Assessment of Healthcare Waste Management Strategies in Selected Hospitals in Abuja, Nigeria

Agbanusi Uchechukwu Jonathan
Research Student in Doctor of Public Health Administration, Department of Public Health Administration, Texila American University, Georgetown, Guyana, South America

Abstract

Improper healthcare waste management practices, capable of contributing to poor human health and negative environmental impacts, inundate Abuja hospitals. Therefore, the purpose of this study is to assess risk perceptions and awareness among healthcare workers handling hospital waste in Abuja, Nigeria. In this study, mixed methods design of quantitative approach using cross-sectional study and qualitative approach using descriptive case study were applied to explore the risk perceptions and awareness of healthcare waste handlers within the four selected (two public and two private) hospitals in Abuja. Coding and analysis of the quantitative and qualitative data helped in triangulation, which improved the quality of work. Major trends found through investigations, include that: most Abuja hospitals were fraught with poor healthcare waste management practices; healthcare waste attendants handling hospital waste in Abuja seldom appreciate the danger involved; there exists risky exposures of hospital waste to human health; coupled with negative environmental impacts. Summary of interpretation for the study points at improper healthcare waste management practices.

Keywords: Environmental impacts, Healthcare waste management, Healthcare workers, Human health, planned behaviour theory, Risk perception, social care, Waste Management Theory.

Introduction

Proper management of healthcare waste in any given society is an essential part of ensuring that health and social care activities do not pose a risk of infection to man and the environment. Therefore, healthcare wastes if not properly managed can constitute a greater threat than the original diseases themselves [1]. Hence, because of the potential health problems associated with the management of healthcare wastes, it has continued to generate increasing public interest [2-4]. Besides, if healthcare activities that generate infectious healthcare waste (IHCW) are poorly managed, then, they could constitute risks to both humans and the environment [5]. Although, the amount of IHCW generated in most healthcare facilities (HCF) is minimal compared to the total amount of other types of waste generated in most communities, even so, considering their potential risks, there is growing concern for its management [6]. Most especially, as the levels of knowledge and attitudes towards waste management practices by the clinical staff in developing countries are often low [7, 8]. Unfortunately, most of these developing countries have not been able to manage healthcare waste to satisfactory degrees of safety [9]. The main reason is that proper management of healthcare wastes in those countries have received less attention and the priority it deserves [10].

However, this study was anchored by two theories that formed its theoretical basis: the waste management theory (WMT); a unified body of knowledge on waste and waste management, propounded by [11] to channel environmental sciences into engineering design; and also the theory of planned behavior (TPB),

developed by [12, 13], as a general model to predict and explain behavior across a wide range of different types of behaviors, including healthcare waste management operations.

Therefore, the first active step in this study is to seek answers to the research questions, which are given thusly:

RQ 1: How to do low-level risk perceptions in terms of knowledge and practices among healthcare workers in Abuja hospitals cause adverse human health and negative environmental impacts?

RQ 2: What preventive strategic measures should healthcare workers in Abuja hospitals take against potential human health challenges and negative environmental impacts?

Moreover, the overall objectives of this healthcare waste management study are to:

1. assess the level of risk perceptions and awareness of health workers regarding healthcare waste management (HCWM) within both public and private hospitals in Abuja, Nigeria.

2. assess the current waste management practices within the four selected hospitals to identify any potential human health and environmental impacts resulting from the handling of healthcare waste at the site.

3. assess the level of compliance with the best practices for the sustainable management of healthcare wastes and recommend appropriate handling and disposal measures.

The rationale for this study is based on an issue of topical relevance. Therefore, the aim of this study was to assess the risk perceptions in terms of knowledge and practices of HCW with regards to HCWM within the selected hospitals in Abuja urban areas. This site was chosen because it had not previously been studied within the selected hospitals in Abuja. Very few studies have paid close attention to urban healthcare waste management in both public and private hospitals in Abuja, hence, the need for this study. Most of these hospitals seldom care about any form of pre-treatment of medical waste before disposal. Rather, they allow their healthcare waste to be disposed alongside the municipal wastes stream, thereby rendering all other types of waste produced in these hospitals hazardous and infectious.

Research Methodology

It could be noted that various methodologies have been used all over the world to assess and quantify healthcare waste (HCW). These methods include but are not limited to the use of physical observation, questionnaire administration and quantification [14-16]. Moreover, [17], states that multiple techniques of data collection can lead to 'deeper insight into the phenomenon under study.' Therefore, this methodology section reveals the approach to explore the topic while it also allows the reader to critically evaluate the study's overall validity and reliability. The healthcare wastes management system in Abuja hospitals pose significant public health concerns; their existing methods showed lack of due diligence to discourage commingling of hazardous and non-hazardous wastes generated at these hospitals. Therefore, this research employed mixed methods design comprising of both quantitative and qualitative approaches to thoroughly explore the study.

For the quantitative approach, a cross-sectional study design was used among 210 professional and non-professional staff. Data were collected with questionnaires that were analyzed using quantitative analytical method that involved computational and statistical analysis. The Chi square test was applied to judge the association of study variables with their perceptions and knowledge. While the qualitative approach was also applied using the exploratory case study design where interview guide was used to collect personal interviews of 12 purposively selected participant healthcare workers that were used as informants. The two research approaches fit into the overall research design for the study as both approaches explore the research work in detail.

