FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 7 No. 3, June, 2023, pp 245 - 248
DOI: https://doi.org/10.33003/fjs-2023-0703-1839

MANAGEMENT OF LIQUID MEDICAL WASTES IN SELECTED HOSPITALS IN YOLA, ADAMAWA STATE, NIGERIA

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ABSTRACT

Liquid medical waste management has been a critical challenge in healthcare facilities and poses a severe threat to public health, particularly in developing countries. As such, this study was conducted to assess the prevailing practices of managing Liquid Medical Wastes in selected Hospitals in Yola, Nigeria, to improve on the existing practices and mitigate the dangers of mishandling liquid medical waste. One hundred and eight structured questionnaires were administered to healthcare workers and waste contract staff. Visits were made to various locations to observe the entire process of liquid medical waste (LMW) generation and its ultimate disposal. The data were subjected to a t-test using SPSS version 23.0. The study revealed that the major types of LMW reported by respondents were infectious wastes, with Hospital One (H1) reporting 69% and Hospital Two (H2) reporting 78%. The least common types of LMW generated were pharmaceutical waste, with H1 at 12% and H2 at 10%. The different types of LMW generated between H1 and H2 did not exhibit any significant distinction ($P > 0.05$). The various techniques used in managing LMW at the selected hospitals include segregation, temporary storage, treatment, and on-site transportation. There was a significant difference between H_1 and H_2 in terms of the techniques used in managing LMW ($P = < 0.05$). The study revealed that H2 doesn't treat their LMW before disposal as compared to H1, where LMW from the laboratories was autoclaved before being taken to the incinerator on-site for further treatment.

Keywords: Liquid Medical Wastes Management, public health, healthcare workers, infectious wastes

INTRODUCTION

The quantity of medical waste generated has increased due to the expansion of the health care industry. Improper liquid medical waste disposal endangers patients, healthcare workers, and visitors while adding substantial expenditures to health care. The vast majority of the ecosystem, including air, water, soil, and wildlife, is at risk from medical waste. As a result, medical waste must be handled in a safe way, utilizing appropriate treatment and disposal procedures.

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Health facilities are primarily renowned for their expertise in providing medical care to individuals in need, while communities often exhibit limited awareness regarding the detrimental consequences associated with the waste they generate. It is a paradox that hospitals, which offer vital support to the sick, are also responsible for generating various forms of waste that potentially jeopardize the well-being and safety of healthcare personnel. It is unfortunate that medical waste cannot be avoided. Only a small portion of this waste poses a toxic and hazardous threat, not just to the employees and patients but also to the wider public (Patan and Mathur, 2015). Various public health risks have been associated with the unregulated treatment and disposal of medical waste (Solberg, 2009). Around the globe, medical waste has frequently been used vice versa with other words like clinical waste, health care waste, biomedical waste, or bio-hazardous waste (Jang, 2011). These health care facilities bear the responsibility of providing patient care services, and during these processes, different kinds of waste are generated in the form of tissues, swabs, blood, discarded syringes, body fluids, expired drugs, chemicals, unused specimens, organs, and body parts, as well as waste resulting from surgical procedures and autopsies. The remarkable progress made in the field of medicine and healthcare has significantly contributed to the recent rise in the generation of medical waste (Kardanmoghadam et al., 2014). It would be an understatement to emphasize the importance of waste management and sanitation, as they serve as crucial foundations for development. (Omofunmi *et al*., 2016). Improper management of liquid medical waste has the potential to cause hazardous infections and pose a significant threat to both the environment and the individuals involved in its handling, as well as the public. In the 21st century, the challenges surrounding the safe disposal of liquid medical waste (LMW) are increasingly complex due to the rising number of infectious diseases treated in healthcare facilities and the growing complexity of the pathogens involved (Wiafe et al., 2016). Presently, inadequate treatment methods and practices for hospital liquid waste are causing severe environmental issues in local communities and cities in Ghana, exposing residents to air pollutants, contaminated water, foul odors, and toxins from nearby healthcare facilities (Asante et al., 2016). Unfortunately, the risks associated with medical waste, especially liquid waste, are not receiving the necessary attention they deserve (Omofunmi et al., 2016). This is primarily due to the common practice of pouring untreated liquid waste into sanitary sewers and onto bare soil, particularly in developing countries, which is considered normal by many (Wiafe et al., 2016). However, the World Health Organization (WHO) and the Center for Disease Control (CDC) in the United States have empirically demonstrated that medical liquid waste contains a high number of microorganisms that can be harmful to individuals

