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Healthcare waste management in southwest Nigeria: a cross-sectional study among healthcare workers in a private tertiary hospital

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Abstract

Introduction: *the generation of health-care waste (HCW) has been on the increase due to increasing world's population, increased number of health care facilities, and advancement in technological practices. HCW may contain microorganisms which may be drug-resistant with potentials to cause harm to patients, health care workers and the general public when spread from the facility to the environment. Management of HCW is a big challenge particularly in LMIC due factors related to poor awareness and funding.* ***Methods:*** *the study was cross-sectional among 210 health-care workers of Babcock University Teaching Hospital using self-administered questionnaire using simple random sampling. Data was analyzed using SPSS version 27. Chi-square test and multivariable logistic regression analysis were done to determine the factors associated with knowledge and practices of HCW management. At 95% confidence interval, a p < 0.05 was considered statistically significant.* ***Results:*** *the mean age was 29.9 ± 7.8 years with 51% of the participants males. Sixty-five point five percent (65.5%) of the participants have ever received training on HCW management. The study found that 110 (53.4%) of the participants had adequate knowledge on HCW management while good practices were found among 155 (75.2%) of the participants. Only good knowledge was found to have statistically significant association with practice (aOR: 0.196, 95% CI 0.090-0.423, p= 0.0001) while awareness of the availability of HCW management guideline had statistically significant association with the knowledge on HCW management (aOR: 0.344, 95% CI 0.319-0.852, p= 0.021).* ***Conclusion:*** *this study found that knowledge on HCW management was fair while practice was good. The study also showed statically significant relationship between good knowledge and practice. Adequate education and training should be provided for health-care workers on HCW management in order to improve practices on the management of HCW. This may reduce exposure of health-care workers and the general public to the health risks associated with poor HCW management practices.*

Introduction

Health care waste (HCW) is the by-product of health care services. It includes wastes produced in health-care facilities, biomedical laboratories and research centres [1]. Such waste includes sharps, items contaminated with blood, blood and blood products, body parts and tissue, chemicals, pharmaceuticals and radioactive materials [2,3]. About 85% of HCW is non-hazardous while the remaining 15% is considered to be hazardous materials which may be infectious, toxic or radioactive affecting the environmental health and the health of the public [4,5]. In high income countries, an average of about 11 kg of hazardous wastes are generated per hospital bed per day while it is about 6 kg in low-income countries. However, in low-income countries, HCWs are not segregated into hazardous and non-hazardous and this has made the quantity of hazardous waste higher [4,5]. About 16 million injections are administered yearly globally, however, not all the needles and syringes used for these injections are properly disposed after use [4].

HCW may contain microorganisms which have potentials to cause harm to the patients, health care workers and the general public. In addition, they may also contain some drug-resistant microorganisms which may spread from the facility to the environment due to poor waste management by health-care workers [4,5]. HCW generation has been on the increase over the years, and this is attributed to the increasing population of the world, increase in the number of health care facilities, and the advancement in

technological practices [5]. Studies have revealed some level of poor knowledge and practices on HCW management which increases the health hazards on the health worker, patients and the community [6]. A study in Ethiopia showed that in 35% of health care facilities the management of HCW is poor resulting in an increased risk of exposure and injuries to health care workers and the general public [7]. Also, in Zambia [8] and in Kaduna, Nigeria [9] poor HCW management were reported among health-care workers. Poor management of HCW may result in risk to health following the release of microorganisms and other pollutants which are toxic into the environment [4], contaminating the soil, surface water and ground water with resultant effect on the environmental health, animal and human health [4,10].

Management of HCW is a big challenge particularly in low-and middle-income countries (LMIC) due to combination of factors which include poor awareness of the hazard associated with HCW, inadequate training of health-care workers on HCW management, lack of waste management and disposal systems, insufficient funds and human resource for health and the low priority given to HCW management [4,11]. This poor management of HCW will lead to the exposure of health-care workers, individual who handle wastes, patients and their relations as well as the community to infections and injuries which are preventable [11]. Health-care workers are key in the proper management of HCW [12], hence, this study aimed to assess the knowledge and practices of health-care workers on HCW management as adequate knowledge and safety practices will ensure proper disposal of HCW [4].