Using the cross-sectional study design, data was collected from many different individuals at a single point in time, and only the variables were observed as exposure status were not altered. Therefore, a population-based survey was applied to assess the prevalence of healthcare workers that handle medical waste, as well as the exposure and the outcomes at the same time. The 210 participants in this cross-sectional study were selected based on the inclusion and exclusion criteria set for the study. For the qualitative approach, an exploratory case study was used. The case study was applied as an intensive, systematic investigation of the 12 participant healthcare workers examined for in-depth data, based on several variables that made the study findings grounded in participants' experiences.

Additionally, observational research technique was applied to watch the participants' ongoing behavior towards healthcare waste handling at those facilities investigated, as photographs of the phenomenon were taken at their natural settings. This method section further explored in detail, other relevant issues with the following sub-headings:

Study Area

The setting for this study was based on the four selected hospitals (two public and two private) located within the Abuja municipal - urban area. The selection of hospitals from the municipal area of Abuja was based on the prevailing general waste disposal system in the municipality that is below the standard practice. In most places within the urban area, healthcare waste was not separated from the general municipal waste stream. Some hospitals in Abuja municipality are without comprehensive waste treatment mechanism and disposal system, such as lack of incinerators, hence, they resort to open dumping of healthcare waste in the communities. Sadly, those scavenging the open dumps for recyclable materials are unaware of the harmful consequences of exposure to the contaminated and hazardous waste [18].

Therefore, scavengers who collect items can spread many components of the trash within the surrounding area, and risk the community's health, which negates the principle of sustainable waste management that tends to reduce adverse effects of waste on human health, the environment, planetary resources, and aesthetics [19].

Study Population

Research design parameters of this study were based on the characteristics of the study population. This study's population involved the healthcare waste workers (HCW) from the selected two public and two private hospitals in Abuja. A mixed methods approach was used in this study, where quantitatively, a calculated sample size of 210 participants out of a total population of 460 healthcare workers were selected as respondents as systematic sampling technique was applied. Respondents were stratified into three groups to ensure representation of all categories of healthcare workers (HCW) within the hospitals under study. In total, these categories of healthcare workers and their respective number of respondents were: (i) Medical doctors (40), (ii) Nurses (80) and (iii) Healthcare waste handlers (90) making a total of 210 respondents from the four hospitals. While qualitatively, personal interviews of other purposively selected 12 participant healthcare workers were used as informants respectively.

Sample Size

Sample size is a term commonly used in market research that refers to the number of respondents to a survey. The Sample size of this study is =210. The sample size was calculated using Andrew Fisher's Formula for sample size calculation.

Study Tools

To understand the general characteristics of this study population, two different survey data collection tools were used to obtain both quantitative and qualitative data. Questionnaires

were used for quantitative data collection, while the qualitative data was obtained using the interview guide tool, containing open ended questions.

The interview guide questions were served to the 12 participants who acted as informants that gave more in-depth views and understanding of the study topic, based on their personal experiences.

Data Analysis

The use of mixed methods approach in this study necessitated the analysis of data that involved methodological triangulation of both quantitative and qualitative data to enhance the validity, to create a more in-depth picture of this research problem, and to interrogate different ways of understanding the problem. Hence, as the use of qualitative method emphasized in-depth knowledge, quantitative method emphasized objective measurements and statistical analysis of data. The quantitative data were analyzed using the IBM-SPSS version 23 analysis package.

Method and Procedure of Data Analysis

Data collected were entered, coded, and analyzed using Statistical Package for Social Sciences (SPSS) version 23. The study employs descriptive analysis and inferential analysis methods. The descriptive analysis includes frequencies, percentages, and charts, while the inferential analysis include a chi-square test.

Chi-square Analysis Technique

The study also adopts chi-square analysis method (a non-parametric test) to assess the significance of the respondents' views as well as testing for association between set of variables. The Chi-square statistic is stated as follow:

$$\chi^2 = \sum_i \sum_j \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

where O_{ij} is the observed value (the actual count of cases in each cell of the group); E_{ij} is the expected value (calculated below). Thus,

$$E_{ij} = \frac{M_R \times M_C}{N}$$

where E_{ij} represents the cell expected value, M_R represents the row marginal for that cell, M_C represents the column marginal for that cell. N represents the total sample size.

Results of Data Analysis and Discussion

This section discusses the analysis of results obtained from the study. This includes the descriptive analysis of the respondents' characteristics and opinions, followed by chi-square analysis to assess the significant, relationship between healthcare workers' duration of experience and their perceptions in terms of healthcare waste management knowledge, its impact on human health and the environment.

All sub-sections have individual interpretations in the context of the study and analyses carried out with respect to all forms of respondents' responses in percentages and all data were analyzed using IBM-SPSS version 23 analysis package.

Background Assessments of the Respondents (Quantitative)

Table 1. presents the demographic information of the participated healthcare workers (respondents). Table 1. reveals that just above half (52%, n=110) of the respondents were female. Also, the results show that one-fourth (26%, n=55) of respondents were between age 41-45years and significant minority (21%, n=44) of them were between age 26-30 years as well as age 36-40 years. Additionally, Table 1. depicts equal proportions of medical professions i.e., doctors, nurses, and healthcare waste handlers for both public and private hospitals under survey.

