MEDICAL AND HEALTHCARE WASTE MANAGEMENT IN AFRICAN CITIES: A CASE STUDY

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ABSTRACT

Medical wastes consist of all types and categories of waste generated by medical establishments. Infections and hazardous health care waste pose a substantial danger immediately or over a period of time in human, plant and animal life if not properly managed. This study evaluated the generation, collection, transportation and management of medical waste in selected private and public medical establishments in thirteen local government areas (LGAs) of Lagos State, Nigeria. Field observations, interviews and questionnaire were employed in the course of this research to collect data. The data collected were analysed and discussed. The results showed that the medical waste generated out weighted the current management strategies employed by the medical establishment authorities and regulatory bodies in Lagos State, Nigeria. There are no structured staff training and development policies, plans and practices for staff members involved in medical waste management. The on-site handling, storage, processing and collection facilities of medical waste are obsolete. The study therefore recommends the need for the federal ministry of health, Lagos State ministry of health, professional bodies, regulatory agencies, and the management of health care establishments to review the current medical waste management strategies, upgrade the on-site medical waste handling facilities and embark on training and retraining of staff members involved in medical waste management in Lagos State and other States of the Federal Republic of Nigeria.

KEYWORDS*: Nigeria; obsolete; staff training; waste generation; waste management*

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1.0 INTRODUCTION

Medical waste includes all the waste generated by health care and medical establishments, research facilities and laboratories. Medical wastes are a special category of waste because they often contain materials that may be harmful and can cause ill health to those expose to it. A number of studies have indicated that the inappropriate handling and disposal of health are waste poses health risks to health workers who may be directly exposed to health care waste and to people near health facilities, particularly children and scavengers who may become exposed to infectious wastes and higher risk of diseases like hepatitis and HIV/AIDS (Coker et al., 1999).

Although waste is generated from any were such as the home, office, industry, agriculture, school, and health care establishments, of more concern are that of health care waste due to its hazardous nature and disease transmission characteristics of some of the waste (Ngwuluka et al., 2009). Health care establishments generate wastes which can be classified into infectious and non-infectious wastes (Patil & Shekdar, 2001). When hazardous health care waste are not properly managed, exposure to them could lead to infections, infertility, general deformities, hormonally triggered cancers, asthma, neurological disorders in children, typhoid, cholera, hepatitis, AIDS/HIV and other viral infectious through sharps contaminated with blood (Askarian et al., 2004 ;Blenkham 2006; Lee et al., 2004).

According to Ngwuluka et al. (2009), 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 contaminates soils and water with their consequent effects on plants, aquatic and wild lives, may take a long time to be corrected. Hence, the health risks, the increased workload for health workers and its damage to environment call for a collective commitment to waste management.

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 (Longe & Williams, 2006). In a study Da Silva et al. (2014), found out that, except sharp wastes, other types of medical wastes receive little or no attention. According to Manyele (2004), medical waste management in Tanzania is poor and that the general awareness on issues relating to medical waste management is

generally lacking among generators and handlers. Poor management of medical and health care waste exposes medical and health care staff members, waste handling workers, scavengers and the general public to infectious disease, toxic effects and injuries, a situation that poses serious threat to public health, animals, plant and the environment particularly in developing countries.

Disposal of medical and health care waste is a growing environmental concern in the developing world. The problem is growing with an ever- increasing number of private and public hospitals, clinics, pharmaceutical companies, diagnostic laboratories universally. Medical waste is highly infectious and hazardous waste, posing serious threats to environmental health and public health. It requires specific treatment and management prior to its final disposal (Manyele, 2004). Until recently, the management of medical and health care waste have received little attention despite their potential environmental and health hazardous nature, which could be dangerous if not properly handled, the worst scenario being in developing countries (Slack et al., 2004).

According to Toyobo et al. (2012), it is a common phenomenon that poor scavengers, women and children collect some of the medical wastes (e.g. syringe needles, saline bags, blood bags etc.) for reselling despite the deadly health risk. They stated it has long been known that the re-use of syringes can cause the spread of infections such as AIDS and hepatitis. They concluded that open dumping of medical waste within the hospital premises, or at government authorized dump sites and non-treatment of infectious waste before final disposal pose great danger to the public health and the environment. According to Longe and Williams (2006), medical waste is collected, handled through the municipal collection system and is mostly disposed of in open dumps thus creating a serious health risk to the municipal waste workers, the public and the environment. There are no landfills specially designed to receive infectious wastes either in any other state in Nigeria or in Lagos State, hence, the urgent need to pay serious attention to medical waste management and its associated problems by all stakeholders.

