

## Evaluation of Health Risks of Improper Biomedical Waste Management among Health Workers in Selected Hospitals in Abuja, Nigeria

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### Abstract

*Improper biomedical wastes management could lead to health risks and environmental hazards. The study aimed to evaluate the health risks of improper biomedical wastes management among health workers. A descriptive cross-sectional study was conducted among 400 health workers across private and public hospitals in Abuja, Nigeria, using a self-developed and administered questionnaire. Analysis of the data involved descriptive and inferential statistics. The Nurses were the predominant respondents (28%), and many respondents had bachelor's degree qualifications (86%). The respondents agreed that health workers are exposed to several health risks following poor handling of biomedical wastes from the point of generation, transport, treatment, and disposal. The study revealed satisfactory practices of precautionary measures while experience, gender, and type of hospital were significantly associated with the transmission of blood-borne infections such as Human Immunodeficiency Virus (HIV) and Hepatitis B Virus (HBV) through needle pricks and injuries from sharps ( $p < 0.0001$ ). Gender and hospital type were significantly related to environmental pollution ( $p < 0.0001$ ), and work experience was significantly linked to water and foodborne infections such as cholera and typhoid ( $p < 0.0003$ ). Work experience and hospital type were significantly associated with the public health risks of improper biomedical wastes management ( $p < 0.0001$ ). Training of health workers on appropriate safety procedures of biomedical waste management is essential to prevent occupational health hazards, achieve a safe working environment, and efficient health service delivery. Government and hospital management should enforce appropriate safety measures.*

**Keywords:** *Biomedical Wastes, Health Risks, Infections, Injuries, Occupational Health Hazards.*

### Introduction

In developing nations like Nigeria, biomedical waste issues have not been given merited attention because of the limited resources competing for several national needs [1, 2, 3]. As a result, governments and health institutions have neglected biomedical waste management. Moreover, the populace is unaware of the potential health risks and environmental pollution caused by poorly handled biomedical wastes [4].

Biomedical wastes have been characterized as infectious and hazardous [5] that harbour pathogens sufficient to transmit diseases on exposure to them [6]. A relatively small portion 10-25% [7, 8] of the total waste stream generated is regarded as hazardous characterized as toxic, genotoxic, reactive, radioactive [9] to body cells, tissue, and systems, corrosive to skin, inflammable, explosive and shock sensitive [10]. Accident, carelessness, negligence, ignorance could lead to exposure to hazardous wastes with

negative health impacts with different or same outcomes. Therefore, if biomedical wastes are not appropriately managed, they can be detrimental to workers, patients, waste handlers, and the community as they are predisposed to infections, toxic effects, injuries, and environmental pollution. Consequently, the segregation of biomedical wastes at the point of generation is pivotal to proper biomedical waste management [11, 12].

Some health risks associated with improper handling of biomedical wastes include gastroenteric, respiratory, skin infections [13], and nosocomial infections. Pathogenic viruses such as Human Immunodeficiency Virus (HIV) infection, Hepatitis B and C viruses [14] have been discovered to be associated with poor management of biomedical wastes due to pricks and injuries of sharps. Biomedical wastes usually contain heavy loads of pathogenic and antibiotic-resistant microorganisms, if not properly treated and disposed of, can spread the infection to persons and the immediate environment. Skin punctures, abrasions, and cuts from sharps, including exposure to chemical irritants [5], are health hazards encountered. It is estimated that about 5.2 million people, including 4 million children die as a result of wastes related diseases [15].

World Health Organization estimates that each year there are about 8-16 million infections (32% of all new cases) of Hepatitis B virus (HBV), 2.3-4.7 million infections (40% of all new cases) of Hepatitis C virus (HCV), and 80,000 to 160,000 infections of HIV (5% of all new cases) due to injections with contaminated syringes and needles owing to improper biomedical waste management systems [16, 17].

Exposure to chemicals and radioactive wastes originating from radiotherapy, if not disposed of properly, can lead to death and severe radiation burns [18]. Also, health risks are associated with improperly treated and disposed pharmaceutical wastes such as leftovers/expired medicines and vaccines from homes and hospitals [18, 19]. Attenuated live microbes from expired vaccines

could infect waste handlers rather than cause immunity; long exposure to pharmaceuticals from the environment can harm pregnant women and children [20]. Pharmaceutical wastes have been found to contaminate surface water, drinking water, and cause acute and chronic health issues together with reproductive and cell damage [21, 22].

