables, cans, plastics, cartons, diapers etc. Results on solid and liquid wastes disposal methods showed that 49% of solid waste in large hospitals are disposed off at designated dumpsites (prescribed by government authorities) followed by 22% open burning, 12% incineration, 7% burial while 7% was recorded for waste bins (Figure 5).

Liquid waste generated in large hospitals were disposed of by flushing through the drains/sewers/sinks. This practice was followed by collection in colour coded bags while the rest were discharged by "discarding" in the open environment/surroundings (Figure 6). For solid waste in medium hospitals, 30% was recorded for disposal in open dumps followed by the use of waste disposal agents of 19%, while the other disposal options such as burial recorded 9%, 7% for incineration and 6% for open burning (Figure 7). On liquid waste disposal, flushing down through the sink recorded 56% followed by 30% for those discarded into open drains/sewers while the rest discharge their liquid waste in colour coded bags

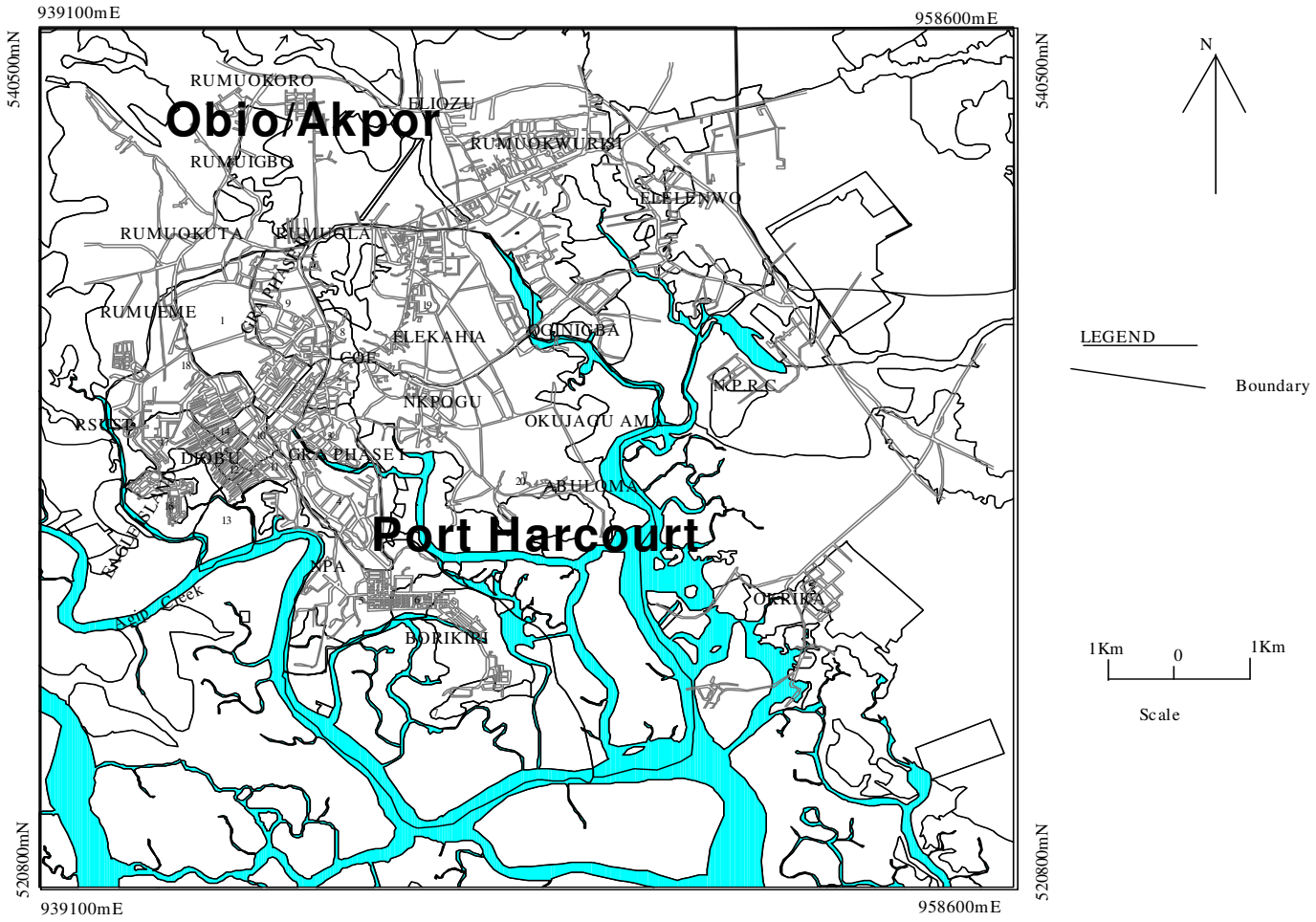

Figure 1. Study area: May of Port Harcourt Metroplois

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

Waste description	Hospital categories		
	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	17.66 kg	7.89 kg	2.36 kg

(Figure 8). Small scale hospitals showed that greater proportion (56%) of their waste was disposed of using waste disposal agents followed by open dumps (17%) and burning (12%) (Figure 9). Liquid waste generated were discharged mostly by flushing down in sinks, followed by discarding into open drains or sinks and discharging others in colour coded bags (Figure 10). The rest wastes were indifferent in the discharge approach.

