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RESEACH ARTICLE

ASSESSMENT OF THE KNOWLEDGE AND PRACTICE OF HEALTHCARE WORKERS OF THE UNIVERSITY OF ILORIN TEACHING HOSPITAL, ILORIN, NIGERIA TOWARD BIOMEDICAL WASTE MANAGEMENT

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Abstract

Background: Effective biomedical waste management is crucial for protecting the health of hospital staff, community members, and the general public from infectious diseases. This study aims to quantify the volume of waste and evaluate the knowledge and practices of healthcare workers at the University of Ilorin Teaching Hospital, Ilorin, regarding biomedical waste management practices. To determine the daily waste generation, waste was segregated at the point of origin into hazardous and non-hazardous categories, weighed, and recorded over seven days. A total of 120 well-structured questionnaires were distributed to various categories of healthcare workers across twenty departments/units using simple random sampling to select the participants. The findings show that an average of 122.10 kg of biomedical waste is generated daily across the 20 departments studied, with non-hazardous waste accounting for 58% and hazardous representing 42% of the total volume of the biomedical waste generated. Regarding Biomedical Waste (BMW) management knowledge, over 80% of the healthcare workers demonstrate good knowledge. Additionally, more than 69% of respondents exhibit good practices in various aspects of BMW management. Thus, the knowledge and practices of healthcare workers at the University of Ilorin Teaching Hospital, Ilorin, can be considered good. It is, however, recommended that the management of the hospital engage in formal training of more of its staff on biomedical waste management, especially those outside of core medical professions.

Keywords: Biomedical waste, healthcare workers, infectious diseases, knowledge, practice, waste management

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INTRODUCTION

The health sector has witnessed a rapid growth with increasing demand for user-friendly products that have led to increased use of disposable medical products and thus contributing to a large volume of biomedical waste generation (Silva et al., 2005). Reports have shown that several hundreds of tons of both hazardous and non-hazardous healthcare wastes are generated across Nigerian hospitals (Abah and Ohimain, 2011; Mitiku et al., 2022), most of which end up in open dumps, which negatively impact on public health and the environment (Mitiku et al., 2022).

Biomedical, medical, or healthcare waste is any waste generated during diagnosis, treatment or immunization of humans or animals. This type of waste is generated in healthcare facilities such as hospitals, blood banks, veterinary clinics, pharmaceutical centres, medical research institutes and laboratories (USEPA, 2013). It has been established that about 75% of waste generated in hospitals is non-hazardous, while the remaining 25% presents potential health hazard to health workers, the public and the environment (Chandra, 1999; Prus et al., 1999). Biomedical hazardous waste includes a wide range of materials, such as used needles and syringes, soiled dressings, body parts, diagnostic samples, blood, chemicals, pharmaceuticals, medical devices, and radioactive materials (Ananth et al., 2010; WHO, 2017).

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Improper management of biomedical waste can lead to the spread of infections, pollution of air, water, and soil (Sachan et al., 2012), thereby resulting in deterioration of public and environmental health. To ensure effective medical waste management, the national guidelines require that handling, storage, transportation, treatment, and disposal of medical waste be tracked by trained personnel. The tracking system allows for monitoring of wastes, which in turn assists in evaluation of any potential harm to the environment and the public health (FEPA, 1991; Slack et al., 2004). Other important components of biomedical waste management systems include waste minimization, policy guidelines, waste management planning, waste management training, etc. (Ezeudu et al., 2022).

Sustainable healthcare waste management in low-income countries such as Nigeria faces challenges due to poor awareness, inadequate training of personnel on waste management techniques, insufficient availability of treatment and disposal facilities (Ali et al., 2017; Awodele et al., 2016; Chisholm et al., 2021). Adequate knowledge and practice among healthcare workers are critical factors for a successful biomedical waste management system, as they are the necessary preconditions to protect public health and the environment (Asadullah et al., 2013; Mitiku 2022; Parida et al., 2019).

