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*Research Article*

# Impediments to Proper Handling of Biomedical Waste in the Tertiary Health Facilities of Ekiti State, Southwest Nigeria

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**ABSTRACT**

This study examined owners-based exogenous factors that could hamper adequate management and treatment of Biomedical Waste (BMW) at the Federal and State governments owned tertiary health facilities located in Ekiti State, Nigeria. Failure to address these impediments has been identified as bane of inadequate BMW management, capable of escalating insurgence of epidemics. The study employed survey research design using a well-structured five-item based questionnaire to elicit primary data from 103 purposively selected health officers from the two healthcare facilities. Evidence from relative importance index and One-way Contingency Chi-Square tests unveil that the five factors examined possess latency to impede adequate BMW management, but more for lack of modern medical waste management equipment and less for the health workers salary and allowances while the factors are found to be statistically significant in obstructing proper management of biomedical waste. The study concludes that failure to ensure that these factors are put in place can lead to inappropriate handling of medical waste which in turn can worsen disease outbreak in the environment. Thus, as a proactive measure to curb epidemics, it is recommended that government and hospital management boards should provide adequate fund to support this course in line with global best practices.

**Keywords:** *Biomedical waste, Environmental health, Healthcare, Medical waste*

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## INTRODUCTION

Unprecedented growth in the population of developing nations cannot be divorced from the consequential increase in healthcare delivery that may result in the upsurge of Biomedical Waste (BMW) generation. According to Kaur, Pandey, Tekwani, Bedekar, Pai and Agarwal (2015), hospitals generate about 3.2 million tons of medical waste each year out of which nearly 15 to 35 percent of the waste is reported as infectious (Radha, Kalaivani & Lavanya, 2009).

BMW are infectious and non-infectious solid or liquid materials spawning in the course of health protection, medical treatments and diagnosis, and scientific research activities employed in the production or testing of biologicals (Kaur et al., 2015; Dehghani, Azam, Changani & Dehghani, 2008). Consistently with World Health Organisation (WHO), these wastes are classified into eight categories which are; general waste, pathological, radioactive, chemical, and infectious to potentially infectious waste, sharps, pharmaceuticals, and pressurized containers (Mathur, Patan & Shobhawat, 2012).

Whereas, economic and environmental consequences of poor biomedical waste management have become concerns in developing countries recently. As a case, Mitiku, Admasie, Birara, and Yalew (2022) recorded low biomedical waste management practice even during ravaging Covid-19 era in Ethiopia. According to Awodele et al. (2016), Kaur et al. (2015), and Mathur et al. (2012), improper management, handling and indiscriminate disposal of healthcare wastes orchestrated by certain inhibiting factors could lead to greater health risks than the original diseases. Adeolu, Enesi and Adeolu (2014) pointed out that devastating level of waste management in Nigeria cannot be distanced from inadequate

facilities, poor funding and implementation of policies, urbanisation, economic development, and improved standard of living.

In a country like Nigeria, where there have been recurrent industrial disputes between health workers and government as a result of poor health financing, it could be adduced that adequate BMW management might have been hampered by certain factors such as unavailability of equipment, poor funding, under staffing, inadequate training etc. The situation could even appear more precarious in a low urbanised state like Ekiti state of Nigeria due to weak support from the government. This situation could be made worse through the devastating poor standard of living and/or economic recession, leading to a disease outbreak.

BMW are expected to be properly managed and treated prior to final disposal through environmentally sustainable and friendly techniques such as autoclave, incineration, microwave irradiation, chemical disinfection method, plasma pyrolysis (Singh, Ogunseitan, & Tang, 2022; Jacob, et al. 2021; Mathur et al., 2012; Kumar et al. 2010). However, Radha et al. (2009) have identify dearth of education, awareness and trained personnel as well as paucity of funds as key concerns to proper management of BMW in India. As a case, Malini and Bala (2015) observe that none of the multipurpose health workers in a tertiary care hospital in Puducherry have received training about BMW management while Kuchibanda and Mayo (2015) note lack of formal training in waste management techniques among the healthcare workers in Tanzania. Perhaps the reason for Kaur et al. (2015) to advance the need for intensive training and orientation programs should be conducted for the medical staff to boost adequate BMW management. Kumar, Shaikh, Somrongthong and Chapman (2015) point out further that insufficient budget, poor safety, lack of training, poor coordination, monitoring and supervision are bane of inadequate BMW management in Rawalpindi tertiary hospitals. Longe (2012) also traced inappropriate medical waste treatment systems to poor funding and lack of professionally competent health workers.

