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# MEDICAL WASTE MANAGEMENT PRACTICES IN NIGERIA, THE CASE OF LAGOS AND IBADAN

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**Abstract:** Most developing countries are facing serious challenges on medical waste (MW) management. The current management practices of medical waste in Nigeria was studied using Lagos and Ibadan, an emerging mega city and the largest city in West Africa as case study. Sources of data were through questionnaire administration, waste sorting and characterization as well as sampling and analysis. The study revealed that there is no proper segregation of MW in most health care facilities studied. Over 75% of the MW handlers in Lagos and 98% in Ibadan are unaware of any policy and legislation regarding the management of MW. About 60% and 99%, respectively had no form of training in MW management and as such, are greatly exposed to different health risk. Furthermore, the States Waste Management Authority has no separate and appropriate dumpsites and landfills for disposal. The current system of MW management in Nigeria is in dire need of immediate attention and improvement. It is essential to develop a national policy on MW management and implementation of the existing ones to provide environmentally sound management measures to improve MW management in the country.

**Keywords:** Medical waste, characterization, legislation, disposal, management

## 1. Introduction

The issue of sustainable medical waste management practices in Nigeria with over 140 million people is facing a serious setback because in most cases different wastes such as municipal solid waste, industrial waste and medical waste are co-disposed in open dumpsites and then burned in the open thus creating a serious health risk to municipal workers, the public and the environment. Medical solid waste is any waste that is generated in the

diagnosis, treatment or immunization of human beings or animals or in research pertaining thereto, or testing of biological, including but not limited to soiled or blood-soaked bandages, culture dishes and other glassware. It also includes discarded surgical gloves and instruments, needles, lancets, cultures, stocks and swabs used to inoculate cultures and remove body organs (Chimuka et al., 2007; WHO, 1999).

Poor management of medical waste exposes medical staff, waste handling workers and the general communities to infectious, toxic effects and injuries, a situation that poses a serious health problem in most developing countries of the world (WHO, 1999). Some health impacts and disease transmission in humans have been traced to exposures to hazardous medical wastes (Shang and Jia, 2002). These impacts include; mutagenic, teratogenic and carcinogenic effects, respiratory damage, central nervous system defects, reproductive system damage etc., (Blackman, 1993); diarrhea, lepspirosis, typhoid, cholera, hepatitis B, and human immunodeficiency virus (Mato and Kaseva, 1997).

In Nigeria, a typical developing country, there is no existing systematic approach to the collection, transportation and disposal of medical waste generated. Both staff and patients in healthcare facilities (HCFs) are exposed directly or indirectly to these wastes at the source of generation while the environment and handlers could be impacted in the course of transportation and disposal. At the moment, there is no general National Policy on Waste Management in the country. However, there are regulations guiding hazardous wastes which include; National Policy Guidelines on Solid Waste Management, Blue Print on Municipal Solid Waste Management 2000, etc. There is no specific guidelines or policy on medical waste management. Also, there are no landfills specifically designed to receive infectious wastes. Hence, the need for government to pay more attention to this problem of improper management of medical waste as the uncontrolled dumping of these wastes and co-disposal with municipal solid waste has the potential for transporting pathogens.

The aim of this research is therefore to investigate the common healthcare waste management practices in Nigeria using Lagos, a mega city with a population of over ten million and Ibadan, the second largest city in Africa with over three million inhabitants as the case study; to characterize and quantify healthcare wastes generated in the two cities and to identify the current shortcomings in the execution of sustainable medical waste management practices.

## 2. Experimental: Materials and Methods

### 2.1. Description of the study area

Lagos lies approximately between Longitudes 2°42'E and 3°42'E and Latitudes 6°22'N and 6°52'N. The Southern boundary of the state is formed by the 180 km long Atlantic coastline, while its Northern and Eastern boundaries are shared with Ogun State. On the Western side, the state is bordered by the Republic of Benin. Lagos state is one of Nigeria's foremost states in commerce and industry having a size of about 3,345 $km^2$ and an estimated population of over 10 million people (NPC, 2006) that spread over its 20 Federal Government recognized Local Government Areas (LGAs). Ibadan is between Latitude $7^0$ 23' 16.00"N and Longitude $3^0$ 53' 47.004"E with about 3,565,810 people (NPC, 2006). It is the biggest city in terms of land mass in Nigeria with 11 LGAs (5 urban and 6 rural). This study was conducted between September 2008 and March 2009.