Various studies have shown that lack of awareness, inadequate training, lack of adequate resources, negligence, and unfavorable attitude of the healthcare staff were the main challenges of healthcare waste management in Nigeria (Anozie et al., 2017; Coker et al., 2009; Ogbonna, 2013; Olukanni et al., 2014; Sarkingobir et al., 2022).

This study, therefore, aims at assessing the knowledge and practice of healthcare workers at the University of Ilorin Teaching Hospital, Ilorin. The specific objectives of the study are to:

(a) characterize and quantify biomedical waste generated at the University of Ilorin Teaching Hospital,

(b) assess the knowledge of the healthcare workers of the institution toward biomedical waste management, and

(c) evaluate the practices of the hospital workers toward biomedical waste management.

MATERIALS AND METHODS

The Study Area

This study was carried out at the University of Ilorin Teaching Hospital (UITH), Ilorin, Nigeria. The hospital is located along the Old Jebba Road on latitude 8° 28' 47"N and longitude 4° 31' 56"E. UITH Ilorin is a tertiary, second-generation teaching hospital in Nigeria whose operation began in 1980. It is a 600-bed capacity healthcare facility with 20 departments.

This study was conducted in February, 2023 at 20 departments of the hospital. The departments include Physiotherapy, Radiology, Ophthalmology, Obstetrics & Gynecology, Morbid Anatomy & Pathology, Chemical Pathology, Microbiology, Hematology, Pediatrics, Behavioral Science, Anesthesia, Epidemiology & Community Health, Nursing Service, Pharmacy, Ear, Nose & Throat (ENT), Family Medicine, Health Information Management, Nutrition & Dietic, Internal Medicine and Medical Social Service.

Methodology

To determine the quantity (kg/day) of waste (both hazardous and non-hazardous) generated per day in each department, two plastic waste bins with different colour (black and yellow) and coated with black polyethylene bag were provided at each department for waste collection. Segregated waste samples were collected every 24 hours for seven days. The collected waste was weighed on a 50kg capacity weighing scale while ensuring a strict use of personal protective gadgets.

Based on the staff strength of the hospital, UITH, Ilorin boasts of about 2500 personnel with about 2000 staff serving the hospital on a permanent basis while the remaining staff are on contract. Of the 2000 permanent staff, around 800 are on outpost to various clinics under the management of UITH, Ilorin. These clinics are scattered in different locations within and even outside of Kwara state. The healthcare staff considered for this research are, therefore, those permanent staff that are posted to departments within UITH, Ilorin. To assess the knowledge and practice of healthcare workers towards biomedical waste management, 120

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respondents (15% of the total population) were selected across the 20 departments and administered with structured questionnaires. The respondents included various categories of healthcare workers (medical doctors, nurses, laboratory scientists, cleaners, environmental health officers).

The questionnaire was structured into three (3) sections which include social demographic information of the respondents, knowledge of the respondents on biomedical waste management and their practice of biomedical waste management. A proportional sampling method was used to select healthcare workers from different departments/units (Uchechukwu et al., 2017)

Ethical Consideration

Ethical approval was obtained from the Department of Health Research and Ethics (HRE) of the University of Ilorin Teaching Hospital (UITH), Ilorin, through an approval letter referenced UITH/CAT/189/VOL.21B/344.

The experimental procedures were explained to the individual participants and, thereafter, their consent to participate in the study was obtained. Those who declined to participate were excluded.

Statistical Analysis

Data was entered into MS Excel and then exported to Statistical Package for Social Sciences (SPSS) version 20.0 data editor for analysis. The statistical significance of association between variables was assessed using Chi-square test at $p<0.05$. The results of this study are presented in tables and charts.

RESULTS AND DISCUSSIONS

Quantification and Characterization of Waste

The University of Ilorin Teaching Hospital, Ilorin generated an average of 122kg of waste daily (Table 1). This result is similar to the work of Muhwezi et al. (2014) that showed similar average waste generated per day by a tertiary healthcare centre.