The analysis of variance of solid waste methods adopted by the three hospital categories shows no significant differences in the method adopted by each category of hospital at 0.05 level of significance (ANOVA = 1.46 < f (2.99) 0.27).

On the other hand the two-factor analysis of variance of liquid waste disposal methods adopted by the three hospital categories shows a significant difference at 0.05

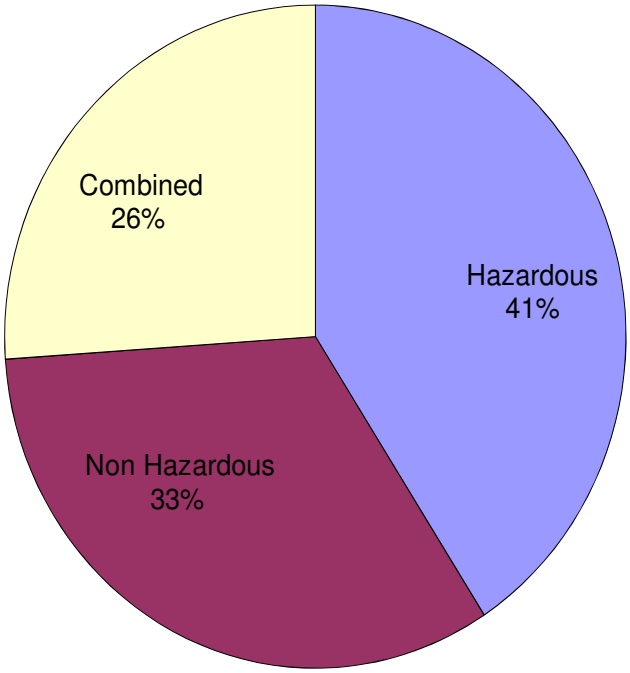

Figure 2. The nature of waste generated in large Hospitals.

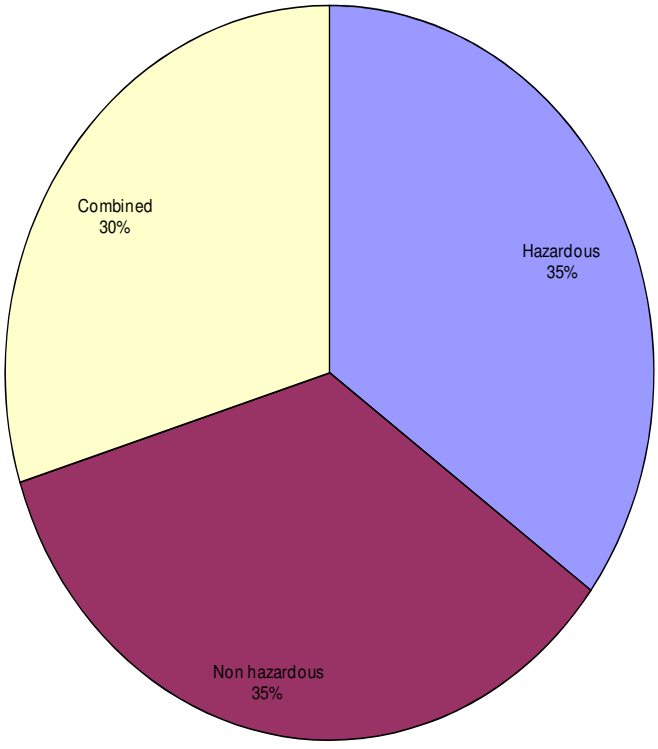

Figure 3. The nature of waste generated in medium Hospitals.

level of significance (ANOVA = 15.43 > f (4.75) 0.003).

DISCUSSION

The result obtained from the study showed that both hazardous and non-hazardous wastes are generated by the three categories namely; large, medium and small sized hospitals. The high proportion for combined wastes (51%) (that is, hazardous and non-hazardous) generated by small hospitals shows a low level of specialization in wastes handling in this category of hospital. It appears from the distribution that small hospitals generate more of combined wastes when compared to the distributions from the large and medium hospitals. Wastes generation at the rate of 17.66, 7.89 and 2.36 kg/day for large, medium and small sized hospitals respectively is considered low when compared to the result of a similar study in Dares Salaam hospitals (Mato and Kaseava, 1999). The reason for lower values for Port-Harcourt hospitals may partly be associated with the perception of the people about patronizing the hospitals and also the institutional inability to control drug administration in the hospitals. Most people prefer to visit patent medicine stores or pharmacy for prescription of drugs for a perceived illness than going for the services of a doctor in a hospital or clinic.

