

Assessment of Hospital Wastes Management Practices in Lagos, Nigeria, using Two Health Care Centres as Case Studies

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ABSTRACT

Hospital wastes are highly infectious and can pose serious threat to human health. As the rate at which these wastes are generated is getting rapidly higher because of rapid urbanization and population growth, also the problem of disposal of these wastes is becoming more serious. It is of utmost importance that these wastes receive specialized treatment and management prior to their final disposal. Some of these wastes are mixed with household wastes, and the entire pile becomes a great public health hazard. Scavengers search through the piles for salable items, which they wash, repack and resell to the public, endangering their lives, and that of the entire public. Until recently, the management of medical wastes has received little attention despite their potential environmental hazards and public health risks. The collection, storage and disposal of medical wastes in Lagos are of growing environmental problem which needs immediate attention. This study was carried out to assess the current waste management practices in terms of type of wastes and quantities of waste generated in the healthcare facilities and the waste handling and disposal practices; also, to assess the level of awareness of health workers regarding hospital and clinical waste management. Two health care facilities in Lagos state were used as case studies. These hospitals are secondary facilities providing emergency, surgical, material and child health services. The methodology design was mainly of qualitative and involved physical observation, questionnaire administration, quantitative data collection procedures and manipulation, data analysis and interpretation. The findings showed that there was almost no knowledge of hospital waste management policy in the two health care facilities among the management staff, which seemed to confirm the premium on hospital wastes and their poor management.

Keywords: Lagos, Healthcare facilities, Hospital wastes, Waste management, Environmental health.

1.0. Introduction

Lagos is a mega city in Nigeria, which is highly populated with over 15 million of the total 150 million people in the country. The population is still growing at a very fast rate due to industrialization and urbanization. Environmental issues in such a city have to be properly managed to avoid outbreak of diseases, which could be very disastrous. As it is the case in other developing countries, health concerns in Nigeria are more on placing priorities on utilizing the available limited resources, rather than giving the well deserved attention to the management of healthcare wastes. The proper management of hospital or clinical wastes commonly referred to as health care wastes (HCW) is of great importance for the safety of the general public. HCW which comprise mostly of biological products are highly infectious and can be a serious threat to human health. Babatola (2008) reported an estimate of at least 1kg of infected wastes from every 4kg of waste generated in a hospital. It is good that more hospitals are springing up to cope with the growing populations in our country but it is of utmost importance that waste treatment facilities be put in place in all these hospitals for the protection of public health. There is a very low level of awareness of the health workers regarding healthcare waste, as well as lack of skills by the institutions engaged in hospital waste generation and disposal in the city. The world health

organization estimates that 15% of the waste generated at the health care facilities (HCFs) will be pathological and infectious waste which needs to be managed through the contracted medical waste management service (WHO, 2005a). Inappropriate handling and disposal of healthcare wastes poses health risks (that is a higher risk of disease like hepatitis and HIV/AIDS (Coker et al., 2008)) to health workers and to people near the health facilities, particularly children and scavengers to infectious wastes. It is not certain that there is much difference between how general wastes and HCW are managed in Nigeria. In a study in Lagos, Olubukola (2009) reported that the similarity in waste data and HCW management practices in two general hospitals is showing the similarity of lack of waste minimization or waste reduction strategies, poor waste segregation practices, lack of instructive posters on waste segregation and disposal of HCW with general waste. In the investigation on the medical waste categories and its management practices in five different hospitals as representative health care institutions in Port Harcourt city, Nigeria, Ogbonna et al., (2007) discovered that solid waste disposal method adopted by health institutions are preferably open dumpsites disposal methods while liquid wastes are mostly disposed of by flushing through drains/sinks. According to WHO Fact sheet No 253: Wastes from Healthcare Activities (WHO, 2007), the various reasons towards the poor waste management practices around the globe include the absence of waste management plan, lack of awareness about the health hazards, insufficient financial and human resources including poor control of waste disposal, lack of strict and appropriate regulations and the clear attribution of responsibility of appropriate handling and disposal of waste. This is the situation in Nigeria where the power to enforce activities that might impact the environment is vested in the federal ministry of environment (FMEnv) and the Federal Ministry of Health. There are national policies and legislations that have been put in place to take care of all kinds of environmental issues but the same reasons stated in the WHO fact sheet 253 (WHO, 2007) are the likely reasons for failure. Such national policies and legislations include the National Health Policy (NHP) (1988), National Policy on Environmental (1988), Environmental Protection Agency Decrees No 58 (1988), Anatomy Act (1990), National Policy on Injection Safety and Healthcare Waste Management 2007. So many reports of improper methods of disposal of HCW have been reported in Nigeria. A near total absence of institutional arrangements for HCW in Nigeria has also been reported by others (Coker et al., 1998). This study was therefore carried out to assess hospital waste management practice in two health care facilities in Lagos, Nigeria, as proper medical waste management is essential for the minimization of the health risk developed from health care facilities. This research is important as it will add to the limited practical information on healthcare waste management and the public health implications of inadequate management of health care wastes in our society.