The management of medical and health care wastes, therefore, should be of major concern due to potentially high risks to public health, animals, plants and the environment at large. The aim of this study is to evaluate the medical and health care waste management strategies and problems in public and

private health care and medical establishments, research and laboratories (hospitals, clinics, pharmaceutical establishments, diagnostic laboratories, research centres etc.) in Lagos State, Nigeria. The objectives of this study are to:

(a) evaluate the characteristics of medical and health care waste generated
(b) evaluate the current management strategies of medical and health care waste
(c) assess the level of compliance with recommended best practices for sustainable medical and health care waste management policies and registrations and
(d) assess the implementation of the existing policies, the monitoring and evaluation strategies by the regulatory agencies.

2.0 METHODOLOGY

The study was performed from January to August 2016, covering thirteen local government areas (LGAs) out of the Twenty Local Government Area (LGAs) of Lagos State, Nigeria. The Local Government Areas covered are Alimosho LGA, Ajeromi – Ifelodun LGA, Kosefe LGA, Mushin LGA, Oshodi –Isolo LGA, Ojo LGA, Surulere LGA, Agege LGA, Ifako- Ijaye LGA, Shomolu LGA, Amuwo- Odofin LGA, Lagos main –land LGA and Lagos Island LGA. Extensive literature search, questionnaire, Interviews and field observations were employed to collect primary and secondary data in the course of this research.

Private and public health care and medical establishment's research centres and laboratories (Hospitals, clinics, pharmaceutical establishments, diagnostic laboratories, etc.) in the local government areas mentioned above were visited and staff members of the medical and health care establishments were interviewed in the course of this research. Data collected were analysed and discussed.

3.0 RESULTS AND DISCUSSION

3.1 Number of respondents, their distribution by gender and educational levels

According to Longe and William (2006), Lagos State is located in south western Nigeria on the coast of Africa and it occupies an area of 3,577 square kilometre, which is just about 0.4% of the total land area of Nigeria. It is the smallest state

but one of the most densely populated states in Nigeria. Private and public medical and health care establishments, research institutes and laboratories, including hospitals, health centres, medical institutes, clinics, pharmaceutical establishments, diagnostic laboratories, maternity homes etc. are randomly located all over Lagos State. Waste generated by these medical and health care establishments are in most cases mixed with municipal waste.

There are twenty local government areas (LGAs) in Lagos State, Nigeria. A total of 2600 questionnaires were distributed in thirteen local government areas of Lagos State. Tables 1, 2, 3, and 4 show the number of respondents, their distribution by gender, age and educational levels.

Table 1: Number of questionnaires distributed and the number of respondents.

S/N	Local Government Areas (LGAs) of Lagos State, Studied	Total Number of Questionnaires Distributed	Total Number of Respondents	
			Frequency (*f*)	Percentage (%)
1.	Alimosho LGA	200	119	59.50
2.	Ajeromi –Ifelodun LGA	200	124	62.00
3.	Kosofe LGA	200	141	70.50
4.	Mushin LGA	200	109	54.50
5.	Oshodi –Isolo LGA	200	101	50.50
6.	Ojo LGA	200	148	74.00
7.	Surulere LGA	200	157	78.50
8.	Agege LGA	200	114	57.00
9.	Fako-Ijaye LGA	200	131	65.50
10	Shomolu LGA	200	155	77.50
11.	Amuwo-Odofin LGA	200	163	81.50
12.	Lagos Mainland LGA	200	128	64.00
13.	Lagos Island LGA	200	147	73.50
	Total	**2600**	**1737**	**66.81%**

Table 2: Distribution of respondents by gender

Gender	Frequency (*f*)	Percentage (%)
Male	1088	62.64
Female	649	37.36
Total	**1737**	**100%**

Table 3: Distribution of respondents by their age categories

Age Categories (Years)	Number of Respondents (*f*)	Percentage (%)
< 30	338	19.46
31 – 40	502	28.90
41 – 50	517	29.76
51 and above	380	21.88
Total	**1737**	**100%**

Table 4: Educational level of the respondents

Educational level	Frequency (*f*)	Percentage (%)
Less than primary school	107	6.16
Primary school	248	14.28
Secondary school	596	34.31
Tertiary	786	45.25
Total	**1737**	**100%**

3.2 Factors that affect medical and health care waste generation rates in Lagos State, Nigeria

In the course of this research, it was observed that some factors affect medical and health care waste generation in Lagos State. These factors include; geographical location, ownership of the medical and health care establishment (public and private), number of patients, level of service to the patients, waste management policies, legislations and strategies in place, the characteristics of the management and staff members of the establishment, and the attitudes of the patients and visitors of each medical and healthcare establishment. This concurs with the findings of Lange and Williams (2006), Toyobo et al. (2012), Abah and Ojimain (2011), and Ngwuluka et al. (2009).

