

Medical Waste Management Practices in Bingham University Teaching Hospital, Jos, Plateau State, Nigeria

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Abstract

Medical waste management is one of the major challenges facing many developing countries, including Nigeria, as unsafe disposal could pose serious health risks and environmental degradation. This study investigated medical waste management practices among staff and patients of Bingham University Teaching Hospital (BUTH), Jos. The specific objectives were to: characterize the composition of medical waste, find out means of collecting and storing the waste and assess ways of managing medical waste. Mixed research designed was employed, while questionnaire, field observations and camera were used to collect data. Stratified sampling and simple random techniques were used to collect data. Copies of structured questionnaire were administered to 150 respondents and descriptive statistics, aided by SPSS-22 were applied in data analysis. Results showed that sharps (needles & syringes) (31%), blood (23%), and pharmaceuticals (13%) accounted for two-thirds of the medical waste generated in BUTH. The medical waste were collected and stored by means of: dustbins (31%), bucket (29%), truck to transport (17%), burning (15%) and color-red bags (8%). Field observations showed little compliance for waste segregation at source of generation, and incineration (36%) and collection of waste (24%) accounted for three-fifths of medical waste management in BUTH. Although, enclosed incinerator was seen, but burning medical waste often pollute the air and exacerbates the problem of asthmatic patients, aside causing environmental degradation. The paper recommended strict compliance to the WHO guidelines for safe disposal of medical waste and the need to sensitize the public on how best to dispose of biohazardous waste materials with minimal risk to the entire ecosystem.

Key words: Medical Waste, Management, BUTH, Healthcare Facility

INTRODUCTION

Every organism, including man requires intrinsic peace, ease, and comfort in order to enjoy life to its fullest. Human activities in healthcare facilities, which involve prevention, protection, restoration and saving human lives from pain, diseases and dead (PDD) ought to play this fundamental role. However, health concerns often arise from improper handling and disposal of the by-products generated by these healthcare facilities (HCFs) which, sometimes lead to serious health risks and adverse environmental consequences. Medical waste (MW), which is synonymous with healthcare waste (HCW), biomedical waste (BMW), clinical waste (CW), and health facility waste (HFW) refers to any by-product of unwanted material generated from healthcare activities, ranging from used needles, syringes, body parts, blood, soiled

clothing, chemicals, diagnostic samples, pharmaceuticals, medical devices and radioactive materials (Janic-Karpinska, Brancaloni, Niemcewicz, Wojtas, Foco, Podogrocki, & Bijak, 2023). Waste management is an essential part of healthcare, because when medical waste is not properly disposed of, it can adversely affect the environment, human beings and the terrestrial and aquatic ecosystems.

The World Health Organization (WHO, 2024) has recognized six major sources of medical waste to include: hospital and other health facilities, laboratories and research centers, mortuary and autopsy centers, animal research and testing laboratories, blood banks and collection services, as well as nursing homes for the elderly. These healthcare facilities (HCFs) generate on daily basis: chemical waste, radioactive waste, sharp objects,

pathological waste, pharmaceutical waste, infectious and non-hazardous waste. Janic-Karpinska et al. (2023) reported that, of the total volumes of global waste generated, 85% is non-hazardous, while 15% is biohazardous. Furthermore, the most likely people to become victims of improper medical waste management are: the health personnel, support staff, waste handlers, visitors to these institutions, patients, medical students and the general public, aside water bodies, the soil, air and ecosystems that bear the brunt (Pepin, Abou-Chakra, Pepin, Nault & Valiquette, 2014; Janic-Karpinska et al., 2023).

In 2010, unsafe injections were responsible for as many as 33,500 new cases of HIV infections, 1.7 million hepatitis B infections and 315,000 hepatitis C infections and death of many waste handlers because some of the medical waste are biohazardous (Abdel, 2010; Walkinshaw, 2011; Okechukwu, Oparah, Aguora & Soni, 2013)). The management of healthcare waste requires increased attention and diligence to avoid adverse health outcomes associated with poor practices, including exposure to infectious agents and toxic substances. This explains in part why Governments' commitment and support is needed for universal sustained and long-term improvement in medical waste management.

The issue of healthcare waste management has since dominated the 50th National Council of Healthcare meeting in January 2007, and efforts to address the problem were arrived as (as cited by Blueprint report of Monday 09 February 2025). It was resolved that every healthcare facility should put in place an infection control and waste management committee to include Head of the Hospital, the Heads of Departments, and the Registered Environmental Health Officer in care of waste management, and all healthcare facilities should adopt the World Health Organization's (WHO) standard coding for various categories of waste storage and disposal. Healthcare facilities were also expected to address other aspects, such as regulatory framework, planning issues, waste minimization and recycling, handling storage and transportation, treatment, disposal options and training (Blueprint, February 09, 2025).