Often health risks and environmental hazards are associated with the release of toxic fumes like dioxins and heavy metals from disposal methods such as burning and incineration of biomedical wastes. These fumes are carcinogenic, with mutagens capable of producing adverse effects in humans even at low doses [23, 24].

The impact of health risks caused by poor management cannot be over-stressed. Health workers (e.g., doctors, nurses, sanitary staff, maintenance personnel) are not the only ones affected. Even out-patients, caregivers, visitors, support services staff (laundry), wastes handling and transportation services, workers in waste disposal facilities, and the public are all high-risk groups [6, 18, 12]. Occupational health hazards among health care workers increase morbidity, mortality, and socioeconomic loss.

Accordingly, identifying health risks associated with improper biomedical wastes management is important to create awareness about occupational health hazards, formulate occupational health safety policies and waste management policies. Therefore, it is imperative to ensure proper hygiene and sanitation in the health institutions and the safety of workers and environs [2]. These biomedical wastes require proper treatment to minimize direct exposure and harm to humans and the environment [25].

This study seeks to evaluate the health risks of improper biomedical wastes management among health workers and determine the association (if any) with gender, work experience, type of hospital, and membership in waste management teams across the public and private hospitals surveyed.

## Methods

### Study Area

The study took place in Abuja, Nigeria. According to United Nations Fund for Population Activities, UNFPA, [26] Federal Capital Territory is estimated to have a population of 3,324,000 people. Abuja consists of six Area Councils, of which Abuja Municipal Area Council is a densely populated area as the seat of government and the public services. The city harbour many private and public (district) hospitals to serve the sprawling population.

### Sample Size Determination

The researcher used Cochran's formula for calculating sample size for an infinite population [27].

$$(n_0 = z^2 pq / e^2)$$

Where:

$n_0$  = sample size

$z$  = a selected critical value of desired confidence level

$p$  = represents estimated proportion of an attribute present in the study population

$q$  =  $1 - p$

$e$  = represents the desired level of precision taking 95% confidence level with  $\pm 5\%$  precision

$p = 0.5$ ; hence  $q = 1 - 0.5 = 0.5$ ;  $e = 0.05$ ;  $z = 1.96$

$$(n_0 = z^2 pq / e^2)$$

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

$$n_0 = 384.16$$

An overage of 12% was added to the minimum sample size (384) to offset non-response, incomplete response, and late response in order to have the acceptable minimum response size for the study.

### Sampling Technique

Six (6) hospitals were randomly selected for the study, 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

system. The hospitals were lettered alphabetically to ensure anonymity/confidentiality.

### Data Collection

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

### Data Analysis

Structured self-administered and self-completed questionnaires were administered to participants to collect data for the study. The questionnaires retrieved from the respondents were verified for completeness, accuracy, and consistency. Usable 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 [28]. The ordinal data were converted to interval data (numerical data) and subjected to statistical analysis. Statistical Package for Social Sciences (SPSS Version 20.0) was used for inferential analysis.

### Results and Discussion

The study showed that the respondents were medical staff that included doctors, nurses, pharmacists, medical laboratory scientists, and other healthcare professionals. However, the predominant respondents were nurses (29.0%). This finding is consistent with the previous studies [29, 30, 31, 32] that nurses counted as the majority of the respondents. The greater proportion of the respondents were bachelor's degree holders (86%), and the finding is in conformity with the report of an earlier study [29]. The majority of the respondents work with

public hospitals, and this finding is similar to the result of previous work [33], and about half of the respondents were members of the biomedical waste management team.

The study revealed that the respondents are aware of the potential health risks, environmental hazards, and public health issues associated with improper biomedical wastes management in the hospitals. This finding is similar to the work conducted in Ondo, Osun, and Uganda respectively [30, 12, 29, 34]. The health workers may have received training that improved their knowledge and produced satisfactory practices towards biomedical waste management [35, 36] and use of job aids [29].

Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) infections, chemical irritation, Tetanus, and physical injury are health risks that health workers encounter as a result of needle pricks, injuries from sharps, spills of chemicals and negligence of safety measures. These health risks are consistent with previous reports [12, 18, 29, 37, 38].

The years of working experience significantly impacted the health risks domain of the proliferation of rodents, parasites, and vectors. The respondents with 1 to 5 years of working experience believed that rodents, parasites, and vectors are health risks associated with improper biomedical management. Regardless of gender, hospital type, and participation in the waste management team, health workers may have encountered this hazard within their few years of working in the hospital. This finding agrees with the report [33] that vector-borne disease is a health risk encountered by health workers.

