

A PRELIMINARY STUDY OF MEDICAL WASTE MANAGEMENT IN LAGOS METROPOLIS, NIGERIA

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ABSTRACT

A survey of medical waste management (MWM) practices and their implications to health and environment was carried out in metropolitan Lagos. Lagos is currently the most populous and urbanized city in the country with an estimated population of over 13 million people. The study assessed management practices in four (2 privates and 2 publics) hospitals ranging in capacity from 40 to 600 beds. Empirical data was obtained on medical waste generation, segregation, storage, collection, transportation and disposal. The observed MWM practices in all hospitals indicate absence of full compliance with the protocol for handling medical waste as stipulated in the relevant sections of the guidelines and standards for environmental pollution control in Nigeria. Three hospitals demonstrated high priority for segregation of infectious medical waste. Average generation rate of medical waste in the investigated hospitals ranged from 0.562 kg/bed.day to 0.670 kg/bed.day. Infectious waste accounts for between 26 to 37% of this volume. Only two of the hospitals investigated carry out treatment of their infectious and sharp waste types by incineration before final disposal. Burning and burial of medical waste is an unusual but common practice among the hospitals. All the hospitals employ the services of the state owned solid waste management company, the Lagos State Waste Management Authority (LAWMA) for final collection, and disposal of their medical waste at government approved sites.

Key Words: Medical waste, management, infectious, incineration, disposal

INTRODUCTION

Solid waste management (SWM) is a major problem in most developing countries of the world due to its ever growing and endless generation coupled with poor management. In the same vein, medical waste management (MWM) is yet to receive sufficient attention in the overall solid waste management and often times neglected. Though medical waste constitutes a small fraction of the municipal solid waste (MSW), the potential environmental and health hazards could be deleterious if not properly handled, the worst scenario being in developing countries (WHO, 1999). In a survey of MWM from 91 healthcare facilities in the southern Brazil, Da Silva *et al.*, (2004), found out that aside from sharp waste, little attention was given to the management of other types of medical waste. They reported that the overall management of medical waste was without

a perspective for recycling and their collection was through the municipal collection system. The authors concluded their finding by adjudging that medical waste management situation in the region, though far from being satisfactory was better than what existed in other regions of Brazil. In Africa, the situation appears to be more critical as reports from around the continent indicate poor MWM practices (Leonard, 2003; Manyele, 2003). Manyele (2003), described MWM in Tanzania as being poor, further he posited that the general awareness on issues related to medical waste management was generally lacking among generators and handlers. This scenario of poor MWM is the same in South Africa, Mozambique, Swaziland and Kenya. Illegal dumping appears a serious problem in most countries. In Kwazulu Natal Province for instance; about 45% of medical waste generated could not be accounted for while a general lack of adequate capacity, to properly

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manage medical waste generated existed. Even though, reported medical waste management in Tanzania was said to be poor, more recently, moves to confront the problems posed by poor management led to the construction of 13 pilot small scale incinerators (SSI) in various parts of the country. The success achieved through this programme motivated the government to extend the SSI to all referral, regional and district hospitals (Manyele, 2004). Poor management of medical waste exposes medical staff, waste-handling workers and the surrounding communities to infectious, toxic effects and injuries, a situation that poses a serious health problem in most developing countries of the world (WHO, 1999).

Medical waste has been defined as any solid waste generated in the diagnosis, treatment, or immunization of human beings or animals, in related research, production or testing of biologicals from all types of healthcare institutions, including hospitals, clinics, doctor(dental and veterinary) offices, and medical laboratories (Manyele, 2004). Table 1 presents a simplified medical waste classification (WHO, 1999, WHO, 2005a). Medical waste can be infectious or non infectious.