Another possible reason could be the economic predicament that majority of the citizenry are facing, hence cannot afford the cost of medicare in the area. However, a similar study in Ibadan, Nigeria by Coker et al. (1999) noted that a higher value of medical waste of 186.9 g/person/day obtained at a privately owned – Alafia hospital, as against an average of 132.3 g/person/day for two public hospitals in Oni and Ring road hospitals are generally patronized by middle and high class citizens who can afford the more exorbitant charges compared to the public/government owned hospitals. Also the variation in waste generation observed among the three hospital categories is expected. This largely depends on a number of factors such as the type or level of technology employed in its services and sometimes the location and reputation of the hospital. This observation corroborates the assertion of various authors in similar studies (Coker et al., 1999; Mato and Kaseava, 1999; Pruss and Townsend, 1998; Waseem et al., 1995). They affirmed that the variation in waste generation rate from one ward or unit to another within each hospital is dependent upon the nature of activities or services in that particular ward. Finally, the result of waste generation trend as obtained in this study are also in agreement with the findings of Swai and Mato (1996) on waste generation rates for hazardous and non-hazardous rates in some health care facilities in Dares Salaam, but differs from the contribution of Mato and Kassenga (1997).

The results on the hospital solid waste disposal observed that open dump sites was most preferred method for disposal of solid wastes amongst the large and medium cadre hospitals while the small scaled hospitals showed preference to the use of waste disposal agents who invariably dumps them into open dump sites.