2.0. Materials and Methods

This study was carried out on two different health care facilities in Lagos state, which are secondary facilities providing emergency, surgical, material and child health services. These two secondary facilities which are located in the mainland part of Lagos have 55 and 15 bed spaces respectively. Wastes were generated from different sections of health care facilities including, laboratory, out patients unit, theatres, pharmacy, emergency, accidents wards etc.

2.1. Field survey design

The field survey for this project was based on aims and objectives. The investigation of medical wastes employed multiple methods. This strategy provided a mix of both quantitative and qualitative data, with the extensive questionnaire survey providing breadth of coverage; while the interviews with nurses in the hospitals and in-depth interviews with different respondents (medical technicians, hospital cleaners, doctors and environmental health attendants) allowed greater depth of understanding of waste management system within which each of the hospitals operate. The survey design composed mainly of qualitative and quantitative data collection procedures and manipulation, data analysis and

interpretation. Other studies including the study by Adegbite et al., (2010) also made use of physical observation, questionnaire administration and quantification in their studies.

2.2. Method of data collection

A reconnaissance survey was made to the two healthcare facilities, prior to the period of data collection for the purpose of familiarization with the hospital system and the existing situation of the waste management practices. Several methods were used to collect data, namely site visits, questionnaires, interviews and survey. Data collection regarding waste generation, separation, collection, storage, transportation and disposal of medical wastes were carried out during site visits to the hospitals. These visits were conducted to provide information about the medical waste management and its working condition. Both primary and secondary sources of data were collected in the course of this study. The secondary data were obtained from literature review on documents (printed research thesis, journals, books, hospital waste management manuals etc) which provided background information regarding the medical operations and services of the two hospitals, nature of hospital waste and management plan etc. The primary data constituted the relevant information required for the empirical analysis of the study with reference to the two hospitals in particular. These included the identification of the types of waste generated, the waste management procedures of generation, collection, transportation, treatment and disposal, and the management system adopted for each category of waste, and the assessment of the effectiveness of the waste management practices of the two hospitals. A weight measuring scale was used to determine the amount of waste generated per bed/day by the hospital prior to disposal. The quantity of different categories of waste was deduced by estimation while the type of waste was identified through direct observation. Different medical units were identified in the hospitals including the environmental health department. Questionnaires were distributed to different health facility workers in different departments of the selected health facilities mainly nurse, doctors and environmental health attendants.

Data collection also involved using the techniques of oral interviews, researcher's observation strategy and physical involvement. Involvement of nurses and cleaners was simple enough but interactions with the hospital management and health professionals needed care to confirm the credibility of stories and understand the empirical reality in the face of pre-determined answers.

At the HCFs, bins containing colored bags were supplied to the departments treating patients and the laboratories, they were labeled 'hazardous waste', 'highly hazardous waste', while safety boxes were provided for sharps. The weight of each was recorded before they were transferred to bigger bins outside the building. These wastes were monitored from the point of storage to collection, transportation and final disposal. The result from the questionnaires and field study were analyzed with simple descriptive statistics to arrive at the quantities and types of waste generated. The methods of handling were assessed to document proper containment as well as any evidence of spillage.