It becomes infectious only when it is capable of producing an infectious disease and it is likely to have been, contaminated by an organism likely to be pathogenic to healthy humans, if such organism is not routinely and freely available in the community, and such organism has a significant probability of being present in sufficient quantities and with sufficient virulence to transmit disease. Based on the National Guidelines on Solid and Hazardous Wastes Management in Nigeria, Infectious medical waste includes the following materials (FEPA, 1991):

- Culture and stock of infectious agents;
- Pathological wastes;
- Waste human blood and products of blood;
- Sharp instruments that have been used in patient care or in medical, research or industrial laboratories
- Contaminated animal carcasses, body parts etc.
- Wastes from surgery or autopsy that were in contact with infectious agents.
- Laboratory wastes from medical, pathological, pharmaceutical or other research, commercial or industrial laboratories.

Table 1: Simplified medical waste classification

Contaminated waste	Description
Regulated/domestic wastes	Food remains, used toiletry, food container, and used office papers.
Wastes from surgery and autopsy	Soiled dressings, sponges, drapes, lavage tubes, drainage sets, under pads, and surgical gloves.
Sharps	Disposable needles, syringes, scalpel blades, Pasteur pipettes and broken glasses, disposable culture dishes, specimen containers or any other item that could cut the skin.
Pharmaceutical wastes	Expired drugs and chemicals or ones returned from wards spoilt and or contaminated
Dialysis unit wastes	Tubing, filters, disposable sheets, towels, gloves, aprons, and lab coats.
Contaminated equipment	Equipment used in patient care, medical laboratories, research, and certain pharmaceuticals.
Radioactive medical waste	Solid, liquid and gaseous wastes contaminated with radio-active substances used in diagnosis and treatment of toxic quitois.
Miscellaneous Laboratory wastes	Specimen containers, slides and cover slips, disposable gloves, lab coats and aprons. Cultures and stocks of infectious agents from clinical research.

The national guidelines require that handling, storage, transportation and disposal of medical waste must be tracked, inspected and monitored by appropriate regulatory bodies for effective management. The tracking programme allows for understanding of wastes from cradle to grave and also assists in the evaluation of any potential harm to the environment and human health (FEPA, 1991,

Slack *et al.*, 2004). It is also a corporate obligation for waste generators to conduct monitoring, testing or risk assessment and as well put in place policies for safe disposal of medical waste.

The procedure for compliance order and violations of this regulation as stipulated in the provision appears ineffective as there is no existing systematic approach to the collection, transportation and

disposal of medical waste in Nigeria in spite of the provisions. Medical waste is collected, handled through the municipal collection system and is mostly disposed off in open dumps thus creating a serious health risk to municipal workers, the public and the environment. There are no landfills specifically designed to receive infectious wastes either in the country or in Lagos state, hence, the urgent need to pay serious attention to MWM and its associated problems by all stakeholders. The primary aim of this study was to evaluate medical waste management practices and problems as well as their implications to health and environment in selected private and public hospitals in Lagos, Nigeria. Medical waste generation rate was estimated for each healthcare facility.

Study area

Lagos state is located in south western Nigeria on the West Coast of Africa and it occupies an area

of 3,577 square kilometer, which is just about 0.4% of the total land area of Nigeria. It is the smallest but the most densely populated state in the country with an estimated population of over 13million inhabitants. About 80 percent of this population resides in metropolitan Lagos making the state the most urbanized in Nigeria. Healthcare facilities such as hospitals, health centers, medical institutes and clinics are scattered all over the metropolis, and waste generated from them are in most cases mixed with domestic and municipal wastes. Four hospitals (2 private and 2 public) located in different parts of the city were selected for this research work. The waste management programme of each hospital was carefully studied, and information on the management, segregation, generation, storage and disposal of medical waste was obtained. Table 2 presents a summarized description of the selected hospitals.