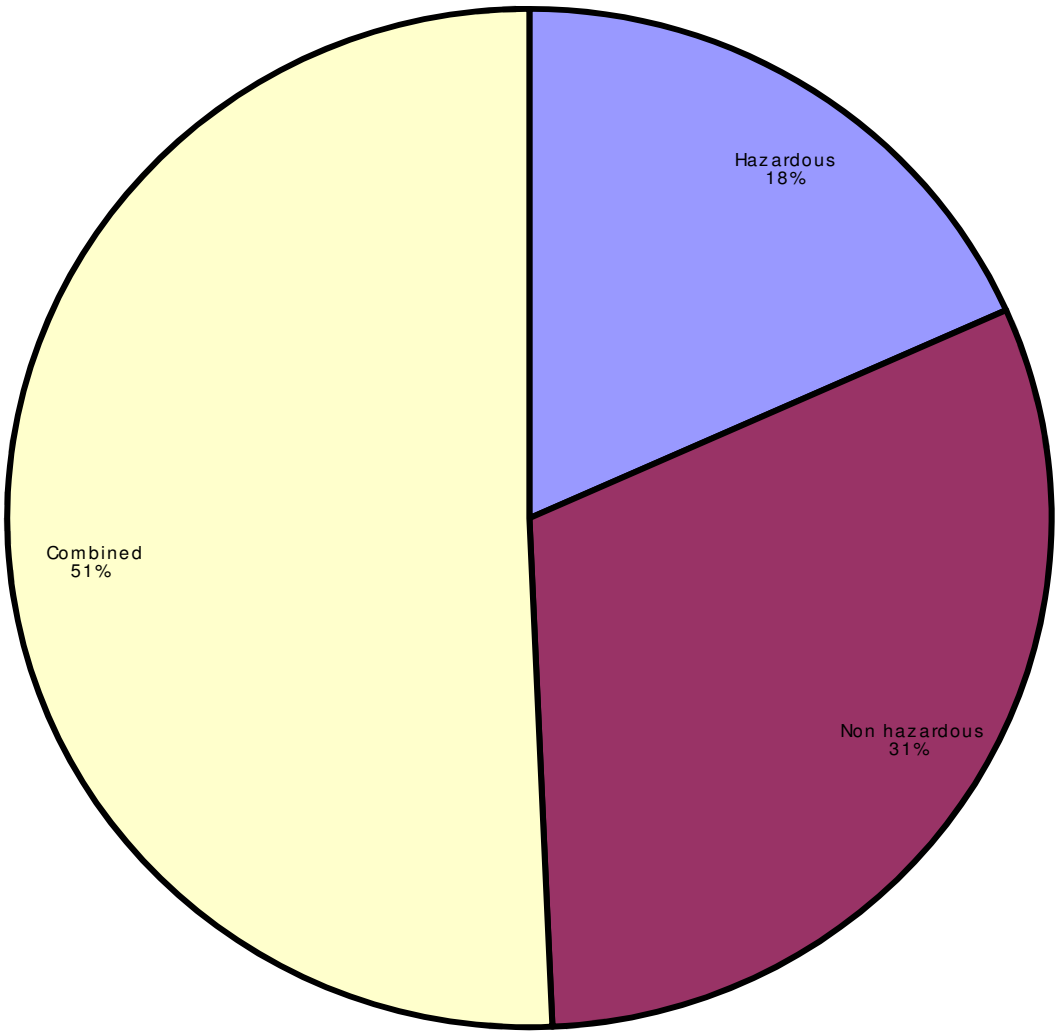

Figure 4. The nature of waste generated in small hospitals.

This corroborates the findings of Olowomeye (1991), Sridhar (1995), Coker et al. (1999) and Mato and Kaseava (1999). The implication of using the open dumpsites for hospital wastes disposal lies in its tendency to pollute the soil and groundwater due to their leaching (Allsopp et al., 2001; Echegaray et al., 2002). This observation is consistent with several studies (Adegoke, 1989; FEPA, 1988; Olowomeye, 1991; USEPA, 1990; Mato and Kaseava, 1999; Foster et al., 1996; Chapman et al., 1982; Forsyth, 1997). It also posses a great health risk to dumpsite scavengers, municipal workers as well as the general public. In this study, a safe and proper manner of waste disposal practices in terms of waste treatment options can also employ the use of special landfill (Abdulla et al., 2001). After incineration, with a view to reduce leaching, the ashes can be stabilized in cement before disposal. Various studies have been carried out successfully on solidification- stabilization of fly and bottom ash from municipal waste incinerators with cement to render it less toxic and dispose off to landfills in an environmental friendly manner (Gavasci et al., 1998; Lombardi et al., 1998; Filipponi et al., 2003; Genazzini et al., 2003). According to Idris and Saed (2002), the high temperature melting treatment of incinerated municipal waste ash produces a stabilized non-hazardous product called “slag” which stabilizes or bind metals which do not show during leaching. However, the two-factor analysis of variance for solid wastes disposal methods adopted by the three hospitals shows no significant difference in the methods adopted by each hospital category at 0.05 level of significance.

This implies that there is no appreciable difference in both the methods of disposal and amongst the different category of hospitals. The result also revealed that only 12 and 7% of large and medium hospitals respectively adopt incineration as a disposal method, while the small hospitals do not incinerate wastes. This shows that incineration is not popular among the three hospital

