

*Full Length Research Paper*

# Waste management in healthcare establishments within Jos Metropolis, Nigeria

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**Poor management of healthcare waste exposes health workers and the public to the toxic effects of wastes generated from health establishments. The disposal of these wastes could also lead to environmental problems if not done properly. This study has assessed the waste management practices in hospitals and compared same with international standards. A survey was carried out in six major hospitals in Jos metropolis. The findings indicated that these hospitals fell below the recommended waste management practices as prescribed by World Health Organization and other regulatory authorities. Wastes were not segregated, and were inappropriately disposed. The health workers were unaware of relevant regulations and the existence of a hospital waste management policy. Recommendations have been made for staff training 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.**

**Key words:** Healthcare waste, waste management, waste disposal, hospital waste, medical waste, infectious waste, pharmaceutical waste, chemical waste, cytotoxic waste, waste management policies/regulations.

## INTRODUCTION

In developing countries such as Nigeria, the international policy that the generator of waste is responsible for the proper management, treatment and disposal of waste has remained on paper and is yet to be implemented. The notion that waste is the responsibility of the government authorities has not enabled waste generators to appreciate the negative impact of improper waste disposal. Although waste is generated from anywhere such as the home, office, industry, agriculture, school, living things and healthcare establishments, of more concern is that of healthcare waste due to its hazardous nature and disease transmission characteristics of some of the wastes.

Healthcare establishments generate wastes, by-products of health care which can be classified into infectious and non-infectious wastes (Patil and Shekdar, 2001). Infectious wastes contain pathogens in quantities sufficient to transmit infectious diseases on exposure to

them. Health care waste is also categorized as non-hazardous (non risky) and hazardous (risky) wastes (Pruss et al, 1999). Non-hazardous wastes are general healthcare wastes such as paper, packaging, food and debris which are not harmful. However, no waste is completely or totally unharmed. Hazardous wastes are further classified into infectious, pharmaceutical, pathological, genotoxic, sharps, chemical, radioactive and those with high heavy metal contents. A hazardous waste is one which may be toxic, genotoxic, corrosive, shock-sensitive, flammable, reactive, explosive, radioactive, containing infectious agents and/or sharps (Pruss et al, 1999). Exposure to hazardous wastes can be as a result of an accident, ignorance, nonchalance, deliberate negligence on the part of waste handlers; from water, food, household products, breast milk, and to fetus in the womb. The different categories of hazardous waste have their negative health impacts which may differ or have similar outcomes. 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

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**Table 1.** Details of Healthcare establishments.

S/N	Healthcare facility	Type of Ownership	Type of services offered	Level of healthcare
1	Teaching Hospital, Jos	Public not for profit	In-Patient and Out-Patient	Primary to tertiary Health care
2	State Specialist Hospital, Jos	Public not for profit	In-Patient and Out-Patient	Primary to tertiary Health care
3	Missionary Hospital, Jos	Private not for profit	In-Patient and Out-Patient	Primary to tertiary Health care
4	Missionary Hospital, Jos	Private not for profit	In-Patient and Out-Patient	Primary to tertiary Health care
5	Private Specialist Hospital, Jos	Private for profit	In-Patient and Out-Patient	Primary to tertiary Health care
6	Private Hospital and Maternity Home, Jos	Private for profit	In-Patient and Out-Patient	Primary to tertiary Health care

drugs are good examples of products that are harmful throughout their lives' cycle and disposal.

When hazardous health care wastes are not properly managed, exposure to them could lead to infections, infertility, genital deformities, hormonally triggered cancers, mutagenicity, dermatitis, asthma and neurological disorders in children; typhoid, cholera, hepatitis, AIDS and other viral infections through sharps contaminated with blood (Johannessen et al., 2000; Smith, 2002; NIOSH, 2004; Askarian et al., 2004; Blenkharn, 2006a, b). The people at risk of healthcare hazardous waste include; healthcare workers, patients, visitors to healthcare establishments, workers in support services, workers in waste disposal facilities, foetuses in the wombs of mothers, members of public and scavengers (Pruss et al., 1999; NIOSH, 2004). Unfortunately the adverse effects of healthcare hazardous wastes are usually not attributed to them unless a careful and thorough investigation is carried out.