Lastly, the medical professional experience duration of the respondents presented in Table 1 shows that the majority (81%) of them had above 6 years of professional experience. The background assessments of the respondents

indicate that the respondents are appropriate and highly experienced, hence they have the versatile requisite knowledge to provide the required answers to the administered questionnaire.

**Table 1.** Demographic Data of the Respondents

Respondents	Frequency	Percent (%)
Male		
Male	100	47.6
Female	110	52.4
Age Group		
20-25 Years	21	10.0
26-30 Years	44	20.9
31-35 Years	36	17.2
36-40 Years	44	20.9
41-45 Years	55	26.2
Above 45 Years	10	4.8
Medical Profession		
Doctors from Public hospitals	20	9.5
Nurses from public hospitals	40	19.1
Healthcare waste handlers from public hospitals	45	21.4
Doctors from private hospitals	20	9.5
Nurses from private hospitals	40	19.1
Healthcare waste handlers from private hospitals	45	21.4
Professional Experience Duration		
1-5 Years	40	19.1
6-10 Years	55	26.2
11-15 Years	44	20.9
16-20 Years	45	21.4
Above 20 Years	26	12.4

Source: Field Survey 2022

Descriptive Analysis of Participants' Responses

Furthermore, Figure 1. to Figure 7. present the assessment of the respondents' knowledge and awareness of healthcare activities and the impacts of those activities on healthcare workers with regards to healthcare waste management from the sampled four hospitals. According to Figure 1. results, most of the respondents had the knowledge about HCW segregation and handling in the hospitals except for healthcare waste handlers from the public hospitals with just below half (49%) had the knowledge. Also, Figure 2. which presents the assessment of respondents about their awareness of HCW storage areas, the figure reveals that most of the respondents were aware of HCW storage areas, however significant minority of doctors (40%) and nurses (45%) from public hospitals as well as nurses (37%) from private hospitals were not aware of the HCW storage areas. Thus, the doctors and nurses from public hospitals as well as nurses from the private hospitals need to be enlightened with regard to HCW storage areas.
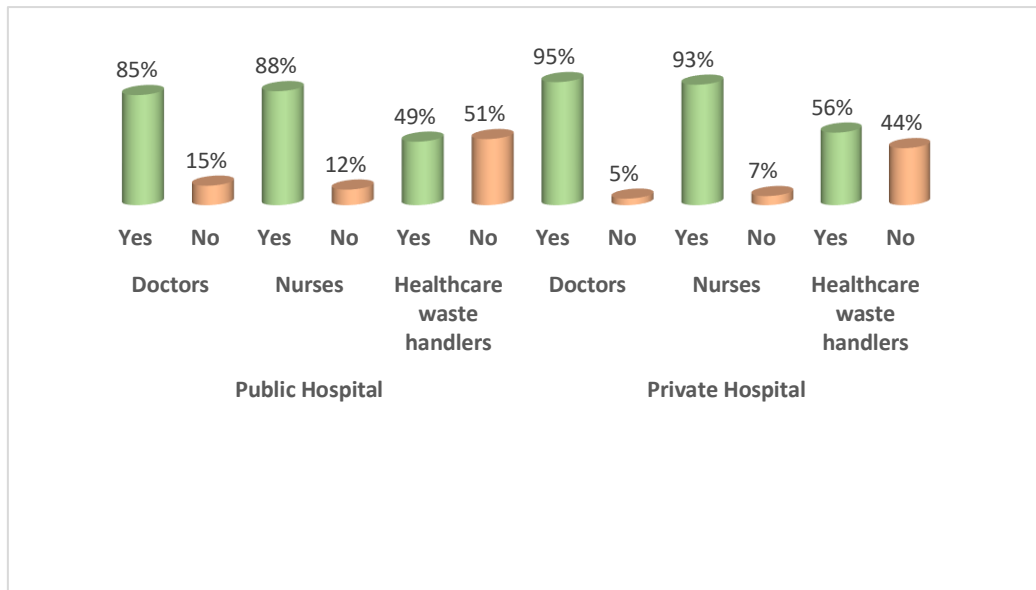
**Figure1.** Have Knowledge about HCW Segregation and Handling
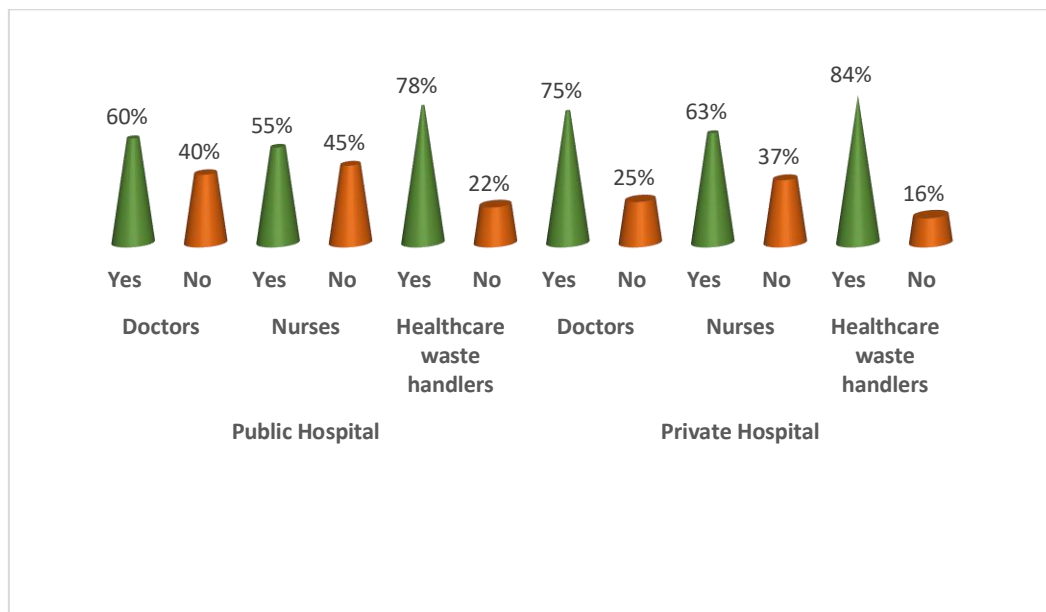
Figure 2. Awareness of HCW Storage Areas