To obtain information about the final disposal techniques of health care waste, a formal interview was conducted with a representative of Lagos State Waste Management Authority (LAWMA) and a visit to their website was also done.

2.3. Sample survey

A total of 30 questionnaires were sampled, of which 20 were sampled in the healthcare facility A (with 55 bed spaces), and 10 in the healthcare facility B (with 15 bed spaces). The issues addressed in the questionnaire included types of waste, sources of wastes, amount of wastes generated, existing waste management and qualitative aspects for management views. Moreover, informal interviews with some hospital cleaners were also employed. A total of 20 respondents from facility A were interviewed for this project. The respondents were selected from all the wards, operating theatres, laboratories, accidents and emergency and other departments. Among the interviewee in facility A, 14 (70%) were female and 6 (30%) were male respondents. All the female respondents were nurses, while all the male

respondents were doctors, environmental officers and medical technicians. The average age of the respondents was about 42 years and the average length of service was about 12 years. In facility B, 10 respondents provided information through the questionnaire survey. Of the 10, 8 were female (nurses, medical technicians, hospital cleaners) and 2 were male (doctors) and their average age and service length were 32 and 7 years respectively.

3.0. Results and Discussion

In the two healthcare facilities, nurses were the group that answered more to the questionnaires and the doctors were the group that answered less to the questionnaires. Nurses and hospital cleaners were the medical groups with a higher daily contact with medical waste. Medical technicians showed relatively daily contact. In the hospitals, the total medical staff that answered to the questionnaires (45), 82.2% were daily in contact with medical waste.

3.1. Characteristics of waste generated in HCFs A and B

Table 1 indicates the types of waste found in the two HCFs. The wastes were characterized as HCWs in the two HCFs. HCWs include discarded biological product such as blood or tissue (removed from operating rooms, morgues, laboratories or other medical facilities). Other HCWs waste include; Sharp waste, anatomical waste, cultures, discarded medicines, chemical wastes, disposable syringes, swabs, bandages, body fluids, human excreta, bedding, and similar materials that have been used in treating patients and animal carcasses or body parts used in research (Babanyara et al., 2013). The characteristic of waste generated between the two HCFs varied. However, the two HCFs are full-fledged hospitals but they do not practice routine teaching, and they are equipped to carry out minor surgeries only. The difference in services they rendered was responsible for the differences in characteristics of the medical wastes observed in this study.

Table 1: Characteristics of healthcare wastes generated in facilities A and B in Lagos

Characteristics of waste	HCF A	HCF B
Body parts removed during surgery e.g. flesh cut off, teeth, placenta, tissues, organs etc	Present	Present
Infectious waste during treatments, e.g. gauze bandages, plasters, cotton wool, syringes, razor blades, needles etc	Present	Present
Highly infectious waste e.g. blood samples, stool, urine etc	Present	Present

As shown on Table 2, it was observed that HCF A generated higher HCW than HCF B because of the type and frequency of medical services rendered. It was also observed that the high number of bed spaces contribute to the higher amount of waste generated by HCF A. HCF B performs similar medical services but in a lesser capacity when compared to HCF A. The difference in the quantity of waste generated in both secondary health facilities was because of the number of bed spaces, number of in-patients and the number of units where these waste were generated since the type and frequency of medical services rendered in the two HCFs were similar. We were not able to obtain the information on the exact number of inpatients and outpatients in HCF A, during our six months study period, but the numbers were much higher than in HCF B, judging from the activities and the crowds of patients observed throughout the study period. A previous study on HCW management in a HCF (teaching hospital having 52 health workers) in Nigeria by Abah and Ohimsain (2008) reported 0.62kg/person/day at the outpatient units and 0.81kg/bed/day in the inpatient wards. Their study showed a proportion of respondents who had received specific training in the management of HCW to be 11.5%, and the

number who understood the importance of HCW management in the provision of safety to the public to be 46%. This report shows how training could create reasonable awareness of HCW management, and this was probably done because it was a teaching hospital. This was better compared to our present study of the two HCFs A and B, also in Nigeria (but not teaching hospitals) having on the average a total of 3.11kg/bed/day and 0.76kg/bed/day respectively, with no training of the health care workers, except doctors that received training as part of their professional training. According with DGS (2006) the national average is 3.5kg/bed/day for the total of medical wastes and 1.38kg/bed/day for the hazardous wastes in Portugal. The waste size from Portugal, a developed country, is quite comparable to the size obtained in our study on the two HCFs in Nigeria.

