

# Health Care Waste Management Practices in Liberia: An Investigative Case Study

V. Emery David Jr., J. Wenchao, D. Mmerek, Y. John, F. Heriniaina

**Abstract---**Healthcare waste management continues to present an array of challenges for developing countries, and Liberia is of no exception. There is insufficient information available regarding the generation, handling, and disposal of health care waste. This face serves as an impediment to healthcare management schemes. The specific objective of this study is to present an evaluation of the current health care management practices in Liberia. It also presented procedures, techniques used, methods of handling, transportation, and disposal methods of wastes as well as the quantity and composition of health care waste. This study was conducted as an investigative case study, covering three different health care facilities; a hospital, a health center, and a clinic in Monrovia, Montserrado County. The average waste generation was found to be 0-7kg per day at the clinic and health center and 8-15kg per/day at the hospital. The composition of the waste includes hazardous and non-hazardous waste i.e. plastic, papers, sharps, and pathological elements etc. Nevertheless, the investigation showed that the healthcare waste generated by the surveyed healthcare facilities were not properly handled because of insufficient guidelines for separate collection, and classification, and adequate methods for storage and proper disposal of generated wastes. This therefore indicates that there is a need for improvement within the healthcare waste management system to improve the existing situation.

**Keywords---**Disposal, Healthcare waste, management, Montserrado County, Monrovia.

## I. INTRODUCTION

HEALTH care waste management is a significant public health and environmental problem particularly in developing countries where it is hampered by technological, economic, social difficulties and inadequate skilled manpower for the handling and processing of wastes [1]. [2]. However, in most developed countries established regulatory policy framework in relation to healthcare waste management are in place [3] to protect public health and the environment [4]. For many years, the World Health Organization (WHO) has advocated that healthcare waste be treated as special waste [12]. It is now commonly acknowledged that certain categories of healthcare waste are amongst the most hazardous and of all wastes generated in communities.

In Liberia the Public Health Law of 1976 details a number of environmental laws and decrees and also calls for the highest standard of healthcare among other things [5]. The public health law of 1976 also emphasized effective management of health care waste but did not include specific

mandates regarding the set of guidelines for management of healthcare wastes. There are key actors involved in the management of Health care waste in Liberia. An act creating the Environmental Protection Agency which empowers the agency with the principal authority in Liberia for the management of the environment and to coordinate, monitor, supervise, and consult with relevant stake-holders on all activities in the protection of the environment and sustainable use of natural resources. Several policies have been promulgated and they include: The "Environmental Protection and Management Law" with sections on air quality standards and solid waste management and the public health law of 1975 [6].

Guidelines and policies regarding proper healthcare waste management in Liberia are still in the process of being developed in line with best practices.

In recent years, the Environmental Protection Agency in collaboration with the Ministry of Health and social welfare has worked to create regulation for healthcare waste management. These are still in the developmental process as there is little or no data regarding the generation of waste (quantities and composition), handling and disposal of waste [7] As a result, an investigative study regarding healthcare waste management in Liberia was therefore essential to describe the healthcare waste management practices (HWMP) as the basis for development of appropriate waste management strategy.

## II. MATERIALS AND METHODS

Liberia covers an area of 111,369 square kilometers and is bordered by the Atlantic Ocean to the south, Côte d'Ivoire to the east, Sierra Leone to the northwest and Guinea to the northeast. Administratively, it is divided into 15 counties and had a total population of 3,476,608 million in 2008. One-third of the population in Liberia lives in Monrovia, Montserrado County [8]. The study was conducted in the capital city, Monrovia, Montserrado County, Liberia. Monrovia was selected due to difference in size and population. Monrovia is the capital city and it still faced with challenges of solid waste management. Taking into account the increasing population of Monrovia and the consumption patterns compared to other counties, there is a likelihood that solid waste generation is going to increase [9]. Liberia had a total of 618 healthcare facilities in 2010 and has increased to 725 in 2014. These includes hospitals (35), health centers (51), clinics (639) and laboratories/pharmacies. Some of these facilities are government owned (396) facilities, private for profit (98), and private non-profit/ faith-based-NGO-funded (73) which all