3.3 Waste collection systems used by medical and health care establishments in Lagos State.

Tables 5 and 6 show the waste collection systems employed by different medical and health care establishments in Lagos State, Nigeria, and the data on the type and sizes of containers used for the on-site storage of medical and health care wastes respectively. Tables 7 and 8 show the typical data on vehicles and containers used with hauling container system and stationary container system of waste collection respectively.

Table 5: Types of waste collection systems employed by medical and health care establishments in Lagos State, Nigeria.

Types of Waste College Systems	Frequency (*f*)	Percentage (%)
Large containers mounted on rollers	402	23.14
Stationary container systems and on-site storage	420	24.18
Hauled container systems	281	16.18
Establishment to establishment system (waste bagged and placed in front of the establishment)	391	22.51
Cart pushers	243	13.99
Total	**1737**	**100%**

Table 6: Data on the types and sizes of containers used for the on-site storage of medical and health care wastes*.

Container types	Capacity		
	Unit	Range	Typical
Small Capacity			
Plastic or metal (office type)	L	16 -40	28 -32
Plastic or galvanized metal	L	75 – 150	120 - 140
Barrel: plastic, aluminium or fibre	L	75 -250	120 – 200
Disposable paper bags	L	75 -210	120 -150
Standard leak resistance and leak proof disposable bags	L	50 - 150	120 -140
Plastic containers with wheels	L	300 – 380	340 -360
Medium Capacity			
Side or top loading	M^3	0.75 -9	3 -6
Large Capacity			
Open top, roll off (also called debris boxes)	M^3	9 – 38	27 – 35
Used with stationary compactors	M^3	15 – 30	23 – 26
Equipped with self-contained compaction mechanism	M^3	15 – 30	23 – 26
Trailer-mounted open top	M^3	15 - 38	27 – 35
Enclosed, equipped with self-contained compaction mechanism	M^3	15 - 30	27 - 30

(**Source: Fieldwork*)

According to Peavy et al. (1985), on site handling refers to the activities associated until they are placed in the container used for their storage before collection. Depending on the type of collection service, handling may also be required to move loaded containers to the collection point and to return the empty containers to the point where they are stored between collections. In the course of this study,

it was observed that in most medical and healthcare establishments, waste that accumulate in the offices, wards, theatres, emergency wards, outpatient wards, in –patient wards, laboratories etc. are usually collected in relatively large containers mounted on rollers. Once filled, these containers are removed manually or by means of the service elevator, if there is one, and emptied into (1) large storage containers, (2) compactors used in conjunction with the storage containers (3) stationary compactors that can compress the material into bales or into specially designed containers or (4) other processing equipment such as incinerators. In other medical health care establishments, research institutes, laboratories, etc., waste is collected by waste management staff members, cleaners, porters etc. from each ward and each floor in the case of high-rise buildings and taken to the basement service area or the central collection points within the medical and health care establishment premises/compound.

Table 7: Typical data on vehicles and containers used with hauled containers system of waste collection (Peavy et al.,1985)

Vehicle	Collection container types	Typical range of container capacities M^3
Tilt- frame	Open top, also called debris boxes	8 – 40
	Used in conjunction with stationary compactor	10 – 30
	Equipped with self-contained compaction mechanism	15 – 30
Truck tractor	Open top crash trailers enclosed trailer mounted containers equipped with self-contained compaction mechanism	10 - 30

Table 8: Typical data on vehicles and containers used with stationary containers system of waste collection (Peavy et al.,1985)

Vehicle	Collection container types	Typical range of container capacities M^3
Compactor (mechanically loaded)	Open top and enclosed top and side –loading	0.6 - 8
Compactor (manually loaded)	Small plastic or galvanized metal containers, disposable paper and plastic bags	75 -200 *+

* = litters

\+ = Loaded mass of container should not exceed 30kg.

According to Peavy et al. (1985) factors that must be considered in the on-site storage of medical and health care wastes include (1) the type of container to be used (2) the container location (3) public health and aesthetics (4) the collection methods to be used. From interviews conducted and field visitations, the types and capacities of the containers to be used depends to a large extent on the characteristics of the solid wastes to be collected, the collection frequency, and the space available for the placement of the containers. The types and capacities of containers now commonly used for on-site storage of medical and health care wastes in Lagos State, Nigeria are summarized in Table 6. In new medical and health care establishments, containers for waste are usually placed by the side or rear of the compound or building. In older establishments, the containers are located in the alleys. In low rise and high-rise buildings, the storage containers are located in a basement or ground floor service area. Often because the containers are not owned by the commercial or industrial activity, the locations and type of containers to be used for on-site storage must be worked out jointly between the medical and health care establishments and the public or private waste collection agencies.