The gender, years of working experience, and hospital type had an effect on the health risks domain of transmission of typhoid and cholera, while membership of the biomedical wastes management team did not affect the apparent transmission of typhoid and cholera. The result showed that male health workers with more than 15 years of working experience in public hospitals believed that the transmission of

typhoid and cholera are health risks associated with improper biomedical wastes management. Typhoid and cholera are classified as health hazards that could occur due to the long exposure of health workers to contaminated food, water, and poor hygienic practices in the working environment [34].

The gender, years of experience, and type of hospital had an effect on the risk domain of hepatitis and HIV through injuries from sharps and needle pricks contaminated with human blood, while membership of the hospital waste management team did not. The result showed that male health workers with more than 15 years of experience in public hospitals believed that hepatitis and HIV through injuries from sharps and needle pricks contaminated with human blood are health risks associated with improper biomedical wastes management. This finding is consistent with the previous reports [14, 29, 39] that health workers are at high risks of blood-borne infections. Health workers are unavoidably exposed to poorly managed sharps and needle pricks [33, 30]. Hepatitis B Virus (HBV) infection was among the early occupational health hazards that affected health workers, and its incidence rate was 386 cases per 100,000 populations which implies higher risk [40].

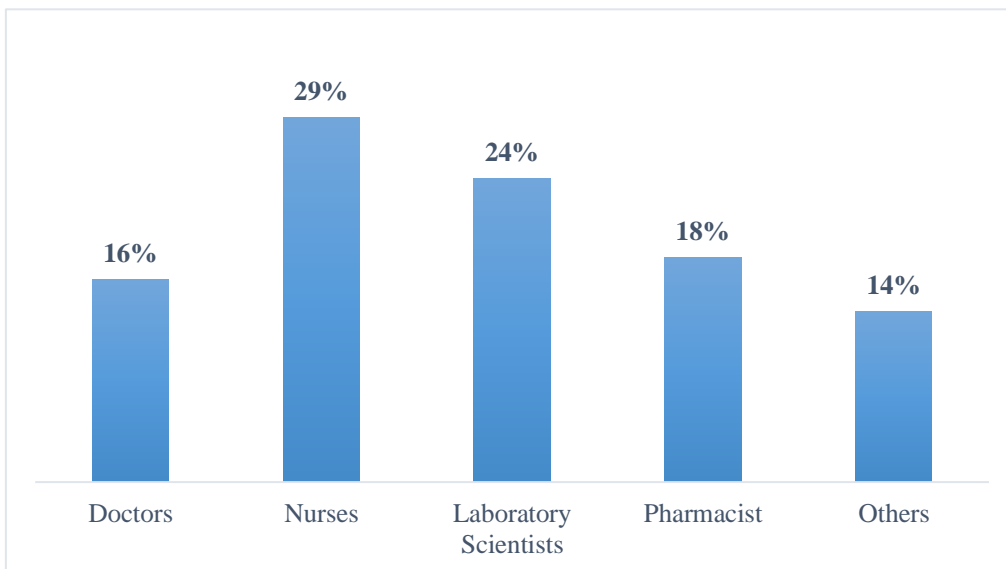
The health risk domain of environmental pollution and the unpleasant smell was affected by gender, type of hospital, and membership of the hospital waste management team, while years of experience did not. The result showed that male health workers in public hospitals that are not members of the waste management team believed that environmental pollution and unpleasant smell are among health risks of improper biomedical wastes management. This finding agrees with the reports from previous studies conducted in Tanzania, and Nigeria [3, 24, 41] that improper treatment and disposal practices of biomedical wastes can cause environmental pollution. The male workers, irrespective of years of working experience, may be at higher risk as they are typically involved in

the handling of biomedical wastes, especially the treatment and disposal procedures.