3.2. Amount of health care waste generated in HCFs A and B

Table 2: Amount of HCW generated in facilities A and B in Lagos

HCF	In-patients	Out-patients	Bed spaces	Amount of waste generated per bed per day		
				Sharps	Infectious waste	Highly infectious waste
A			55	0.6kg/bed/day	1.38ky/bed/day	1.13kg/bed/day
B	12	40	15	0.2kg/bed/day	0.35kg/bed/day	0.21kg/bed/day

The amounts and type of wastes generated by the individual HCF were established to determine the column generated by them. This was essential for recommendations for the establishment of a good waste management system for these facilities, in terms of the waste transportation and disposal system, the container sizes at the storage place prior to collection and the size of the vehicle to collect the waste. Mismanagement of healthcare waste can pollute the air, soil and water resources, thereby posing health risk to the people and the environment. The percentages of wastes types generated by the individual HCF, as shown in figure 1, reveals that infectious wastes had the highest values in both HCFs, with almost same values (44.37% and 46.05% in HCF A and HCF B respectively). The percent of sharp wastes in HCF A was smaller than in HCF B, though the former facility A is much bigger than B. The percentages of sharp wastes and highly infectious wastes in HCF B were almost same values (26.32% and 27.63% respectively), whereas in HCF A the percentage of highly infectious wastes was almost double (36.33%) that of the sharp wastes (19.29%). These indicated that highly infected wastes are more generated in bigger HCFs than in smaller HCFs. WHO has identified that the percentage of infectious waste in health care wastes is between 10-25% (Pruss, 1999).

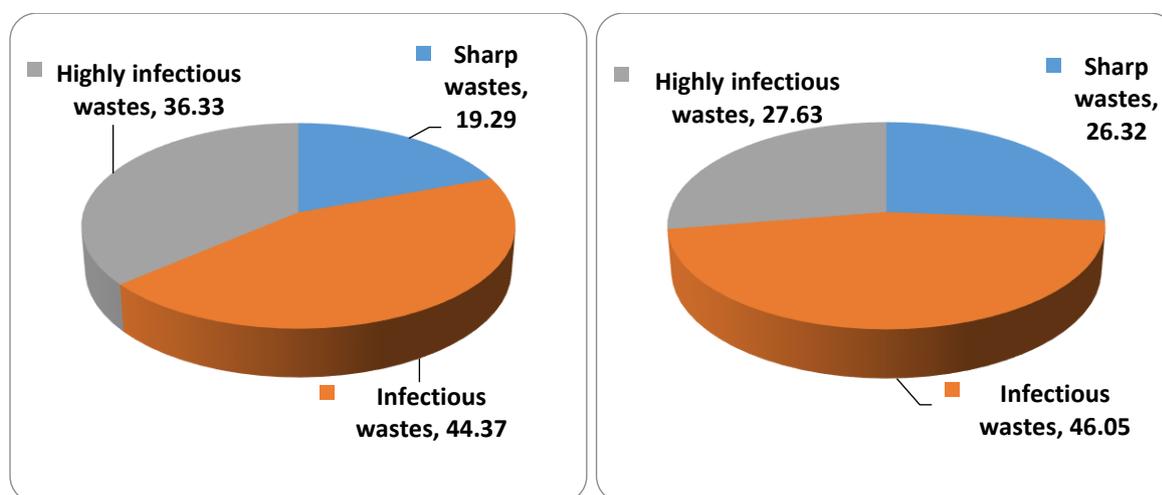


Figure 1: Percent distribution of waste types in HCFs A and B

3.3. Units that generated HCW in HCFs A and B

During the study period, it was observed that wastes were generated from all the units in HCF A, whereas there were no wastes from the maternity ward and the accidents/emergency unit of HCF B, as shown on Table 3. The two units, maternity ward and accidents/emergency contribute significant amounts of HCWs in a HCF as shown in the difference in the average waste sizes in HCF A (3.11kg/bed/day) and B (0.76kg/bed/day). HCWs such as soiled clothing, swabs, hand gloves, used dressing materials, used infusion, used blood transfusion sets, needles and syringes are generated from the accidents/emergency units. From the maternity units, HCWs such as found in the accidents/emergency units are present with other additions like placenta, papers, and empty medicine bottles and packaging.