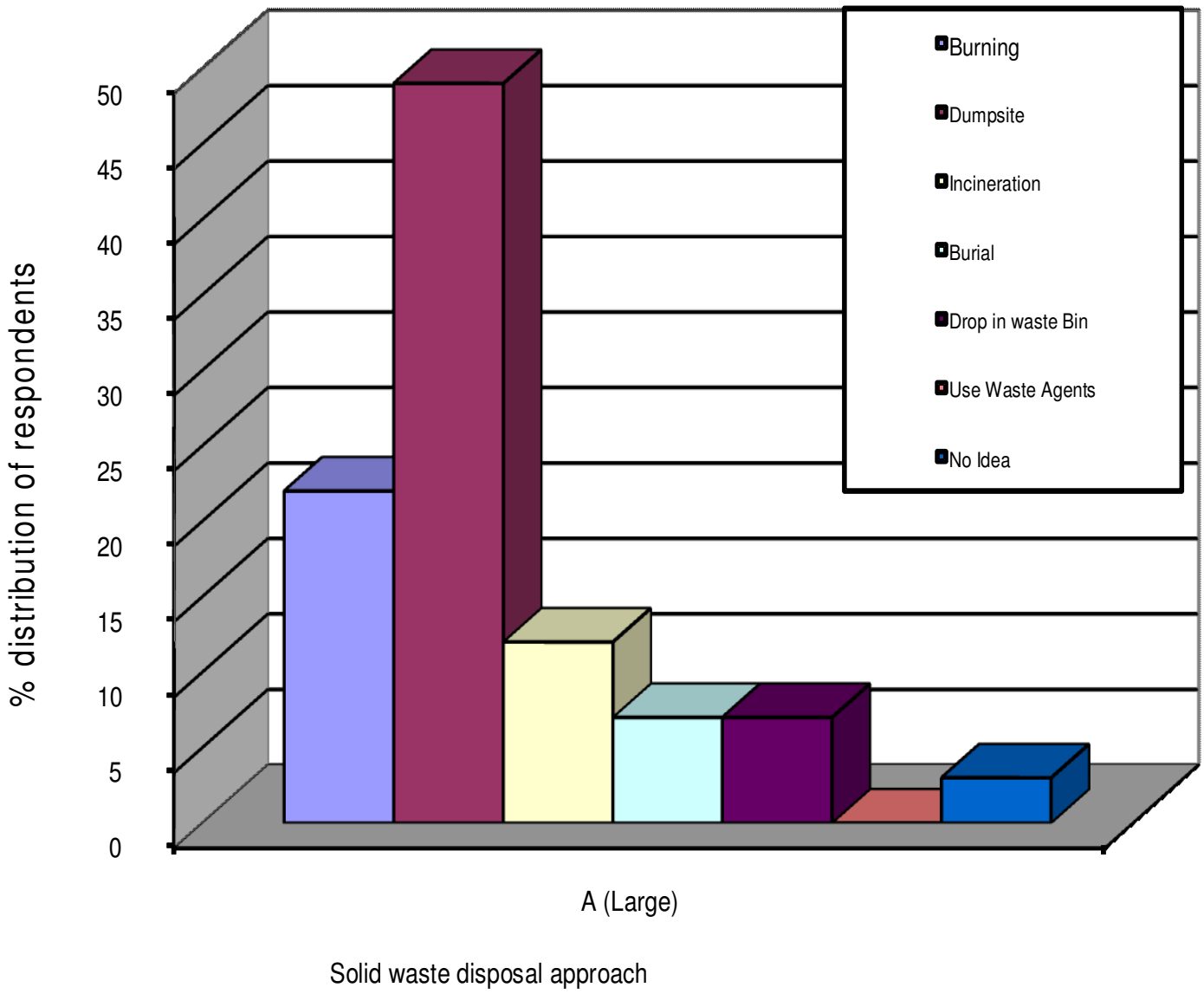

Figure 5. Relative approach of solid waste disposal by large hospital.

categories. A possible reason for this observation could be due to the high cost of procuring an incinerator especially by the medium and small sized hospitals. Another reason could be the fact that there is no direct hospital/ medical waste policy in existence at the moment to enforce the use of incinerators as part of hospital waste disposal process. Incineration is an engineering process, which employs thermal decomposition that results in the reduction of mass by 70% and volume by 90% (Rao and Garg et al., 1994; Stegemann et al., 1995; Grochowalski, 1998; Lee, 2000; Allsopp et al., 2001) and to destroy the organic fraction of the waste (Oppelt, 1987; Saxena and Jotshi, 1996; Penner, 1989). However, inadequate incineration of medical wastes can result in the release of toxic pollutants into the air in large concentrations and these may travel long distances before they return to earth.

FEPA decree No 58 (1988) only defines medical wastes tracking programme as well as identify types of harmful/ dangerous/hazardous medical wastes to be tracked, and records of such wastes kept by the operators at the waste generating facility. The decree made no provision for the enforcement of this essential part nor did it define the scope of clinical waste incineration process to include monitoring of the emission and standards as it is the case in the advanced countries of the world. Mato and Kaseava (1999) and Singh and Prakash (2007) observed that many incinerators are rudimentary and as such leads to partial burning of wastes and thus constitutes health hazards and air