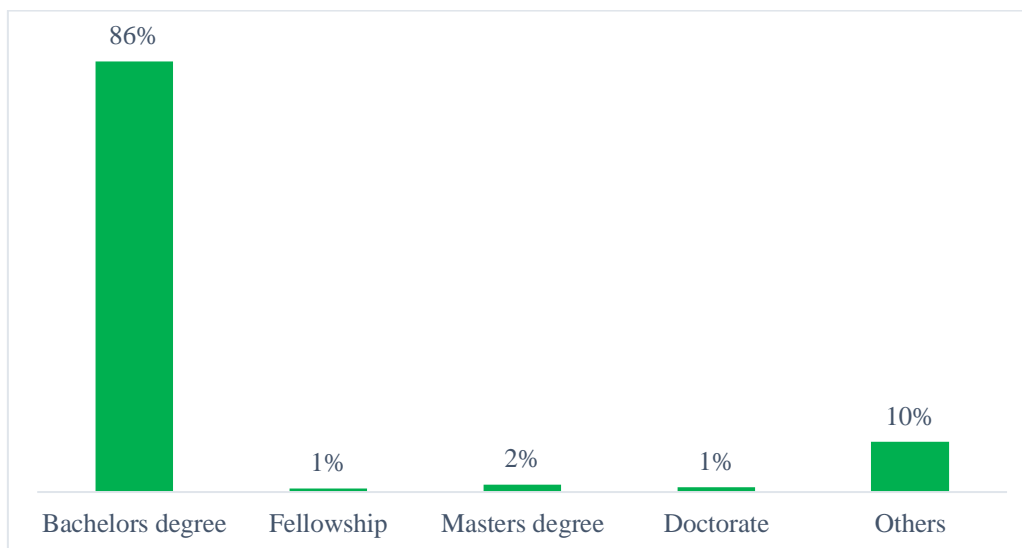
Working experience, type of hospital, and membership of waste management team had an effect on the domain of public health risks while gender did not. The result showed that health workers with over 15 years of experience in public hospitals that are not members of the waste management team believed that public health risks are associated with improper biomedical waste management.

Both male and female health workers who have worked over the years, especially in public hospitals, would have experienced either biological or non-biological risks. Notably,

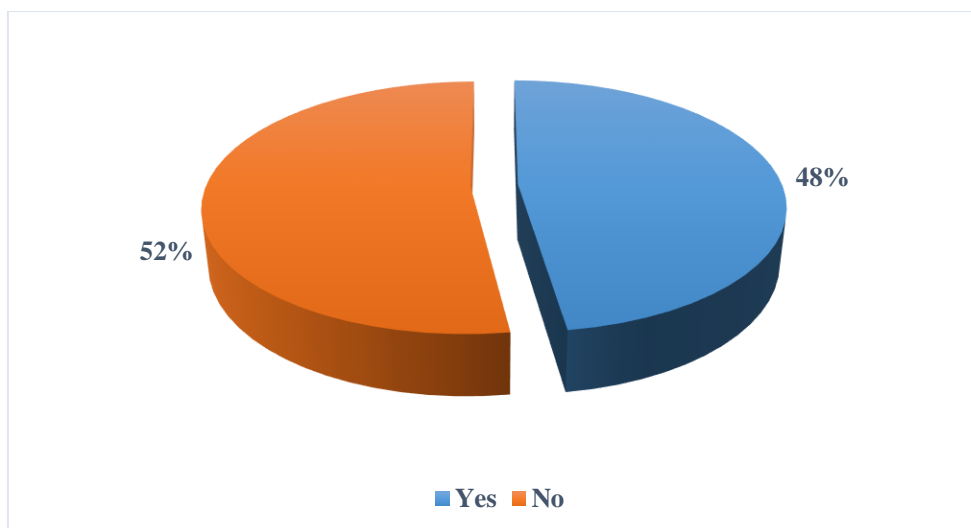
hospital-acquired infections (nosocomial infections) and blood-borne infections have increased the incidence of hospital stay and morbidity among the general population [3]. The study showed that the respondents were highly aware of the safety and precautionary measures. The respondents agreed that training on proper biomedical waste management was important and agreed to using personal protective equipment (PPE). The finding agrees with the reports of previous work [29, 34] that health workers were trained, aware of the safety and precautionary measures, and exhibited satisfactory practices in order to forestall occupational health risks.