Victor Emery David Jr, J. Wenchao, D. Mmerek, Y. John and F. Heriniaina are with the Chongqing University of Engineering and Technology, Chongqing 400044 China (phone: +86-18725610889; e-mail: emerydavid2011@gmail.com, wehjiang@cqu.edu.cn, ani.mmerek2@gmail.com, jyasinta@gmail.com, fenoheriniaina@gmail.com).

constitutes the healthcare waste generators. [10] To carry out the study, a snowballing technique was used to select the three facilities in order to describe the HWMPs in Liberia. The selected healthcare facilities included one teaching hospital, which is the largest hospital in Montserrado and serves as the county's referral hospital, one Health center which is also the largest in Montserrado and one clinic which is the largest maternity clinic in Montserrado. In order to clearly have a true representation of the waste generators, the three facilities selected for the study included a government owned facility which is a (Teaching hospital & county's referral hospital), a private facility (Health center) and a faith-based-NGO- funded facility (Clinic). This was due to the fact that standard operating procedures at facilities are basically the same in terms of private –private facilities, government facilities etc. [11]. Mixed methods were used to collect data. Survey questionnaires were distributed by the authors to various wards and departments within the hospital, health center and clinic. The use of questionnaires by the authors for this research was seen to be cost-effective as the authors did not have funding for this research and also a way of maintaining confidentiality. These questionnaires were based on recommendations by the World Health Organization assessment of hospital Waste Management practices [12]. There were modifications made for relevance to the organization of health establishment in Liberia. The content of the questionnaires was based on information on the generation of waste, methods of collection and segregation, sorting, transportation, treatment, final disposal and guidelines used. Sufficient time was spent at the facilities recording observations and taking notes about the practice of healthcare waste management at each healthcare facility. Onsite visits were made to the waste transfer station and face-to-face interviews were conducted with the coordinator of the facility. Face-to-face interviews were also conducted with key informants, which included the Officers-in-Charge (OIC), Heads of Departments, Doctors, Nurses and those responsible for the collection, handling and disposal of waste [13].

### III. RESULTS

#### A. Collection and Segregation

From the three facilities surveyed, it was found that the collection of waste is carried out two (2) times a week). There is inadequate segregation of waste at the source which poses threats to the waste handlers. The waste collected are stored in a room at the facility and is later transported to the waste transfer station by the (MCC) Monrovia City Corporation or a company that is sub-contracted (Zoom-lion) for final disposal to the landfill.

TABLE I  
FREQUENCY OF WASTE COLLECTION

Frequency of waste collection	Percentage
Once a week	25.0
2 times a week	50.0
Everyday	25.0
<b>Total</b>	<b>100.0</b>

#### B. Generation of Waste

Solid waste generated from each facility was weighed and the average quantity of the weight was determined. It was observed that the amount of waste generated from the hospital, health center and clinic ranges from 0-7kg per day to >31 kg per day. It was observed that 0-7kg of waste was the highest for the clinic and health center while 8-15 kg of waste per day was generated by the hospital. It can be concluded that hospitals generates more wastes than other facilities due to its size, closing time and higher bed occupancy as well as offering highly specialized services. The waste generated by the facilities included Papers, Glass Ceramics, Metals, Plastic, Rubber, Putrescible, sharps and body parts that were expelled from surgical procedures. It was found that only the hospital waste was composed of body parts. It was also observed that there was a lack of quantification and characterization of waste which poses threat to waste handlers, scavengers, as well as health and environment (Fig. 1).

TABLE II  
GENERATION OF WASTES FROM FACILITIES

Amount of waste Generated	Percentage
0-7kg	75.0
8-15kg	25.0
Total 16	100.0



Fig. 1 Waste generated by facilities

#### C. Existing Current Status of Healthcare Waste Disposal in Monrovia, Liberia Particularly at the 3 Surveyed Facilities

Fig. 2 describes the current status of healthcare waste disposal with waste generators, collection up to onsite disposal. There are inadequate containers for the collection of waste, inadequate identification of waste, poor disinfection, inadequate storage before incineration, inadequate disposal of the ash etc.

#### D. On-Site Storage

On-site inspection of the storage facilities was carried out at the three healthcare facilities. It was observed that the storage facilities were in poor condition. Also, the on-site storage facilities were not secured and sanitized. Inappropriate equipment was used. The containers or boxes were not covered, thus creating health hazard to public health. The facilities didn't have temporary storage area. The wastes were simply dumped in the corner of the hospital room until it could be transported to the transfer station. Owing to the facts that

these wastes are hazardous, it therefore poses threats to health as well as handlers and the local community coming into contact with it.