Table 3: The various units where waste are generated in HCFs A and B in Lagos

Units	HCF A	HCF B
Nursing room	Present	Present
Injection room	Present	Present
Laboratory	Present	Present
Operating theater	Present	Present
Pharmacy	Present	Present
Maternity ward	Present	Absent
Accidents/emergency	Present	Absent
Isolation ward	Present	Present

3.4. Healthcare Waste Management (HCWM) practices at HCFs A and B

As indicated on Table 4, both HCFs practiced segregation of waste. Colored nylon bags were provided for every unit where wastes were generated. All sharps (razor blades, needles, syringes) were collected in a yellow safety box. Infectious waste like cotton wool, bandages, gauze, hand gloves, plasters, sanitary pads, wipes and tubing were collected in yellow nylon bags while highly infectious waste like blood samples, body tissues, blood bags, stool etc. were collected in red nylon bags. All the steps in a proper waste management system are very essential; once a step is missed, the whole system is faulted. Waste segregation is the key step to efficient waste management system, but the segregation becomes meaningless when the proper waste handlers are not used. Also, the segregation is to no effect because the untrained waste handlers mix the wastes at the temporary point of storage. HCF A used Environmental health attendants to handle their wastes, whereas HCF B used hospital cleaners to handle their own wastes. In both cases, the waste handlers were not trained on handling such wastes. There was no proper management of the HCWs in the two HCFs. There are six steps of focus recommended by WHO for the proper HCWM plan (WHO 2002). These steps include (1) designate a responsible person; (2) conduct an HCWM survey and invite suggestions; (3) recommend HCWM improvements and prepare a set of arrangements for their implementation; (4) draft the HCWM plan; (5) approve the HCWM plan and start implementation; and (6) review the HCWM plan. There are also some technical guidelines formulated by UNEP on the environmentally sound management of bio medical and health care waste (UNEP 2003), which can be followed.

Table 4: Waste management practices in HCFs A and B in Lagos

HCF	Segregation	Types of containers	Labeling on containers	Handlers of waste	Training for waste handlers	Method of disposal
A	Yes	Plastic dustbins with nylon bags.	Black, yellow and red	Environmental health attendants	No	LAWMA medical
B	Yes	Plastic dustbins with nylon bags.	Black, yellow and red	Hospital cleaners	No	LAWMA medical

3.5. Training of waste handlers of wastes in HCFs A and B

The questionnaire and oral interview indicated that in all the three HCFs, training was not provided for doctors, nurses, hospital cleaners, and other personnel about hospital waste management and their potential hazards except for a few. This is reflected in the information in table 4. In both facilities newly employed hospital cleaners that are in charge of taking the waste bags from various units of generation to the temporary storage point are often instructed on what to do on spot. They have no formal training on waste handling before they start work. Some doctors and nurses revealed that they got their training on medical waste as a part of their professional training, accepting that on spot training for hospital cleaners was the major cause for the observed mixing up of infectious waste with non-infectious waste. These were strong evidence that these unskilled waste handlers, with lack of awareness of the hazards attached to such wastes, could be disposing these wastes into dustbins, drains and canals and other locations where they would pose serious public health hazard. Poor management of clinical wastes exposes health workers, waste handlers and the community to infections, toxic effects and injuries (Ecoaccess, 2004). This seems to confirm the report by Abah and Ohimain, (2010) that it is believed that several hundreds of tons of healthcare wastes are deposited openly in waste dumps and surrounding environments, often alongside with non-hazardous solid waste. Obviously, such open dumpsites become breeding ground for insects, rodents and other disease vectors and a gathering place for dogs, wild animals and poisonous reptile. The frequency with which HCW collection points are serviced is also important to the limit negative environmental consequences of HCW exposure. Lack of training for the medical waste handlers in the HCFs expose them directly to infectious wastes and place them at high risks of contacting the associated diseases.

