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Assessment of Disposal Practices among Health Workers in Selected Hospitals in Abuja

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Abstract

Safe disposal procedures of biomedical wastes cannot be overstressed in achieving efficient waste management and mitigating environmental hazards and risk of exposure to humans. The investigation was conducted to assess the disposal procedures of biomedical waste in selected hospitals in Abuja. Data were collected using a structured questionnaire and on-the-spot observation. Six hospitals that provided health care services in Abuja were surveyed. Descriptive, inferential statistics and reliability tests were used to analyze the data. Chi-square ($\chi 2$) test was used to determine the association between standard handling practices of biomedical waste and biomedical waste management with ($p<0.05$). The result showed that the respondents agreed to these methods of disposal in this order where the burning pit was the predominant method of disposal, followed by incineration, dumping site, landfill, and burial. The disposal plans were inefficient as black bags of wastes littered the temporary dumpsite at the hospital premises and the use of unprotected dysfunctional incineration. The Cronbach's alpha $\alpha = 0.830$, loading factor (0.735-0.939) which indicates that the measuring tool was reliable and the items on the questionnaire showed interrelatedness and consistency. A coordinated system for tracking and monitoring treatment and disposal procedures of biomedical wastes is critical in the combat against epidemics and environmental pollution. Improved, safe and environmentally friendly disposal procedures should be employed. The health workers who are the waste generators are obliged to monitor, conduct risk assessments, and formulate policies for the safe disposal of biomedical wastes.

Keywords*: Biomedical waste, Disposal Procedures, Efficient, Environmental pollution, Hazards, risk exposures.*

Introduction

Biomedical waste management is an issue of serious concern, especially in developing nations like Nigeria, owing to the non-existent policies, limited resources, and lack of sensitization of health workers on waste handling and disposal [1, 2]. This has resulted in the poor handling and disposal of biomedical wastes in many countries, thus causing a high risk to the health workers and the environment. The 20-15% of the hazardous biomedical wastes which has been further categorized into infectious and toxic wastes [3, 4]. The composition of these hazardous wastes varies from country to country [5], depending on the preparedness to mitigate the health risks and environmental hazards associated with poor biomedical waste management. It becomes expedient that the disposal processes of these hazardous wastes be given utmost interest due to the threats it poses to humans.

The patients, caregivers, healthcare workers, disposal site workers, scavengers, drug addicts, and the general public are vulnerable to infectious pathogens (HIV/AIDS and hepatitis B and C), toxic chemicals, heavy metals, and

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genotoxic substances [6, 7]. These infectious agents can gain entry into the body through pricks and injuries in the skin, mucous membranes in the mouth, inhalation from polluted air into the lungs, careless swallowing, and vector-borne transmission [8]. Poorly managed and disposal of biomedical wastes could be a menace to the immediate surroundings and the cities at large by diffusing stench smells, defacing the aesthetic value of the environment, and contamination of the soil, groundwater levels, atmosphere, plants, and animals [9].

To achieve safe disposal of biomedical wastes requires that the hazardous wastes are subjected to specific treatments. These treatment techniques are intended to alter the biological composition of the waste and render the waste safe for release [10]. The choice of treatment and disposal methods should be guided by the following factors: cost-effectiveness, sustainability, feasibility, simplicity to apply, and environmentally safe [11, 12].

More so, the quantity and nature of medical wastes, availability, and proximity of waste treatment sites, trusted means of transportation, climate condition, existing legislation on biomedical waste management, geological setting, and power supply will influence the choice of treatment and disposal options [13]. Safe and environmentally friendly treatment technologies are recommended in order to ensure that the infectious agents are completely destroyed to avoid contamination when the treated wastes are released into the general non-risk wastes and then disposed off [14]. These treatments include microwaving, chemical disinfection, dry heat disinfection, high temperature autoclaving, gasification, pyrolysis, and anaerobic digestion [15,16] as gasification and pyrolysis are used as a thermochemical treatment of wastes. Others are autoclaving, and incineration [17], high-temperature incineration/ combustion, and low-temperature alternative technologies are employed in developed countries [18]. Sustainable, safe and environmentally tolerable disposal options are stipulated by WHO, namely sanitary landfills, incineration, designated dumping, decontamination by autoclaving, and disposal on land (pits and dumpsites) [19, 20].