Table 2: Statistics of surveyed hospitals

Hospital	Description	Type of hospital		Number of wards	Number of beds
		Public	Private		
Hospital A	Located in a medium to high densely populated area of Surulere of the metropolis. The hospital treats both general and specialized cases.		✓	4	50
Hospital B	Located in the low to medium densely populated area of the state capital in Ikeja. It treats both general and specialized cases.		✓	5	40
Hospital C	A teaching and specialist hospital. It is located in a densely populated area of Surulere in the metropolis.	✓		20	761
Hospital D	A referral hospital that specializes in accident and burns. It is located in a medium to high densely populated areas of Igbobi in the metropolis.	✓		15	378

MATERIALS AND METHODS

The research design employed involved the use of surveys and also interviews with officers in charge MWM in each hospital. A simple and objective questionnaire based on the guidelines of the safe management of waste from health care facilities (WHO, 1999) was administered in each hospital. Health care managers, nurses, nursing assistants and waste handlers within and outside the hospitals were among those interviewed. The questionnaire contained information on waste generation and main aspects of segregation, collection, storage, transportation, treatment and final disposal of medical waste. Information

gathered was used to analyze profile of the management programme adopted by the hospitals for their medical waste. Site visits were conducted for a period of 3 months between April and June, 2005 to supplement and support information gathered from the survey. Site visits were particularly helpful to obtain primary information data on common practices of MWM. Generation rate of medical waste in kg/bed.day in each hospital was evaluated.

RESULTS

Table 3 presents the management consideration used to assess the medical waste management

practices. Table 4, presents the results of medical waste characterization, while Table 5 presents medical waste generation in surveyed hospitals in kg/bed.day and the total waste generated in kg/day.

The actual medical waste generation in surveyed hospitals was based on the number of 50 litre waste bins used for collection and storage of wastes that were filled daily.

Table 3: Medical waste management consideration

Designation	Hospital Type	Tracking program	Monitoring and testing	Abatement facility.	MWMP
A	Private	Absent	Absent	None	Absent
B	Private	Absent	Absent	None	Absent
C	Private	Absent	Absent	Incinerator (not functional)	Absent
D	Public	Absent	Absent	Incinerator	Absent

MWMP: medical waste management plan

Table 4: Composition of medical waste from hospitals in percentage

Waste category	Hospital A (Private 1)	Hospital B (Private 2)	Hospital C (Public 1)	Hospital D (Public 2)	Average
Regulated Waste	51	66	50	50	54
Infectious Waste	34	19	37	37	32
Sharps/Pathological	11	10	10	10	10
Chemical	2	4	3	3	3
Others	2	1	-	-	1
Total	100	100	100	100	100

Table 5: Medical waste generation in surveyed hospitals

Designation	Hospital Type	Number of beds	Total waste generated (kg/day)	Generation rate (kg/bed/day)
A	Private	40	22.5	0.563
B	Private	50	28.1	0.562
C	Public	600	399.6	0.666
D	Public	378	161.3	0.427
Total		1068	611.5	0.573

Average = 0.573 kg/bed.day

DISCUSSION

Waste management practices

The adequacy or otherwise of the waste management practices of surveyed hospitals were measured against three principal criteria as stipulated in the National Guidelines for the management of medical waste. These include the presence or absence of a Tracking Programme, Monitoring and Testing and the existence or otherwise of any Medical Waste Management Plan (MWMP) in place. Results of investigation revealed a complete absence of medical waste tracking, monitoring and testing programme in all the hospitals whether public or private. Equally,

noted was the absence of an institutionalized medical waste management plan in any of the hospital. Abatement facility in form of incineration was present in the two public hospitals but only one is functional. It was understood that the other one was broken down many years back. Results from survey thus revealed non compliance of any of the healthcare facility investigated with the existing national regulatory requirements. Though the requirements are necessary management consideration, there has not been any known serious compliance by the hospitals in general or enforcement by the relevant regulatory bodies in particular.