3.6. Disposal of health care wastes in HCF s A and B

Well, the table shows that the waste disposals were carried out by LAWMA medical. A lot of damage could have taken place before the arrival of the LAWMA team for the disposal of what remains of the wastes, knowing very well that these untrained waste handlers, apart from themselves being exposed to the dangers from such wastes, could expose those wastes to scavengers prior to the arrival of the LAWMA medical team. During this study, it was discovered that the contractor (LAWMA medical) visits the HCFs once a week to collect the wastes. According to Babanyara et al., (2013), healthcare wastes if not properly managed can pose an even greater threat than the original diseases themselves. From this study, HCW in Lagos are disposed of by LAWMA but without the direct involvement of the HCFs in the final disposal of their medical wastes. LAWMA medical is saddled with the responsibility of medical waste management by providing skilled, effective, safe and enduring medical waste management and disposal services to hospitals, health centers, clinics and laboratory in Lagos state. The treatment and disposal done by LAWMA medical to waste collected from such facilities include: 1. Disinfection, treatment and burying of non-recyclable waste and covering with laterite. This is done in three dumpsites in Lagos, Epe, Alimosho (solous), Owutu in Ikorodu. 2. The use of hydroclave machine, this machine shreds and detoxify. The action of which reduces the waste to 80% of its initial volume, and 3. Incineration of medical waste is the controlled burning of such waste in a dedicated waste incinerator. Incineration has the advantage of reducing the volume of the waste; sterilize the waste and eliminating the need for pre-processing of the waste before treatment. The resulting incinerated waste (ash) is disposed of in landfills.

3.7. Health care waste handling in HCFs A and B

The result on Table 5 reveals the waste management practice observed during the study on the two health care facilities in Lagos. One of the most important aspects of handling healthcare waste is storage at the place of origin. As shown on table 5, the wastes from both facilities were stored outside the facility but open to the public. One week is long enough time for scavengers to go through the wastes repeatedly before the arrival of the LAWMA medical team for the disposal. Proper waste storage is important because this would determine the spread and prevention of diseases. Each HCF should shoulder that responsibility of proper management of the HCW generated by them such that they do not

impact negatively on humans and the environment. Some people in the immediate environment might have experienced many illnesses linking to the exposure of these wastes but a common African might not attribute it to this practice but to other things. The common person is not aware of the dangers these exposed wastes could cause, instead they see the benefits of having access to the wastes for whatever they can extract from it. It is therefore of a necessity that the HCFs lock away these wastes from the public while LAWMA, Federal Ministry of Environment, the Ministry of Health and all authorities concerned team up together to educate the public on why they should not be exposed to these wastes. HCM in the developing countries seem to be generally poor compared to the developed countries because the technology, regulations, education and training waste management policies in developed countries are at an advanced stage than in developing countries (WHO 2007). This is evident in the findings from our study, as well as from other developing countries. For instance, Mato and Kassenga (1999) in their study, pointed out there is a serious inadequacy in handling medical solid wastes in Dares Salaam of Tanzania and improper waste disposition is increasingly becoming a potential public health risk and an environmental burden in Tanzania. Similar poor HCW managements have been reported in Tanzania by Manyele (2004), in South Africa by Leonard I (2003), in Bangladesh by Rahaman and Ali, (2000), and more.

Table 5: Waste management practices in the two health care facilities

Variables	HCF A	HCF B
Waste management plan	Present	Present
Waste management team	Present	Present
Waste segregation practice	Present	Present
Place of waste segregation	At source	At source
Temporary waste storage facility	Present	Present
Location of the temporary waste facility	Outside the facility	Outside the facility
Length of stay of waste at the temporary waste storage site	One week	One week

4.0. Conclusion

From this study it can be concluded that there was little or no knowledge of hospital waste management policy in the two HCFs, which seems to confirm the poor healthcare waste management in Nigeria. No evidence of enough attention to healthcare waste management was found in the two HCFs as any policy or plan existed. This situation has exposed many Nigerians to risks of contacting diseases associated with poor healthcare wastes management.