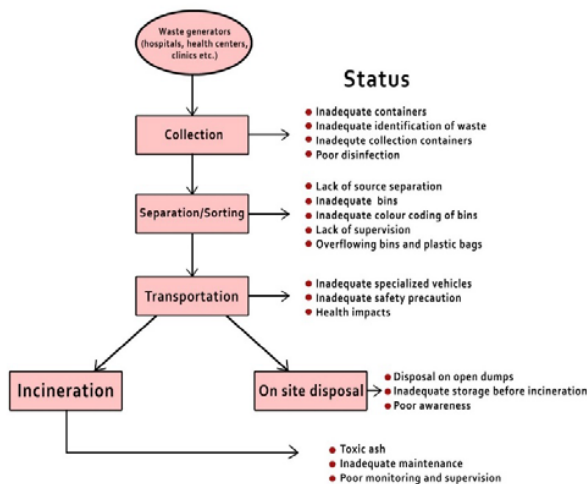


Fig. 2 Existing current status of healthcare waste disposal in Monrovia, Liberia particularly at the 3 surveyed facilities



Fig. 3 On- site Storage at a facility

#### E. Healthcare Waste Treatment

Incineration is one of the methods used to destroy pathogens from healthcare waste [14]. The three facilities surveyed had incinerators one of which was not functional. These incinerators were used for the combustion of waste generated from the facilities. Furthermore, they didn't adhere to the international standards. In the United States and some developing countries, autoclaving, Microwave disinfection, etc., are used as treatment method of wastes. However, with the lack of finances, most West African countries tend to practice incineration as the only cheaper treatment method. It was observed that the incineration facility was operated by unskilled personnel, and the incineration process was not subjected to internal and external monitoring as well as proper maintenance and inspection. Ash produced from the incineration process was improperly disposed of. It was also observed that operators of incinerators had no protective clothing. This however was due to the lack of equipment. At present there is no centralized treatment facility in Liberia.



Fig. 4 Inside view of the Incinerator and ash produce after incineration

#### F. Off-Site Transport

The transportation of wastes is carry out from the facilities to the transfer station in Stockton creek and then to the landfill in Whein town. This is usually carry out by the Monrovia City Corporation (MCC) for Government owned facilities. Private for profit facilities, private –non for profit facilities and NGO sponsor facilities usually contract a local company (Zoom – Lion) for the transportation of wastes from their facilities to the transfer station and subsequently to the landfill. There are no procedures for the transportation of wastes. The frequency of transport varied from daily to twice or thrice a week. The transport is usually done by tractors or open trucks as they are the only means of transporting these wastes due to the lack of specialized vehicles. The open tractors pass through residential areas, through rough roads thereby increasing potential risk to the environment and public health. The waste transfer station is a make shift structure operated by the Monrovia city corporation and is not operating in accordance with international standards and does not follow best practices in line with international best practices. There is a need for the establishment of a centralized waste transfer station in line with the World Health Organization standards for the management of medical wastes. All health care facilities disposed of waste along with domestic waste in an open dump site outside the city (Whein Town). In these open dumpsites, health care waste was randomly mixed with general domestic waste and buried or occasionally burnt.





Fig. 5 Transportation of healthcare waste in Liberia

#### G. Disposal

Landfilling was the most commonly practiced disposal method of healthcare waste at the three surveyed facilities. Burial pit was used for disposal of body parts that were generated from surgical procedures. The location of the burial pit is situated within a close proximity of the facility. In addition, the burial of other putrescible was done at the landfill situated in Whein town. However, it was found that incineration of waste was done under low temperature, which resulted in lapses as there was incomplete combustion of waste as well as inadequate disposal of the ash. This however poses threats to public health and the Environment. On the other hand, all health facilities dispose of waste along with domestic waste in an open dump site outside the city. These wastes were randomly mixed together and was then buried or incinerated. The public health Law of Liberia 1976, The Environmental Protection Law of Liberia, The Ministry of Health Division of Environmental and Occupational Health all have mandates to conduct sanitary inspection, evaluate compliance with the public health law on the management of medical waste, up till present there are no guidelines or standards on healthcare waste handling and management.