The effect of the exposure may not be felt in some cases, until some years after. For instance a pharmacist who had worked full time for 20 months in a hospital intravenous preparation area where she routinely prepared cytotoxic drugs, was found with grade II papillary transitional cell carcinoma twelve years after she started the job (NIOSH, 2004). Therefore, it is paramount that hazardous waste be effectively managed to protect lives. The full environmental effects of dumping of hazardous waste in unrestricted areas that contaminate soils and waters, with their consequent effects on plants, aquatic and wild lives, may take a long time to be appreciated. Hence, the health risks, the increased workload for healthcare workers and its damage to the environment beg for a collective commitment to waste management.

Healthcare establishments owe it as a duty to the environment and public health to abide by agreement by Member States to the Basel convention (Basel Declaration, 1999). The agreement clearly stated that it

remains the responsibility of healthcare establishments to treat and dispose wastes generated by them in such a manner as to ensure that there would be no adverse health or environmental effects. Management of healthcare waste is not strictly about data compilation and technologies of waste treatment and disposal but it also involves training, commitment, management, leadership and effective legislation (Patil and Shekdar 2001).

This article presents the outcome of a survey assessing the waste management practices in six hospitals in Jos metropolis and the comparison with internationally recommended standards. Jos is one of the most cosmopolitan cities in Nigeria with a population of about 500,000 – 1,000,000. Due to the presence of a federal funded teaching hospital, Jos serves as a medical referral center especially for some of the northern states in the country. The study was conducted to determine the waste management practices undertaken by these hospitals which include segregation of waste, types and labeling of containers, method of disposal, training of personnel, existing documentations and regulations.

## METHODOLOGY

The data collection method employed was through the use of a questionnaire administered by interview. Interviews were conducted by researchers and those interviewed included hospital management, health professionals and operational staff. Six health institutions; two of each are public referral hospital, private not for profit mission outfits, and private for profit. Table 1 provides the details of the selected healthcare facilities

The results of interviews conducted in each hospital were collated and treated as one. The information obtained was subjected to simple descriptive analysis whose outcomes are as summarized in the results.

## RESULTS

The results of the administered questionnaires after being pooled from the six hospitals have been summarized in

**Table 2.** Sources of hospital waste.

S/No	Healthcare facility	Sources of hospital waste									
		PS	OT	IC	IW	DU	AR	R	LAB	BB	Pharm
1	Teaching Hospital, Jos	x	x	x	x		x	x	x		x
2	State Specialist Hospital, Jos	x	x	x	x		x	x	x		x
3	Missionary Hospital, Jos	x	x	x	x		x	x	x		x
4	Missionary Hospital, Jos	x	x	x			x	x	x		x
5	Private Specialist Hospital, Jos	x	x						x		x
6	Private Hospital and Maternity Home, Jos	x	x		x			x	x		x

PS - Patient service, OT - Operation theatre; IC - Intensive care, IW – Isolated ward, DU - Dialysis unit, AR - Autopsy room, R – Radiology, LAB – Laboratory, BB - Blood bank.

**Table 3:** List of wastes generated from technical units

#### Types of wastes

Needles, Syringes and other Sharps  
 Used Cotton wool  
 Used Bandages and gauze  
 Used Plasters  
 Used Hand gloves  
 Used Sanitary Pads  
 Wipes  
 Tubings  
 Disinfecting Chemicals  
 Empty Plastics and Glass bottles  
 Remains of faeces, Urine and Blood  
 Body tissues  
 Empty Packs and Cartons  
 Patients' medications  
 Expired Drugs  
 Other disposable materials and equipment

Tables 2, 3 and 4; while Tables 5 and 6 present the recommended segregation and treatment methods by the World Health Organization (WHO).

## DISCUSSION

All the technical departments of the six hospitals in this study generated one or more categories of wastes. This is evident from Tables 2 and 3. Interestingly, all the Departments also generated both hazardous and non hazardous, sharps and non sharps, combustible and not too easily combustible, metallic and non metallic, polymer and non polymer, human and synthetic wastes.