The quantity of the waste was more influenced by the volume of waste generated by Family Medicine, Internal Medicine, Obstetrics & Gynecology, and Behavioural Science departments, which account for about 40% of the total waste generated in the hospital. Family Medicine is found to produce the largest volume of waste, whereas Department of Morbid Anatomy and Pathology produce the least (Table 1).

In all the departments investigated, the hazardous healthcare waste account for 42%, while the non-hazardous waste is estimated to be around 58% of the total waste generated (Figure 2). This result agrees with the findings of Olanrewaju (2020) which reveals that the average waste generated by two state-owned hospitals in Akure is 124.5kg per day each, whereas two-third of the waste is non-hazardous. The present study also agrees with the work of Prus et al. (1999) which finds that the non-hazardous waste constitutes most of the waste generated in healthcare institutions.

The result, however, disagrees with the average world estimates of hazardous waste put between 10% - 25%. The high figure of hazardous waste in the present study could be attributed to poor segregation where the non-hazardous waste is mixed with the hazardous waste. The hazardous waste constitutes a potential threat to workers' health, public, flora and fauna in the area (Chandra, 1999).

Moreover, Departments of Obstetrics & Gynecology, Morbid Anatomy & Pathology, Chemical Pathology, Microbiology, Pediatrics, and Pharmacy generate more hazardous waste than the non-hazardous, while the remaining thirteen (13) departments generate more non-hazardous waste than the hazardous (Figure 3).

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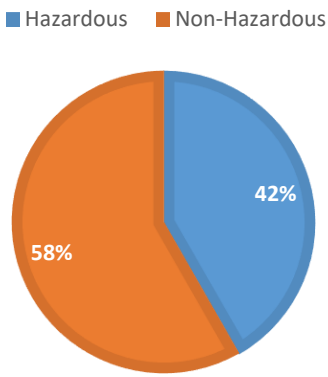


Figure 2: Percentage of Hazardous and Non-hazardous Waste Generated in 20 Departments at UITH, Ilorin

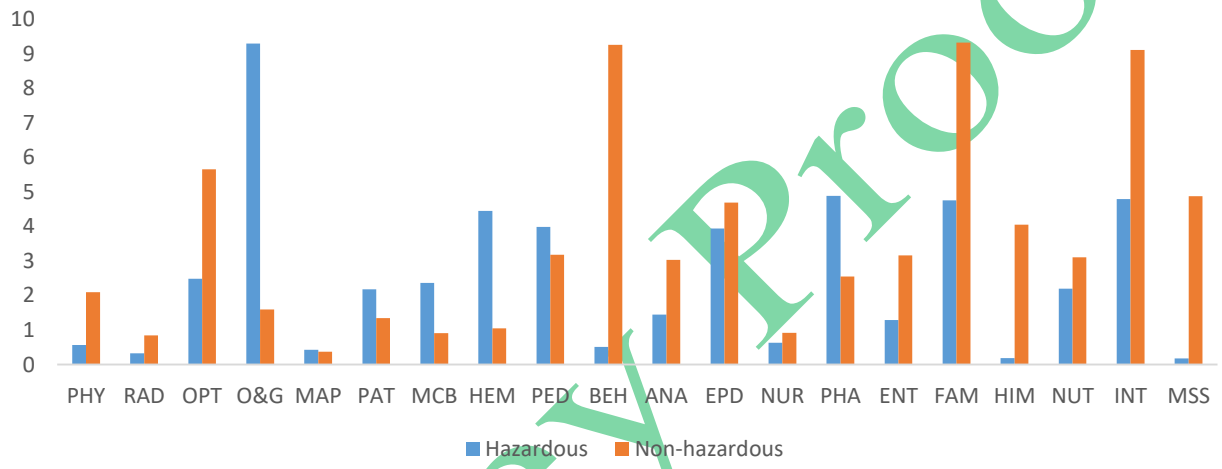


Figure 3: Weight (kg) of Hazardous and Non-hazardous Waste Generated Per Day Per Department.