Similarly, Figure 3 presents the assessment of respondents about their awareness of HCW final disposal sites. The results depict that most of the nurses (private hospitals = 60%) and healthcare waste handlers (public hospitals = 67%, private hospitals = 76%) acknowledged to know the HCW final disposal site, as well as just above half of private hospitals' doctors (55%) and public hospitals' nurses (55%) were aware of the HCW final disposal site. Howbeit, most of the public-hospitals doctors (60%) had no knowledge of HCW final disposal site. Besides,

Figure 4. depicts the assessment of respondents about their knowledge of HCWM regulations, code of conduct in practice. The results reveal that majority of doctors (public-hospitals = 80%, private-hospitals = 100%) and nurses (public-hospitals = 88%, private-hospitals = 80%) had the knowledge of HCWM regulations, code of conduct in practice, however most of the healthcare waste handlers (public-hospitals = 56%, private-hospitals = 61%) had no knowledge of HCWM regulations, code of conduct in practice. Therefore, these empirical

findings reveal that most of the public-hospitals doctors had no knowledge of HCW final disposal site, likewise most of the healthcare waste handlers had no knowledge of HCWM regulations, code of conduct in practice.
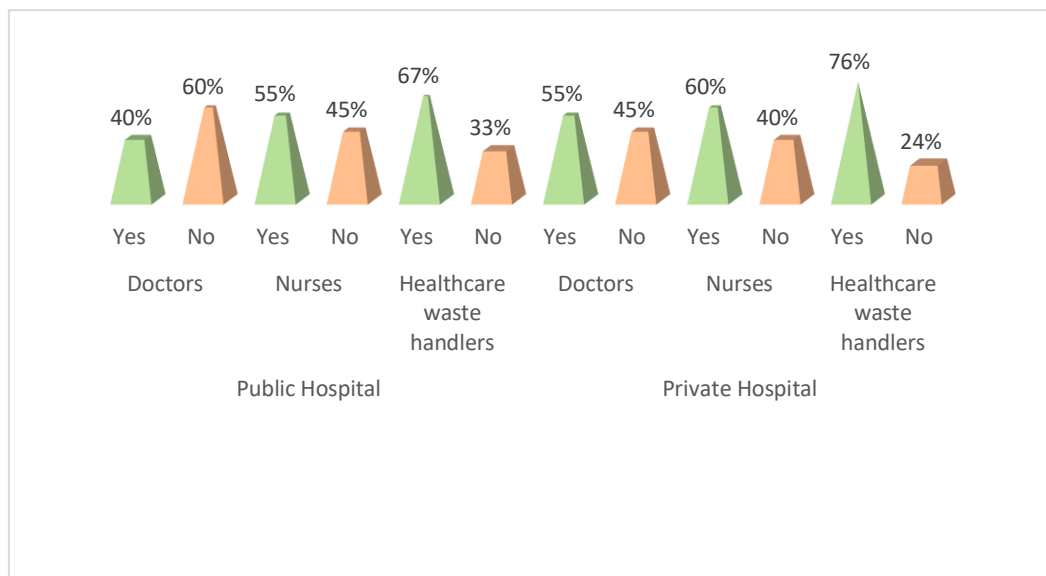

**Figure 3.** Knowledge of HCW Final Disposal Site
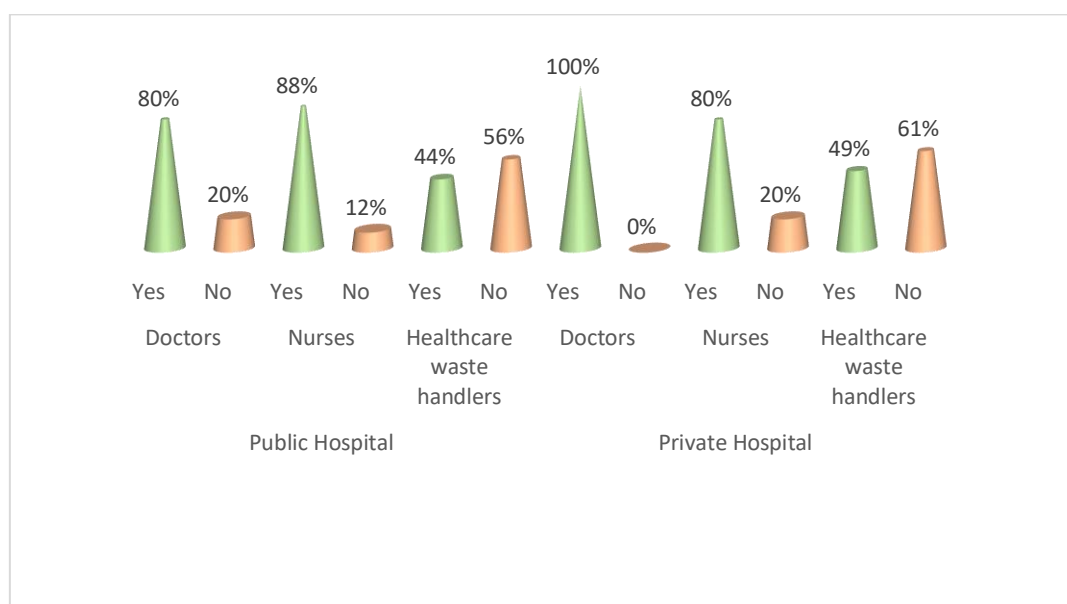
Figure 4. Knowledge of HCWM Regulations, Code of Conduct in Practice