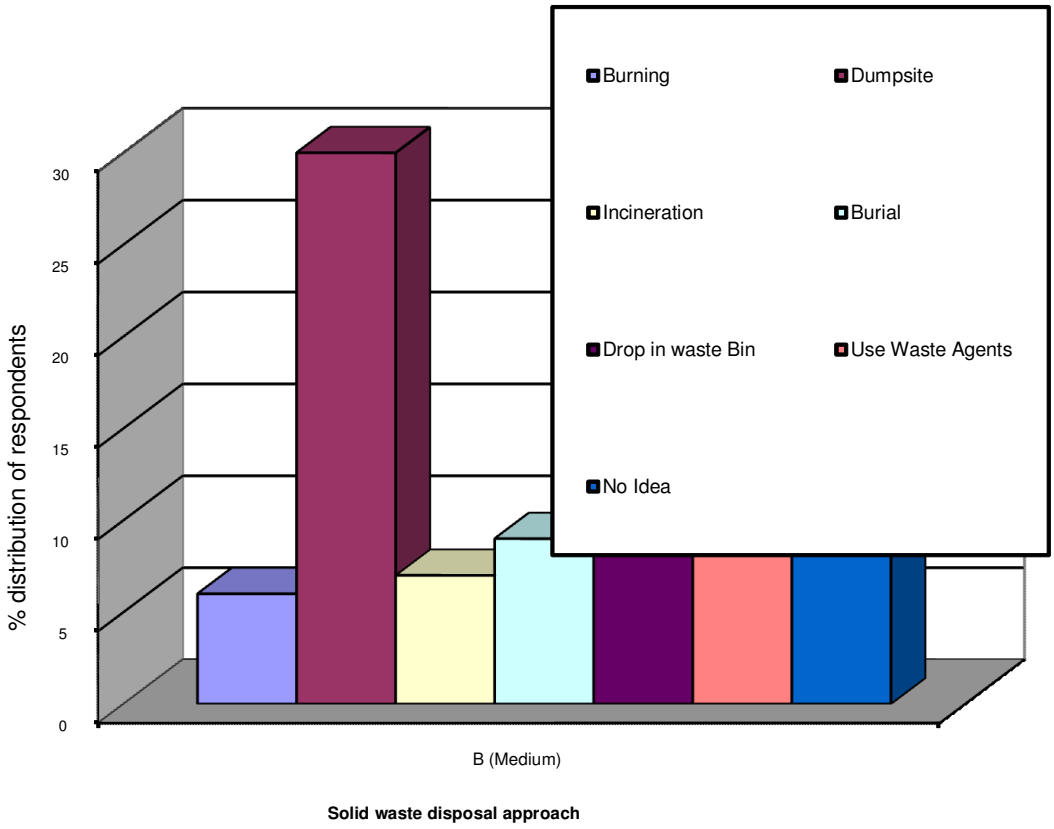

Figure 6. Relative approach of solid wastes disposal by medium hospitals.

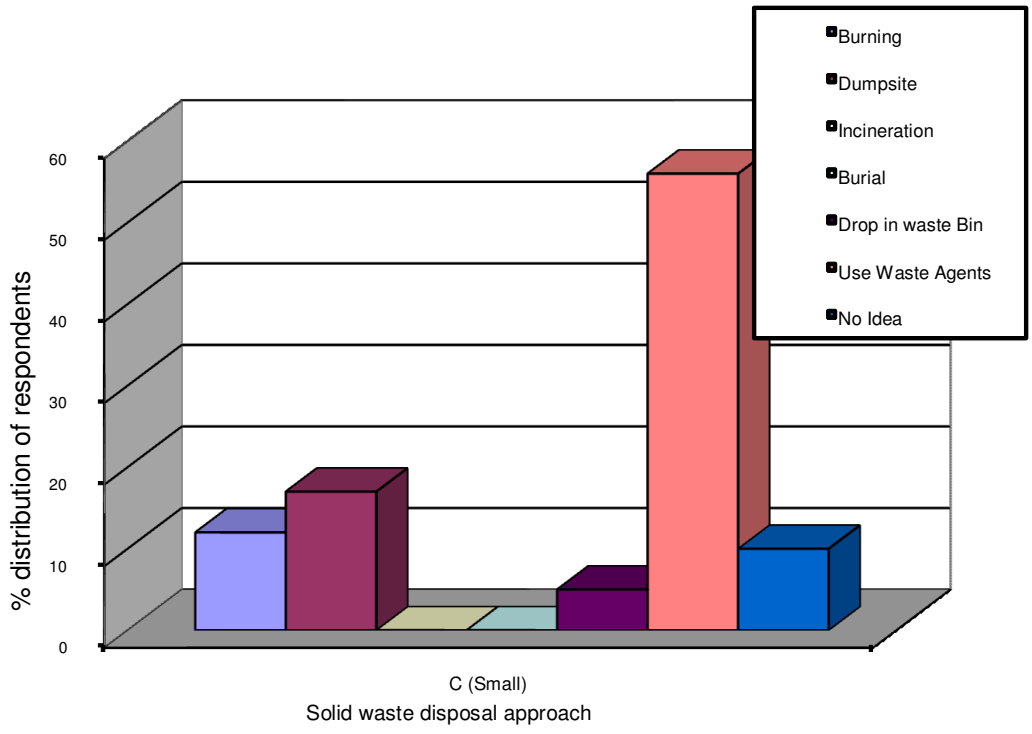

Figure 7. Relative approach of solid wastes disposal by small hospitals.