In the event that healthcare establishments that are expected to ensure formidable healthcare delivery, cure and prevent wide spread of diseases have ironically become notable incubator of epidemics, the need arises to investigate its probable impediments. In Nigeria where supposed 'affordable' public health services have been plagued with several deficiencies including funding, this situation may not be found wanting especially in the least populated and lowest economically endowed Ekiti state in the south-western part of the country. Consequently, the study was structured to reveal factors capable of impeding adequate medical waste management among tertiary healthcare facilities in Ekiti State. The essence is to draw the attention of both government, health boards and management to key impediments of proper BMW handling within the State and lessons for others as well as guide for future research.

## MATERIALS AND METHODS

**Study design and location:** The study employed survey research design which provided basis for cross-sectional data collection method consistently with Awodele *et al.* (2016). This research was carried out within Ekiti State which is located on latitude $7^0$ $15^1$ to $8^0$ $5^1$ North of the equator and between longitude $4^0$ $45^1$ and $5^0$ $45^1$ East of the Greenwich Meridian covering about 6,353square kilometres. It is an upland zone rising above 250 meters above sea level with estimated population projection of 3,166,000 as at 2015; the least populated State in the south-western geopolitical zone of Nigeria.

The study focused on two tertiary healthcare facilities in the State consistent with Delmonico *et al*. (2018). Population of the study consists health workers in each concerned unit of the healthcare facilities where medical wastes are generated and managed. Purposive sampling technique was adopted to select the sample that was drawn from each facility in line with Sefouhi, Kalla, Bahmed and Aouragh (2013) due to failure to official figure of the population. The study relied on primary data which were collected using close-ended five-item based survey research questionnaire.

**Methodology:** Both validity and reliability tests of the research instrument were investigated even though the instrument employed was adapted from Wahab and Adesanya (2011). The validity test involved distribution of the instrument to purposively selected six health workers consisting of a doctor, nurse, CHEW, laboratory scientists, pharmacy and sanitary worker at one of the health facility which helped to improve on the content of the research instrument. Part of the idea obtained during the validity check includes the inclusion of radiology and pharmacy units on the list of the health profession. Reliability tests were conducted on the five items examined (i.e. A1 to A5). The result of Cronbach Alpha Test is presented with Table 1. The Cronbach's Alpha values of 0.733 unveiling internal consistency of the items was above 0.7 which is considered acceptable according to Pallant (2007).

**Table 1:**
Reliability Test Statistical Results

| Basis | Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N |
|---|---|---|---|
| **Factors affecting proper management and treatment of BMW** | 0.733 | 0.743 | 5 |

The study employed descriptive analysis which involved the use of frequency, percentage, mean and charts as well as Relative Importance Index (RII). One-way contingency Chi-square statistic was used to ascertain the direction of tested hypothesis at 0.01 level of significance. Statistical Package for Social Sciences (SPSS) version 21 was exploited for the data analysis.

With respect to National Health Research Ethics Committee (2006), required research site ethical committee procedures were obtained and observed through established

platforms for the purpose of collecting the research data as directed at the two healthcare facilities.

## RESULTS

**Demographic Analysis:** Out of 156 health practitioners purposively sampled (i.e. 81 and 75 at Facilities A and B respectively), 53 and 50 copies of the instruments were returned from the two Facilities in that order as presented in Table 2. This accounts for a response rate of 66% which according to Mugenda and Mugenda (2008), response rate of 60% and above, and above 70% are perceived to be good and very good respectively. The response rate obtained in this study is below 87.5% recorded by Awodele et al. (2016) that examined seven hospitals in Lagos State, Nigeria.

**Table 2:**
Respondents' Response Rate

| | Facility A Federal-owned | Facility B State-owned | Total |
|---|---|---|---|
| **Sampled Respondents** | 81 | 75 | 156 |
| **Actual Respondents** | 53 | 50 | 103 |
| **Percentage of Outcome** | 65% | 67% | 66% |

Regarding distribution of the sample wards and laboratories that the respondents belong, roughly 79 percent of the respondents (representing 81 respondents) were medical professionals functioning in the hospitals' wards while 21 percent of them (i.e. 22 respondents) work in the laboratories (Figure 1).