Methods

Study design and setting

This study was cross-sectional done at Babcock University Teaching Hospital (BUTH), a Seventh-day Adventist owned institution located in Ilishan-Remo, Ogun State. BUTH has a bed space of 200, with a daily average patient load of 168 inpatients and 178 outpatients [13]. The services provided by BUTH include short term hospitalization, emergency room services, general and specialty surgical services, radiology services, laboratory services, inpatient services, intensive care services, out-patient services. In the various departments, the activities are carried out by different health care workers. HCW is generated in different areas of the hospitals and health care workers are largely responsible for the generation and management of the HCW. The hospital serves as a major referral centre for hospitals in Ogun State and other parts of southwest Nigeria.

Study population

The study population was health workers in BUTH. The health-care workers in this study included doctors, nurses, pharmacists, laboratory scientists, laboratory technicians, housekeepers, cleaners and ward attendants. Health-care workers who were on leave, off duty or sick at the time of the study and health-care workers who do not handle HCW were excluded from the study. The sample size was estimated using the Cochran's formula below [14]:

$n = Z\alpha^2pq/d^2$

Where n is the minimum sample size, Zα is the level of alpha error at 95% confidence interval with value of 1.96, a prevalence of 86% of health-care workers from a previous study [15], q= 1-p, and d is the precision taken as 0.05. Substituting the figures into the formula a minimum sample size of 185 was gotten. A non-response rate of 10% was considered. A total of 210 participants was the sample size. Simple random sampling technique by balloting was used to select the study participants from the various departments.

Data collection

Self-administered questionnaire adapted from previous studies [16,17] was used to collect

information form the study participants. The questionnaire had various sections which assessed information of sociodemographic characteristic, knowledge on HCW management and practices on HCW management. Questionnaire was pretested among similar health-care workers at the Olabisi Onabanjo University Teaching hospital to improve validity and correct any ambiguity. Data was collected over a period of three months from (September to November 2023). Data collection was done by trained research assistants.

Definition

The dependent variables were knowledge and practice. Knowledge was analyzed as level of knowledge which was categorized as adequate and inadequate knowledge. Also, practice was analyzed as level of practice which was categorized as good and poor practices. The independent variables were the sociodemographic characteristics of the study participants.

Statistical analysis

Data was entered and analyzed using IBM SPSS Statistics version 27. Quantitative variables like age, knowledge score and practice score were summarized using mean and standard deviation. Other variables were presented on tables using frequency and percentages. For knowledge, the maximum attainable score was 16 from a total number of 16 questions with each correct answer scoring 1 and each wrong answer 0. The mean score was used as a cut-off to determine the level knowledge. So, a total score less than or equal to the mean score was considered as inadequate knowledge while scores above the mean was considered as adequate knowledge. This same rule was applied for practice which was accessed using a total of 9 questions with a maximum attainable score of 9 with each correct answer scoring 1 and a wrong answer 0. Chi-squared test was done to determine the relationship between sociodemographic characteristics of the respondents and their knowledge and practices. Multivariable regression analysis was done to determine the factors associated with knowledge and practices. The multivariable regression analysis was built using independent variables found to have statistically significance at 10% with knowledge and practices, and other factors based on other studies found to be associated with knowledge and practices [15]. Using odds ratio (OR) and 95% confidence interval (CI), a p value less than 0.05 was considered to be statistically significant.

Ethical considerations

Ethical approval for this study was obtained from the Babcock University Health Research Ethics Committee with reference number BUHREC 883/23 and the study was carried out in accordance with the regulations of the approving body. Participation of subjects in the study was voluntary and written informed consent was obtained from all the participants prior to the administration of questionnaire. Confidentiality and anonymity of information obtained was strictly adhered to and participants were not required to provide any identifier on the questionnaire. Participants were informed of their right to withdraw at any point in the course of the study without losing any benefits that may accrue from the study.

Results

Participants

A total of 210 respondents participated in this study, however, 206 respondents had complete information which were analyzed.