### 2.2. Questionnaire administration

Lagos State Waste Management Authority (LAWMA) is solely in charge of management of all waste generated in the state including medical waste. According to the Lagos State Healthcare Facility and Monitoring Accreditation Agency (HEFAMAA) and LAWMA's survey, there are 126 public health centres, 26 general hospitals, estimated 3000 private hospital/clinics, estimated 160 trado-medical health centres, estimated 2000 laboratories, and estimated 0.8-1.75 kg/bed/day of healthcare waste (HCW) generated (LAWMA, 2008). From

Lagos State Ministry of Health, the total number of registered HCFs as at 2008 is 2,044 with more than 7,600 bed spaces. The data on the total number of registered HCFs in Ibadan was not available as at the time of this study. Ibadan Solid Waste Management Authority (ISWMA) established over twenty years ago is responsible for the management of different waste generated in the city.

The 20 LGAs in Lagos and 11 LGAs in Ibadan were ranked based on the number of HCFs and the available bed spaces. The top six LGAs were selected in Lagos while the top five were selected in Ibadan. Agege, Alimosho, Ojo, Oshodi/Isolo, Shomolu and Surulere were the top six LGAs in Lagos while Ibadan North/East, Ibadan South/East, Oluyole, Ona-Ara, and Lagelu were the top five LGAs in Ibadan. Data on solid waste management practices in the HCFs in the selected LGAs were obtained through direct questionnaire surveys and interviews. The first questionnaire was designed to obtain data on the history of the HCFs, solid waste management practices and their level of awareness on policies and legislation on HCW management. The respondents were mainly medical superintendents, management/administrative staff and environmental health officers. The second questionnaire was targeted at the waste handlers in the various HCFs. It provided data on the age and sex distribution of waste handlers, level of training they had undergone, their waste handling habits and ailments/diseases they had suffered from in the course of their duty. The third questionnaire was designed to obtain data on the existing government approved dumpsites in the cities, amount of wastes generated annually as well as the type of treatment the wastes undergo at the final stage of disposal. The questionnaire was administered to the existing solid waste management authority in both cities. A total of 65 healthcare facilities were selected across the 6 LGAs in Lagos, which consist of 19 primary, 40 secondary and 6 diagnostic HCFs. 26 hospitals were selected from the 5 LGAs in Ibadan out of which 24 were private and 2 were government owned hospitals.

### 2.3. Waste characterization and segregation

Medical wastes from each of the selected facilities in the two cities were segregated into three categories namely; general, infectious and sharps. General wastes are domestic wastes, office papers and cardboards (Chandra, 1999). Infectious wastes are culture from laboratory works, wastes from surgery, dressings from wounds, soiled cotton wools and bandages, and disposable gloves (Sheth et al., 2006) while Sharps are things that could cause a cut such as needles, syringes and so on (WHO, 2000). Each category of these wastes were weighed directly in government owned and secondary hospitals in Lagos because they were stored in different colour coded containers and boxes as shown in Fig. 1. In Ibadan and some other HCFs in Lagos, the wastes were sorted prior to measurement since the wastes were not segregated at source according to their types.

## 3. Results and Discussion

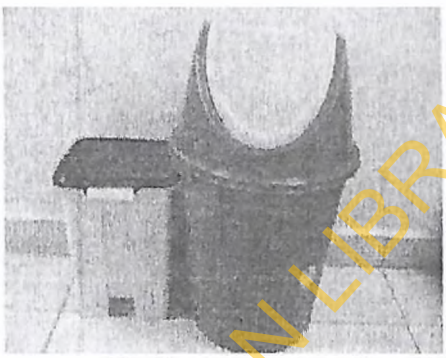
### 3.1. Waste management legislation in Nigeria

Waste management policy embodied in the national policy on the environment formulated in 1989 and revised in 1999 only alludes to hazardous wastes and does not refer to medical wastes (FME, 2006). Yet the number of HCFs in the country at large is on the increase. However, a national law on HCW management may stand alone or may be a part of a more comprehensive legislation such as (a) law on management of hazardous wastes, (b) law on hospital hygiene and infection control, (c) national policy on injection safety and HCW management (Lambo, 2007). In both cities, none of the HCFs studied knew of any directive or legislation as regards the management of HCW. This revealed that government has not given medical waste management the priority it requires or has trivialize the management of this waste.