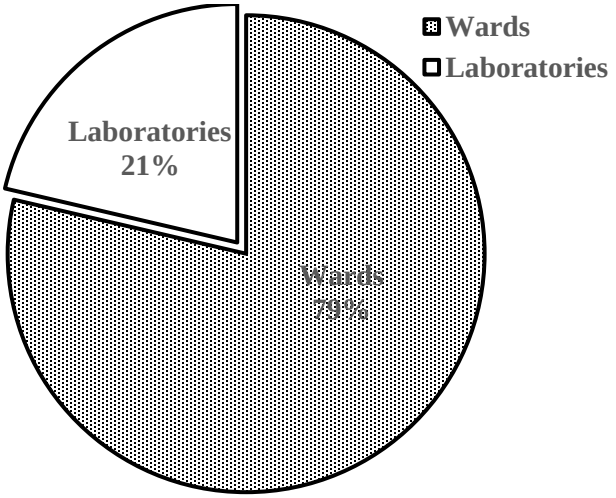


**Figure 1:**
Percentage Distribution of the Sampled Wards and Laboratories

As shown through Figure 2, 9 of the respondents were from Accident and Emergency, 8 from Anaesthesia, 13 from Community Medicine, 8 from GOPD, 2 from Gynaecology, 10 from Medical, 9 from Paediatrics, 8 from Pharmacy, 14 from Surgical ward. It is believed that health workers in these units would be able to identify factors impeding proper BMW in the healthcare facility based on their experiences. Respondents from laboratories are 4 and 3 from pathology and radiology respectively, microbiology 2, haematology 5, Chemistry 2, blood serology 4 and others 2 (which are laundry and stores) as shown in Figure 3.

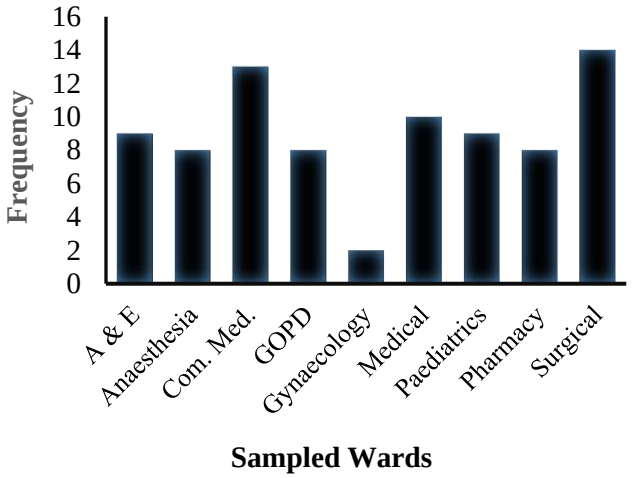


**Figure 2:**
Frequency Distribution of the Sampled Wards

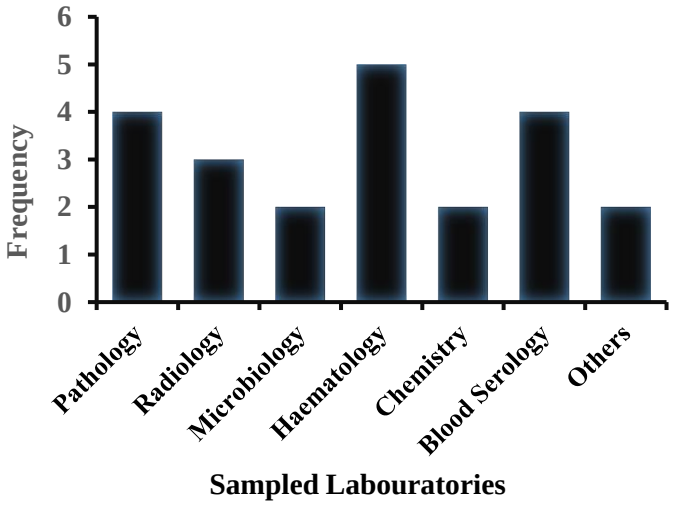


**Figure 3:**
Frequency Distribution of the Sampled Laboratories

As regard year of experience of the respondents presented on Table 3, although the study was able to draw information from healthcare officers who have worked for ten years and above, the larger proportion of the respondents emanates from healthcare practitioners who had ten years and below working experiences. This shows that the study was able to obtain data from more and low experienced respondents in terms of years of service, but perhaps from more agile healthcare givers. As such, this is not perceived to impound negative effect on the outcome of this study in any way.

