

GENERATION, CHARACTERIZATION AND DISPOSAL OF HOSPITAL WASTES IN SOME SELECTED HOSPITALS WITHIN KADUNA METROPOLIS

N. I. ABDULLAHI¹, F. B. IBRAHIM¹ AND A. GIWA

¹ Department of Water Resources and Environmental Engineering, Ahmadu Bello University Zaria, Nigeria

² Department of Polymer and Textile Science, Ahmadu Bello University Zaria, Nigeria
[nurafbg@gmail.com]

ABSTRACT

Health-care services in rural or urban settings inevitably generate wastes that may be hazardous to health or have harmful environmental effects. This paper therefore assesses the generation, characterization and disposal of hospital waste of some selected hospitals within Kaduna metropolis. Nine hospitals were selected for the study. The weight of waste generated in these facilities is measured after which the wastes were segregated into various classes. 927 kg per day was generated out of which 84% is non-hazardous and 16% hazardous. Waste generation rate in these facilities range from 1.14 to 2.32 Kg/bed/day and 0.13 to 0.50 Kg/out-patient/day. The composition of waste across these facilities include; non-hazardous, infectious, sharps, and pharmaceutical wastes. Out of the facilities surveyed, two have locally built incinerator for waste pretreatment, three employ the use of open burning method, and four facilities do not have any form of waste pretreatment. The paper recommends pretreating of hazardous hospital waste before disposal.

Keywords: Generation, Hazardous, Hospital, Infectious, and Waste

1.0 INTRODUCTION

Health-care wastes include all wastes generated by health-care establishments, research facilities, and laboratories. In addition, it includes the waste originating from “minor” or “scattered” sources—such as that produced in the course of health care undertaken in the home (dialysis, insulin injections, etc.). Between 75% and 90% of the waste produced by health-care providers is non-hazardous or “general” health-care waste, comparable to domestic waste. The non-hazardous fraction of health care waste come mostly from the administrative and housekeeping functions of health-care establishments and may also include waste generated during maintenance of health-care premises. The remaining 10–25% of health-care waste is regarded as hazardous and may create a variety of health risks. (WHO, 1999). Health care wastes have been identified to be a source of occupational risk, including HIV and viral hepatitis B, to health care workers. It also has negative effect to public health and environment. These include, but not limited to; ground water contamination, discharging of hazardous particulates in air, destruction of natural environment, and disturbance of ecosystem.

Statistics presented by WHO (1999) reveals eight (8) cases of HIV infection in 1999 as result of occupational accident in France out of which two (2) cases involved health care waste workers. Another thirty nine (39) cases were recognised at United State of America (USA) in 1994. The path of transmission of this infection include; hypodermic needle injuries, blade injury, broken glass from a tube containing infected blood, contact with non-sharp infectious item, and exposure of skin or mucous membranes to infected blood. Viral hepatitis B infection as a result of sharp injuries among various health workers in USA was found to be more than 250.

Pollutants from healthcare waste are persistent in the environment as observed in a review conducted by Akter (2000). Other environmental hazards of medical wastes according to the review include; accumulation of toxic chemicals within the soil, ground water contamination, decrease in water quality, bio-accumulation in organism's fat tissues, bio-magnification through food chain, repeated and indiscriminate application of chemicals over a long period of time that have serious adverse effects on soil microbial population - reducing the rate of decomposition, generally lowering the soil fertility, wind blown dusts from indiscriminate dumping that have the potential to carry hazardous particulates, and public nuisance (such as odors, scenic view, blocking of walkway, aesthetics, etc.).

Some microorganism that cause these environmental hazards are pathogenic in nature. Omojasalo et al. (2009) isolated *streptococcus pyogenes*, *Escherichia coli*, *Entrobacter aerogenes*, and *Aspergillus flavus* from dump site of a hospital in Illorin, Nigeria. These organisms are documented pathogens. They also isolated some opportunistic pathogenic microorganism like *Staphylococcus aureus*, *S. saprophyticus*, *Pseudomonas aeruginosa*, and *Actinomyces israeli* from the same dump site. *Aspergillus flavus* and *Actinomyces israelii* were also isolated from dump site of a hospital in Niger, Nigeria by Oyeleke and Istifanus, (2009). This pathogens present in hospital wastes, as observed by Manyale (2004) can enter and remain in the air within hospital premises for a long time in the form of spores or as pathogens themselves. This can result in hospital-acquired infection that has serious health concern to patients and health workers. Patience (2007) stated that poor management of such waste has serious health implication to health workers, patients and the public. Due to the toxic nature of medical wastes, improper handling may lead to the destruction

of natural environment and disturb the balance of ecosystems. This paper therefore assesses the generation, characterization, and disposal of hospital waste in some selected hospitals within Kaduna metropolis, Nigeria.