Table 2: Social-Demographic Characteristics of the Respondents

Variables	Response Category	Frequency	Percentage
Sex	Male	42	36.2
	Female	74	63.8
Age Brackets (years)	20 – 30	28	24.1
	31 – 40	47	40.5
	41 – 50	26	22.4
	Above 50	15	12.9
Academic Qualification	SSCE	18	15.4
	NCE/ND	20	17.6
	Graduate	62	53.3
	Others	16	13.7
Profession	Medical Doctor	17	14.7
	Nurse	26	22.4
	Laboratory Scientist	23	19.8
	Environmental Officer	22	19.0
	Cleaner	15	12.9
	Others	13	11.2
Experience (Years)	1 – 5	64	55.2
	6 – 10	25	21.6
	11 – 15	14	12.1
	16 – 20	08	6.9
	Above 20	05	4.2

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A total of 120 healthcare workers were randomly selected for this study, out of which 116 (97%) participated, whereas 4 (3%) did not return the questionnaire. 63.8% of the respondents were female, while 36.2% were male. Respondents of age bracket 31 - 40 constitutes 40.5% of the number of healthcare workers that participated in this study, while respondents above 50 make up 12.9% of the total population of the respondents, with the former being the highest age bracket and the latter being the lowest. Regarding educational status, 53.3% were first-class degree holders, and 46.7% were NCE/ND holders and below. More than half (55.2%) of the workers had less than 6 years of work experience. The social-demographic distribution of this study is similar to that reported by Uchechukwu et al. (2017) which was conducted at University of Nigeria Teaching Hospital, Enugu. Mitiku et al. (2022) also conducted similar research in private hospitals in Ethiopia with similar results regarding socio-demographic status of respondents.

Table 3: Knowledge of the Respondents Regarding BMW Management

Variables	Response Category	Frequency (n)	Percent (%)
Do you know that hospital waste contains both general and hazardous waste?	Yes	107	92.2
	No	9	7.8
Is there any need for segregation of BMW into different categories?	Yes	98	84.5
	No	11	9.5
	I don't know	7	6.0
Do you know about colour-coding of BMW bins?	Yes	103	88.8
	No	13	11.2
Is there any need to secure stored BMW waiting for treatment and disposal?	Yes	95	81.9
	No	08	6.9
	I don't know	13	11.2
Are you aware that hazardous BMW must be treated before disposal?	Yes	106	91.4
	No	10	8.6
Do you know about different disposal methods?	Yes	103	88.8
	No	13	1.2
Are you aware that improperly managed BMW can cause disease outbreak?	Yes	115	99.1
	No	01	0.9
Are you aware of the available guidelines for managing BMW?	Yes	93	80.2
	No	23	19.8
Have you ever attended any training on BMW management?	Yes	78	67.2
	No	38	32.8
Is there any need to put on protective gadgets when handling BMW?	Yes	112	96.5
	No	03	2.6
	I don't know	01	0.9
Summary of Knowledge	Good	101	87.1
	Poor	15	12.9

Assessing the knowledge of health workers will go a long way in curbing both human and environmental health challenges associated with improper BMW management. From the results of this study, about 92% of the respondents are aware that hospital waste contains both hazardous and non-hazardous wastes with 85% agreeing on the need to separate the waste into different categories at the point of generation. Of the 116 respondents, 103 (89%) have knowledge of colour-coding waste bins, 82% know that the generated waste should be secured while awaiting treatment/disposal. The majority (89%) of respondents are aware of different available disposal methods. 99% of the respondents are aware that improper management of medical waste can lead to disease outbreak. 80% of the respondents are aware of the availability of formal guidelines for managing BMW. Despite this, only about 67% have any training on BMW management, while 97% of the 116 respondents are aware that protective gadgets must be used while handling hospital waste. Summarizing the respondent's knowledge on BMW management, it can be seen that about 87% have good knowledge while 13% respondent show poor knowledge of BMW management. The finding of this study is similar to the findings of a study done at the University of Nigeria Teaching Hospital, Enugu where it was revealed that healthcare workers had adequate knowledge on BMW management (Uchechukwu et al., 2017). The current study also agrees with the findings of Mitiku et al. (2022) which showed adequate knowledge of healthcare workers on BMW management at both private and public hospitals in Ethiopia. The findings of the present study are, however, in contrast with the

