

Biomedical Waste Management and Disposal Practices among Hospital Staff in Port Harcourt, Rivers State, Nigeria

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ABSTRACT

Objectives: the study aimed at ascertaining the biomedical waste management and disposal practices among hospital staff in Port Harcourt, Rivers State.

Methodology: A hospital based, cross sectional study was conducted among 325 respondents using a stratified and simple random technique and the study population included health workers of the selected hospitals in the group of doctors, nurses, pharmacists, staff of laboratory and waste handlers. Questionnaire administration and field observation of biomedical wastes was used in this study.

Results: 35% (106) of the respondents were between 35-44 years of age. Overall knowledge of biomedical waste management among the hospital workers was 80.2%. Eighty three percent of the respondents agreed that biomedical waste is hazardous, 52% agreed that there is good management of waste while 64% said proper management is financial burden on the hospital. Also 65% approved sterilization of infectious waste before disposal while 87% accepted upgrade of knowledge training. In regards chi-square analysis, Age ($p=0.00923$), Level of Education ($p= 0.0025$) and Length of experience ($p= 0.0457$) were all associated with the level of knowledge of biomedical waste management.

Conclusion: this study shows that a significant number of hospital workers are aware of biomedical waste generation, management and disposal practices. This includes the use of PPEs and color-coding of hospital wastes before disposal. However, the attitude to biomedical waste management and disposal practices is average and therefore a challenge.

Keywords: biomedical waste, hospital, waste management, knowledge and attitude.

INTRODUCTION

Biomedical waste or hospital waste is any kind of waste containing infectious (or potentially infectious) materials. It may also include waste associated with the generation of biomedical waste that appears to be of laboratory or medical origin (example unused bandages, packaging, infusion kits), also research laboratory waste containing organisms or biomolecules that are mainly restricted from environmental release²⁶. Biomedical waste management involves

activities from generation of waste to final disposal. It can be solid or liquid²³ and has become a major public health concern globally due to the potential of poorly managed hospital waste to cause disease and injury. The sustainable management of hospital waste has continued to generate increasing public health interest due to the health problems associated with exposure of human beings to potentially hazardous wastes arising from healthcare¹⁹. In Nigeria, hospital waste is divided into two groups

which include infectious waste (unwanted microbiological cultures, pathological waste, waste from surgery, sharps and laboratory waste) and non-infectious wastes (general hospital wastes generated in the course of administrative)²². However, about 10-25% of hospital wastes is hazardous, and can create variety of health risks if not properly managed and disposed²⁹.

MATERIALS AND METHODS

Study design

This is a hospital-based cross-sectional study. The study population included health workers of the selected public and private hospitals in Port Harcourt in the group of doctors, nurses, pharmacists, staff of laboratory and waste handlers. Port Harcourt metropolis has a population of 5,198,716 as of the 2006 census. Rivers State is a diverse state that is home to many ethnic groups, including the Ikwerre, Ogba, Ijaw, and Ogoni people. The state is particularly noted for its linguistic diversity, with 28 indigenous languages being said to be spoken in Rivers State.

Settings and sample

A stratified and simple random sampling techniques were used to draw out the number of respondents from each hospital using a table of random numbers for the study. The health workers were stratified according to their professional groups and the waste handlers. Then selection of respondents was done using simple random sampling via a computer generated table of random numbers. There was a list of staff in each stratum in all of the selected hospitals. Then serial number was assigned to each staff in keeping with the order of the list. Using the computer-generated table of random numbers, participants were selected daily from each stratum in proportion to sample size until the total sample size was reached for both public and private hospitals.

Ethical consideration

An approval was obtained from the research ethical committee of Public Health Department, School of Health Technology, and Federal University of Technology Owerri alongside a letter of introduction issued from the administrative office of Public Health Department. Ethical approval was sought from the Health Research Ethics Committee of the Ministry of Health, Government of Rivers State Nigeria and also from the Ethics Committee of the University of Port Harcourt Teaching Hospital before the research commenced. The questionnaire was completed privately and anonymously (none of the respondents was identified by name at any point during data collection). Verbal informed consent was obtained from all the participants before being allowed to participate in this study.

Data collection

Data were collected between September, 2021 and February, 2022. Data collection was done using quantitative method. The quantitative method was carried out using structured interviewer-administered questionnaire. The questionnaire was administered to the health workers of the hospitals in the category of doctors, nurses, pharmacists and staff of laboratory departments, and waste handlers. Field observation of biomedical waste generation rate and quantification in both public and private hospitals was also carried out.