2.0 METHODOLOGY

Purposive approach of sampling was used in selecting hospitals surveyed. Purposive sampling is employed in

order to have good understanding of how different type of hospitals generate and dispose their waste. As such, the hospitals surveyed include one (1) tertiary, five (5) secondary, and three (3) primary hospitals. The tertiary hospital, two (2) of the secondary, and two (2) primary health care centers are public owned hospitals. Others are privately owned hospitals. The list of hospitals surveyed is presented in Table 1.

Table 1: HOSPITALS SURVEYED

<i>FACILITY</i>	<i>CATEGORY</i>	<i>OWNERS HIP</i>	<i>SERVICE PROVIDED</i>
NATIONAL EAR CARE CENTRE (NECC)	Tertiary	Public	Out-patient and In-patient
YUSUF DANTSOHO MEMORIAL HOSPITAL (YDMH)	Secondary	Public	Out-patient and In-patient
GENERAL HOSPITAL KAWO (GH KAWO)	Secondary	Public	Out-patient and In-patient
GIWA HOSPITAL (GIWA)	Secondary	Private	Out-patient and In-patient
GARKUWA SPECIALIST HOSPITAL (GRK)	Secondary	Private	Out-patient and In-patient
FOMWAN HOSPITAL (FOMWAN)	Secondary	NGO	Out-patient and In-patient
PRIMARY HEALTH CARE CENTRE HAYIN BANKI (PHC HYB)	Primary	Public	Out-patient and In-patient
PRIMARY HEALTH CARE CENTRE UNGUWAN SANUSI (PHC UGS)	Primary	Public	Out-patient only
PRIMAL DIAGNOSTIC CENTRE (PRIMAL)	Primary	Private	Out-patient only

A quantity of wastes generated by each hospital was estimated in terms of it weight. The estimate was done in rainy and dry seasons. For each season, the quantity of waste generated by hospital was collected and weighed for seven (7) days and it average calculated to get weight of wastes for each season as described in (UNEP/WHO, 2005). The wastes were segregated in to various classes. Wastes such as papers, plastics, food left over, nylon bags, peel of fruits, juice bottles/packs, and empty cartons are collected under the class of non-hazardous/non-risk waste. Waste that has come in contact with blood and body fluid such as used cotton wool, bandages, sanitary pads, gloves, and remains of faeces and urine are grouped as infectious waste. Needles, blades, scalpel, and any waste that has the potential of cutting or punching human skin like broken glass are classified as sharps. Expired or un-used drugs or any other waste that contains pharmaceutical preparation is classified as pharmaceutical waste. Every class collected was measured using weighing scale. The average weight of dry and rainy season is calculated to get weight of waste per day.

Structured questionnaire that also adopted the guideline of HCWM for sub-Saharan countries, prepared by WHO/UNEP in 2005 was administered to the selected facilities. Data collected with the aid of the questionnaire includes information on transportation, treatment, and disposal of the hospital wastes.

A forum discussion was organized with staff of private firms responsible for transportation and final disposal of

the waste. The discussion centered on their general knowledge of effect of hospital waste on public health and environment. Issues on type of protective wears used by the staff were also discussed.

3.0 RESULT AND DISCUSSION

3.1 Weight of the Hospital Waste Measured In the Facilities

The weight of waste generated by the hospitals was measured. The average weight of waste of the surveyed hospitals is 927 Kg. Hazardous waste was found to be 149 Kg representing 16% of the total composition while non-hazardous waste had 84% of the total composition with 778 Kg.

From the results of the study, it was found that the average weight of solid waste generated in secondary hospitals (with exception of FOMWAN hospital) ranges between 121 Kg to 232 Kg. The weight of solid waste generated in the primary hospitals was found to be lower than that of secondary hospitals with a range of 19 Kg to 31 Kg. Just as in the case of volume of solid waste generated by the hospitals, solid waste generated by government owned facilities in both secondary and primary hospitals weighed more than that of privately owned hospitals probably because of the higher level of patronage they receive. Most of the findings of secondary hospitals is similar to that of Umar et al. (2009) that found waste generation in some hospitals at Katsina state, Nigeria to be around 99 – 144 Kg per day. Figure 1 presents the graphic view of total average weight of waste generated by the hospitals surveyed.