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work of Abah and Ohimain (2011) and Manzuru et al. (2008) both of which found lack of adequate knowledge of healthcare staff at a teaching hospital in Nigeria and a city hospital in Dhaka, Bangladesh respectively. This lack of knowledge could be attributed to inadequate training of healthcare personnel.

The chi-square statistical analysis shows that there is a significant association at $p < 0.05$ level between gender and knowledge level of BMW management among the healthcare workers. Likewise, there is a significant association between profession and knowledge level among hospital workers. Majority of doctors and nurses were conscious of the need for adequate BMW management. This is not so when compared with workers belonging to other professions. This finding is similar to a study conducted by Sachan et al. (2012). In contrast, there is no significant association between other social-demographic variables (Age ($p = 0.375$), qualification ($p = 0.245$), experience ($p = 0.60$)) and level of knowledge.

Table 4: Practice of the Respondents Toward BMW Management

Variables	Response Category	Frequency (n)	Percent (%)
Do you separate BMW according to their type?	Yes	95	81.9
	No	21	18.1
Do you follow colour-coding while temporarily storing BMW?	Yes	104	89.7
	No	12	10.3
Do you wear glove when handling BMW?	Yes	116	100
	No	0	0
Where do you temporarily store non-infectious waste like paper, plastics, and other supplies?	Black waste bin	92	79.3
	Yellow waste bin	18	15.5
	Safety box	06	5.2
Where do you temporarily store hazardous waste like used cotton, gauze and other items contaminated with blood and other bodily fluid?	Black waste bin	17	14.7
	Yellow waste bin	95	81.9
	Safety box	04	3.4
Where do you temporarily store sharp wastes?	Black waste bin	08	6.9
	Yellow waste bin	19	16.4
	Safety box	89	76.7
Do you disinfect/decontaminate re-usable devices after each use?	Yes	104	89.7
	No	12	10.3
How long does it take waste collector to evacuate BMW from temporary storage in your facility?	24 hours	81	69.8
	48 hours	19	16.4
	72 hours	16	13.8
What type of treatment does your facility apply to BMW?	Chemical (Disinfection)	84	72.4
	Biological (Micro-organism)	00	0
	Physical (Autoclaving)	32	27.6
What type of disposal method is used by your hospital?	Secure landfill	78	67.2
	Sanitary landfill	04	3.4
	Open dump	34	29.3
Summary of Practice	Good practice	99	85.6
	Poor practice	17	14.4

Among all the hospital workers that participated in this study, 95 (82%) do separate waste at the point of generation whereas 90% consent that they use colour-coding bins for temporary storage of waste. All the 116 respondents use gloves when handling hospital waste. A vast majority of respondents temporarily store waste in the appropriate coloured bins while an appreciable number stores waste in wrong-coloured bins. About 90% of the respondents disinfect/decontaminate any re-usable equipment after use. 70% of the respondents consent that temporarily stored waste is evacuated within 24 hours in the hospital. As for waste treatment, 72% adopt chemical treatment while 28% adopt physical treatment. 71% of the respondents state that the hospital waste is disposed in landfills while 29% dump the waste in an open dump. In all, 86% of the healthcare workers have a good practice of

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BMW management, while 14% do not practice proper waste management. This finding agrees with previous findings of Mitiku et al. (2022) which reported good practice of BMW management by healthcare professionals in Ethiopia. However, the result of this study is found to be far higher than previously reported findings (Abah and Ohimain, 2011; Devi, 2019; Uchechukwu et al., 2017; Mitiku et al., 2022). This disagreement might in part be due to the difference in healthcare facility setup and frequency of training of personnel in the hospitals. So, hospitals might have a good practice of BMW management due to adequate training of its staff as well as provision of basic waste management tools.

