



Evaluation of Biomedical Waste Management in Tertiary Healthcare Centers in Osogbo Osun State Nigeria

Olatunji A.A.^{a*}, Familusi A.O.^b, Lamidi I.O.^c, Olusami J.O.^d, Oyedele M.O.^e

^{abcde} Civil Engineering Department, Federal Polytechnic Ede, Ede, Nigeria

Abstract – Biomedical waste management (BMWM) is a serious environmental issue that must be addressed as it represents a significant health risk and environmental pollution concern due to its hazardous characteristics. The study was conducted at two hospitals in Osogbo, Osun State, Nigeria - H-A and H-B. Questionnaires, semi-structured interviews and direct observations were used to gather all the data required for the study. A total of 25 and 11 individuals were involved in the survey at H-A and H-B respectively using purposive sampling method. However, hospital records were used as an additional tool to acquire information. The result from the study showed that knowledge on BMWM legislation/policy of H-A valued at 61.6%, why that of H-B was 47.2%. In the same vein, the BMWM practice of H-A was 75.43% positive response, whereas, 55.57% was recorded at H-B. Attitude towards biomedical waste (BMW) was 77.6% positive response and 70.8% positive response for H-A and H-B respectively. The results from the study shows that H-B waste handlers have limited knowledge on biomedical waste management legislations and guidelines while the waste handlers at the H-A have positive attitudes towards biomedical waste management and are aware of common practices of BMWM. Generally, BMWM is poor at H-B, while H-A has the potential to meet the standard of BMWM. However, it is recommended for both hospitals to aim for positive goals in accordance with WHO and set a time frame at which the goals are expected to be achieved.

Keywords: *Biomedical Waste, Dumpsite, Healthcare, Hospital, Waste Management.*

1. Introduction

After nuclear waste, healthcare waste, also known as biomedical waste (BMW), is considered the second most harmful type of waste. Patients seeking treatment in hospitals for various infections utilize medical equipment, which is considered biomedical waste after usage. Many hospitals, particularly in developing nations, improperly handle biomedical waste, endangering patient lives (Datta *et al.*, 2018).

A medical facility's internal and external infection rates are further increased by improper handling of biological waste. Due to a lack of attention, improper handling of biological waste has grown more common, particularly in the northern region of Nigeria. Waste handlers in the majority of Nigerian hospitals are hired without taking into account their degree of training or certification (Longe & Williams, 2006).

Medical waste is defined by the World Health Organization as waste produced by health care activities. This includes bodily parts, chemicals, medications, radioactive materials, diagnostic samples, blood, soiled dressings, used needles and syringes, and body parts (WHO, 2023).

Because this type of waste is produced at medical institutions, it poses a risk to both humans and other living things outside the facility's boundaries. Waste segregation is significant problems in healthcare facilities since infectious and non-infectious wastes are sometimes combined in the same containers, increasing the amount of infectious waste (Sahiledengle, 2019).

Inadequate training of healthcare professionals, a lack of resources to carry out essential procedures, and a lack of awareness regarding one's responsibilities for handling waste generated are other issues that contribute to inappropriate healthcare waste handling and management. Financial, technological, and manpower shortages, as well as inadequate education and training, are some of the main causes of the inefficient management and control of biomedical waste in many nations (Kagonji & Manyele, 2016).

Finding biomedical waste mixed up with household waste at Nigerian dump sites is the most frequent

issue among all the issues related to BMW in Nigeria. Children who live in rural areas or even less wealthy urban youngsters have developed the practice of using rubbish disposal sites to get resources that they need, such toys and other useful items. The improper disposal of biomedical waste is closely linked to the habit of picking from dump sites, which puts youngsters and scavengers at risk of contracting the disease (Awodele *et al.*, 2016).

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It is regrettable that not all hospitals in underdeveloped nations prioritize the proper management of biomedical waste, despite the fact that this is a critical issue that contributes significantly to the spread of nosocomial infection epidemics (Bathma *et al.*, 2012). Making sure that no one's health is at danger is the main objective of biomedical waste management. More specifically, improper handling of biomedical waste can worsen patient conditions and present an extraordinary risk to workers. A hospital can be thought of as a closed community, which greatly increases the likelihood of breakouts. Possible remedies include lowering risk and liability, controlling costs, planning, and announcing an instrumental commitment to safeguard human life (Bathma *et al.*, 2012).