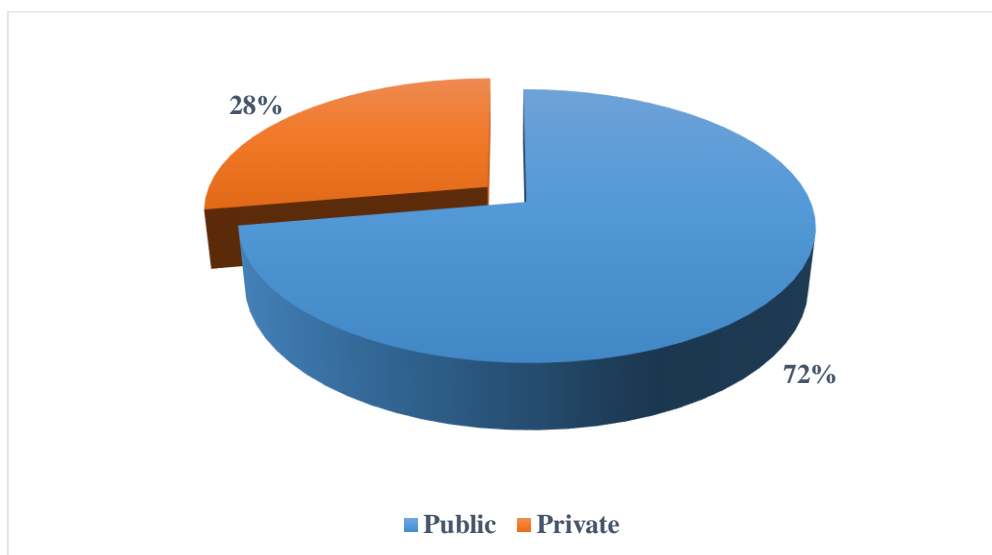
**Figure 1.** Job Category/ Profession of Respondents (N= 400)



**Figure 2.** Highest Educational Qualification of Respondents (N= 400)



**Figure 3.** Membership of Biomedical Waste Management Team (N= 400)



**Figure 4.** Types of Hospital where Respondents are Working (N= 400)

**Table1.** Health Risks of Improper Biochemical Wastes Management (N= 400)

Items	Positive Responses
	Frequency N (%)
Growth and multiplication of vectors like insects, rodents and parasites	392 (98.0)
Transmission of diseases like typhoid, cholera	350 (87.5)
Hepatitis and AIDS through injuries from syringes and needles contaminated with human blood	392 (98.0)
Environmental pollution and unpleasant odour	386 (96.5)
Public health risk	370 (92.5)

Positive responses = Agree/ Strongly Agree

**Table 2.** Effect of Socio-Demographic Characteristics on Health Risks of Improper Biomedical Wastes Management (N= 400)

Items		Gender		Years of Experience				Hospital Setting		Membership of Biomedical Waste Management Team	
		female	male	1-5	6-10	11-15	16&above	Public	Private	Non-member	Member
Growth and multiplication of vectors like insects, rodents, and parasites	No	13	13	13	40	67	72	143	55	51	45
	Yes	167	207	80	41	27	60	146	56	158	146
	P-value	0.4143		<0.0001				=1.000		0.4752	
Transmission of diseases like typhoid, cholera	No	13	13	13	27	26	14	41	52	39	40
	Yes	167	207	80	54	68	118	248	59	170	151
	P-value	<0.0001		0.0003				<0.0001		0.4508	
Hepatitis and AIDS through injuries from syringes and needles contaminated with human blood	No	34	14	13	27	26	14	27	52	62	54
	Yes	146	206	80	54	68	119	267	59	147	137
	P-value	<0.0001		<0.0001				<0.0001		0.6630	
Environmental pollution and unpleasant smell	No	26	15	27	27	26	28	69	52	53	45
	Yes	154	205	66	54	68	91	220	59	156	146
	P-value	<0.0001		0.4733				<0.0001		0.0003	
Public health risk	No	13	14	13	41	26	13	41	52	48	45
	Yes	167	206	80	40	68	119	248	59	161	146
	P-value	0.6880		<0.0001				0.0001		0.0003	

## Conclusion

The study has revealed that health workers are aware of the health risks of improper biomedical wastes management and the precautionary measures. The health risks of improper biomedical wastes management affect male health workers in public hospitals with long years of working experience than others. Thus, indicating that the male health workers are more involved in the handling of biomedical wastes, making them vulnerable to infections and other health hazards.

## Recommendations

Health managers and health policymakers should organize training and workshops for health workers on safety measures and the

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consequences of improper biomedical wastes management. Hospital management should ensure an adequate supply of personal protective equipment and enforce their use. The vaccination, use of personal protective equipment, and practicing universal precautionary measures is crucial in health risks prevention and control.

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## Conflicts of Interest

The authors declare that no conflicts of interest exist.

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