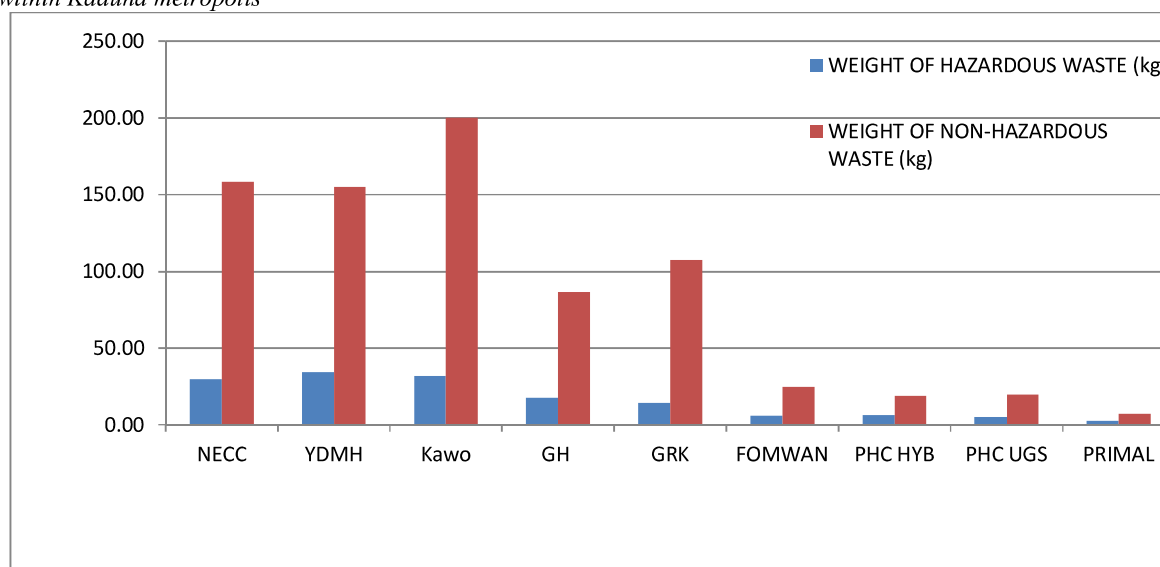


Fig. 1: Total Average Weight of Hospital Waste of the Facilities Surveyed

3.2 Waste Generation Rate of Hospitals Surveyed

Tables 2 and 3 show waste generation rate of the hospitals surveyed. The generation rate of hospitals that have bed (offered both out-patient and in-patient services) ranged between 1.14 kg/bed/day to 2.43 kg/bed/day. GRK and GH Kawo has higher generation rate than the rest of the hospitals with 2.43 kg/bed/day and 2.32 kg/bed/day respectively. FOMWAN with 1.14 kg/bed/day has the lowest generation rate

Most of the findings correspond with work done by Toyobo et. al (2009) that found average generation rate of Obafemi Awolowo University Teaching Hospital and University College Hospital to be 1.5-2 kg/bed/day and 1.3-1.5 kg/bed/day respectively. Similar rate was

reported by (Bassey et. al. 2006) where they found hospital generation rate in some selected Abuja hospitals to be 1.98 Kg/bed/day to 3.59 Kg/bed/day.

The generation rate of hospitals that do not admit patients but offered only out-patient service was found to be 0.13-0.50 kg/out-patient/day. Primary health care Hayin Banki with 0.5 kg/out-patient/day is public owned hospital and Primal diagnostic centre with 0.13 kg/out-patient/day is privately owned facility. The finding is similar with that of (Wahab et. al 2011) that found waste generation rate of public hospital to be between 0.37-1.25 kg/head/day and that of privately owned to be 0.12-0.28 kg/head/day.

Table 2: Waste Generation Rate of In-patient Hospitals

<i>FACILITY</i>	Average Number of Beds	Average Weight of Waste/Bed (Kg/bed/day)
NATIONAL EAR CARE CENTRE	100	1.88
YUSUF DANTSOHO MEMORIAL HOSPITAL	128	1.48
GENERAL HOSPITAL KAWO	100	2.32
GIWA HOSPITAL	50	2.09
GARKUWA SPECIALIST HOSPITAL	50	2.43
FOMWAN HOSPITAL	27	1.14
PRIMARY HEALTH CARE CENTRE UNGUWAN SANUSI	18	1.38

Table 3: Waste Generation Rate of Hospitals that Offered Out-patient Service Only

<i>FACILITY</i>	Average Number of Out-patients	Average Weight of Waste/Out-patient (Kg/out-patient /day)
PRIMARY HEALTH CARE CENTRE HAYIN BANKI	50	0.50
PRIMAL DIAGONISTIC CENTRE.	75	0.13

3.3 Classification of Hospital Waste of the Hospitals Surveyed

Types of Waste Encountered

During the course of this research, different kinds of wastes were encountered. Table 4 summarize wastes commonly found in the hospitals surveyed.