The phases of the Bio-Medical Waste Management (BMWM) system that need to be put into place are Segregation, Labeling, Treatment, Transportation, Storage, and Disposal, according to WHO (2018) and BMWMHR (2016). Therefore, the study aim at evaluating the BMWM of some selected hospitals in Osogbo, Osun State.

2. Materials and Methods

Two tertiary hospitals were selected in Osogbo; one State government owned public tertiary healthcare institution, a teaching hospital and considered to be the largest in the city was coded: H-A. The second one is a privately owned tertiary healthcare institution with faith-based name and was coded: H-B. Purposive sampling method was used because of the peculiarity of these the two hospitals as the only two tertiary hospitals in the city, and the respondents were purposely selected to have ties with BMW generation and management.

The areas of these hospitals where garbage is produced were physically inspected. We conducted interviews with doctors, nurses, supporting medical personnel, directors of works, and other relevant parties to determine the kind of waste being produced and how it is being disposed of, collected, and transported. A variety of techniques were used to gather the data, such as semi-structured interviews, field research, and questionnaires.

Direct observation, semi-structured interviews, and questionnaires were utilized at H-A to collect all the data needed for the study. Participants in the poll included the hospital's waste manager, waste handlers at the hospital's dumping location, and ten other people. Observation checklists were utilized to document procedures in six distinct wards: laboratory complex, male and female ward, accidents/emergency ward, theater, and pediatric unit. Waste handlers were watched in real time throughout working hours.

The H-B environmental and health department provided all the necessary data. The department's employees, waste handlers, the human resource manager, and a few nurses were given questionnaires. In order to evaluate the biomedical waste management procedures, such as waste segregation inside wards, an observation checklist and interviews with the staff members involved were also carried out. The male and female medical wards were the two departments under observation.

3. Results and Discussion

Every ward that was observed had a safety box installed along with a warning sign. In certain wards, wastes were segregated at the moment of creation, but they were mixed together during disposal and transit. Medical sharps should be stored in safety boxes that can withstand punctures; waste segregation at the source is generally done at H-A and not at all at H-B (BMWMHR, 2016). Segregations outside the wards were not in existence except Theater wastes that were put in separate nylon at both hospitals. Wastes were not treated at all as revealed by the persons in charge of wastes at both hospitals, transportation to disposal site take place twice a day at H-B, but once or twice in some cases at H-A. Wastes are disposed at H-A by staff in charge of wastes to the temporary dump site behind the hospital fence as shown in Figure 1, where everything is packed together and burnt, whereas, private organization disposes the wastes collected from the dumps of H-B in every four days. Workers at H-A were seen fully kitted in personal protective equipment PPE (masks, thick gloves, boots, and gowns); meanwhile, workers do not wear gown or any protective clothing at H-B. Training session for a new worker is compulsory at H-A, but at H-B, the new

Corresponding author's name and paper title

workers are attached to the existing ones to learn, whereas, the later manages wastes based on their personal perspectives.



Fig. 1: Temporary Dumpsite at H-A

3.1 Informed workers handling

About 82% of the waste handlers at H-B have above Primary education, which was more than 80% of same category of workers at H-A as shown in Figure 2. This should ordinarily translate to having more informed workers handling the waste; however, reverse was the case as evident in Table 1. This could be attributed to the training workshop organizes by H-A for the new workers as it was lacking at H-B.