(a) Infectious waste bin

(b) Safety boxes for sharp wastes

(c) Container for general waste



(d) Waste containers in a HCF

Figure 1: Containers for waste segregation in HCFs in Lagos.

3.2. Statistics of surveyed hospitals

The total number of the different HCFs and the waste handlers in the selected LGAs considered in this study is shown in Table 1.

Table 1: HCFs studied in the selected LGAs in Lagos and Ibadan

| LGAs | Primary HCF (P in Ibadan) | Secondary HCF (G in Ibadan) | Diagnostic | Total No of HCFs | No of waste handlers |
|---|---|---|---|---|---|
| **Lagos** | | | | | |
| Agege | 2 | 3 | 4 | 9 | 9 |
| Alimosho | 1 | 14 | 0 | 15 | 10 |
| Ojo | 4 | 6 | 0 | 10 | 7 |
| Oshodi/Isolo | 5 | 11 | 0 | 16 | 8 |
| Shomolu | 4 | 3 | 0 | 7 | 11 |
| Surulere | 3 | 3 | 2 | 8 | 7 |
| Total | 19 | 40 | 6 | 65 | 52 |
| **Ibadan** | | | | | |
| IB N/E | 5 | 0 | 0 | 5 | 12 |
| IB S/E | 4 | 0 | 0 | 4 | 10 |
| Lagelu | 6 | 1 | 0 | 7 | 12 |
| Oluyole | 3 | 1 | 0 | 4 | 15 |
| Ona-Ara | 6 | 0 | 0 | 6 | 10 |
| Total | 24 | 2 | 0 | 26 | 59 |

Note: P = Private, G= Government, IB N/E = Ibadan North/East, IB S/E = Ibadan South/East

3.3. Current MW management practices in Lagos and Ibadan

This study covered a total of 19 primary, 40 secondary and 6 diagnostic HCFs in the top 6 LGAs in Lagos. From the study, it was observed that over 75% of medical practitioners are unaware of any policy or legislation applicable to the management of HCW. However, about 83.1% practice segregation of waste, majority of which is done at the point of generation using colour coded bins and injection safety boxes made of cellulose material (Fig. 1). This is in contrast to the practice in Ibadan, where waste are collected at the point of generation into metal dust bins, drums, plastic bins, baskets, pans, cartons, buckets or bowls before transferring into a larger or final disposal containers (Coker et al, 2008). None of the HCFs studied in Ibadan practiced total segregation. 57.7% segregated sharps only while 42.3% did not sort at all. Solid MW characterization in the selected LGAs in Lagos and Ibadan is presented in Table 3. The segregation of medical waste can be done at point of generation using colour coded plastic materials for waste collection (Chandra, 1999; Michell, 1999) as practiced in the majority of the HCFs in Lagos.

Table 3: Solid MW characterization in the selected LGAs in Lagos and Ibadan

| LGAs | No of HCFs | Average general waste (kg/day) | Average infectious waste (kg/day) | Average sharp waste (kg/day) | Total waste (kg/day) | Average No of patient per day | Waste generation (kg/patient/ day) |
|---|---|---|---|---|---|---|---|
| **Lagos** | | | | | | | |
| Agege | 4 | 6.64±7.0 | 3.30±4.1 | 1.19±1.7 | 11.1 | 18 | 0.62 |
| Alimosho | 7 | 4.87±5.9 | 5.85±4.2 | 1.66±1.5 | 12.4 | 23 | 0.54 |
| Ojo | 6 | 2.75±0.3 | 4.33±0.3 | 1.13±0.1 | 8.21 | 15 | 0.55 |
| Oshodi/ Isolo | 7 | 7.12±11 | 6.91±7.3 | 1.92±2.3 | 16.0 | 20 | 0.80 |
| Shomolu | 9 | 3.91±3.0 | 1.68±0.8 | 0.9±0.9 | 6.49 | 7 | 0.93 |
| Surulere | 5 | 2.99±1.8 | 1.06±0.8 | 0.42±0.2 | 4.47 | 6 | 0.75 |
| **Ibadan** | | | | | | | |
| IB N/E | 5 | 2.85±0.3 | 1.20±0.5 | 0.52±0.3 | 4.57 | 7 | 0.65 |
| IB S/E | 4 | 1.99±0.9 | 0.63±0.2 | 0.26±0.1 | 2.88 | 26 | 0.11 |
| Lagelu | 7 | 2.12±0.8 | 1.35±0.1 | 0.54±0.1 | 4.01 | 9 | 0.45 |
| Oluyole | 6 | 0.97±0.1 | 0.43±0.1 | 0.19±0.1 | 1.59 | 10 | 0.16 |
| Ona-Ara | 4 | 1.35±0.3 | 0.25±0.1 | 0.71±0.1 | 2.31 | 12 | 0.19 |