These safe disposal techniques are essentially meant to control disease spread, reduce the chances of pollution, and deter scavengers from repackaging and resales of contaminated sharps and medicines [21]. Even with the precautionary measures, these disposal methods (landfill, dumpsites, and incineration) are not completely without disadvantages, as their adverse effects are evident on humans and the environment through epidemics and environmental pollution.

In view of these challenges associated with poor handling of biomedical wastes at the time of treatment and disposal procedures, therefore the study intended to investigate the disposal procedures in selected private and public hospitals in Abuja.

Materials and Methods

Selection of the Area

The study was carried out in Abuja, the political and administrative headquarter of Nigeria. According to United Nations Fund for Population [22]), Abuja, the Federal Capital Territory, is estimated to have a population of 3,324,000 people. The city is home to many private and public (district) hospitals to serve the growing population.

Sample Size Determination

Cochran's formula:

$$n_0 = z2pq/e2$$

for calculating representative sample size for the infinite population was used [23].

n_0 = sample size
z = 1.96 (this is the selected critical value of desired confidence level)
p = 0.5 (assuming the maximum variability, which is equal to 50%)
q = 1- p
e = 0.05 (±5% desired level of precision at 95% confidence level)

$$n_0 = (1.96)2(0.5)(0.5)/(0.05)2$$

$$n_0 = 384.16$$

Therefore, $n_0 = 384$ (minimum sample size for this study).

An overage of 12% was added to the minimum sample size (384) and summed up to 430 to offset non-response, incomplete response, and late response.

Sampling Technique

Six (6) hospitals were selected for the study, using a random sampling method such that each hospital had a fair chance of being selected. The hospitals were stratified into two groups, private and public, based on the ownership and management of the hospitals. The hospitals were lettered alphabetically to ensure confidentiality.

Data Collection

Structured self-administered and self-completed questionnaires were used to collect the data. The intent of the study and questionnaire were explained to the participants to obtain their consent to participate in the study. Participation was voluntary, and participants were free to withdraw at any time. Confidentiality was assured by excluding all the identifiers of the hospital and respondents.

Data Analysis

Returned questionnaires were checked for completeness, accuracy, and consistency. Valid questionnaires were numbered serially and coded. All items were responded to on a Likert scale of 1-5 (5-point scale), where 5 = strongly agree and 1 = strongly disagree for positive items and reverse score so that the opposite is true (i.e., 1 = strongly agree and 5 = strongly disagree) for negative questions.

The ordinal data were converted to interval data (numerical data) and subjected to descriptive analysis. Reliability and inferential analysis of data was carried out using Statistical Package for Social Sciences (SPSS Version 20.0).

Results and Discussion

Table 1-5 capture the results of this study. The result showed that the respondents practiced disinfection, microwaving, and shredding. This agrees with an earlier study [21]. The result showed that respondents supported the practice of chemical disinfection of infectious wastes generated from the laboratories and theatres. This agrees with the previous study [24]. Over half of the respondents practiced autoclaving, especially of medical wastes generated from the laboratories. This finding was similar to previous studies [25-27] where steam autoclaving was employed. Autoclaving is an appropriate treatment that involves thermal decontamination of non-anatomical wastes, especially laboratory medical wastes that are pathogenic in nature [10].

On-site treatment is beneficial in the following ways by reducing the risks to public health and the environment and limiting the infectious biomedical wastes within the hospital compound from spreading [14]. Biomedical wastes such as sharps are treated and disposed of by incineration and landfills. This agrees with a previous study [21] where incineration, autoclaving, and shredding of sharps were employed. Incineration was the major means of treatment, and autoclaving was employed for the treatment of a few medical wastes [1], and infectious wastes and sharps were incinerated [28]. Contrastingly, incineration was infrequently employed [29]. However, incineration is supposed to be an ideal treatment method [10] and the best means of disposal [29]. Nevertheless, incineration is widely employed in biomedical, medical waste management in Dakar [10] but low usage of incinerators in health care institutions in Nigeria [6, 28].