Moreover, Figure 5. presents the reported cases of needle stick injuries among the surveyed healthcare workers. The results show that reported cases of needle stick injuries were higher among the healthcare waste handlers (public-hospitals = 29%, private-hospitals = 26%) and nurses (public-hospitals = 18%, private-hospitals = 16%) than the doctors. Also, Figure 6. presents the recorded hepatitis B & C infection rates among the surveyed health workers. Similar to the findings in Figure 5, Figure 6. reveals that recorded hepatitis B & C infection rates were higher among the healthcare waste handlers (public-hospitals = 37%, private-hospitals = 30%) and nurses (public-hospitals = 13%, private-hospitals = 10%) than the doctors. Hence, the empirical findings in this section deduce that needle stick injuries and hepatitis B & C infection are higher among the healthcare waste handlers and nurses than the doctors.
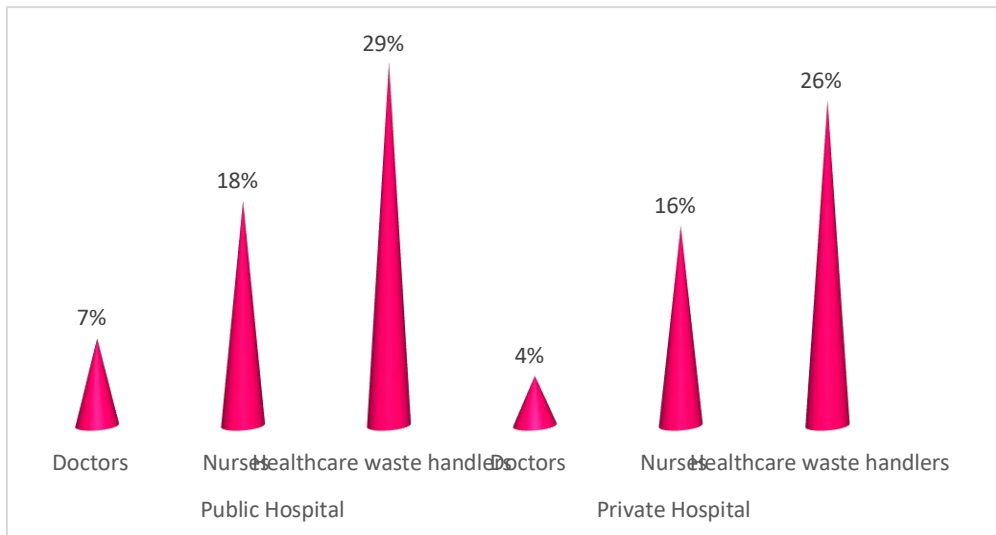
Figure 5. Reported Cases of Needle Stick Injuries
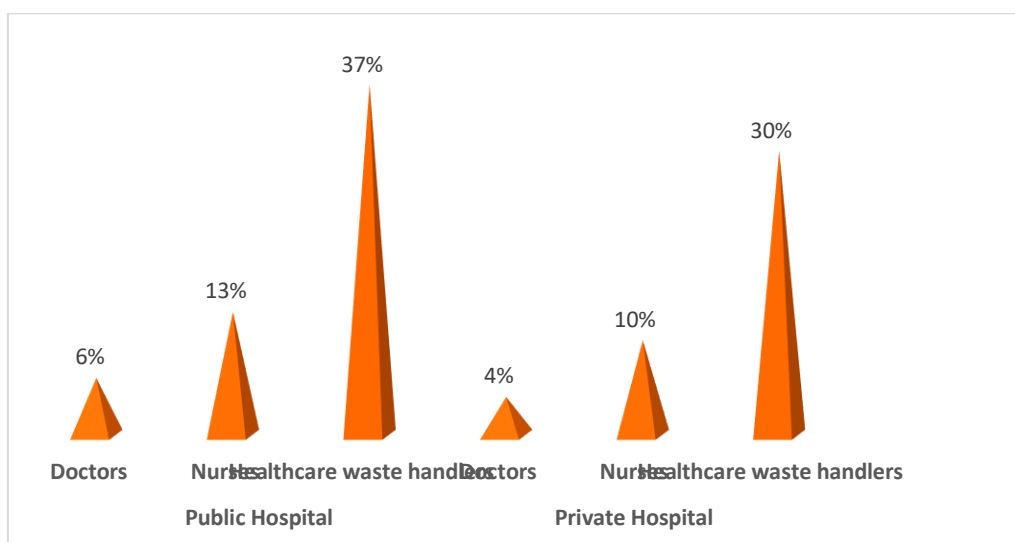
Figure 6. Recorded Hepatitis B & C Infections Rate
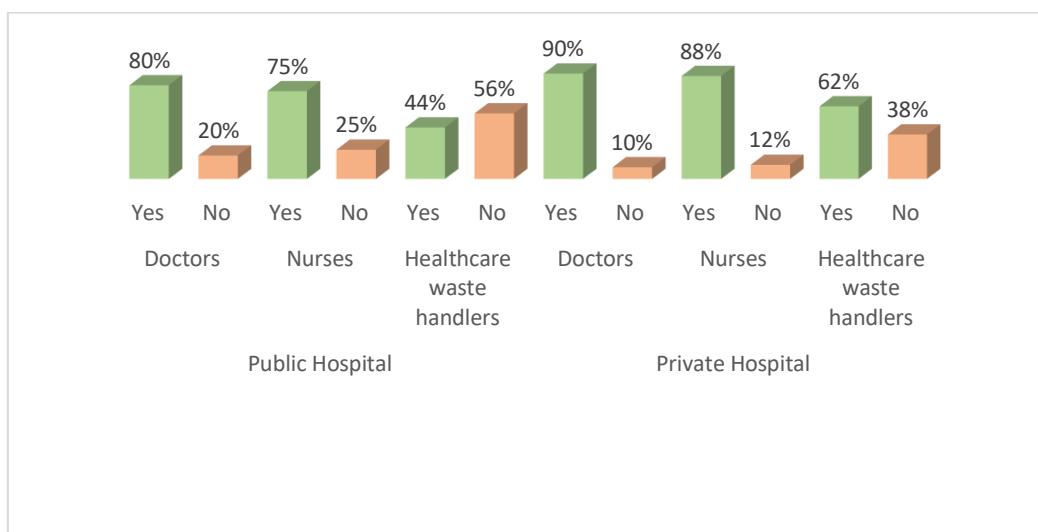
Figure 7. Knowledge of HCW Policy Budget