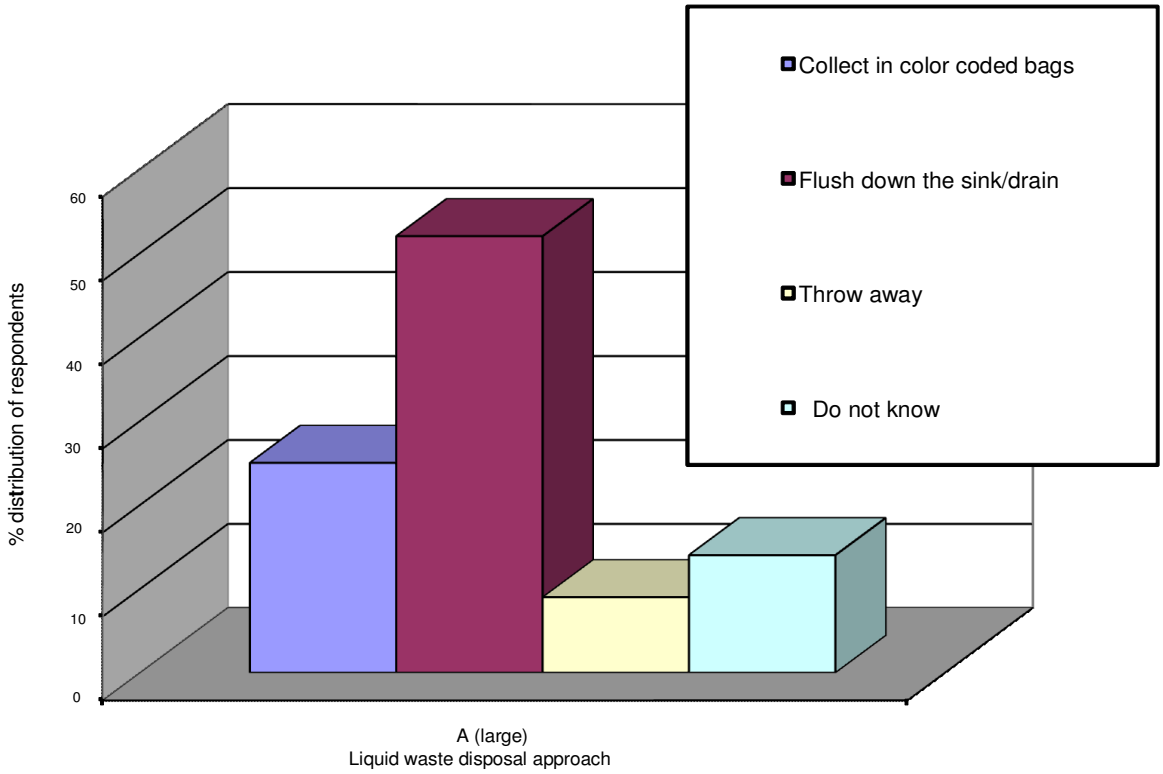

Figure 8. Relative approach of liquid wastes disposal by large hospitals.

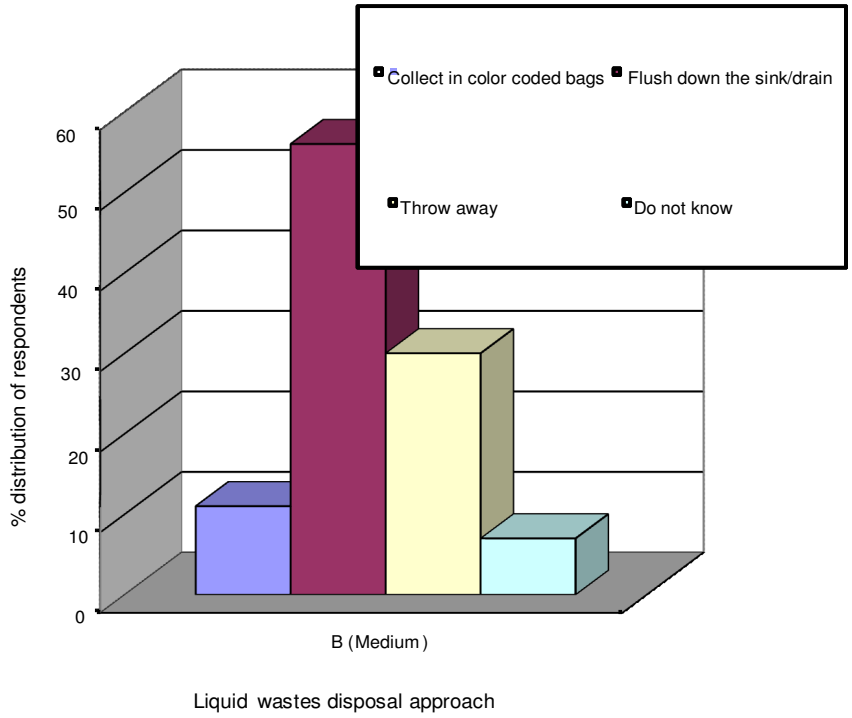

Figure 9. Relative approach of liquid wastes disposal by medium hospitals.