who encounter it (Nema et al., 2011). Therefore, it is crucial for healthcare facilities and their personnel to ensure the use of appropriate technologies and receive proper training on the safe management of liquid medical waste in health facilities. The aim of this study was to investigate the management of liquid medical waste in some selected hospitals in Yola, Adamawa State, Nigeria.

MATERIALS AND METHODS

The research took place in two public hospitals situated in Yola North and Yola South Local Government Areas (LGAs) of Adamawa State, Nigeria. These hospitals are positioned within the coordinates of 9° 15'N 12o 25'E / 9° 20' N 12o 30'E, covering a combined area of 1,213.30km2. Yola experiences a tropical climate characterized by distinct dry and rainy seasons. The season typically begins in May and ends in October. (Adebayo and Tukur, 1999). The researcher employed purposive sampling techniques to choose the sample of healthcare facilities. Sampling was conducted among the two selected hospitals to investigate the management of liquid medical waste. Structured questionnaires were used for interviewing health care workers, ancillary staff from the selected healthcare facilities, as well as the contractors responsible for liquid medical waste collection. Interviews were conducted with the respondents to gather their perspective on various aspects related to liquid medical waste, including the types of waste generated, the practices employed for its management, the training they received on liquid waste management, and the pathways through which liquid medical waste moves within the health facilities. Information pertaining to the management of liquid medical waste was gathered through site visits and the utilization of an observation checklist. Site visits through the healthcare facilities enabled the assessment of the working conditions and the gathering of basic information, specifically on matters concerning the management of liquid medical waste.

To ensure confidentiality regarding the collected data and the utilization of information obtained from each hospital, the names of the hospitals were coded as H1 and H2.

Data Analysis

Raw data was obtained from the responses of the respondents. The collected data was analyzed using simple percentages and the Statistical Package for Social Science version 23.0 (SPSS). The statistical analysis of the data was performed using the student's t-test. The information obtained is presented in tables, and comments were made on the findings.

RESULTS AND DISCUSSION

The frequent types of liquid medical waste (LMW) indicated by respondents of Hospital One (H_1) and Hospital Two (H_2) (Table 1) were body fluids, blood, urine, sputum, and pus; these wastes are classified as infectious waste. The least common types of liquid medical waste generated in H_1 and H_2 were expired infusions, vials, syrup, eye drops, and intravenous injections; these wastes are categorized as pharmaceutical waste. Contrary to the findings of Ngwuluka *et al*. (2009), the various types of waste generated include sharps, wipes, body tissues, used gloves, disinfecting chemicals, expired drugs, used sanitary pads, used bandages, and gauze. A comparison between the wastes generated from H_1 and H_2 indicated that there were no significant differences in the liquid medical waste generated between the two hospitals. ($p=0.157 > 0.05$). This could be attributed to both H_1 and H_2 being referral hospitals with a high influx of patients seeking treatment daily. The various liquid medical wastes in H_1 and H_2 can be classified as infectious, chemical, and pharmaceutical wastes. Akum (2014) reported a similar classification of medical wastes in Ghana as general, infectious, sharps, pharmaceutical, and chemical waste.