The study also finds that there is no significant association between age group and practice of BMW management among the healthcare workers. There is also no significant association between qualification and practice. There is, however, a significant association between profession and practice. Likewise, there is statistically significant association between experience and practice.

Conclusion

The results from this study reveal that the hospital generates an average of 122.10kg waste per-day with the non-hazardous waste being predominant. On the knowledge and practice of hospital staff toward BMW management, it can be concluded that a larger percentage of staff have adequate knowledge of handling BMW. More so, most of the respondents demonstrate a good attitude toward managing BMW. The hospital management are, however, encouraged to organize in-training for more staff, especially those in other professions aside medical doctors and nurses.

Authors Contribution

YAI – conceptualization, data collection and manuscript writing, MS - manuscript, including review/editing and MOT – draft preparation and data collection.

Competing interests

The authors declare that they have no competing interests

Ethical approval: Ethical approval was obtained from the department of Health Research and Ethics (HRE) of the University of Ilorin Teaching Hospital (UITH), Ilorin

Availability of data and materials: The datasets/information used for this study are available within the manuscript.

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References

Abah, S. O. & Ohimain, E. I. (2011). Healthcare waste management in Nigeria: A case study. *Journal of Public Health and Epidemiology*, *3*(3), 99-110.

Ali, M., Wang, W., Chaudhry, N., & Geng, Y. (2017). Hospital waste management in developing countries: A mini review. *Waste Management & Research*, *35*(6), 581-592.

Ananth, A., Prashanthini, V. & Visvanathan, C., (2010). Healthcare Waste Management in Asia. *Waste Manage*., 30: 154-161.

Anozie, O. B., Lawani, L. O., Eze, J. N., Mamah, E. J., Onoh, R. C., Ogah, E. O. & Anozie, R. O. (2017). Knowledge, attitude and practice of healthcare managers to medical waste management and occupational safety practices: Findings from Southeast Nigeria. *Journal of Clinical and Diagnostic Research: JCDR*, *11*(3), IC01.

Asadullah, K., Karthik, G. & Dharmappa, B. (2013). A study on knowledge, attitude and practices regarding biomedical waste management among nursing staff in private hospitals in Udupi city, karnataka, India. *Revista Internacional de Geologı ´a, Ciencias Terrestres y Ambientales* 3: 118–123. 17.

Awodele, O., Adewoye, A.A. & Oparah, A.C. (2016). Assessment of medical waste management in seven hospitals in Lagos, Nigeria. *BMC Public Health*. 16, 269.

Chandra, H. (1999). Hospital waste: An environmental hazard and its management. *C. Newsletter of ISEB, India*, *5*(3), 80-5.

Chisholm, J.M., Zamani, R., Negm, A.M., Said, N., Abdeldaiem, M.M., Dibaj, M. & Akrami, M. (2021). Sustainable waste

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management of medical waste in African developing countries: A narrative review. *Waste Manag. Res.* 39, 1–15.

Coker, A., Sangodoyin, A., Sridhar, M., Booth, C., Olomolaiye, P., & Hammond, F. (2009). Medical waste management in Ibadan, Nigeria: Obstacles and prospects. *Waste Management*, *29*(2), 804-811.

Devi, A., Ravindra, K., Kaur, M., & Kumar, R. (2019). Evaluation of biomedical waste management practices in public and private sector of health care facilities in India. *Environmental Science and Pollution Research*, *26*, 26082-26089.

Ezeudu, O. B., Ezeudu, T. S., Ugochukwu, U. C., Tenebe, I. T., Ajogu, A. P., Nwadi, U. V. & Ajaero, C. (2022). Healthcare waste management in Nigeria: A review. *Recycling*, *7*(6), 87.