Waste characterization

From Table 4, survey results show variations in the composition of medical waste from one hospital to another with no distinction between private and public hospitals. It could be observed that the regulated waste made up of "domestic waste" constitutes the larger percentage of the waste stream in all the hospitals. The percentage composition ranged between 50% and 66%. Infectious waste (FEPA, 1991), constitutes between 19% and 37% of the entire medical waste stream. Sharps constitute between 7% and 10% of the total waste stream. The chemical waste on average constitutes only 3% of the waste stream while others are insignificant except in one hospital.

Waste segregation

Medical waste segregation is an important step in reducing the volume of hazardous waste as it offers the ability to make more accurate assessment about its composition with the use of labeled bags to separate infectious waste from domestic waste effectively. Segregation of hazardous/infectious waste types is a key to achieving sound medical waste management therefore a right step to health risk reduction. Results from investigation revealed that three out of the four hospitals gave high priority to segregation from source of infectious and sharp wastes by use of color coding system. One of the privately owned hospitals has the most efficient color coding system; colored buckets are used; red for sharps and broken glasses, green for syringes and needles and blue for all blood stained cottons, gauze and bandages. Regulated waste is collected in dustbins. In the other private hospital, infectious waste is sourced into black plastic bags, while sharps are stored in boxes prior to treatment and eventual disposal. One out of the two public hospitals practices waste segregation while there is a complete absence in the other which invariably is the largest of all the surveyed hospitals.

It was further observed that there is no uniformity in color coding of medical waste in all the hospitals. The existing National Guideline is also silent about this important aspect of the MWM. However, all the healthcare facilities collect and store their regulated waste in black plastic bags for eventual

disposal as required by the Lagos State Environmental sanitation law. A noticeable problem here is the multiple uses of black plastic bags for storage of both infectious waste and regulated waste without appropriate labeling. Despite the commendable level of segregation of medical waste currently achieved in the hospitals, surveys revealed that segregated medical wastes are sometimes mixed together by collectors either at the point of collection or at the dumpsites. The whole mixed volume therefore could be considered as being infectious which portends a serious risk to the general public (WHO, 2005a). By the WHO report, it estimated that, in 2000, worldwide, injections undertaken with contaminated syringes caused about 23million infections of Hepatitis B and Hepatitis C and HIV (WHO, 2005a).

Waste generation

From Table 5 presents medical waste generation in surveyed hospitals in kg/bed.day and the total waste generated in kg/day. It was discovered that most hospitals had no record of the volume of waste being generated by them. The amount of wastes generated is easily expressed in volume as most storage facilities are in liters aside those at depot centers. However, all data were evaluated and presented on a weight basis. Medical waste generation rates ranged between 0.427 and 0.666 kg/bed.day, while on average, a generation rate of 0.573kg/bed/day was obtained. This could not be taken as an absolute value for the entire metropolis due to existence of multiplicity of healthcare facilities within the mega city. The result however, serves as a reference point in our initial understanding of medical waste management situation in the mega city. The current results are comparable and consistent with the results obtained by Phengxay *et al.*, (2005). The total volume of medical waste generated in all the hospitals was 611.5 kg/day. This translates to 17.19 Kg/bed.month and a calculated total waste volume of 18,345.00 kg/month by all hospitals. Out of this, infectious waste is 5,870.4 kg/month, sharps, 1,845 kg/month and chemical waste 550.35 kg/month. Regulated domestic waste constitutes 54% of the total medical waste stream. Another noticeable inference is that the proportion of medical waste from the two public hospitals was more than 91%

of the total volume of waste stream. The percentages by weight of infectious waste generated by these hospitals are also of higher magnitudes compared with others. The only explanation for this has to do with the number of available medical services and facilities in the two public hospitals.