STATISTICAL ANALYSIS

Data collected in this study were edited, coded and entered into the Statistical Product and Service Solutions (SPSS) version 20.0 and Microsoft Excel 2010. Table of frequencies and percentages were constructed. Chi-square test and p-value less than 0.001 were used to show that there is a significant association between the hospital workers and the biomedical waste management and disposal practices in the selected hospitals.

RESULT

The Socio demographic characteristics of the respondents are summarized in Table 1 below, 35% (106) of the respondents were between 35-44 years of age, 23% (69) and just 13% (39) included respondents between ages 45-50. Majority of the respondents were of Igbo origin (58%) and 4% (12) Fulani. Considering educational level, 84% (254) had attained the tertiary level of education and 3% (9) had no formal education. When asked about their length of experience, 29% (70) replied "1-5 years" and only 2% (5) had an experience of 21 years and above. Majority (71%) of the respondents accepted they were hospital staff, while 29% (88) replied "No". Sixty-one-point five percent (149) (n = 243) affirmed they were public staff, while about 38.5% (94) chose 'Private'. On the cadre of workers of the hospital staff 28% (68) were Nurses and eight percent (19) of the respondents were waste handlers.

For the respondent's knowledge on biomedical waste management and disposal practices, the result in table 2 below summarized it. Eighty three percent (251) of the respondents accepted it was important to know about biomedical medical waste generation, its hazards and safe management, while 17% (51) did not accept. When they were asked if they thought it was good to put all types of hospital waste into one container, 54% (163) replied "No" while 5% (15) replied "May be". On question concerning knowledge of color-coding segregation of biomedical wastes, majority of the respondents 61% (184) replied "Yes" and 5% (15) replied "May be". Seventy seven percent (233) of the respondents attested that they followed color-coding for biomedical waste, while 23% (69) denied. Also 65% (196) of the respondents took precautionary measures in handling hospital wastes according to the colours of their containers, while 35% (106) did not. Additionally, 65% (197) believed Personal protective equipments (PPES) can be useful in handling hospital waste, while 35% (105)

denied. Thirty two percent (98), (n = 302), used PPEs such as Cover-alls, 22% (66) used Safety boots, 17% (51) used personal protective gear not listed but labeled 'Others', 15% (45) used Hand gloves while 14% (42) used safety goggles. Forty nine percent (113) (n = 231) of the respondents always wore PPEs and 22% (51) only wore PPEs occasionally. When asked concerning disposing needles in general waste containers, 67% (202), replied "No", while 33% (100) said "Yes". Forty six percent (139), reported they re-capped the used needles before disposal and 10% (30) replied "No". Also 61% (184) discarded the used needles immediately, while 39% (118) did not. Concerning needle stick injuries, 83% (251) obliged it was a problem, while 17% (51) did not accept. Twenty four percent (72) reported to be victims of Needle stick injuries while 76% (230) had not experienced such accidents. Majority (72%), (n = 149), of the Needle stick injury victims had experienced it about 1-5 times and 74% (110) of them filed a report. The respondents that demonstrated awareness of the consequences of needle-stick injuries were 62% (187), while 38% (115) denied. On disposal of hospital wastes in open places, 86% (260) denied, while 14% (42) accepted, the former said to have buried them (31%), Incinerate them (27%), Burn them (6%), land fill them (7%) and 29% (79) of the respondents opted for disposal methods not listed but labeled 'Others'. Sixty five percent (196) of the respondents demonstrated use of covered trucks for hospital waste disposal, while 35% (106) used open trucks. Majority of the respondents 92% (278), also dumped hospital wastes in Municipal dumpsites, while 8% (24) reported 'Rivers'. From figure 1, the respondent's good knowledge of biomedical waste was 80.2% and poor knowledge was 19.2%.

Under the respondent's attitude on biomedical waste management and disposal practices, the result illustrated in table 3 below showed that 83% (251) replied "Yes" when asked if biomedical wastes are

hazardous, while 17% (51) replied “No”. The respondents (n = 268) reported they handles such wastes carefully, 28% (75) replied “Like common waste”, 32% (86) did not specify but opted to choose ‘Others’. Fifty two percent (157) scored safe management of biomedical waste as Good and 13% (39) Fair. When the respondents were asked if proper management of biomedical waste can be seen as a financial burden on the hospital management, 64% (193) replied “Yes” and 36% did not oblige. The respondents who confirmed that proper management of biomedical waste can be achieved in the hospital through Team work were 26% (79), 25% (76) opined “Public Health Awareness”, 18% (54) chose individual efforts, 11% (33) accepted all options were necessary and 20% (60) rejected all available options. Seventy six percent (230) of the respondents reported that safe management of biomedical waste disposal was an extra burden on the workers duties, and 58% (175) obliged containers should be labeled before filling with waste. Also 65% (196) of the respondents agreed that infectious waste should be sterilized from infections before disposal. The respondents were asked if they would voluntarily attend programmes that will enhance and upgrade their knowledge about biomedical waste, 87% (175) agreed, while 13% (27) did not accept.