The majority (54%) of the respondents from H_1 agreed that liquid medical waste in the healthcare facility was segregated (Table 2). This could be attributed to the level of training and advocacy in the hospital concerning medical waste management, although it was observed that wastes were intermingled at the temporary storage site. This finding aligns with a study conducted in Ghana, where a majority of the participants mentioned that the separation of various types of liquid waste was carried out before disposal. (Bakobie *et al*., 2018). The majority (38%) of the respondents from H_2 mentioned that the LMW were not segregated (Table 2). This situation could be attributed to a deficiency in training and awareness in the hospital concerning medical waste management. It was also observed that various forms of waste were dumped in baskets in the wards, units, and laboratories. In Lagos, Nigeria, Omofunmi et al. (2016) reported similar results, where waste separation was ranked poor. To ensure effective management of medical wastes, it is necessary to separate and store them in color-coded containers at the point of generation.

Interview results (Table 2) on the storage of LMW using leak proof bags in H_1 indicated that the bulk (81%) of those interviewed mentioned the use of leak proof bags for temporary storage of LMW, while a minority (9%) mentioned that leak proof bags were not used. This could be attributed to the provision of leak-proof bags by the hospital's management and health workers knowledge of the hazards that can be caused by spilled liquid medical waste. From observations, LMW mostly generated from the laboratories in H_1 were temporarily stored in leak-proof bags labeled biohazard, which prevented leakages of the LMW, while those from the wards or units were either discharged into the drains or toilets at the point of generation. Although the waste collectors mentioned that, sometimes they found urine bags containing urine in the waste bins. The results from H_2 (Table 2) indicate that the bulk (76%) of the respondents mentioned that LMW were not temporarily stored using leak-proof bags, while only a few (24%) agreed that leak-proof bags were used for temporary storage of LMW. This could be associated to a lack of provision for leak-proof bags by the hospital's management. Site visits revealed that LMW generated at the laboratories in H_2 was not temporarily stored in leak-proof bags; this may be due to the lack of provision of leak-proof bags while those from the wards or units were either discharged into the drains or toilets. Contrary to the result reported in Ghana by Wiafe *et al*. (2016), liquid clinical waste generated at a regional hospital was temporarily stored in the anthwart pit.

Interview results from H_1 (Table 2) revealed that the majority (45%) of the respondents mentioned that LMW generated in the health facility were pre-treated prior to disposal, while a minority (38%) stated that LMW were not treated before disposal. According to the study findings, H2 (Table 2) did not undergo any treatment for their LMW prior to disposal, as evidenced by a higher percentage (72%). The insufficient treatment of LMW in H1 and H2 could be connected to a lack of awareness and the inadequate availability of treatment equipment. Contrary to the study by Bakobie *et al*. (2018) in Tamale Metropolis, Ghana reported that the majority of hospital liquid wastes were treated prior to disposal. Observations from the surveyed hospitals in Yola indicated that not all the liquid medical wastes from the wards, units, and laboratories were pre-treated before disposal.

Consequently, this situation may contribute to an unsanitary and perilous environment surrounding healthcare institutions, posing potential risks to patients, staff, and the community at large. LMW generated at the laboratories in H_2 was untreated prior to disposal, while LMW generated in the laboratories at H_1 was autoclaved at 121^0C for 15 minutes to destroy microorganisms before being dumped into collection waste bins and taken to the incinerator for further treatment. This finding aligns with the research conducted by Ananth et al. (2010), which indicated that the most commonly employed treatment method for medical waste was incineration. In some wards and units, chemicals like hypochlorite were only used to disinfect the surface areas and containers where the LMWs came into contact.