Also, transportation of waste within the hospital premises in Ibadan was not done in a sustainable manner as waste was usually carried through the patient care areas and the containers for carrying the waste have no wheels. They are usually carried on shoulders, head or towards the chest. Chandra, (1999) also reported that there should be a designated route to avoid passage of waste through the patient care areas. There should also be designated wheeled containers, trolleys or carts to transport the waste/plastic bags to the site of storage or treatment. Though, no form of pre-treatment of the waste is carried out while waiting for final disposal. The containers should be designed in such a way that it will be easily loaded, secure during transportation with no sharp edges and easy to clean and disinfect. One of the HCFs operate low efficient incinerator or locally made incinerator shown in Fig. 2.

Presently in Lagos, there is a medical waste management unit in LAWMA. The unit involved Private Sector Participation (PSP) Operation in medical waste collection and disposal. Collaboration with Health Facilities Accreditation Management Authority

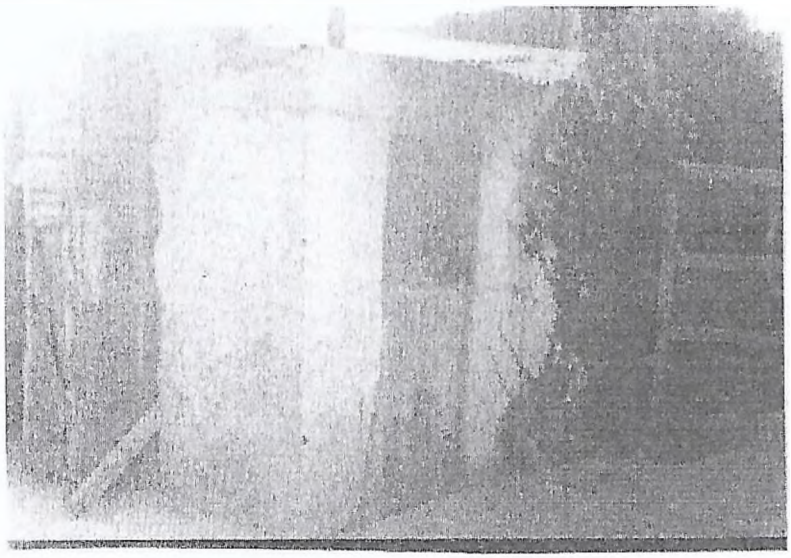


Fig. 2: An incinerator at one of the hospitals in Ibadan North/East

(HEFAMA) to ensure HCFs conforms to the Polluter Pays Principle. The unit organizes annual training programme on HCW management for public and private HCFs. The unit also provides HCFs with HCW management commodities such as safety boxes and bin liners of different colour codes. The agency has also installed an autoclave with shredder for treatment of HCW with the following activity.

- There is an increase in the number of PSP Operators from 4 to 15 servicing all HCFs daily
- A total number of 3,500 HCFs are presently being served with free distribution of colour coded bags.
- Over 200 million colour bags and 500,000 sharps boxes have been distributed by the Lagos State Government.
- LAWMA now have hydroclave automated machine situated at the former incinerating plant at Oshodi that treat the medical waste before final disposal. The machine has a hoist loading system where the waste is shredded and the original volume is reduced by 80%. It utilizes stream and the shredded waste is heated at temperature of 135$^{O}$C and 4 bar pressure. The final products is then disposed of with other general waste.