Many developed countries are declining the use of incinerators due to the associated health risks and environmental hazards [10]. A good incinerator should meet certain conditions, such as two chambers, each 750°C, and 860°C, respectively, for an incinerator with two chambers [10]. However, a previous study [30]

reported that incinerators should be provided with emission control systems with some control devices like cyclones, baghouse filters, and chimneys constructed over the incinerator to remove emitted gases far from human settlements to avert potential causes of respiratory diseases.

A functional and well-designed incinerator should completely burn waste to the minimal quantity of ashes as incomplete combustion will release carbon monoxide and dangerous particles [31]. Ashes produced from incineration are highly toxic as they contain a high quantity of heavy metals [32] and, if not treated to reduce the toxicity level, could contaminate the soil where it is released into.

The result of this study showed that the majority of the respondents agreed to the practice of burning pits. This finding agrees with previous studies where burning was practiced as a means of disposal [27-29]. Open burning of biomedical wastes may seem cheap and fast to conduct and reduce the volume of waste but it still exposes the public to health risks of toxic gases released into the atmosphere [33]. The finding in this study is consistent with previous studies [26, 34-36], where most health care facilities in Nigeria practice open dumpsites and periodical burning of medical wastes.

Untreated open dumping sites present their own issues, such as leakage of toxic substances into the environment, picked by insects and rodents, causing vector-borne diseases. Open dumping within health care centres or government-designated areas is still challenging as there is no control of access to unauthorized persons and environmental pollution [37].

In modern waste management, open dumpsites are engineered and converted to sanitary landfills in order to protect the environment and human health [38]. The result revealed that respondents agreed to the disposal practice of burying. This result is similar to previous studies [28, 35, 39, 40], where highly infectious wastes such as placenta and amputated human parts are buried or given to patients to dispose of due to personal, cultural, and religious reasons. If the biomedical waste pit is not treated or lined could contaminate groundwater levels, particularly in shallow and porous soil [41]. The burning pit and ash pit in unprotected environments, open dumping, and placenta pit are prohibited and not recommended in the guidelines [42].

The study revealed that the respondents supported the use of landfills for the disposal of biomedical wastes. This finding is similar to the previous study [10], where landfill is used because incinerator is not available. Most of the landfills in developing countries are operated as dumpsites because they are not well constructed and do not meet the necessary conditions to operate as landfills for the disposal of biomedical waste [28, 33]. Waste released on this land can cause surface contamination and groundwater contamination [43].

The transportation and movement of medical wastes from the place of generation to the final disposal site is critical. If not managed well could be source of spread of disease and pollution of the surroundings. The study revealed that treated and untreated medical wastes were observed to be carried by the waste handlers with their gloved hands collected in mostly black bags and plastic containers to the temporary disposal site and barely moved on trolleys. This finding is similar to the previous study [44] and differs from previous studies [1] and [44], where wheeled trolleys were used to transport medical wastes in the hospitals. It is critical that medical wastes are carried on wheeled trolleys or carts designated only for that purpose [45]. The final pick-up is usually done by a private waste disposal company without minimal supervision by the hospital authorities. This finding is similar to the previous study [1], where a private waste company lifted the medical for final disposal.

The mean ± standard deviation score (3.1095 ± 0.9135) for biomedical waste disposal procedures indicates that existing procedures are good and can support efficient waste

management. Factor loading (0.735-0.939) is good and requires that all mean components are added to the summation. Cronbach's alpha, α = 0.830, revealed the measuring tool was reliable, and the items on the questionnaire showed interrelatedness and consistency.

Chi-square ($\chi 2$) test was used to determine the association between disposal procedures of biomedical waste and biomedical waste management with ($p<0.05$). It revealed that the practice of handling biomedical waste is a significant factor in biomedical waste management.