It is against this backdrop that this study set out to investigate medical waste management practices in Bingham University Teaching Hospital (BUTH), Jos. The specific

objectives were to: characterize the composition of waste generated; find out the various means of collecting and storing medical waste; and assess ways of medical waste management practices. The Bingham University Teaching Hospital (BUTH), Jos was purposely selected because it is one of the oldest and biggest hospitals in Jos still operating in the city center. Since it is located within moderately crowded community, the outcomes of the study on medical waste management will guide in making informed decision on the need to safeguard people's health and prevent environmental degradation, in line with SDG 12, which emphasizes "Responsible consumption and production, in relation to biohazardous waste and sustainable management practices".

MATERIALS AND METHODS

Study Area

Bingham University Teaching Hospital (BUTH) lies on Lat 9.931045°N and Long 8.877625°E in Jos North Local Government Area (LGA) of Plateau State, Central Nigeria (see Figure 1). BUTH is about one kilometer West of Jos North Local Government Secretariat. The entire Jos Plateau of which BUTH is found has average elevation of up to 1,250 meters above mean sea level (MSL). The study area is noted for its near temperate climate, with mild, cool, and friendly weather- mean annual temperature of 22.5°C, which attracts many citizens and foreign nationals for residence.

The area experiences two distinct seasons, Wet and Dry. Wet season prevails from April to October while Dry season spans from November to March. Wet season is warm with annual rainfall of between 1300- 1500mm per annum. Dry season is cold and dusty with dessicating effect on human skin, surface water and plants. While Wet season favours environmental pollution and water-borne diseases (eg cholera, typhoid and malaria), Dry season exacerbates air-borne ailments such as dry cough, common cold and pneumonia. This justifies to some extent, the establishment of BUTH at its present site. BUTH is drained by a nearby stream, located between Lat 9°50'09.0"N; 9°49'28.7"N and Long 8°51'38.4"E; 8°52'19.5"E, which spans from Plateau Club to Bingham University Teaching Hospital axis in Jos North LGA in South- North direction (NEWMAP, 2020).

Human Population and History

Based on the 2006 national population census records and the annual population growth rate of 2.40%, Jos North LGA had a projected population of 619,023 for 2018 (NEWMAP, 2020); and has risen to 970,000 (United Nations World Population Prospects, @<https://www.macrotrends.net/cities/22003/jos/populations>). However, NEWMAP (2020) has surveyed and documented a total of 241 households, with 1,222 household members in BUTH community, which spans from Plateau Club-BUTH gully erosion control site to Agwan Suya.

Information obtained about BUTH (<https://www.bhuth.org>) indicated that the healthcare facility is one of the oldest in Plateau State, established in 1959. Between 1977 and 1979, the Plateau State Government took over the management of the hospital.

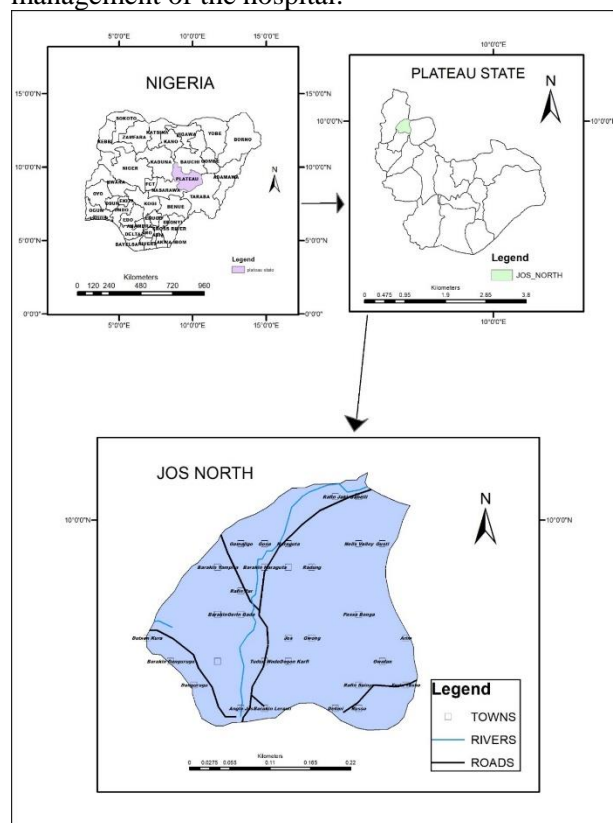


Fig. 1. Jos North in Plateau State, and Plateau State in Nigeria

Source: GIS Lab, University of Jos (2023).