For the association between the Socio demographic characteristics and Level of Knowledge of biomedical waste among health workers table 4 below are the results for the test of a statistically significant relationship between Socio-demographic characteristics and Level of knowledge of biomedical waste among health workers. There was a statistically significant relationship between Age and Level of knowledge of biomedical waste among health workers in the study population, $\chi^2 =$

1.342, $df=3$, $p= 0.00923$. We therefore reject the null hypothesis of no significant relationship between Age and Level of knowledge of biomedical waste among health workers in the study population. Considering the hypothesis between Level of Education of health workers and knowledge of biomedical waste among health workers among relevant population, there was a statistically significant relationship between them, $\chi^2 = 1.2348$, $df=3$, $p= 0.0025$, therefore we reject the null hypothesis of no significant relationship between Level of Education of health workers and knowledge of biomedical waste among health workers in the study population. Given the relationship between Length of experience in years and knowledge of biomedical waste in the study population, there was a statistically significant association; $\chi^2 = 3.432$, $df=3$, $p= 0.0457$, therefore we reject the null hypothesis of no significant association between Length of experience in years and knowledge of biomedical waste in the study population. On the hypothesis between being a hospital staff and knowledge of biomedical waste among primal population, there was a statistically significant relationship between Being a Hospital Staff and knowledge of biomedical waste in the study population, $\chi^2 = 2.653$, $df=1$, $p= 0.00789$. We therefore reject the null hypothesis of no significant relationship between Being a Hospital Staff and knowledge of biomedical waste in the study population. Considering the association between position in the hospital and knowledge of biomedical wastes, there was a statistically significant relationship. $\chi^2 = 1.324$, $df=1$, $p= 0.00765$, Therefore we reject the null hypothesis of no significant association between position in the hospital and knowledge of biomedical wastes among relevant population.

Table :1 Socio demographic characteristics of the respondents

Characteristics	Frequency (n=302)	Percentage (%)
Age		
15-24	69	23%
25-34	88	29%
35-44	106	35%

45-50	39	13%
Total	302	100
Ethnicity		
Igbo	175	58%
Hausa	45	15%
Yoruba	51	17%
Fulani	12	4%
Others	19	6%
Total	302	100
Educational level		
Informal education	9	3%
Primary	18	6%
Secondary	21	7%
Tertiary	254	84%
Total	302	100
Are you a Hospital Staff		
Yes	214	71%
No	88	29%
Total	302	100
Length of experience in years		
1-5 years	70	29%
6-10 years	68	28%
11-15 years	54	22%
16-20 years	46	19%
21 years and Above	5	2%
Total	243	100
Hospital category		
Public	149	61.5%
Private	94	38.5%
Total	243	100
What is your position?		
Doctor	27	11%
Nurse	68	28%
Pharmacist	63	26%
Laboratory Technician	66	27%
Waste Handlers	19	8%
Total	243	100

Table 2 Respondents Knowledge on Biomedical Waste Management and Disposal Practices

Variables	Frequency (n=302)	Percentage (%)
Do you think it is important to know about biomedical medical waste generation, its hazards and safe management?		
Yes	251	83%
No	51	17%
Total	302	100
Do you think it is good to put all types of hospital waste into one container?		
Yes	124	41%
No	163	54%
May be	15	5%
Total	302	100
Do you know about colour-coding segregation of biomedical wastes?		
Yes	184	61%
No	103	34%
May be	15	5%
Total	302	100
Do you follow colour-coding for biomedical waste?		
Yes	233	77%
No	69	23%
Total	302	100
Do you take precaution in handling hospital wastes according to the colours of their containers?		
Yes	196	65%
No	106	35%
Total	302	100
Do you believe that personal protective equipments (PPES) like gloves can be useful in handling hospital wastes?		
Yes	197	65%
No	105	35%
Total	302	100
Do you wear Personal Protective Equipments?		
Hand Gloves	45	15%