Internal medical waste collection and storage
Cleaners and nursing assistants are responsible for the collection of medical waste from wards to storage centers in all the hospitals. The survey revealed poor handling by this set of workers who are therefore exposed to high occupational and health hazards. Resource recovery exists in an informal level and affects mostly office papers, cardboards, plastics, metal cans and glass bottles. The hospital personnel mostly involved are cleaners. All the hospitals have internal storage facilities: regulated domestic waste is collected and stored in 50litres capacity plastic bins or metallic bins with capacities ranging from 2 to 6 tones. Wooden or aluminum boxes are used for the storage of sharps waste type while infectious waste is stored in 50 liters black or red plastic bags depending on the hospital.

Collection of medical waste from the wards to the depot centers is effected about two to three times daily. The frequency of collection from internal storage facilities by external waste collectors is irregular; collection could be once or twice a week.

Treatment and disposal

Burning and burial of medical waste are practiced; sadly enough medical infectious waste is not excluded from this practice. A common practice is the disposal of infectious and regulated waste types either on fallow land within hospital premises or in canal. This observed poor medical waste management practices is a risk to public health especially when most hospitals are surrounded by densely populated communities. As earlier on indicated the two public hospitals are equipped with incinerators with only one being functional. Infectious medical waste and sharps are incinerated in-house by the hospital's engineering department. To its credit, it is the only hospital that engages the service of an environmental officer

to oversee the treatment and eventual disposal of its medical waste. A collaborative effort does exist between the hospital and one of the private hospitals for the incineration of their infectious and sharp waste types. This collaboration is seen as a welcome step and its continuation will surely enhance sound MWM practices in the state and also guarantees the quality of the environment.

All the hospitals employ the services of private waste collectors for MW collection and final disposal at government authorized dumps. Notable among these private collectors is the state owned waste management authority that specializes in the collection of industrial wastes from most industrial set ups within the mega city. Two major observed challenges to the environment are open dumping either within the hospital premises or at government recognized dumpsites; and non treatment of infectious waste before final disposal. Open dumps are known to have no controls over access of unauthorized persons or environmental pollution, hence, the potential health risk (WHO, 1999). The national policy on environment stipulates specific roles for appropriate government agencies to be among others; the determination and the use of environmentally safe and technologically sound techniques for disposal of toxic, hazardous and radio-active wastes. The various dumpsites within the vicinity of the metropolis do not meet necessary design criteria to operate as landfills for hazardous waste. The current medical waste management practices observed within and outside healthcare facilities calls for a specific waste management policy for medical waste in the country and in Lagos state in particular. Treatment of infectious waste and sharps waste needs adequate legal backing and sanction in case of non-compliance by erring hospitals, health institutions and clinics.

In conclusion the results of our investigation on the four selected hospitals gave a global view of MWM practices in private and public hospitals in Lagos metropolis in particular and in the nation in general. Medical waste even though, attracted a high level of segregation in most hospitals; it is generally co-disposed with the municipal solid waste stream by waste handlers. The disposal of medical waste in municipal landfills therefore poses

serious health and environmental hazards erstwhile landfills are mostly open dumps without adequate design consideration to guaranty protection of the environment from the disposal of such hazardous wastes. Leachates from beneath the landfill base may contain heavy metals and other organic pollutants that could lead to gross contamination of surface and groundwater resources, Longe *et al.*, (2005). Hazardous medical waste requires proper monitoring for an effective tracking at all times. Control of medical waste can only be fully achieved when adequate monitoring facilities are available. Control means that competent authorities can act rapidly to ensure the possibilities of minimizing inappropriate handling and dumping of medical waste. It also translates to mean that regulatory authorities should have the powers both legally and financially, to act quickly in order to reduce dangers posed to human health and the environment. In order to enhance adequate monitoring and control of medical waste in Nigeria, governments at national and state levels need a comprehensive guideline on hazardous solid waste management other than what is currently in existence. For effective management therefore, there is need for cooperation among medical waste generators and environmental agencies with coordination among the various persons and corporate bodies involved in the control of medical waste activities. Also, handlers of medical waste within healthcare facilities should be trained on methods and new techniques of medical waste management and in hazardous effects of medical waste using WHO manual (WHO, 2005b).

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