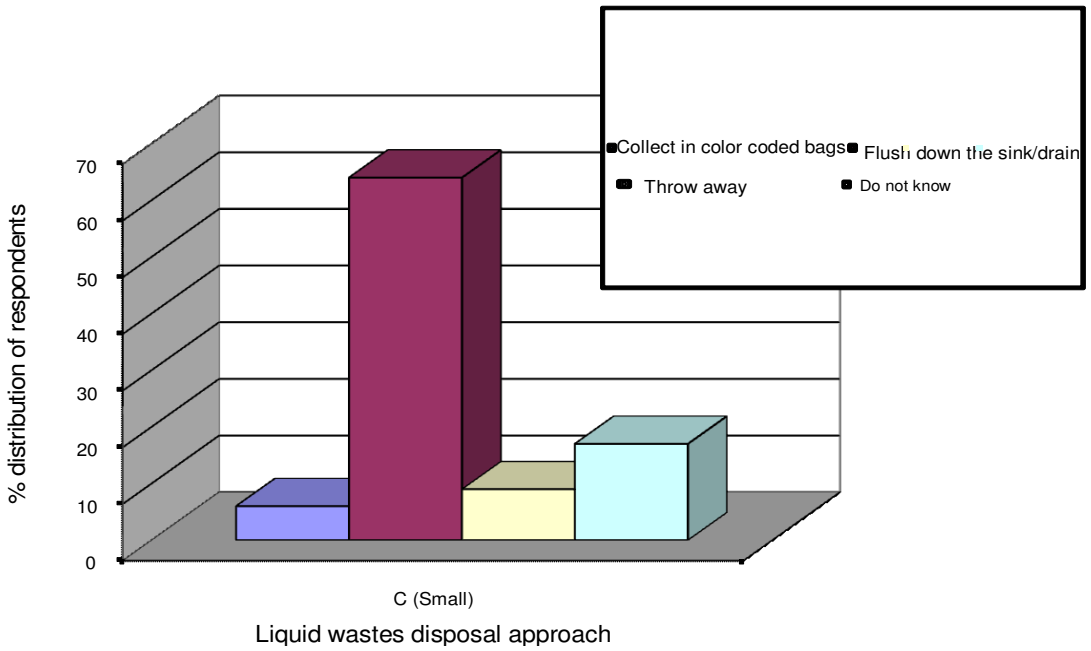

Figure 10. Relative approach of liquid wastes disposal by small hospitals.

pollution problems. Results on liquid waste disposal method showed that flushing of liquid wastes down the sink/drains/sewers or discarding wastes recklessly remains the dominant approach to liquid waste disposal in the hospitals. This trend shows that little or no attention is given to liquid wastes generated in our health care institutions. This practice could lead to sub-soil and groundwater contamination and this therefore confirms the findings of Coker et al. (1998) who stated that urban agriculture flourishes on the banks of streams, and rivers where open drains from hospital kitchen, laboratory, wards, theatres, laundry and bathroom finally end up.

It also corroborated Oluwande et al. (1978), Forsyth (1997), Chapman et al. (1982); Foster et al. (1996); Sridhar (1995) and Adegoke (1989) reports on the magnitude of hazards resulting from the practice.

Conclusion

This study was carried out to assess hospitals waste management practice in Port-Harcourt metropolis, Nigeria. It identified waste generation rates and various waste disposal options by different categories of hospital. It was further evident in this study that hospital waste management issues and problems are not peculiar to Port Harcourt metropolis alone. Solid waste disposal methods indicated that open dump sites is most preferred while incineration was non existent in the hospitals, clinics samples, all other hospitals do not segregate wastes into marked or colour coded containers for the different waste streams neither do they keep records of waste generation and disposal. In addition, the survey revealed that both hospital waste generators and handlers treat hospital wastes as a usual domestic waste. Therefore disposal of ashes containing toxic metals from Hospital waste incineration can be done through solidification-stabilization of fly and bottom ash with cement because it appears to be the best method to render ash less toxic. Similarly, the concentration of toxic heavy metals in the ash of hospital waste incinerator can be avoided to some extent through segregation of the waste prior to incineration. Lack of relevant training and protective equipment for waste handlers was a common feature in the survey. Generally, Port Harcourt, as a fast growing city in Nigeria, like most developing countries, lacked the infrastructure, human and financial resources as well as institutional capacity necessary to effectively manage medical wastes as part of the effort to enhance protection of human life and the environment from health hazards arising from improper management of hazardous waste.

It was further observed that open dump sites are not even engineered or treated, thus expose the entire public to risks of infection. Except for the oil company clinics such as the SPDC, all the other hospitals sampled do not have any unit or department responsible for waste management. Knowledge, attitude and practices towards environmental issues are relatively low among the various actors in the tasks of hospital waste management. A number of institutional hindrances such as lack of political will to enforce the regulations were also identified as being responsible for the gap.

Therefore, it becomes imperative for the government to

adopt sound hospital waste management policy as part of the guidelines and standards to avoid the enormous future cost of abating hospital wastes related problems. Hence the implementation of the findings of this study by the relevant government agency will help to ensure an effective hospital waste management system in Port Harcourt metropolis.

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