In addition, Figure 7. presents the assessment of respondents' knowledge about HCW policy budget. The results reveal that most of the categories of respondents were aware of HCW policy budget, howbeit more than half (56%) of the healthcare waste handlers from public-hospitals were not aware of HCW policy budget, which shows lack of adequate involvement, training, and insufficient dissemination of information within this category of healthcare workers.

Assessment of the Association between Health Workers' Knowledge, Healthcare Activities and Professional Experience Duration

Table 2. presents the Chi-square analysis results of the dependency relationship between the HCW management knowledge and health worker's professional experience duration. According to the results, all the assessed levels of HCW management knowledge; "HCW segregation and handling", "Awareness of HCW storage areas", "HCW final disposal site", and "HCWM Regulations, code of conduct in practice" returned with significant association with respondents' professional experience duration. Thus, the HCW management knowledge is dependent of health workers professional experience duration.

Explicitly, the results reveal that higher number of respondents (56%) with 1-5 years of professional experience significantly (i.e., since $0.003 < 0.05$) had no knowledge about HCW segregation and handling. Also, Table 2. depicts that higher proportion of respondents (95%) with low-level of professional experience (1-5 years) significantly (i.e., since $0.001 < 0.05$) had no knowledge of HCW storage areas. In addition, the results further reveal that higher respondents with low-level of professional experience (1-5 years) significantly had no knowledge of HCW final disposal site (56%) and HCWM Regulations, Code of conduct in practice (92%). Thus, the results in Table 2. infer that low-level of HCW management knowledge among the health workers significantly associated with the health workers low professional experience (1-5 years). This implies new table for their easy assessment as shown below:

Furthermore, Table 3. presents the Chi-square analysis results of the dependency relationship between the adverse human health among the health workers and the HCW management knowledge.

According to the results, the assessed adverse human health; "Reported cases of needle stick injuries", and "Recorded hepatitis B & C infections rate" returned with significant association with the respondents' HCW management knowledge in Table 2. above. Therefore, the reported/recorded adverse human health among the health workers significantly is dependent on health workers' HCW management knowledge.

Moreover, while Table 3. depicts that health workers with no HCW management knowledge significantly had higher reported cases of needle stick injuries and hepatitis B & C infections, the results further clearly reveal that higher number of healthcare waste handlers (public-hospitals = 25%, private-hospitals = 23%) who had no HCW management knowledge were significantly (i.e., since $0.000 < 0.05$) reported with cases of needle stick injuries.

Similarly, Table 2. also reveals that higher number of healthcare waste handlers (public-hospitals = 33%, private-hospitals = 23%) who had no HCW management knowledge were significantly (i.e., since $0.000 < 0.05$) reported with hepatitis B & C infections. Thus, these empirical findings infer that adverse human health such as cases of needle stick injuries and hepatitis B & C infections are associated with health workers (particularly the healthcare waste handlers) who had no HCW management knowledge.

In all cases the significance level adopted was $p < 0.05$.