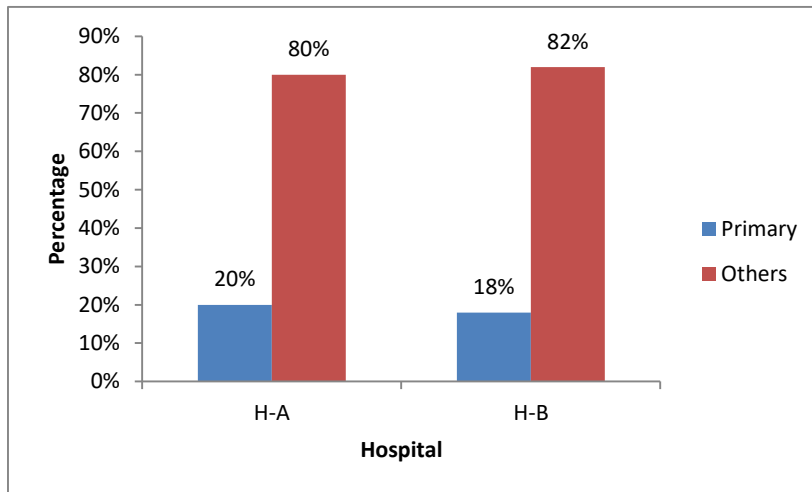


Fig. 2: Educational Level of the Waste Handlers for the Two Hospitals

3.1.1 BMWM legislation/policy

The percentage of hospital waste handlers that are knowledgeable of BMWM legislation and policy is displayed in Table 1. Both hospitals concurred that BMWM is crucial. Only 9% of workers at H-B are aware of the 1998 BMWM and handling guidelines, compared to around 40% of workers at H-A. Just 28% of the workers at H-A and none at H-B are aware of the amendments that were made to the aforementioned rules that became effective in 2016. It will be quite challenging to practice in accordance with that policy because the majority of workers are unaware of the international regulations on BMWM.

Table 1. Knowledge of BMW Legislation/Policy

KNOWLEDGE PARAMETER		H-A (N=25)		H-B (N=11)	
Perception on Importance of BMWM	Important	20	80%	8	72%
	Somewhat	5	20%	3	28%
1998 BMWM and Handling Rules	Known	10	40%	1	9%
	Not Known	15	60%	10	91%
Amendments of 1998 BMWM and Handling Rules (2016 Rules)	Known	7	28%	0	0%
	Not Known	18	72%	11	100%
Waste Storage Time Limit According to the WHO	Known	22	88%	10	91%
	Not Known	3	12%	1	9%
Are there any BMW Policies in your Hospitals?	Yes	18	72%	7	64%
	No	7	28%	4	36%

Waste should not be disposed of inside the hospital, and it is required to wear appropriate clothes before handling waste, according to part of the BMWM policy at H-A. Approximately 72% of workers are aware of this policy, whereas 64% of H-B workers claimed to be aware of their hospital's BMWM policy but failed to mention just one.

3.1.2 BMWM practice

When the level of worker awareness regarding BMWM practices was measured at both hospitals, it was startling to see that, as shown in Table 2, only 45% of H-B workers knew the steps involved in BMWM. At H-A, the percentage was 60%, but this was still insufficient for effective management of BMW, as it was even lower than the 74.3% of workers that Awodele *et al.* (2016) found. Infectious waste is typically classified Yellow, pathological waste is coded Red, and general waste is typically coded Black in BMWM waste bins (BMWMHR, 2016). It appears that a higher proportion of staff members at both hospitals are aware of the BMW coding segregation, as evidenced by the figures 88% and 72% for H-A and H-B, respectively. The H-A value was greater than the 81.9% that Awodele *et al.* (2016) found. It is hardly shocking that just 36% of H-B workers are aware of the disposal method for medical sharps, likewise, 45% for anatomical waste disposal method. The required training for them to be aware is not in existence, even though about 64% of them are aware of the hazards associated with BMW.

Table 2. Knowledge/Awareness on Biomedical Waste Management Practice

AWARENESS PARAMETER		H-A		H-B	
Awareness of Steps Involved in BMWM	Aware	15	60%	5	45%
	Not aware	10	40%	6	55%
Color-Coding Segregation of BMW	Aware	22	88%	8	72%
	Not aware	3	12%	2	18%
Importance of Waste Segregation	Aware	20	80%	6	55%
	Not Aware	5	20%	5	45%
Disposal Method for Medical Sharps	Aware	18	72%	4	36%
	Not aware	7	28%	7	64%
Disposal Method for Anatomical Waste	Aware	20	80%	5	45%
	Not aware	5	20%	6	55%
Adherence to Color-Coding at the Hospital	Yes	19	76%	8	72%
	No	6	24%	3	18%
Awareness of Hazards Associated with BMW	Aware	18	72%	7	64%

Not aware	7	18%	4	36%
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3.1.3 Attitude towards BMW

Table 3 demonstrates that while all hospital staff members acknowledged the problem with BMW, but failed to understand that safe management of BMW is important to both the hospital and general populace as 60% of them at H-A sees it as an extra burden at work and 55% of them at H-B.