Table 9 shows the percentage involvement of the formal sector and the informal sector in medical and health care waste management in Lagos State. It was observed that the public medical and health care establishments make use of the formal waste collection agencies while the private medical and health care establishments make use of both formal and informal waste collection agencies.

Table 9: Percentage involvement of formal and informal sectors in medical and health care waste management in Lagos State

Sector	Frequency (*f*)	Percentage (%)
Formal sector (Lagos state government agencies, federal government agencies, relevant professional bodies, regulatory agencies, waste management consultants, registered non-governmental organizations, international donor agencies, registered waste contractors, recycling firms, monitoring and evaluating firms).	1414	81.40
Informal sector (car pushers, scavengers, resource merchants, unregistered waste contractors and waste merchants).	323	18.60
Total	**1737**	**100**

3.4 Solid waste transfer means and methods, waste processing techniques and the waste management policies employed.

Table 10 shows the medical and health care waste transfer means and methods, and the waste processing techniques employed by private and public medical and health care establishment in Lagos State, Nigeria. The cart pushers and motor vehicles are the major means and methods of transferring medical and health care waste from on-site collection and storage points to final disposal points.

Field observations show that burning and burial of medical and health care waste are the most practiced waste management strategies employed by both private and public medical and health care establishments in Lagos State. Medical infectious wastes are not excluded in these strategies. A common practice is the disposal of infectious and regulated waste either on fallow landfills within the hospital premises or in canals/streams.

Table 10: Medical and health care wastes transfer means and methods

Transfer means and methods	Frequency (*f*)	Percentage (%)
Cart pushers	589	33.90
Motor vehicles	1148	66.10
Rail roads	0	0.00
Ocean – going Vessels	0	0.00
Total	**1737**	**100**

This observed poor medical and health care management practices and policies pose great risk to public health, especially when most medical and healthcare establishments, research centres and densely populated communities surround laboratories. All medical and health care establishments employ the services of public waste collectors for medical and health care waste collection and disposal. According to Longe and Williams (2006), 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 radioactive wastes. The two major observed challenges to the environment are open dumping either within the hospital premises or at dump sites/landfills and non-treatment of infectious waste before final disposal.

3.5 Awareness of medical and health care waste treatment, training of waste handlers and waste management policy.

Table 11, shows the awareness of medical and health care waste treatment, training of waste handlers and waste management policies in Lagos State. According to Ngwuluka et al. (2009) and Toyobo et al. (2012), private and public hospitals carry out open burning at a temperature below the recommended temperature of 1000oC. They opined that burning of pharmaceuticals and cytotoxic drugs should be done in a well-constructed incinerators at recommended temperatures with facilities to control emission.

In the course of this research, many medical and health care establishments claimed that waste handlers were trained, but the outcome of the survey indicated otherwise. If indeed they were being trained and re-trained, then the training is substandard and had not been impacted on their skills and knowledge of the recommended measures on 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 exception in the hospitals, thereby creating awareness of waste, its effects, the importance of guidelines and the implementation of the waste management options for the different categories of waste.

From field investigations, it was observed that there is little or no knowledge of medical and health care management policy among the hospital management staff members, which confirms the findings of previous researchers. No evidence was found that enough attention has been given to waste management as no policy or plan existed. It appears that the State Ministry of health and environment, the relevant government regulatory agencies had no guidelines on waste that comes from medical and health care establishments and services. A waste management plan should include medical waste treatment, recycling, transport, and disposal options and must be cost effective (Ngwuluka et al., 2009).

Table 11: Awareness of medical and health care waste treatment, training of waste handlers and waste management policy.

Response	Frequency (*f*)	Percentage (%)
Yes	83	4.78
No	1654	95.22
Total	**1737**	**100**

3.6 Factors affecting medical, health care management and their remedies

In Lagos State, the major problems facing medical and health care waste management vary/ranges from poor funding, legislation, and poor implementation of policies, poor monitoring and evaluation team, limited infrastructure, lack of trained staff members, the level of awareness of the dangers associated with poor management of medical and health care waste, poor disposal techniques (Abal & Ohimain 2016). This research identified similar problems.