Most of the respondents in H_1 (79%) and H_2 (93%) (Table 2) revealed that the regular mode for on-site transportation of infectious liquid medical wastes from wards or units to temporary storage areas was through pipes. This could be for the purpose of avoiding accidents and spillages while transporting the liquid medical waste. A minority (12%) in H_1 mentioned tricycles, and a few (4%) in H_2 mentioned "hands" as means of on-site transportation of infectious wastes to temporary storage areas. This agrees with the findings reported in Ghana, where various departments transported infectious and pathological liquid wastes through a pipe into a temporary storage facility. (Wiafe *et al*., 2015). The laboratories at H1 employed tricycles to transport pre-treated liquid medical waste to the temporary storage area, aiming to facilitate a safer and more efficient waste transfer process. In a similar manner, healthcare facilities examined in Malasia and China utilized rickshaw trolleys to transport medical waste to storage rooms (Dasimah et al., 2012). On the other hand, untreated liquid medical waste from H2 laboratories was manually carried to the temporary storage area. Dehghani et al. (2008) also documented similar results, revealing that half of the healthcare facilities in Iran relied on manual hand transfer of medical waste to temporary stations. The contracted companies responsible for managing medical waste at H1 and H2 primarily used open vehicles for off-site transportation. Unfortunately, sometimes some medical waste would inadvertently fall off the vehicles when encountering potholes, presenting significant health risks and environmental concerns.

Table 1: Forms of Liquid Medical Wastes generated in the Selected Hospitals

Types of LMW	Waste classification	H_1 (N=58)	H_2 (N=50)
Blood, urine, pus, body fluids, sputum, and watery stool	Infectious waste	40 (69.0 %)	39 (78.0 %)
Expired reagents, formaldehyde and fixer solutions	Chemical waste	11 (19.0 %)	6 (12.0 %)
Expired infusions, vials, syrup, eye drops, intravenous injection	Pharmaceutical	7 (12.0 %)	5 (10.0 %)
Total		58 (100 %)	50 (100 %)

P=0.157

Key: LMW= Liquid medical waste; H_1= Hospital one; H_2= Hospital two; N= Sample size

Table 2: Techniques used in Managing Liquid Medical Wastes in the Selected Hospitals

	Number of Respondents					
Waste management techniques	**H_1 (N=58)**			**H_2 (N=50)**		
	Response		**Percentage (%)**	**Response**		**Percentage (%)**
Segregation of LMW from others	Yes	31	54.0	Yes	12	24.0
	No	21	36.0	No	38	76.0
	Don't know	6	10.0	Don't know	0	0.0
Storage of LMW using leak proof bags	Yes	47	81.0	Yes	12	24.0
	No	9	16.0	No	38	76.0
	Don't know	2	4.0	Don't know	0	0.0
Treatment of LMW before disposal	Yes	26	45.0	Yes	4	8.0
	No	22	38.0	No	36	72.0
	Don't know	10	17.0	Don't know	10	20.0
On-site transportation of infectious LMW to temporary storage area	Tricycle	12	21.0	Tricycle	0	0.0
	Pipe	46	79.0	Pipe	46	92.0
	Hand	0	0.0	Hand	4	8.0
	Pedal bin	0	0.0	Pedal bin	0	0.0
	Wheel barrow	0	0.0	Wheel barrow	0	0.0
			-			

P= 0.032

Key: H_1= Hospital one; H_2= Hospital two; N= Sample size

CONCLUSION

The common types of liquid medical wastes (LMWs) generated from H_1 and H_2 were blood, body fluids, urine, sputum, and pus; these waste materials are classified as infectious waste. Segregation of liquid medical wastes was poor in H_2 as compared to H_1. Leak-proof bags were used for temporary storage of LMW in H_1. LMWs mostly generated from the laboratories in H_1 were pre-treated and temporarily

stored in leak-proof bags labeled biohazard, while LMWs generated at the laboratories in H_2 were not pre-treated and temporarily stored in leak-proof bags. Thus, LMWs generated by hospitals should be treated before disposal.

ACKNOWLEDGEMENTS

The authors appreciation goes to the Adamawa State Ministry of Health for granting permission to carry out this study and also to the management and staff of the selected hospitals for allowing this work to be carried out in their health facilities.

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