Federal Environmental Protection Agency (FEPA) (1991). Guidelines for the management of solid and hazardous wastes. In *Guidelines and Standards for Environmental pollution Control in Nigeria*.

Manzuru, H. M., Ahmed, S. A., Rahman, K. A., & Kanti, T. (2008). Pattern of medical waste management existing scenario in Dhaka city, Bangladesh. BMC Public Health; 8: 36. Marthur V, Dwivedi S, Hassan MA and Misra RP. knowledge, Attitude and Practices among health care personnel: A cross sectional study. *Indian Journal of Community Medicine, 36*(2), 143-145.

Mitiku, G., Admasie, A., Birara, A., & Yalew, W. (2022). Biomedical waste management practices and associated factors among healthcare workers in the era of the covid-19 pandemic at metropolitan city private hospitals, Amhara region, Ethiopia, 2020. *PloS One*, *17*(4), e0266037.

medical and paramedical staff in tertiary healthcare centre. *International Journal of Scientific and Research Publications*, *2*(7), 1-6.

Sarkingobir, Y., Yabo, A. G., Yarima, S. A., Miya, Y. Y., Sule, I. F., Bello, N. R., & Shehu, A. (2022). Biomedical waste management among primary healthcare workers, Bauchi local government area, Bauchi state, Nigeria. *Jurnal Teknokes*, *15*(4), 242-251.

Silva, C.E., Hoppe, A.E., Ravanello, M.M. & Mello, N., (2005). Medical wastes management in the South Brazil. *Waste Management* 25, 600-605.

Slack, R.J., Gronow, J.R. and Voulvoulis, N., (2004). Hazardous Components of Household Wastes. *Critical Reviews in Environ. Sci. Technol., 34 (5): 419- 445.*

Uchechukwu, E. E., Babatunde, I. O., & Anne, C. (2017). Investigating knowledge, attitude and health care waste management by health workers in a Nigerian tertiary health institution. *Global Journal of Health Science*, *9*(4), 222.

United States Environmental Protection Agency (USEPA), July 2013. "Definition of Medical Waste"

Muhwezi, L., Kaweesa, P., Kiberu, F., & Eiyoku, L. E. (2014). Health Care Waste Management of Uganda – A Case study of Soroto Regional Referral Hospital. *Int. Journal of Waste Management and Technology*, 2(2), 1-2.

Ogbonna, D. N. (2013). Characteristics and waste management practices of medical wastes in healthcare institutions in Port Harcourt, Nigeria. *African Journal of Environmental and Waste Management Vol*, *1*(1), 013-021.

Olanrewaju, O. O. (2020). Quantification and characterization of medical waste in public healthcare facilities within Akure Metropolis, Ondo State, Nigeria. *EPH-International Journal of Agriculture and Environmental Research*, *6*(2), 15-22.

Olukanni, D. O., Azuh, D. E., Toogun, T. O. & Okorie, U. E. (2014). Medical waste management practices among selected healthcare facilities in Nigeria: A case study.

Parida, A., Capoor, M. R., & Bhowmik, K. T. (2019). Knowledge, attitude, and practices of Bio-medical Waste Management rules, 2016; Bio-medical Waste Management (amendment) rules, 2018; and Solid Waste Rules, 2016, among health-care workers in a tertiary care setup. *Journal of Laboratory Physicians*, *11*(04), 292-296.

Prüss, A., Giroult, E. and Rushbrook, P. (Eds.). (1999). Safe management of wastes from health-care activities. World Health Organization.

Sachan, R., Patel, M. L., & Nischal, A. (2012). Assessment of the knowledge, attitude and practices regarding biomedical waste management amongst the

World Health Organization (WHO), 2017 Safe Management of Wastes from Health-Care Activities: A summary. World Health Organization. 54: 1-30.

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