Cover-alls	98	32%
Safety booth	66	22%
Safety goggle	42	14%
Others	51	17%
Total	302	100
If Yes, how often do you wear PPEs?		
Rarely	67	29%
Always	113	49%
Occasionally	51	22%
Total	231	100
Are needles supposed to be put into general waste containers?		
Yes	100	33%
No	202	67%
Total	302	100
Do you re-cap the used needle?		
Yes	139	46%
No	30	10%
Not always	133	44%
Total	302	100
Do you discard the needle Immediately?		
Yes	184	61%
No	118	39%
Total	302	100
Is needle-stick injury a concern?		
Yes	251	83%
No	51	17%
Total	302	100
Have you had needle stick injury in the past one year?		
Yes	72	24%
No	230	76%
Total	302	100
If Yes, how many times?		
1-5	107	72%
6-10	26	17%
Above 10	16	11%
Total	149	100
Did you fill an incident report?		
Yes	110	74%
No	39	26%
Total	149	100
Are you aware of the consequences of needle-stick injury?		
Yes	187	62%
No	115	38%
Total	302	100
Do you dispose hospital waste in open Places?		
Yes	42	14%
No	260	86%
Total	302	100
If No, What do you do with them?		
Burn Them	17	6%
Bury Them	85	31%
Incinerate Them	74	27%
Land fill Them	19	7%
Others	79	29%
Total	274	100
What kind of trucks do you use in disposal of hospital wastes?		
Covered Trucks	196	65%
Open Trucks	106	35%
Total	302	100
Where do you dump the hospital wastes?		
Municipal dumpsites	278	92%
Rivers	24	8%
Total	302	100

Figure 1: Overall Knowledge of biomedical waste management among Respondents

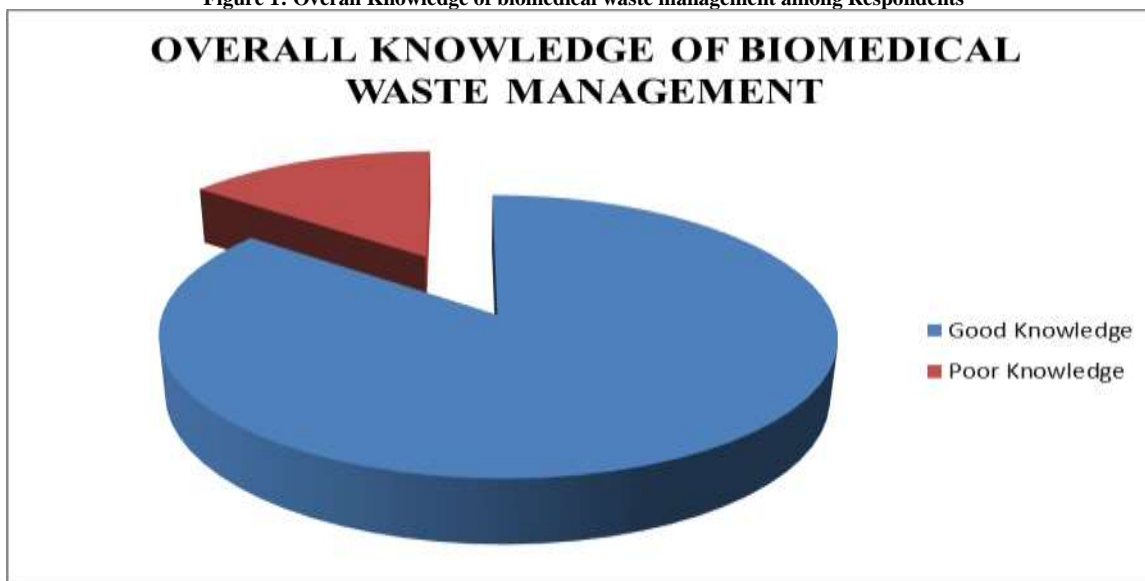


Table 3 Respondents Attitude on Biomedical Waste Management and Disposal Practices