Table 1. Socio-demographic Characteristics of Respondents (N = 400)

Socio-demographic Characteristics	**Category**	**Study Participants N (%)**
Gender	Male	220 (55.0)
	Female	180 (45.0)
Health Professionals	Doctors	64 (16.0)
	Nurses	115 (28.8)
	Laboratory Scientists	96 (24.0)
	Pharmacists	71 (17.8)
	Others	54 (13.5)
Years of Working Experience	1-4	98 (24.5
	5-9	80 (20.0)
	10-15	88 (22.0)
	> 15	134 (33.5)
Educational Qualification	Bachelor's degree	343 (85.7)
	Fellowship	3 (0.8)
	Master's degree	6 (1.5)
	Doctorate	4 (1.0)
	Others	44 (11.0)
Member of Biomedical WMT	Yes	191 (47.8)
	No	209 (52.2)
Hospital Type	Public	289 (72.2)
	Private	111 (27.8)

WMT- Waste Management Team

Table 2. Percentage Frequency of Methods of Biomedical Waste Treatment

Items	**Positive Responses Frequency N (%)**
Disinfection	400 (100.0)
Autoclaving	286 (71.5)
Microwaving	66 (16.5)
Shredding	103 (25.8)

Positive responses = Agree/ Strongly Agree

Table 3. Percentage Frequency of Biomedical Waste Disposal Procedures

Items	**Positive Responses Frequency N (%)**	**TWF**	**RII**	**Rank**
Burning Pit	288 (72.0)	1595	3.99	1
Incineration	270 (67.5)	1572	3.93	2

Dumping	133 (32.3)	1183	2.96	3
Landfill	47 (11.8)	1016	2.54	5
Burial	118 (29.5)	1133	2.83	4
Recycling	75 (18.8)	1016	2.54	5

Positive responses = Agree/ Strongly Agree

TWF- Total Weighted Frequency

RII- Relative Importance Index

Table 4. Analysis of Disposal Procedures of Biomedical Waste (N= 400)

Items	**Mean**	**SD**	**Factor Loading**	**Cronbach's Alpha**
Biomedical waste disposal procedures vary from one hospital to another and include				**0.830**
Burning in pits	3.903	0.9462	0.922	-
Incineration	3.968	0.7988	0.899	-
Dumping	2.870	1.1517	0.939	-
Landfill	2.500	0.7625	0.735	-
Burial	2.838	0.8990	0.814	-
Recycling	2.578	0.9226	0.755	-
Mean ± SD	**3.1095**	**0.9135**	-	-

Table 5. Association between Disposal Procedures of Biomedical Waste and Biomedical Waste Management

Biomedical Waste Management	**Disposal Procedures of Biomedical Waste**						**Total**	χ^2	**p-value**
	Burning Pit	**Incineration**	**Dumping**	**Landfill**	**Burial**	**Recycling**			
Good waste management	85 (33.3%)	94 (36.8%)	40 (15.6%)	14 (0.1%)	12 (0.0%)	10 (0.0%)	255 (100.0%)	19.4534	0.0215
Poor waste management	30 (20.7%)	25 (17.2%)	56 (38.6%)	25 (17. 2%)	5 (3.4%)	4 (2.8%)	145 (100.0%)		

Null Hypothesis (Ho): The practice of handling biomedical waste is not a significant factor in biomedical waste management. Alternative Hypothesis (Ha): The practice of handling biomedical waste is a significant factor in biomedical waste Management.

Conclusion

The study has shown that the health workers practiced some safe treatment and disposal techniques such as autoclaving, chemical disinfection, microwaving, and incineration. Also, the study revealed the poor disposal practices such as open dumping, open burning, and burial.

The study further revealed poor handling during transportation for disposal and poor temporal storage conditions.

Recommendations

The hospital waste management and infection control team should employ the use of safe, sustainable, environmental friendly techniques and technologically driven methods of treatment and disposal of biomedical wastes. Ensure maintenance of the incinerators and periodic risk assessment of the pollution in the environment.

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Conflicts of Interest

There are no conflicts of interest.

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