Fig. 6 Side view of the Burial pit

#### H. Health Care Waste Management and Regulation

The survey revealed that there is no existing guidelines or specific policy regarding the proper management of healthcare waste in the country. As a result, no reference document on the job description of health care staff were found and there were no clearly defined procedures for collection and handling of waste at facilities. No regular reports were compiled in any of the three facilities. No documentation was available concerning the collection and disposal of waste, nor the methods used to perform these tasks. The management of waste has not been carried out in accordance with the World Health Organization [15] standards and procedures. Recycling of waste is not being practiced. In comparison to South Africa the health care waste management is governed by a number of legislative frameworks including: The Health Act (Act 63 of 1977), Hazardous Substances Act (Act 5 of 1973), Occupational Health and Safety Act (Act 85 of 1993) which all have guidelines regarding the safe management of medical waste [16].

#### IV. CONCLUSION

The study has demonstrated that healthcare waste management in Monrovia at the 3 surveyed facilities is faced with many challenges including the unavailability of data on the quantities and nature of the waste generated [17]. Such baseline data is critical for planning and development of waste management procedures. Moreover, there are no set guidelines put in place for healthcare waste handling and management. Therefore, there is an urgent need for the government of Liberia to develop a set of guidelines to manage healthcare waste as well as well-formulated waste minimization strategies for healthcare waste management system.

#### REFERENCES

- [1] Ruoyan, G., Lingzhong, X., Huijuan, L., Chengchao, Z., Jiangjiang, H., Yoshihisa, S., Wei, T., Chushi, K., 2010. Investigation of healthcare waste management in Binzhou District, China. *Waste Management* 30, 246–250.
- [2] Alagoz, A. Z., and Kocasoy, G. (2008). Improvement and modification of the routing system for the health-care waste collection and transportation in Istanbul. *Waste Management*. 28. p 1461–1471.
- [3] Blenkham J. I. (2007), Standards of clinical waste management in hospitals – Second look, *Journal of Hospital Infection* 121, pp. 540-545.
- [4] Mbongwe, B., Mmereki, B.T & Magashula, A Healthcare waste management: Current practices in selected healthcare facilities in Botswana. *Waste Management and Resources*. 28, pp.226–233, 2008.

- [5] The Public Health Law of Liberia, 1975.
- [6] Environmental protection Policy and Law, Liberia, 2003, ([http://postconflict.unep.ch/liberia/index\\_4a.php?m=4&sm=4a](http://postconflict.unep.ch/liberia/index_4a.php?m=4&sm=4a)).
- [7] Country Situational Analysis Report, Ministry of health and social welfare, Liberia, July 2011.
- [8] Demographic and Health Survey, LIGIS, 2007.
- [9] United Nations Environment Programme Post-Conflict and Disaster Management Branch in collaboration with the Environmental Protection Agency of Liberia July 2007.
- [10] Republic of Liberia- Investment plan for building a Resilient Health system in Liberia, 2014-2021
- [11] Askarian, M., Vakili, M & Kabir, G., Results of a hospital waste survey in private hospitals in Fars province, Iran. *Waste Management*, 24, pp. 347–352, 2004b.
- [12] Pruss A, Giroult E & Rushbrook P., Safe management of wastes from health care activities, Geneva, WHO, 1999. Available from: [http://www.who.int/water\\_sanitation\\_health/Environmental\\_saniE/MHCWHanbook.htm](http://www.who.int/water_sanitation_health/Environmental_saniE/MHCWHanbook.htm), 1999. Date accessed: 19 September 2011.
- [13] F. Abdulla, H. A. Qdais and A. Rabi, "Site Investigation on Medical Waste Management Practices in Northern Jordan," *Waste Management*, Vol. 28, No. 2, 2008, pp. 450- 458. doi:10.1016/j.wasman.2007.02.035
- [14] Lupez Purez Traditional Medical Waste Treatments. *Environmental Chemistry.com*. March 2000.
- [15] WHO (1999), Safe Management of Wastes from Health Care Activities, World Health Organization.
- [16] Manyele, S.V., Medical waste management in Tanzania: Current situation and the way forward. *African Journal of Environmental Assessment and Management*, 8(1), 74-99, 2004.
- [17] National health Policy and Plan, Ministry of Health and Social Welfare, 2007.