3.4. Frequency of waste collection in the HCFs

The frequency of collection of wastes generated from HCFs in the cities which is the duty of waste contractors operating under the auspices of LAWMA in Lagos and ISWMA in Ibadan varies between HCFs. Fig. 3 shows the relative percentage of times wastes are kept around healthcare premises before the final disposal. In Lagos, 80% of the HFCs keep their wastes for 2 days and above before disposal, while about 30.8% keep theirs for more than 3 days. In Ibadan, 23.1% keep the waste for at most 3 days either to dispose in a nearby bush or burn in the open. This releases poisonous gases such as dioxins and furans into the environment which are detriment to human health (Manyele, 2004 and Connet, 1997).

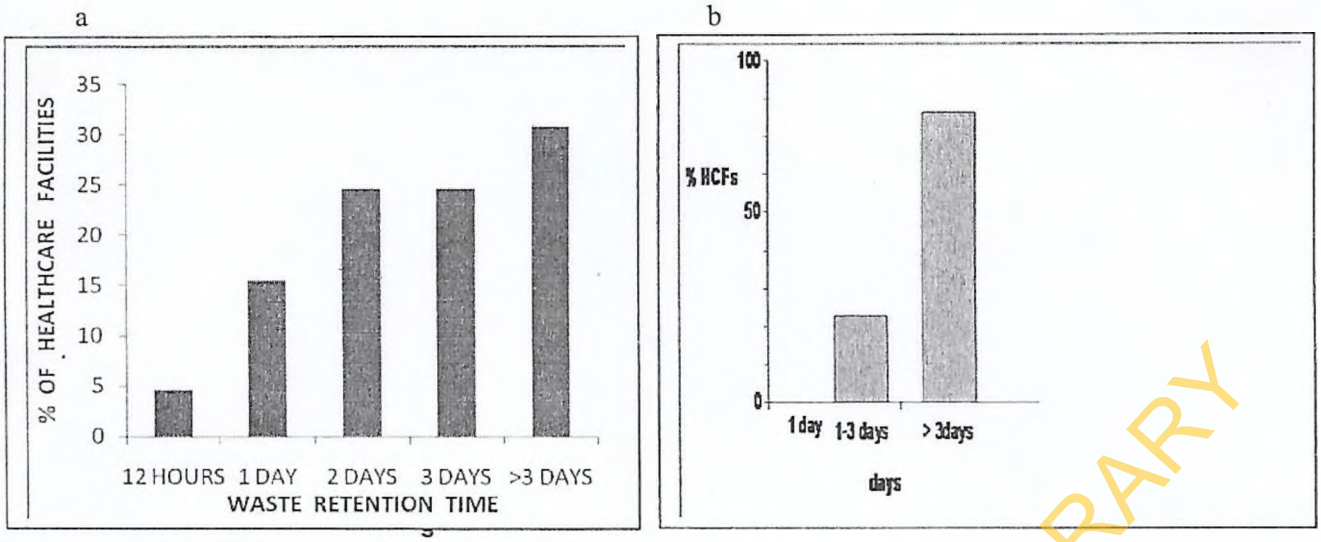



Figure 3: Waste retention times in HCFs before disposal in (a) Lagos and (b) Ibadan

76.9% keep their waste for above 3 days before final disposal. This is because the final disposal is done by contractors who come fortnightly to collect the waste. While awaiting final disposal, the wastes are kept in a metal drum within the hospital premises without any treatment. None of the hospitals in Ibadan dispose of their waste daily. This reflects some observations of cases where waste receptacles were found with over spilled wastes which could attract rodents and domestic animals that are possible vectors of some diseases. Where animals are allowed to graze on such waste, there is a high risk of reintroducing pathogenic micro-organisms into the food chain. Medical wastes therefore pose a risk to individuals, communities, and the environment if not carefully handled (Akter et al., 1998). Furthermore, it was observed that MW produced in HCFs in the city are not given any form of pre-treatment while awaiting final disposal.

3.5. Training and protection of waste handlers

Questionnaire survey revealed that workers who handled medical wastes in both cities are mostly women. In Lagos, the age range of the workers are 21% (between 15-25 years with average of 22.4 years) and 79% (between 26-55 years with average of 37.2 years) while in Ibadan, the age range was between 20-50 years. From the workers interviewed in Lagos, only about 40% had undergone one form of waste management training or the other and only 2% in Ibadan with inadequate protective gears. It is therefore evident that all waste handlers are susceptible to hazard either due to lack of on-the-job training or failure to use appropriate protective gears like aprons, gloves, boots and facemasks while handling the waste. The gross illiteracy of many waste handlers and their ignorance of the risk involved in unsafe waste handling posed great danger to their health. Therefore, there is need for more attention to be paid to training of MW handlers.