Table 2. Assessment of the Association between HCW Management Knowledge and Health Workers Professional Experience Duration

Variables	Perceptions Categories	Health Workers Professional Experience Duration					Chi-square [P-value] DF
		1-5 Years	6-10 Years	11-15 Years	16-20 Years	Above 20 Years	
Knowledge about HCW segregation and handling	Yes	6%	17%	10%	30%	37%	15.193 [0.003*] DF=4
	No	56%	33%	11%	0%	0%	
Awareness of HCW storage areas	Yes	9%	18%	19%	19%	35%	15.98 [0.001*] DF=4
	No	95%	3%	2%	0%	0%	
Knowledge of HCW final disposal site	Yes	12%	20%	20%	24%	24%	15.058 [0.004*] DF=4
	No	56%	22%	11%	11%	0%	
Knowledge of HCWM regulations, Code of conduct in practice	Yes	10%	16%	20%	21%	33%	14.072 [0.009*] DF=4
	No	92%	5%	2%	0%	0%	

H0: HCW Management Knowledge is Independent of Health Workers Professional Experience Duration

Note: * denotes significant at 0.05 level

Source: Researcher's compilations from IBM-SPSS 23 Outputs

Table 3. Assessment of the Association between HCW Management Knowledge and Adverse Human Health among the Health Workers

Variables	Knowledgeable of HCW Management	Public Hospitals			Private Hospital			Chi-square [P-value]
		Doctors	Nurses	Healthcare waste handlers	Doctors	Nurses	Healthcare waste handlers	
Reported cases of needle stick injuries	Yes	0%	0%	11%	0%	0%	9%	22.116
	No	9%	11%	25%	3%	9%	23%	[0.000*] DF=5
Recorded hepatitis B & C infections rate	Yes	0%	0%	8%	0%	3%	5%	15.898
	No	6%	12%	33%	4%	6%	23%	[0.000*] DF=5

H0: The Adverse Human Health among the Health Workers is Independent of HCW Management Knowledge

Note: * denotes significant at 0.05 level

Source: Researcher's compilations from IBM-SPSS 23 Outputs

Results of the Qualitative Analysis

The qualitative results from the interviews conducted among the 12 purposively selected participants from the four hospitals (two public and two private), showed that about 60% of the interviewees in the HCF agreed that they have knowledge of the components of healthcare waste but often that they do neglect the inherent danger it portends. For example, a HCW stated that, "We are committed to our jobs, but the non-compliance often comes from most HCW as there is no segregation of wastes at source i.e., in different categories such as domestic waste and other types of hospital waste e.g., sharps and non-sharps wastes." In the same vein, a nurse stated that, "I think, first of all, we need to be well informed about HCWM and then we can conduct a campaign to raise the awareness about the hazards of sharps and contaminated materials like cotton wools and bandages in the healthcare wastes".

Also, a doctor retorted, "Healthcare waste handlers have very low knowledge, for example, about the dangers of NSIs, and it is our responsibility to take action if we are to curb this latent danger and reverse its destructive effects on both human health and the environment." The interviewees attributed the practice of mixing of all types of waste together to many reasons:

1. Lack of healthcare waste management (HCWM) experts within the hospitals.
2. No dedicated department to deal with HCWM, i.e., that can monitor, evaluate, and take appropriate actions as at and when necessary.
3. No enforced policy in place, such as colour coding and labelling for waste disposal.
4. Lack of resources, i.e., shortage of safety boxes and insufficient budget for HCWM.
5. The decision makers are perhaps not aware of the cost effectiveness of training i.e., through training, the knowledge about the segregation and recycling of waste will increase.
6. Lack of training, especially among healthcare waste handlers. According to the interviewees, the key reasons for limited training are included.
7. Limited budgets for training purposes, in addition to the inefficient management of the allocated budget.

Conclusions

The conclusions below helped to check if the study met the overall objectives, based on the results of the analysis.

The result of Chi-square analysis of the dependency relationship between the healthcare workers' management knowledge and their professional experience duration in Table 2 above confirms that the healthcare workers' management knowledge is dependent on their professional experience duration. Therefore, the analysis supports the study's objective number (i), which was to assess the level of risk perceptions and awareness among HCW with regards to healthcare waste management within both public and private hospitals in Abuja. The analysis shows that the consequences of the analyzed low levels of HCW management knowledge, based on the; "HCW segregation and handling", "Awareness of HCW storage areas", "HCW final disposal site", and "HCWM Regulations, code of conduct in practice" were all influenced by the respondents' professional experience duration.

Based on the results from the empirical study, observations and the interviews conducted with the healthcare workers (HCW) from the four selected hospitals in Abuja, it is crystal clear that poor management of healthcare waste by the HCW pose negative impacts on humans and the environment. Hence, the analytical outcome of this study lends credence to its objective number (ii) as it identified at the sites the human health and environmental impacts that resulted from the handling of healthcare waste by the HCW. The impacts on humans include injuries, blood borne pathogens (BBP); which are pathogenic microorganisms that are present in human blood;

and other potentially infectious materials (OPIM) that can cause diseases such as hepatitis B (HBV), hepatitis C (HCV) and human immunodeficiency virus (HIV) while pollution of soil, air and water resources are evidence of environmental impacts.

Based on the results from their personal experiences, the perceptions of the 12 participants in the qualitative interviews that gave more in-depth views and understanding of the study topic, it was found that the Municipal authority were not encouraging waste separation in the hospitals in Abuja. Therefore, this confirms the study's objective number (iii) that was meant to assess the level of compliance with the best practices for the sustainable management of healthcare wastes.