**Analysis of Factors Impeding Proper Management and Treatment of BMW:** The focus of this objective is to assess factors that possibly obstruct adequate management and treatment of BMW at the public tertiary health facility in Ekiti State. Drawing from existing studies, five factors indicated by

items A1 to A5 were identified and examined for the analysis. Both descriptive and semi-parametric Chi-square statistics were performed and reported as shown in Table 4.

**Table 3:**
Respondents Years of Work Experience

| | Frequency | Percent | Cum. Percent |
|---|---|---|---|
| **1 – 5 Years** | 36 | 35.5 | 35.5 |
| **6 – 10 Years** | 37 | 37.6 | 73.1 |
| **11 – 15 Years** | 14 | 10.8 | 83.9 |
| **16 – 20 Years** | 10 | 9.7 | 93.5 |
| **Above 20 Years** | 6 | 6.5 | 100.0 |
| **Total** | 93 | 100.0 | |

**Table 4:**
Descriptive Results of Factors Impeding Proper Management and Treatment of BMW

| S/N | Items | SA | A | D | SD |
|---|---|---|---|---|---|
| A1 | Lack of adequate qualified personnel | 57 (55.3%) | 25 (24.3%) | 14 (13.6%) | 7 (6.8%) |
| A2 | Lack of modern BWM treatment equipment | 62 (60.2%) | 30 (29.1%) | 7 (6.8%) | 4 (3.9%) |
| A3 | Poor salary and allowances | 30 (29.1%) | 24 (23.3%) | 37 (35.9%) | 12 (11.7%) |
| A4 | Inadequate funding | 54 (52.4%) | 33 (32.0%) | 14 (13.6%) | 2 (2.0%) |
| A5 | Lack of up-to-date training for the waste handlers | 61 (59.2%) | 31 (30.1%) | 7 (6.8%) | 4 (3.9%) |

Findings based on the use of frequency, percentages, RII and $\chi^2$ statistic are presented as follows. Drawing from the results on Table 4, sampled respondents appeared to strongly agree that all the factors examined could affect proper management and treatment of BMW but more for lack of modern equipment (60%), followed by lack of training programmes for the waste handlers (59%), inadequate qualified personnel (55%) and inadequate funding (52%). Respondents who strongly agree with poor salary and allowance were just about 29% (which is below 50%) suggesting that the health workers are more interested in the availability of proper tool and up-to-date training as well as well knowledgeable personnel to ensure adequate management and treatment of BMW over selfish need of salary and allowances. It also implies that as much as the healthcare practitioners are interest in their take-home at month-end, proper management and treatment of BMW is much more affected by the other four factors.

Regarding frequency distribution of the respondents who indicated that they agree that the factors could impede proper handling of BMW, inadequate funding (32%) was the most agreed factor responsible for inadequate management and treatment of BMW at the tertiary health facilities. It was followed by poor up-to-date training (30%), lack of modern equipment (29%), lack of qualified personnel as salary and allowance (23%) also appeared as the least affecting factor.

To showcase findings on the factor that inhibit the best way of managing medical waste most, as well as the least possible factor, RII test was employed and carried out. The results are presented in Table 5. The results showed that lack of modern medical waste treatment equipment (RII = 0.864) is capable of impeding proper way of managing and treating BMW most, followed by lack of up-to-date training (RII = 0.862), inadequate funding (RII = 0.837, contrary to finding based on descriptive result), inadequate qualified waste handlers (RII = 0.820) while poor salary/allowance (RII = 0.675) appears as the least consistently with finding using frequency and percentage on Table 4.

**Chi-Square Test of Factors Impeding Proper Handling of BMW:** By way of addressing the null hypothesis which seeks to test statistical significance that the identified factors could impede proper management and treatment of medical waste, analysis of frequencies using One-Way Contingency Method was carried out. Based on data gathered, an expected value for each row is equal to the sum of the observed frequencies divided by the number of rows in the table. In this survey, there were 103 observed responses, resulting in approximately 26 responses per each opinion using the Likert scale. Finally, the residual is equal to the observed frequency minus the expected value. The tests summary is presented in Table 6.