Effective waste management activities include waste segregation, collection, transportation, storage, disposal, minimization, and reuse (Rao et al., 2004). Even though it is becoming well recognized that for proper waste management, waste should be segregated right from the

point of generation; all the healthcare establishments that participated in the study were not involved in any form of waste segregation as can be seen in Table 4. There was no evidence of segregation of non-hazardous (paper packs, left-over foods, debris etc.) from hazardous (infectious, pharmaceutical, chemical, radioactive etc.) but all the wastes were mixed together. It is generally accepted that when non-hazardous waste is mixed with hazardous waste, the mixed waste becomes hazardous (Patil and Pokhrel, 2005) and should be treated as such.

In Nigeria, most of the hospitals also had refuse collection points where all categories of wastes were left and in most cases within the hospital premises in no specific containers. In all the cases studied the wastes were emptied from the containers in which they were conveyed to the waste collection point in open spaces, Waste collection points become easy breeding sites for rodents, cockroaches, etc; and even domestic animals and humans visit to scavenge. Sometimes these wastes are left for days and weeks and are subjected to the direct effects of weather. These untreated wastes when beaten by rain are washed into the drainages, rivers, streams and other waters endangering human and aquatic lives. It was also not uncommon to find hospitals with overflowing open and shallow drainages that contain chemical waste from diagnostic laboratories, pharmaceutical waste from in-patient wards, human waste from theatres and mortuaries which may eventually end up in rivers and streams from which public water supplies are sourced and also used for agricultural irrigation.

### Segregation of wastes

Wastes should be segregated at the point of generation before treatment and disposal to protect both humans and the environment.

Segregation of wastes would result in a clean solid waste stream which could be easily, safely and cost-effectively managed through recycling, composting and land filling (NIHE, 2006). The different categories of healthcare hazardous waste should be segregated, collected in different and suitable containers, appro-

**Table 4.** Waste management practices.

S/No	Healthcare Facility	Segregation of waste	Types of containers used	Labeling on containers	Handlers of waste	Training for waste handlers	Method of disposal	Knowledge of hospital waste Management Policy
1	Teaching hospital	No	Metal dustbin	-	Waste management staff	Yes	Incineration and burial	-
2	State specialist hospital, Jos	No	Metal dustbin	-	Waste management staff	Yes	Incineration and burial	-
3	Missionary hospital, Jos	No	Metal dustbin	-	Waste management staff	Yes	Incineration and burial	-
4	Missionary hospital, Jos	No	Plastic buckets	Blue and Black	Ward attendants	Yes	Incineration	-
5	Private specialist hospital, Jos	No	Open plastic baskets	-	Government agents	Yes	Incineration	-
6	Private hospital and maternity home	No	Metal Dustbin	-	Ward attendants	Yes	Incineration	-

**Table 5.** Recommended colour-coding for health-care waste

Type of waste	Colour of container and markings	Type of container
Highly infectious waste	Yellow, marked "HIGHLY INFECTIOUS"	Strong, leak-proof plastic bag, or container capable of being autoclaved
Other infectious waste, pathological and anatomical waste	Yellow	Leak-proof plastic bag or container
Sharps	"Yellow, marked "SHARPS"	Puncture-proof container
Chemical and pharmaceutical waste	Brown	Plastic bag or container
Radioactive waste	-	Lead box, labelled with the radioactive symbol
General health-care waste	Black	Plastic bag

Source: WHO Safe management of wastes from healthcare activities, 1999 (Pruss et al., 1999)

**Table 6.** Overview of disposal and treatment methods suitable for different categories of health-care waste.

Technology or method	Infectious waste	Anatomical waste	Sharps	Pharmaceutical waste	Cytotoxic waste	Chemical waste	Radioactive waste
Rotary Kiln	Yes	Yes	Yes	Yes	Yes	Yes	Low-level infectious waste
Pyrolytic incinerator	Yes	Yes	Yes	Small quantities	No	Small quantities	Low-level infectious waste
Single-chamber	Yes	Yes	Yes	No	No	No	Low-level infectious waste
Drum or brick incinerator	Yes	Yes	Yes	No	No	No	No
Chemical Disinfection	Yes	No	Yes	No	No	No	No
Wet thermal treatment	Yes	No	Yes	No	No	No	No
Microwave irradiation	Yes	No	Yes	No	No	No	No
Encapsulation	No	No	Yes	Yes	Small quantities	Small quantities	No
Safe burial on hospital premises	Yes	Yes	Yes	Small quantities	No	Small quantities	No
Sanitary landfill	Yes	No	No	Small quantities	No	No	No
Discharge to sewer	No	No	No	Small quantities	No	No	Low-level liquid waste
Inertization	No	No	No	Yes	Yes	No	No
Other methods				Return expired drugs to supplier	Return expired drugs to supplier	Return unused chemicals to supplier	Decay by storage