Table 3. Attitude/Behavior Assessment towards Biomedical Waste

ATTITUDE/BEHAVIOR PARAMETER		H-A		H-B	
Is safe management of BMW an issue in your hospital?	Agree	25	100%	11	100%
	Disagree	0	0%	0	0%
Does waste management system require team work?	Agree	22	88%	9	82%
	Disagree	3	12%	2	18%
Is safe management of BMW an extra burden at work?	Agree	15	60%	6	55%
	Disagree	10	40%	5	45%
Would you like to attend voluntary programs to upgrade your knowledge on BMW management?	Yes	20	80%	8	82%
	No	5	20%	2	18%
Would labeling of waste bins be of any importance in your hospital?	Yes	20	80%	5	45%
	No	5	20%	6	54%

3.1.4 Summary

As can be seen in Figure 3, H-A scored 61.60% on the assessment of their understanding of BMWM legislation and policy, while H-B scored 47.20%. A knowledge assessment on BMWM Practice was also conducted; the results for H-A and H-B were 75.43% and 55.57%, respectively. Similarly, when H-A's attitude toward BMW was evaluated, it received the maximum score of 77.60%, while H-B received a score of 70.80%.

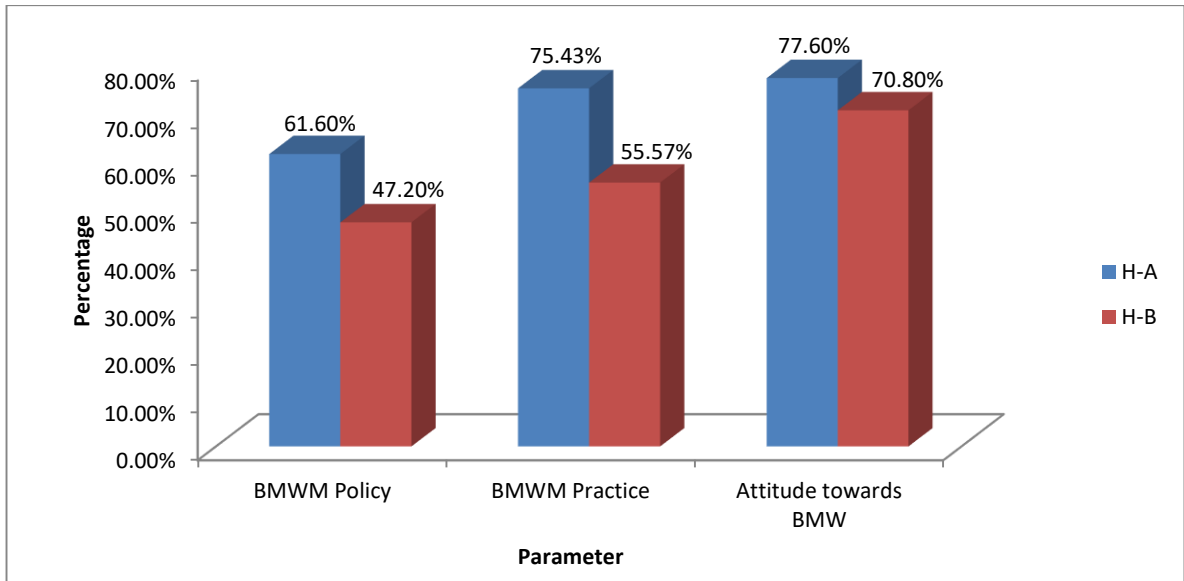


Fig. 3: Positive Response on BMWM Policy, Practice, and Attitude towards BMW

3.2 Semi-structured interview, hospital records and direct observations

3.2.1 Hospital A (H-A)

Senior Technical Officer, Works and Services of H-A claims that medical sharps produce roughly 90 kg of waste each day, and waste generation averages 2750 kg per week, or the equivalent of fifteen 120-liter mobile ground bins. The most challenging aspect of biomedical waste management, segregation, is addressed at H-A. However, adhering to it has proven challenging because it necessitates separation from the point of generation to disposal, meaning that everyone involved with the waste must be knowledgeable about it.