By 1981, it became the first hospital to commence postgraduate residency training

program in family medicine in Northern Nigeria. The hospital was later upgraded to BUTH in 2010, teaching students of Medicine and Allied Health Sciences (<https://bhuth.org.ng/about/history>).

Currently, BUTH is a 250- bed general hospital that offers full program of teaching about 220 students (in 2024) with specialty in: surgery, internal medicine, pediatrics, obstetrics and gynecology, ophthalmology, vesicovaginal fistula (VVF) surgery and HIV care, including antiretroviral treatment programs, among other services (<https://hotels.ng/places/hospitals/1500-bingham-university-teaching-hospital>). As at 2024, the facility has, 220 students, many in-patients and out-patients, and 182 professional and support staff.

Procedure for Data Collection and Analysis

Visit to BUTH was undertaken by the investigators prior to data collection phase sometime in May 2024. During the visit, information on the total number of staff and patients were obtained. The study adopted a mixed research designed which is cross-sectional, as longitudinal survey was not convenient. Since the purpose of the research was to investigate medical waste management practices among patients and staff of BUTH, stratified sampling and simple random techniques were employed to select respondents for the study.

The main instrument of data collection was structured questionnaire, supported by field observations and the use of digital camera. The questionnaire was given to two medical Statisticians who validated it, followed by a pilot study with the aim of detecting any difficulty for amendment before the actual data gathering exercise could commence. Responses to questions from the questionnaire led to some amendments which increased the validity and reliability of the instrument. The questionnaire contain relevant information sought to accomplish the stated objectives such as: personal information of the respondent, composition of waste generated, means of collecting and storing medical waste, and ways of managing medical waste in BUTH.

Information collected from the institution gave the approximate population of staff and patients on ground as 118 and 185 respectively and 30% of each were selected, totalling 150 respondents (see Table 1). After compartmentalization of the target population into

staff and patients, copies of questionnaire were administered to them based on respondents' acceptance. Data collection cut across gender, departments, and professions for fairness. This exercise was carried out with the help of two trained field assistants from the Department of Geography and Planning, comprising a male and a female students. The investigators also participated actively in questionnaire administration. This led to

recovery of 150 copies of questionnaire for analysis. Descriptive statistics, aided by Statistical Package for Social Sciences (SPSS) 22-software were applied to analyze the results, while outcomes were presented by means of Tables and followed by highlights. Tables were used for easy comparison of values with previous works in literature.

Table 1: Distribution of Sampled Population in BUTH

S/N	Respondents	Total	Selected No	Percentage (%)
1	Staff	118	59	39.4
2	Patients	185	91	60.6
	Total	303	150	100

RESULTS AND DISCUSSION

Components of Medical Waste in BUTH

Information on the composition of medical waste in BUTH were analyzed and presented in Table 2. Results revealed respondents' response ratings as:

31.3% needle & syringe, 22.7% blood-borne waste, 13.3% pharmaceuticals, 11.3% radioactive waste, 6.1% pathological, chemical & diagnostic samples, 6.0% soiled dressing, while body parts accounted for the remaining 3.3%.

Table 2: Components of Medical Waste in BUTH

S/N	Medical waste	Respondents	Percentage (%)
1	Needle & syringe objects	47	31.3
2	Body parts	5	3.3
3	Blood-borne waste	34	22.7
4	Soiled dressing	9	6.0
5	Chemical & diagnostic Samples	9	6.0
6	Pharmaceuticals	20	13.3
7	Radioactive waste	17	11.3
8	Pathological waste	9	6.1
	Total	150	100

All these medical wastes are biohazardous because when poorly managed, they could pose health threat to lives.

Means of Medical Waste Collection and Storage in BUTH

In line with the second objective of the study, respondents were asked on the means of collecting

and storing medical waste in BUTH and their responses are displayed in Table 3, in descending order of magnitude as: dustbins (31%), bucket (29%), truck to transport (17%), incineration (15%) and color-red bags (8%). Field observations indicated presence of enclosed incinerator, while "Appendix A" are blue- and green-coded dustbins kept outside patients' wards.