Source: WHO Safe management of wastes from healthcare activities, 1999 (Pruss et al., 1999).

privately stored where required and the appropriate, clean and safe treatment and disposal options used. Tables 5 and 6 show the recommended containers and disposal methods for some identified healthcare wastes.

**Documentation of waste management activities**

The documentation of all activities involved in waste management of hazardous wastes is a

regulatory requirement (Council of the European Communities, 1996; FEPA, 1991). The bags or containers should carry a label, which should indicate the point of production, ward/department in hospital, date of collection, contents and waste

destination. Removed containers or bags should be replaced with new ones of the same type and appropriate colour (Pruss et al., 1999). The transportation of wastes should also be well documented, and all vehicles involved should carry a consignment note from the point of collection to the incinerator or landfill or other final disposal facility; and these vehicles should be cleaned and disinfected regularly.

### Waste treatment

The hospitals in this study, which are the leading ones in Jos city, carry out open burning at temperatures below the recommended temperature of 1000°C. Since there was no segregation, pharmaceutical and cytotoxic wastes that should not be burnt at temperatures below 1000°C, were being burnt together with the subsequent release of toxic emissions into the air. Such toxic emissions may include dioxins, furans and heavy metals emitted as fumes or vapours (Lee et al., 2004; Lee and Huffman, 1996). However, the benefits of incineration include reduced volume of waste, the unrecognizable end-product in form of ash and destruction of pathogens (Lee and Huffman 1996). Burning of pharmaceuticals and cytotoxic drugs should be done in well constructed incinerators at recommended temperatures with facilities to control emissions. For cytotoxic drugs and large pharmaceuticals, rotary kilns designed for industrial waste and operated at temperatures greater than 1200°C should be used (Pruss et al, 1999).

### Training of waste handlers

The establishments claimed that the waste handlers were trained but the outcome of the survey indicated otherwise. If indeed they were being trained, then the training was inappropriate and had not been impacted on their skills and knowledge of the recommended measures for hazardous waste management. It was also not possible to obtain the materials used for the training.

Training and re-training programmes should be instituted for all workers (with no exceptions) in the hospitals thereby creating awareness of waste, its effects, importance of guidelines and the implementation of the waste management options for the different categories of waste

### Waste management policy

There was little or no knowledge of hospital waste management policy among the hospital management staff, which seems to confirm the premium on waste and its poor management. No evidence was found to the effect that enough attention had been given to waste management as no policy nor plan existed. It did appear also that the State Ministries of Health and Environment,

the responsible government regulatory bodies had no guidelines on waste management that comes from healthcare services. A waste management plan should include waste treatment, recycling, transport and disposal options and be cost effective. It is expected that regulatory bodies would issue policy documents and technical guidelines while individual hospitals develop their waste management activities. Hospitals should have waste management teams and units that would implement and supervisors who would inspect and monitor compliance to laid out activities.

### Conclusion

This study has demonstrated that the waste management options in the hospitals did not meet the standard practices. Waste management with safe and environmentally sound methods can not be over-emphasized. The hospital management board and the hospitals should make a conscious and deliberate effort to ensure they do not contribute to the present and future threats to human health and the environment by poor waste management practices. In order to execute standard waste management, an understudy of a healthcare establishment with standard waste management practices in or outside the country may be the first practical step to undertake. A waste management team should be constituted which will prepare waste management plan, policy documents and technical guidelines and in addition supervise waste management activities. Then intensive training and re-training of waste handlers on the effective waste management activities should be performed. Furthermore, the required waste management facilities such as the right containers, incinerators, landfills, waste disposal vehicles and a recycling plant as well as the technologies such as irradiation, encapsulation and chemical disinfection should be installed. However, in order to reduce the cost of waste management, hospitals can collaborate to have central facilities.

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