Waste handlers also reported several cases of recurrent ailments ranging from air borne (31%), water borne (33%), blood related (3%) and stress related (33%) in Lagos while in Ibadan, 25.4% had suffered from air borne ailment, 23.7%, water borne and 50.8% stress related. Air-borne ailments reported are bronchitis, catarrh, tuberculosis, food poisoning while water-borne ailments include cholera, typhoid fever and diarrhea. Also blood related ailments reported are HIV/AIDS and hepatitis, while stress related ailments are headaches, rheumatism, pains and general body weakness. Furthermore, about 67% of the waste handlers in HFCs studied in Lagos reported self responsibility for cost of treatment. The quality of such treatment could in turn be affected by their financial capability. The reverse is the case

in Ibadan where in most cases, the management of the medical institutions are responsible for the medical treatments of the waste handlers.

3.7. Waste generation and characterization

Generally, quantities of waste generated by HCFs depend on the status of the healthcare facility, level of instrumentation and sometimes, the location (Mato and Kaseva, 1999). The result of the MW characterization in the cities showed that the rate of waste generation in HCFs in the selected LGAs in Lagos ranges from 0.54 kg/patient/day in Alimosho LGA to 0.93 kg/patient/day in Shomolu LGA with an average of 0.70±0.2 kg/patient/day. Although all the HCFs visited provide out-patients services, there was dearth of information on both in-patients and out-patients in the city. The average number of inpatient admitted per day in each LGAs is affected by the status of the hospitals. In Agege, Alimosho and Oshodi/Isolo LGAs with Government General Hospitals, the average number of in-patient is higher as well as the average waste produced. Fig. 5 (a) shows the relative composition of infectious wastes and the average wastes produced in HCFs in the selected LGAs in Lagos and (b) shows the % composition of waste in Ibadan .

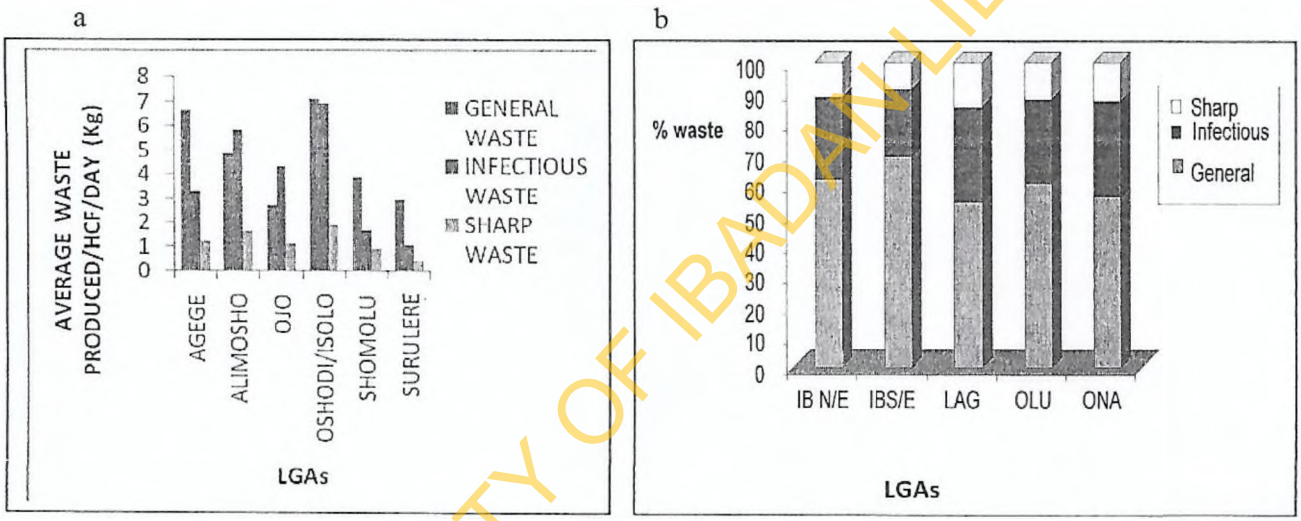



Figure 4: Relative composition of waste produced in the LGAs in (a) Lagos and (b) Ibadan