Table 3: Means of Collecting Medical Waste from BUTH

S/N	Waste container	Respondents	Percentage (%)
1	Dustbins	47	31.3
2	Buckets	44	29.3
3	Red bags	12	8.0
4	Truck	25	16.7
5	Incinerator	22	14.7
	Total	150	100

Medical Waste Management in BUTH

Medical waste is any kind of waste that contains infectious material that has the potential of causing diverse illnesses and this must be properly managed to minimize the spread of diseases among human beings. Table 4 shows medical waste management in BUTH. In descending order of magnitude, the responses were: burning waste in incineration (36%), collection of waste (24%), weighing waste for treatment (16%), temperature control (14%) while moisture control was the least of ways of managing medical waste, which

accounted for 10%. Although, BUTH has an enclosed incinerator, emission of smoke and other particulate matter often pollute the environment and worsen the problem of asthmatic patients. The best way of reducing medical waste and refuse in the environment is to comply with the WHO's global and comprehensive guideline for safe management, of which waste reduction, reuse, recycling, resource recovery and residual management (the 5 Rs) are key to curtailing the spread of diseases and degrading the environment.

Table 4: Medical Waste Management in BUTH

S/N	Medical Waste	No. of Respondents	Percentage
1	Collection	34	24.0
2	Weighing	25	16.0
3	Temperature Control	22	14.0
4	Moisture Control	15	10.0
5	Burning in incinerator	54	36.0
	Total	150	100

Discussion

The study of medical waste management practices have unraveled presence of sharp objects (needles & syringes), body parts, blood-borne waste, soiled dressing, chemicals, diagnostic samples, pharmaceuticals, radioactive waste and pathological waste. Field observations also showed empty take away packs, empty rubber, empty cans of drinks, old dump cloths and old dump bed sheets. These waste are ubiquitous in many healthcare facilities (HCFs), as Abdel (2010) reported waste from Abuja HCFs to include dustbins, buckets, red bags, trucks for collection of hospital waste and then dump them in incinerator for burning to ashes.

Presence of improperly managed sharp objects in HCFs are fast constituting health risks to humans. Janic-Karpinska et al. (2023) reported that every year, an estimated 16 billion injections are administered globally but not all the needles and syringes are properly disposed of afterwards. In unison, Alemayehu, Worku and Assefa (2016), as cited in Janic-Karpinska et al. (2023) stated that an estimated 5% of all HIV infections in Africa are due to unsafe injection administration and exposure to sharp object injuries during unsafe medical waste handling. Pepin et al. (2014) have estimated that an injury from a needle used on an infected

source patient has risks of 30% HBV, 1.8% HCV, and 0.3% becoming infected.

Similarly, about 2 million medical personnel are exposed to pathogens as a result of daily work routines, and at least 5.2 million others die worldwide every year, including 4 million children due to illnesses caused by unmanaged medical waste (Okechukwu et al., 2013; Yazie et al., 2019; Rahman et al., 2020). Medical waste, such as bandages and dressings, hand gloves and masks contaminated with blood-borne pathogens are infectious and can enter the body system via cuts, inhalation, mucuous membranes or injection to cause more than 30 dangerous diseases which when not treated promptly can result in debilitation, pain and even death (Yazie et al., 2019; Janic-Karpinska et al., 2023). This calls for the need to take adequate precautionary measures in handling medical waste, not only in BUTH but in all major HCFs in Nigeria at large.

Chemical solvents and reagents used for laboratory preparations, disinfectants, sterilants and heavy metals contained in medical devices like mercury in broken thermometers and batteries are heavy pollutants that can pollute water bodies, soil and enter food chains to damage vital organs of human beings and kill members of ecosystems. Furthermore, improper handling of radioactive

waste can cause serious injuries, including tissue destruction, headache, dizziness, and vomiting which in some cases requires amputation of the affected body parts (Borowy, 2020; Janic-Karpinska et al., 2023). Improper medical waste management in Nigeria, ranging from non-existing collection systems in some wards of HCFs is an indication of ineffectiveness which is contributing immensely to contamination of drinking water, soil deterioration, transmission of infectious diseases and disruption of smooth functioning of both terrestrial and aquatic lives. Volatile metals, such as mercury, lead, arsenic and cadmium ingested are also most likely to damage the immune and neurological systems, kidneys, brain and lungs (Janic-Karpinska et al., 2023).