Table 4: Waste Encountered at the Hospitals

Hazardous	Non-Hazardous
Syringes and needles	Papers
Used cotton wool	empty plastics
Used bandages and gauze	Empty bottles of water
Used plasters	empty packs and cartons
Used hand gloves	foods leftover
Used sanitary pads	Nylon bags
Wipes	Peel of fruits
Remains of faeces, urine and blood	Empty bottles and Packs of juice
Drugs	
Pressurize containers	

For the purpose of this research, all wastes that have come in contact with body fluid are classified as infectious waste. This is because; of all the facilities visited none was carrying out complete segregation of the solid waste.

The waste encountered in the hospitals visited are classified into; Non-risk waste (Non-hazardous), infectious waste, Sharps and pharmaceutical waste. There were no anatomical and chemical wastes encountered in the facilities visited as at the time of visit. Although four of the facilities acknowledged that they do have anatomical wastes after some specific surgeries which they bury immediately after the surgery. These facilities are YDMH, GH KAWO, GIWA and GRK.

Generally, the non-hazardous wastes were the most generated form of solid waste across all the hospitals surveyed. The percentage composition of non-hazardous waste in these facilities ranges from 73% - 88% of the total composition of the waste. The remaining 12% - 27% is hazardous waste. Out of the total hazardous waste generated, Infectious waste was the most generated form of waste across all the facilities with percentage generation of 64% -88%, and then sharps with generation of 8% - 36% and lastly pharmaceutical waste with generation rate of 4% - 13%.

3.4 Treatment and Disposal of Hospital Waste

Off-site transportation and treatment of the hospital wastes was assessed. All the hospitals visited transport their waste outside the hospital for final disposal. They all engage the services of private firms for the transportation and final disposal. Workers of the firms responsible for off-site transportation and final disposal of the waste seem to be aware of public health implications of such wastes as a result of occupational injuries from sharp waste and they are provided with protective wears by the firms. On the environmental effect of health care wastes, most of the non-skilled staff, that form over 70% of the nominal roll of such

firms are not aware of the adverse effect such waste have on the environment. The firms employed the use of trucks for waste transportation to final disposal point. In most cases the trucks have open body that has the tendency of littering of environment in the course of waste transportation.

Five of the hospitals visited have one or more type of waste treatment plant. NECC, GIWA, and PHC UGS engage the use of uncontrolled open burning in pretreating their wastes before final disposal. This practice according to (Azage & Kumie, 2010) poses environmental risk to waste handlers and stray scavengers. Oyeleke *et al.* (2008) observed that the ashes from such practice can find it way to water bodies and (UNEP/WHO 2005) concluded that the practice constitute a significant source of pollution to the environment through the release of substances such as dioxins, mercury, and furans. GRK and PRIMAL have locally built incinerator where they burn all their wastes before final disposal. In addition to the incinerator, Primal diagnostic centre have needle destructor for destroying needles. Mechanically controlled incinerator is installed at YDMH but is yet to commence operation as at the time of this research.

All the wastes from these hospitals are disposed off at one of the metropolis municipal disposal site. This is irrespective of whether the wastes are treated or not. When hazardous component of the waste come in contact with other municipal waste, the practice has the tendency of contaminating the municipal wastes there by breeding dangerous pathogenic microorganism that may be harmful to public. The contaminated waste will possibly find it way to water bodies thereby increasing the cost of treating the water. It may also cause outbreak of diseases to people that use the water untreated.

4.0 CONCLUSION

The study found the weight of hazardous and non-hazardous waste generation in the hospitals to be 84% and 16% respectively. Across the hospitals, non-hazardous waste generation ranges between 73-88% and that of hazardous ranges between 12-27%. Infectious waste is the most generated form of hazardous waste in all the hospitals surveyed with generation rate of 64-88%. The waste generation rate across the facilities range between 1.14kg/bed/day to 2.32 Kg/bed/day in hospitals that have beds and 0.13 Kg/out-patient/day to 0.50 Kg/out-patient/day in hospitals that offers out-patient service only. The study also found that waste from some hospitals is not pretreated before disposal and both treated and untreated wastes are finally disposed up together with other municipal wastes. This paper recommends all hospital wastes to be appropriately pretreated before final disposal with municipal wastes.

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