References

- Abah S.O Ohimain E.I (2008). Healthcare waste management in Nigeria: A case study. *Journal of Public Health and Epidemiology*. Vol 3(3), pp. 99-110.
- Abah S.O Ohimain E.I (2010). Assessment Of Dumpsite Rehabilitation Potential Using The Integrated Risk Based Approach: A Case Study of Eneka, Nigeria. *World Appl. Sci. J.* 8(4): 436-442
- Adegbite M.A., Nwafor S.O, Afon A, Abegunde A. A. and Bamise C. T. (2010). Assessment of Dental Waste Management in a Nigeria Tertiary Hospital. *Waste Manag. Res.*, 28:769-777
- Babanyara, Y. Y., Ibrahim, D. B., Garba, T., Bogoro, A. G., Abubakar, M. Y. (2013). Poor Medical Waste Management (MWM) Practices and Its Risks to Human Health and the Environment: A Literature Review. *World Academy of Science, Engineering and Technology*, Vol: 7 (11) 780-787.
- Babatola, J. O. (2008). A study of hospital waste generation and management practice in Akure, Nigeria. *African Journals Online*. Pages 292-305.

Coker A O., Ogunlowo O.O and Sangodoyin A.Y (1998). Managing Hospital Waste in Nigeria. 24th Wedc Conference: Sanitation and Water for All

Coker, A., Nsangodoyin, A., Sridhar, M., Booth, C., Olomolaiye, P., Hammond, F. (2008). Medical Waste Management in the South of Brazil. *Wastes Manage*, 25: 600-605. Draft of the National Health Care Waste Management Plan in Nigeria (2007), prepared for the Federal Ministry of Environment (FMEnv). In collaboration with John Snow Incorporation (JSI), Nigeria

DGS (2006). Residuous hospitalares 2005- Relatorio. Direccao Geral da saudedivisao da Saude, Divisao de Saude Ambiental.

Ecoaccess. (2004) information sheet on waste management: determining whether waste is “clinical waste” [www.epa.qld.gov.au]

Leonard I. (2003). Healthcare waste in Southern Africa: A civil society perspective. Proceedings of International Healthcare Waste Management Conference and Exhibition, Johannesburg, S. Africa

Manyele, S. V. (2004) Medical waste management in Tanzania: current situation and the way forward. *Afr. J Environ. Assess. and Manage.* pp. 6-10

Ogbonna, D. N., Amangabara, G. T., Ekerete, O. (2007). Urban Solid Waste Generation in Port Harcourt metropolis and its implication for waste management. *Management of environmental quality An International Journal* 18 (1) 71-88.

Olubukola, B. O. (2009). Comparative Analysis of Health Care Waste Management Practice in two general hospitals in Nigeria available at <http://www.ecoweb.com/edi/index.htm> accessed january 28 2011

Pruss, A., Giroult, E., Rushbroo, P. (1999) Safer management of wastes from health care activities world health organization (WHO) Geneva

Rahaman, H. and Ali, M (2000). Healthcare Waste Management of wastes in developing countries 26th WEDC Conference – water sanitation and hygiene challenges of the millennium Dhaka Bangladesh

Townend, W. K., Cheeseman, C. R. (2005). Guidelines for the evaluation and assessment of the sustainable use of resources and of wastes management at healthcare facilities. *Waste manag. Res* 23:398-408

UNEP (2003) Technical guidelines on the environmentally sound management of biomedical and healthcare waste (Y1; Y3) Chatelaine UNEP.

WHO (2002) Waste from healthcare activities. Facxt sheet no 231 april 2002. Available at (<http://www.who.int/mediacentre/factsheet/fs231/en/>). Accessed 12 september 2009

WHO (2005). Management of solid health care waste at primary health care centres: A decision-making guide. World health organization, Geneva. www.lawma.org.ng

WHO (2007). Health care activities Fact sheet 253. Reviewd November 2007 at <http://www.who.int/mediacentre/factsheets/fs253/en/index.html>

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