Recommendations

Owing to the noted impacts on human health and the environment from this study, it is pertinent to recommend as follows:

1. That the situation necessitates that urgent action be taken by all involved parties: the HCW, decision-making staff at all levels of the hospital management, and the supervisory agency of the government.

2. The mass media should also sensitize the general public and raise their awareness level on environmental risks associated with improper management of medical waste.
3. The colour coding and labelling for waste disposal should be put in place and implemented to improve HCWM.
4. That the initiatives to raise awareness among HCW and the public through education, training, and the launching of campaigns through posters, brochures, media sessions, etc. should be prioritized by hospital owners and operators [20].
5. That the appropriate training and supervision in HCWM is needed to ensure proper handling and disposal of healthcare waste by HCW as poor practices were common sight in a few public and private hospitals in Abuja urban area.

Suggestions for Future Research

There is a need for further studies to be conducted on other aspects of medical waste, not covered by this study, to generate a comprehensive pool of much-needed baseline data in other local governments and the whole Nigeria.

References

[1] Path 2009 Achieving effective sharps waste management in GAVI host countries. A proposed approach with estimates of cost 2006 http://.www.Path.org/files/TS_ach_eff_swm.pdf.

[2] Tudor, Terry (2005). Towards the development of a standardised measurement unit for healthcare waste generation. Journal of Resources, Conservation and Recycling. DOI - 10.1016/j.resconrec.2006.06.007.

[3] Ferreira A.P., Veiga MM (2003). Hospital waste operational procedures: A case study in Brazil. Waste Manage. Res., 21: 377-382.

[4] Da Silva CE, Hoppe AE, Ravanello MM, Mello N (2005). Medical waste Management in the south of Brazil. Waste Manage. 25: 600-605.

[5] WHO (1985). Management of waste from hospitals and other health care establishments.

[6] Report on a WHO meeting, Bergen, 28 June–1 July 1983. Copenhagen, World Health Organization Regional Office for Europe (EURO Reports and Studies, No. 97).

[7] Gai, R.; Xu, L.; Li, H.; Zhou, C.; He, J.; Yoshihisa, S.; Wei, T.; Chushi, K. Investigation of healthcare waste management in Binzhou District, China. *Waste Manag.* 2010, *30*, 246–250.

[8] Sapkota, B.; Kumar Gupta, G.; Mainali, D. Impact of intervention on healthcare waste management practices in a tertiary care governmental hospital of Nepal. *BMC Public Health* 2014, *14*, 1005.

[9] Tabash, M.I.; Hussein, R.A. Mahmoud, A.H.; El-Borgy, M.D.; Abu-Hamad, B.A. Impact of an intervention programme on knowledge, attitude, and practice of healthcare staff regarding pharmaceutical

waste management, Gaza, Palestine. Public Health 2016, 138, 127-137.

[10] Stanley H. O. Okpara K. E. Chukwujekwu D. C. Agbozu I. E. Nyenke C. U. 2011 Health care waste management in Port Harcourt Metropolis American *Journal of Scientific and Industrial Research* 25769773.

[11] Abah S. O. Ohimain E. I. 2010 Assessment of Dumpsite Rehabilitation Potential using the Integrated Risk Based Approach: A case study of Eneka, Nigeria. WorldAppl ju. Sci. J., 8 4 436 442.

[12] Keiski, Pongrácz and Phillips (2004). Evolving the Theory of Waste Management: Defining key concepts}, *Conference proceedings.*

[13] Ajzen, Icek (1985). "From Intentions to Actions: A Theory of Planned Behavior". In Kuhl, Julius; Beckmann, Jürgen (eds.). *Action Control: From Cognition to Behavior*. Springer. pp. 11–39. ISBN 978-3-642-69748-7.

[14] Icek Ajzen. Theory of planned behavior. Organizational behavior and human decision processes 50 (2), 179-211, 1991. 88632,1991.

[15] Adegbita, M. A., Nwafor, S. O., Afon, A., Abegunde, A. A., & Bamise, C. T. (2010).

[16] Assessment of dental waste management in a Nigerian tertiary hospital. Waste. manag. Res., 28, 769-777.

[17] Olubukola BO (2009). Comparative Analysis of Health Care Waste Management Practice in Two General Hospitals in Nigeria. Available at http://www.eco-web.com/edi/index.htm.

[18] Phengxay S. Okumura J. Miyoshi M. Sakisaka K. Kuroiwa C. Phengxay M. 2005 Healthcare Waste Management in Lao PDR: A case study, Waste. Manage. Res., 23 571 581.

[19] Patton, M. Q. (1999). Enhancing the Quality and Credibility of Qualitative Analysis. Health Services Research, 34, 1189-1208.

[20] Bassey B. E. Benka-Coker M. O. Aluyi H. S. A. 2006 Characterization and management of solid medical wastes in the Federal Capital Territory, Abuja Nigeria African Health Sciences, 6 1 58 63.

[21] World Bank (2020) *"Solid Waste Management."* Retrieved September 2020.

[22] Nmere, Obasi & Okolo, Victor & Okechukwu, James & Alio, Felix & Anetoh, John. (2020). Influence of public relations' media public enlightenment campaign and community participation strategies on waste management. Problems and Perspectives in Management. 18. 82-96. 10.21511/ppm.18(1).2020.08.