The various dumpsite /landfills visited do not meet necessary design criteria to operate as landfills/dumpsite for hazardous waste like the medical and health care waste. The current medical and health care management practices, strategies, monitoring and evaluation observed within and outside the medical and healthcare establishments, research institutes and laboratory in Lagos State calls for review, and redesign of waste management policy, legislation, implementation and supervision for medical and health care related waste in Nigeria particularly in Lagos State. On-site handling, collection, transportation, treatment and disposal of infectious, medical and health care waste need legislation, adequate training and retraining, supervision, monitoring and sanction in case of non-compliance by any medical and health care establishment.

According to Bassey et al. (2006) and Jang (2006) every medical and health care establishment should have or develop a waste management plan that includes daily routine for collection, handling, segregation and packaging of the different categories of waste. The medical and health care establishment should ensure that this plan is in place with an adequate budget and trained staff members to implement it effectively. Implementation, monitoring, emulation, review and redesign of medical and health care management plan, strategies and routine monitoring should be carried out together with the training and retraining programmes.

4. CONCLUSION AND RECOMMENDATIONS

In Lagos State, Nigeria, both the formal and informal sectors play important roles in the transportation and disposal of medical and health care waste. The cart pushers and the motor vehicles are the major means used to transfer medical and health care waste from the on-site storage points to the final disposal points. Though medical and health care wastes attract a high level of segregation, on-site handling and procession in most medical and health care establishment, they are generally co-disposed with the municipal solid waste. The disposal of medical and health care waste in landfills and dumpsites therefore poses serious health and environmental hazards. The landfills are mostly open dumps without adequate design consideration to the guaranty protection of the environment from the disposal of such hazardous waste.

According to Longe and Williams (2006) and Manyele (2004), hazardous medical waste requires proper monitoring for an effective tracking at all times. Control of medical and health care waste can only be fully achieved when adequate facilities and equipment are available. Control, means that competent authorities can act rapidly to ensure the probabilities of minimizing poor on site handling, processing and storage, transfer and disposal of medical and health care waste. It also implies that regulatory authorities should have the powers both legally and financially, to act quickly in order to reduce the dangers posed to public health, animals, plants and the environment.

This research also concludes that burial and incineration methods of medical and health care waste were practiced by both private and public medical and health care establishments, institutions and laboratories. Infectious and hazardous waste were not excluded from this practice and the safety measures were not strictly adhered by the staff members involved in the daily on site handling, processing, storage, transfer and disposal of medical and health care waste. The major challenges to the public health, animals, plants and environment are open dumping within the hospital premises or at government authorized dumpsite and non-treatment of infectious waste before final disposal. The current medical and health care waste management strategies, policy implementation, monitoring and evaluation at the medical and health care establishments studied are obsolete, unsustainable and cannot be relied

upon to protect public health and the environment. There is no existing policy, strategy, training programme and no systems in place in most medical and health care establishments for safe and sustainable management of medical and health care waste. Thus, there is an urgent need to take practical, realistic and sustainable steps aimed at safeguarding the public health, animals, plants and environment for present and future generations.

The following recommendations were made at the end of this study;

(a) The Federal Government of Nigeria, the Lagos State Government and all regulatory authorities should develop medical and health care waste management policies and strategies that will ensure sustainable day to day management of the medical and health care waste. Though this is a complex and costly undertaking but it can be divided into two major categories; the direct activities which must be considered and coordinated on a daily basis include: waste transfer and transport, processing and disposal. The direct activities that are also an important part of the medical and health care waste management policy, programme and strategies include; financing, operations, equipment, personnel, cost accounting and budgeting, contract administration, ordinances and guidelines and public communications.

(b) The medical and health care establishments should make sustainability efforts to ensure they do not contribute to the present and future threats to public health, animals, plants and environment by improper medical and health care waste management strategies. They should constitute a waste management team to prepare their internal waste management policies, strategies, technical guidelines in accordance with national and international guidelines. In addition, they should supervise, monitor and evaluate waste management activities.

(c) The Federal Government, the State Government, professional bodies, research and development institutes, regulatory agencies and the management of all medical and health care establishments should invest heavily in training and retraining of staff members of medical and health care establishments. Staff members of the policymaking and regulatory agencies and the public

should be trained on sustainable waste management policies, strategies and the latest technologies involved. There is an urgent need to adhere to safety measure while handling medical and health care waste. Consequently, they should be enlightened on the threats of the improper and careless management of medical and health care waste to the public health, and environment.

(d) In order to enhance adequate and sustainable policy implementation, monitoring, and evaluation, redesign of strategies and control of medical and health care waste management in Nigeria. Governments at national, state and local levels need a harmonized, detailed and comprehensive guidelines and ordinances on medical and health care waste, hazardous wastes and infectious waste management other than what is currently in existence.

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