The hospital uses the color-coding system of waste segregation. Other methods include using polythene bags for pathological waste, such as amputated body parts, and puncture-proof containers for medical

sharps. To guarantee appropriate segregation, the public health department's sanitarians also perform weekly inspections. H-A does not treat any of its wastes before disposal; therefore, it is anticipated that significant consideration will be given to the treatment of wastes prior to disposal in order to create a safer environment.

There are several risks involved with transporting hazardous waste to a disposal site, such as the possibility of spills, environmental pollution, and infection. Waste is transferred using the mobile ground bins when they are only 25% full, however H-A takes efforts to reduce the dangers connected with this stage of BMWM. Every morning, waste is transported from each ward to the disposal site in accordance with WHO guidelines on the longest period of time waste can be held before being disposed of. Employees were seen to be extremely coordinated and well-organized.

In general, H-A's BMWM system may be able to satisfy the standard. Also, despite H-A's best efforts to make sure that every phase of BMWM is incorporated into the system, some stages, including segregation, are still beyond the workers' grasp.

3.2.2 Hospital B (H-B)

The Chief Environmental Officer of H-B's Environmental and Health Department claims that there is no waste measurement done in the hospital and that new employees are mentored by more seasoned staff. Instead of being treated to eliminate harmful germs, wastes are bundled together.

Direct observation indicates that BMWM at the H-B is substandard. The majority of the procedures included in the typical waste management system are left out, which led to the conclusion that was reached. The two main issues with H-B's waste management procedures are waste disposal and segregation. Although there are colored bins (yellow, red, and black) in various parts of the hospital, the staff members who produce waste don't appear to care about the color. Wastes from several sources are thrown into one container and mixed together. These hazardous waste containers are positioned along hospital walkways used by patients, visitors, and other guests; the contents of the containers are not labeled. Some of these containers are even used by people to dispose of any kind of waste without being covered. Although every ward has safety boxes, syringes are still discarded of in waste bins with other BMWs, which puts waste workers at serious risk.

While some workers are aware of various BMW disposal techniques, such as how to get rid of sharps and anatomic waste, these procedures are not parts of their job duties. The survey's findings led to the conclusion that H-B waste handlers' attitudes regarding biomedical waste treatment are less conventional. The majority of respondents think that hospitals have problems managing medical waste, thus they are open to participating in voluntary programs that will advance their understanding of BMWM.

3.3 Comparison of BMWM practice at H-A and H-B

Overall, the study's findings indicate that there is a notable variation in BMWM between H-A and H-B. The most obvious difference is that H-A gives the waste handlers the proper attention, instruction, and resources, and this has resulted in results that are shown in Fig. 3. H-B waste handlers, on the other hand, fall short in this aspect. They manage and handle waste according to their knowledge, which is inappropriate because BMWM demands that waste be treated correctly according to laws and norms.

BMWM at H-A isn't flawless, but the hospital is working hard at getting up to standard. H-A appears to be making the necessary progress in managing BMW in accordance with standard. At H-B, only the processes of disposal and transportation are carried out. Results indicate that H-A has a better system than H-B when it comes to safety and precautions taken in BMWM, taking into account the environment, other employees, and waste handlers. Last but not least, H-A takes record keeping—which is crucial to BMWM—very seriously, whereas H-B does not.

4. Conclusion and Recommendations

BMWM practices have been evaluated at both H-A and H-B, and the study concluded that H-A is having better practices and understanding than H-B, though, both needs improvement. As the Chief Environmental Officer at H-A emphasized, the problem of segregation starts from where the waste is generated; and this includes the doctors, nurses and other employees. The job of the waste handlers starts from packing and transporting the waste to dumpsites, therefore responsibility of waste segregation also lies on those that generate the waste. In a broader view, proper biomedical waste management system at the H-B will only work if there is cooperation and acceptance of responsibility among employees. Also, since waste handlers have a positive attitude towards biomedical waste management, enhancing their knowledge and awareness on the waste management and handling would solve the major problems. All identified drawback should be strategically amended in no distance time.

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