The results of the Chi-square test reveal that lack of adequate qualified personnel, ($\chi$ = 61.19; p = 0.001), lack of modern medical waste treatment equipment ($\chi$ = 71.09; p = 0.003), poor salary and allowances ($\chi$ = 15.52; p = 0.001), inadequate funding ($\chi$ = 57.84; p = 0.003), and lack of up-to-date training ($\chi$ = 75.22; p = 0.003) present statistical significant influence on proper management of biomedical waste in healthcare facilities based on the sample employed.

**Table 5:**
RII Results of Factors Impeding Proper Management of BMW

| **Factors impeding proper management and treatment of Biomedical Waste** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ITEMS** | **1** | **2** | **3** | **4** | **∑F** | **∑FX** | **MEAN** | **RII** | **RANKING** |
| Lack of adequate qualified Personnel | 7 | 14 | 25 | 57 | 103 | 338 | 3.282 | 0.820 | 4th |
| Lack of modern medical waste treatment equipment | 4 | 7 | 30 | 62 | 103 | 356 | 3.456 | 0.864 | 1st |
| Poor salary and allowances | 12 | 37 | 24 | 30 | 103 | 278 | 2.699 | 0.675 | 5th |
| Inadequate funding | 2 | 14 | 33 | 54 | 103 | 345 | 3.350 | 0.837 | 3rd |
| Lack of up-to-date training for the waste handlers | 4 | 7 | 31 | 61 | 103 | 355 | 3.447 | 0.862 | 2nd |

**Table 6:**
Chi-square Tests Summary of Factors Impeding Proper Handling of BMW

| Variables | $\chi^2$ | P-value | Status |
|---|---|---|---|
| Lack of adequate qualified personnel | 61.194 | 0.001 | Significant |
| Lack of modern medical waste treatment equipment | 71.086 | 0.003 | Significant |
| Poor salary and allowances | 15.516 | 0.001 | Significant |
| Inadequate funding | 57.839 | 0.003 | Significant |
| Lack of up-to-date training for waste handlers | 75.215 | 0.003 | Significant |

## DISCUSSION

Based on descriptive analysis of the factors impeding proper management of the BMW, the results suggest that inadequate handling of medical waste could not be informed by salary and allowances or pay-package of the health workers as at the time of this study. That is, adequate management of medical waste is driven by availability of qualified and competent medical officers, requisite medical facilities and equipment, proper funding and trainings, rather than personal pay-package. This was further established by the highest proportion of the respondents disagreeing (about 40%) and strongly disagreeing (roughly 12%) that the factor could obstruct proper handling of the waste. This descriptive finding has policy implication for the government, hospital management authorities and global health crusaders and donors. That is, the aforementioned frontline stakeholders should rise up to the task to forestall imminent consequences of improper medical waste management.

The RII results established further that lack of modern medical waste treatment equipment is the most influencing factor capable of impeding proper management and treatment of biomedical waste, while salary and allowance were adduced as the least relative important factor. This implies that the medical officers are more interested in using appropriate and protective equipment to handle medical waste to avoid costlier and deadlier consequences. It is also a pointer that adequate availability of medical waste management equipment should be prioritised. The finding is not averse to the United Nation SDG 3 which seeks healthy live and promoting well-being for all irrespective of age, education etc.

The results based on Chi-square inferential analysis showed that all the five examined factors significantly hamper proper way of managing and treating medical waste based on samples generated at the Ekiti State public tertiary health facilities, consistent with Cheng, *et al*. (2009) and Radha *et al.* (2009). Each of the factors is statistically significant at 0.01 level. Therefore, the null hypothesis is rejected in all the tests with a submission that these factors have significant effects on proper management and treatment of biomedical waste. This suggested that, for medical waste to be properly managed/handled, governments and respective hospital management boards should pay key attention to the possible setback that could be engendered by the absence of these factors. Hence, these factors should be adequately considered and accorded appropriate attention so as to ensure healthier healthcare facilities and community devoid of unprecedented epidemics.

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