The relative amount of infectious wastes in Lagos increases from Surulere LGA (23.7%), Shomolu LGA (25.9%) through Agege LGA (29.6%), Oshodi/Isolo LGA (43.3%), Alimosho LGA (47.3%) to Ojo LGA (52.7%). However, field observation revealed that due to improper waste management practices in most HCFs, greater portion of the wastes regarded as medical wastes are mere domestic wastes that are mixed or stained with blood or infectious materials. Furthermore, Oshodi/Isolo LGA has the highest rate of 16.0 kg (27.2%) of waste generated in the hospitals in the 6 LGAs in Lagos per day. This could be traced to the high population, over 1.3 million people (Census, 2006) occasioned by commercial activities in the area and the level of medical facilities.

3.8. Common Problems in HCFs in Lagos

- Co-mingling of waste (sharps, soiled swabs, domestic waste etc.)
- In appropriate use of colour coded bags
- Lack of information on how to access colour coded bags and injection safety boxes
- Inappropriate use of injection safety boxes
- Littering of floor with sharps, syringes, swabs etc
- Uncovered waste bin both within and outside the HCFs
- Inappropriate disposal of healthcare waste
- Inadequate/lack of supply of colour coded bags and safety injection boxes
- Ignorance of some HCFs staff on the proper handling of health care waste

3.9. Common Problem in HCFs in Ibadan

- Co-disposal of medical waste with domestic waste
- Unavailability of colour coded bags and safety injection boxes
- Inappropriate storage and disposal of medical waste
- Lack of any form of treatment of the waste before disposal
- Unavailability and lack of use of protective gears by the waste handlers
- Lack of training and enlightenment of medical staff and waste handlers on sustainable MW management

## 4. Conclusions and recommendations

Healthcare waste management is a very important environmental and health safety issue. This study has revealed that HCW management in the two cities in Nigeria i.e., Lagos and Ibadan is being faced with a variety of challenges ranging from dearth of baseline data on the quantity of waste generated, through lack of policies and guidelines for proper environmental friendly disposal of the waste. General and HCW are often mixed together at open dumpsites with no form of pre-treatment especially in Ibadan. About 60% of the waste handlers in Lagos and 98% in Ibadan have had no form of training in waste management while about 67% of the handlers cater for any job-related ailment they suffered from. An average of over 1.7 million tons of medical waste is produced annually in Lagos with an average of 0.7±0.2 kg/patient/day. There is potential risk posed by poor management of medical waste to people and the environment at large thus, proper MW management practices is imperative. The observed medical waste management practices in all the hospitals in both cities indicated the absence of full compliance with the protocol for handling medical waste.

This study revealed that medical wastes produced in Lagos and Ibadan is co-disposed with municipal domestic wastes in open dumpsites. Burning and burial is an unusual but common practices of medical waste management in the two cities. Though, after pre-treatment in Lagos. Indiscriminate dumping can lead to contamination of surface and ground water supplies, while open burning of waste contributes significantly to urban air pollution. It was discovered that the medical centre in Ibadan city handle their wastes in an environmentally unsafe manner. The waste handlers were neither trained nor adequately protected against the harms involved in their job. Some of these hospitals leave their wastes within the hospital premises for several days untreated thus causing air, water and land pollution together with foul odour, flies, cockroaches and rodents. In most cases, government agency is in charge of transportation of MW from source of generation to disposal sites where the waste are either burned in the open or buried at the open dumpsite.

The following are recommendations for better medical waste management in Nigeria:

(a) Government should make policies and directives as regards medical waste management with adequate enforcement

(b) There is the need for a sustainable cooperation among all stakeholders (waste managers, HCFs and government) of a safe and reliable waste management strategy in legislation and policy formulation, monitoring and enforcement.
(c) Managements of HCFs should take the responsibility of ensuring a safer and hygienic system of HCW handling and disposal, taking into cognizance the health of the handlers, the public and the environment.
(d) Stakeholders should embark on proper training and retraining of waste handlers on waste management and associated health risks.
(e) HCFs and waste management authorities should consider the option of environmentally and economically sustainable technologies for healthcare waste management.
(f) Generation of a comprehensive pool of baseline data on medical waste generation and its sustainable management in Nigeria.

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