Nigeria ranks among the top countries globally in terms of medical waste production because of its large population of about 230 million people. Unfortunately, the management of these vast quantities of medical waste is not properly managed, as some empty waste containers (metallic, plastic bottles and buckets, bags and cartons) dropped in open sites are often scavenged for reuse, and recycling to earn a living. Those waste types are not always properly washed and sterilized for reused in packaging perfumes, powder, corn juice, edible oils and other useful items and can harm humans and the environment (Okechukwu et al., 2013). NEWNAP (2020) confirmed that waste types around Plateau Club and BUTH community are indiscriminately dumped at illegal points and adjacent to gully corridor and is considerably hazardous to human health as well as to the effective functioning of ecosystems and storm water drainage systems. This calls for the need to exercise caution in disposal of waste, including medical waste in the study area.

CONCLUSION

Medical facilities, including BUTH generate significant volumes of medical waste on daily basis. Improper management was found to pose health risks and often disrupts effective functioning of ecosystems. This study found the presence medical waste like needles, syringes, body parts, blood, soiled dressing, chemicals, diagnostic samples, pharmaceuticals, radioactive and pathological waste materials which are unsatisfactorily managed in BUTH. This implies that the lives of physicians, nurses, healthcare

support staff, patients, visitors, and neighborhoods are at health risks. This paper wonders if at all there are adequate: medical waste regulations, modern disposal system, and awareness of the dangers of medical waste among BUTH community. Sequel to this ugly state of affairs, the following measures are proffered:

1. The Plateau Environmental Protection and Sanitation Agency (PEPSA) and National Environmental Standards and Regulations Enforcement Agency (NESREA) should enforce compliance in line with WHO's guideline on safe waste disposal of medical waste in all healthcare facilities.
2. There should be mass sensitization of the public using various local communication media on how safe biohazardous waste materials can be disposed of to safeguard human lives and ensure environmental security for all in line with SDG12, which emphasizes "Responsible consumption and production, in relation to biohazardous waste and sustainable management practices".
3. The relevant Government Agencies should address the regulatory framework, planning, waste minimization and recycling, handling, storage and transportation, treatment and disposal options and routine training of healthcare personnel in all healthcare to be more effective in safeguarding public health and the environment.

REFERENCES

- Abdel, S. (2010). Perspective of policy makers and stakeholders about healthcare waste in Abuja, Nigeria. *African Health Sciences*, 6 59-63.
- Alemayehu, T., Worku, A. & Assefa, N. (2016). Medical waste collectors in Eastern Ethiopia are exposed to high sharp injury and blood and body fluids contamination. *Prev. Inf. Control*, 2, 2.
- Borowy, I. (2020). Medical waste: The dark side of healthcare. *Historia Ciencias Saude-Manguinhos*, 27, 231-251.

- Janic-Karpinska, E., Brancaloni, R., Niemcewicz, M., Wojtas, W., Foco, M., Podogrocki, M. & Bijak, M. (2023). Healthcare waste, a serious problem for global health. *Healthcare*, 2023 11, 242.
- Nigeria Erosion and Watershed Magement Project (NEWMAP) (2020). Final report resettlement action plan (RAP) for Plateau Club- Bingham University gully erosion project, Jos North LGA, Plateau State, Nigeria, March 2020. <https://documents.worldbank.org> (23/01/2025).
- Okechukwu, E. C., Oparah, A. C., Aguora, S. O. & Soni, J. S. (2013). Evaluation of health risks of improper biomedical waste management among health workers in selected hospitals in Abuja, Nigeria. *Texila International Journal of Public Health*. Doi: 10.21522/TIJPH (Accessed from 18/01/2025).
- Pepin, J., Abou-Chakra, C., Pepin, E., Nault, V. & Valiquette, L. (2014). Evolution of global burden of viral infections from unsafe medical injections, 2000-2010. *Plos One*, e99677. Accessed 13/01/2025).
- Rahman, M. M., Bodrud-Doza, M. Griffiths, M. D. & Mamun, M. A. (2020). Biomedical waste amid COVID-19: Perspectives from Bangladesh. *Lancet. Glob. Health*, 8,e1262.
- Walkinshaw, E. (2011). Medical waste management practices in Canada. Pp 377-382.
- World Health Organisation (WHO) (2024). Data update on WASH in healthcare facilities for 2023. *World Health Organization*. Geneva, Switzerland. <https://washdata.org/reports>.
- Yazie, T. D., Tebeje, M. G. & Chufa, K. A. (2019). Healthcare management current status and potential challenge in Ethiopia: A systematic review. *BMC. Res. Notes*, 12, 285.