Variable	Frequency (n=302)	Percentage (%)
Is biomedical waste a hazardous waste?		
Yes	251	83%
No	51	17%
Total	302	100
If Yes, how do you handle such waste?		
Carefully	107	40%
Like common waste	75	28%
Others specify	86	32%
Total	268	100
How can you score safe management of biomedical waste?		
Good	157	52%
Poor	106	35%
Fair	39	13%
Total	302	100
Can proper management of biomedical waste be seen as a financial burden on the hospital management?		
Yes	193	64%
No	109	36%
Total	302	100
How can proper management of biomedical waste be achieved in the hospital?		
Individual Effort	54	19%
Team Work	79	26%
Public Health Awareness	76	25%
All of the Above	33	11%
None of the Above	60	19%
Total	302	100
Is safe management of biomedical waste an extra burden on the workers duties?		
Yes	230	76%
No	72	24%
Total	302	100
Do you think that labeling the container before filling it with waste is of any clinical concern?		
Yes	175	58%
No	127	42%
Total	302	100
Do you think that infectious waste should be sterilized from infections before its disposal?		
Yes	196	65%
No	106	35%
Total	302	100
Will you like to attend voluntarily programmes that will enhance and upgrade your knowledge about biomedical waste?		
Yes	263	87%
No	39	13%
Total	302	100

Table 4 Association between Socio demographic characteristics and Level of Knowledge of biomedical waste among health workers.

Socio Demographics	Knowledge of Biomedical Wastes		X2	P-value	Decision
	High (%)	Low (%)			
Age			1.342	0.00923	Sig.
15-24	16(40.0)	34(60.0)			
25-34	36 (60.0)	24(40.0)			
35-44	40(57.1)	30(42.9)			
45-50	25(92.5)	2(7.4)			
Educational level			1.2348	0.0025	Sig.
Informal education	2(30.0)	4(70.0)			
Primary	7(56.0)	5(44.0)			
Secondary	9(61.0)	5(39.0)			
Tertiary	112(66.2)	57(33.8)			
Length of experience in years			3.432	0.0457	Sig.
1-5 years	19(46.5)	22(53.4)			
6-10 years	26(64.9)	14(35.1)			
11-15 years	23(73.3)	8(26.7)			
16-20 years	26(94.7)	1(5.3)			
21 years and above	3(100)	0(0)			
Are you a Hospital Staff			2.653	0.00789	Sig.
Yes	73(51.0)	70(48.9)			
No	39(66.1)	20(33.8)			
What is your Status?			1.324	0.00765	Sig.
Doctor	10(66.6)	5(33.3)			
Nurse	29(72.5)	11(27.5)			
Pharmacist	30(81.0)	7(18.9)			
Laboratory Technician	20(51.2)	19(48.7)			
Waste Handlers	8(66.6)	4(33.3)			

DISCUSSION

Considering the socio-demographic characteristics, with regards to age, findings from the study showed that 35% of the respondents were within the age group 35-44 years, the age seen in this study, is consistent with the statement which said that 44.5% of hospital workers fall within this age category [27]. Further findings from this study showed that 58% of the respondents were of Igbo origin and Christians. This could be because the study was conducted in the Southern part of Nigeria and the hospitals surveyed were located in Port Harcourt, Rivers State which is a neighboring eastern state of the federation predominated by Igbo people. This is also consistent with another study conducted in Port Harcourt [10].

The findings of the study considering the knowledge of the forms of biomedical waste management and disposal practices revealed that 83% of the respondents accepted it was important to know about biomedical medical waste generation, its hazards and safe management. This implies that health workers have significant knowledge of the importance of controlled generation and

disposal of biomedical wastes. This corroborates with a publication which noted that 85.2% of health workers in hospitals have an awareness of biomedical waste management and disposal practices [19]. Concerning knowledge of the colour-coding segregation of biomedical wastes, 61% affirmed that they know about the colour-coding segregation. This could be due to the fact that color-coding segregation of waste is a standard practice and has been adopted by most health facilities. Another study is consistent with this finding [28]. Further investigation into the finding of this study showed that majority (77%) of the respondents demonstrated that they followed colour-coding for biomedical waste, as corroborated by a previous finding by that medical facilities are required to ensure biomedical wastes are color-coded for disposal [23]. Several studies also supported this finding [18,19,20,21,23,24,25]. This study revealed that 35% of the respondents did not take precautionary measures in handling hospital wastes according to the colours of their containers. This could be due to lack of provision of relevant colors of containers for biomedical waste disposal by

the health facilities. This goes in contrast to a statement made in a publication that under 10% of hospital workers in a survey did not take precautions in handling hospital wastes according to the colours of their containers [7]. Some studies disagree with this finding [12,13,14]. Additionally, 65% of hospital workers believed Personal protective equipments (PPES) can be useful in handling hospital waste, and the most adopted PPES are the cover-alls (35%). This could be because the cover-alls ensures limbs and trunk are fully protected from biomedical wastes. This is in line with a similar study conducted on the adoption of cover-alls by hospital workers (39%) [3]. Eighty three percent of the respondents obliged Needle stick injuries are common, while 76% had not experienced such accidents. This finding falls in line with a previous study where 81% of hospital workers demonstrated knowledge of needle stick injuries and 74% in the survey conducted did not experience needle stick injuries [15]. This result is in contrast to another publication [12]. On disposal of hospital wastes in open places, 86% denied. This implies stringent adherence to laws put in place to check the disposal of biomedical wastes. Numerous publications support this finding [1,2,3,4]. Sixty five percent of the respondents illustrated use of covered trucks for hospital waste disposal which is in line with required standard procedure. Majority of the respondents (92%) also dumped hospital wastes in Municipal dumpsites, advance findings from this study showed that under 8% reported 'Rivers'. This could be due to non-availability of designated dumpsites in proximity or no dumpsites at all provided by relevant bodies.

Considering the attitude on biomedical waste management and disposal practices among respondents, the study revealed that based on overall response from the participants, 83% affirmed biomedical wastes are hazardous. This falls in line with previous studies [16,18,19]. Fifty two percent of the respondents said safe management of biomedical waste is 'Good', while 64%

think that proper management of biomedical waste can be seen as a financial burden on the hospital management. This could mean the hospitals lack adequate resources for proper management of biomedical wastes and is corroborated by a publication [9]. The respondents that reported safe management of biomedical waste disposal was an extra burden on the workers duties were 76%. The implication here could be that most hospitals are understaffed and hence workers have to engage in more tasks than they should perform. A previous study by explicitly explained the problems of understaffing [5]. Also 65% of the respondents agreed that infectious waste should be sterilized from infections before disposal. Eighty seven percent of the respondents accepted to voluntarily attend programs that will enhance and upgrade their knowledge about biomedical waste, further check into this study revealed that 13% did not accept. This could be due to lack of motivation and poor attitude to work created as a result of untimely and underpaid monthly earnings. This is in similar to several studies [27,28,30,31].

Findings from this study regarding the association between Socio demographic Characteristics and Level of knowledge of biomedical wastes revealed that Age is significantly associated with level of knowledge of biomedical wastes among health workers ($P = 0.00923$). This implies that there was a significant increase in the level of knowledge of biomedical wastes as the age of the respondents under consideration increased. This could be due to the exposure that come with increased age, which could imply increased length in practice and is in line with studies which found age to be associated with knowledge of biomedical wastes ($P=0.00861$) [19]. Moving further, the study also demonstrated that the level of education of health workers is significantly associated with the knowledge of biomedical waste ($P = 0.0025$). This could be due to the fact that the higher the educational level of the respondents the more likely they must have

come across biomedical waste management and disposal practices. This is in contrast to a report published that the education level of health workers may not affect the level of knowledge of biomedical wastes among primal population [3]. Also, from the study among health workers in selected hospitals in Port Harcourt, Rivers State, it was posited that length of experience in years showed significant association with level of knowledge of biomedical wastes (P = 0.0457). Study showed that the level of knowledge of biomedical wastes was minimal among respondents who have practiced for 1-5 years, compared to health workers with 21 years and above practice experience. This is consistent to studies conducted previously [12,13,14] but not in line with one other publication [24]. The study revealed that level of knowledge of biomedical wastes was high among the waste handlers 66.6% compared to any other position among health workers in the Port Harcourt hospitals and hence a significant relationship (P = 0.00765). Some studies stated that health workers who are responsible for waste handling in hospitals had the highest knowledge of biomedical wastes management and disposal practices [15]. This level of knowledge could be due to one's status in these hospitals respectively.

CONCLUSION

Based on the outcomes of the study, it could be seen that a significant number of hospital workers are aware of biomedical waste generation, management and disposal practices. This includes the use of PPEs and color-coding of hospital wastes before disposal. However, the attitude to biomedical waste management and disposal practices is average and therefore a challenge. The study also revealed that medical facilities lack adequate resources needed to properly dispose off biomedical wastes. Strict laws to guide disposal of hospital waste which have been put in place needs to be reinforced. Also ease of biomedical wastes disposal by creating dumpsites at strategic points should be

considered. Hospital staff/workers should also be sensitized, encouraged on the hazards of biomedical wastes and importance of good waste management. Understaffed hospitals are required to hire workers with relevant qualifications to promote biomedical waste management and disposal practices.

Declaration by Authors

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