Sociodemographic analysis

The mean age was 29.91 ± 7.82 years, with ages ranging from 21 years to 54 years. Respondents with the ages of = 30 years had the highest frequency of 142 (68.9%), 51.0% of the respondents were males. Doctors were the major occupation represented with 79 (38.3%) and majority of the respondents had tertiary level of

education 151 (73.3%). Majority (69.4%) of the respondents had working experience of = 2 years. Sixty-five point five percent (65.5%) had received some training in HCW management while 81.6% were aware of the availability of HCW management guidelines in the hospital. The Yoruba ethnic group were more in number (65.5%), with Christianity been the major religion (96.1%), Table 1.

Descriptive data

Table 2 shows the respondents' knowledge and practices on HCW management. All the respondents have heard about HCW management. Also, all the respondents knew that injury following needle stick or sharp object is a concern. One hundred and nineteen (96.7%) respondents knew that sorting of HCW during collection was part of HCW management. Adequate knowledge on HCW management was found among 110 (53.4%) of the respondents. The number of respondents who sort out HCW at the point of collection, separate sharp waste from blunt waste and use personal protective equipment (PPE) respectively were 178 (86.4%), 177 (85.9%) and 184 (89.3%). Overall, 75.2% of the respondents had good practice (Table 2).

Bivariate analysis

Cadre of health-care worker (p= 0.0001) and awareness of availability of HCW management guideline (p= 0.009) were the factors found to have statistically significant association with knowledge on HCW management, while occupation (p= 0.015), years of experience (p= 0.017) and level of knowledge (p= 0.0001) were found to have statistically significant association with practice of HCW management (Table 3).

Multivariate analysis

Following multivariable regression analysis, only knowledge was found to be associated with practices in HCW management, (aOR: 0.196, 95% CI 0.090-0.423, p= 0.0001), while awareness of availability of HCW management guideline was found to be associated with knowledge on HCW management, (aOR: 0.344, 95% CI 0.319-0.852, p= 0.021) (Table 3).

Discussion

The objective of this study is to assess the knowledge and practices of HCW management among health-care workers in a tertiary health-care institution. The study found that 53.4% of the health-care workers had adequate knowledge on HCW management while 75.2% had good practices of HCW management. The factors found were associated with knowledge on HCW management were the cadre of health-care worker and awareness of the availability of HCW management guideline by the health-care worker in the facility, while the cadre of the health-care worker, number of years of working experience and level of knowledge were associated with the practices on HCW management. However, following multivariable logistic analysis only the awareness of the availability of HCW management guideline had statistically significant association with knowledge of HCW management, and level of knowledge on HCW management had statistically significant association with practices on HCW management.

Overall, 53.4% of the participants had adequate knowledge on HCW management, and this finding was higher than that of the study in Debre Markos, northwest Ethiopia where 45.5% had adequate knowledge [12]. The study in Ethiopia had a small sample size of 55 and this may not be a true representation of the entire workers. Higher cadre health workers such as doctors and nurses were included in the current study as opposed to the study in Ethiopia where only lower cadre of health-care workers were studied. This may also have contributed to the higher number of workers with good knowledge in the current study. The result of the current study was however similar to that of 50% good knowledge among health-care

workers in Yaoundé, Cameroon [15], and closely similar to 47.1% in Saudi Arabia [18]. In comparison to other studies carried out in Akwa Ibom, Nigeria, 86% of the participants had adequate awareness of health-care waste management and its consequences on health [16], and Sri Lanka with 76.9% having good knowledge [19]. The study in Sri Landa involved various health-care workers at all levels of health-care facility while the present study was conducted only among health-care workers in one tertiary health facility. Some good knowledge in the management of HCW found among majority of the participants in this study are, HCW are associated with health hazards, poor handling of HCW increases the spread of infections, needle stick and sharp injuries constitute huge health hazard and sorting of HCW at the point of generation and separation of HCW. This was similar to the findings in Sri Lanka [19].

Cadre of health-care worker and awareness of the presence of HCW management guideline in the hospital were found to be associated with knowledge on HCW management. This was consistent with a study in Gambia [20]. However, following multivariable regression analysis only the awareness of the presence of HCW management guideline had statistically significant association with knowledge on HCW management. Nurses and doctors in the current studies had better knowledge on HCW management when compared to the other cadres of health-care workers. This maybe due to the details involved in the training of nurses and doctors. Adequate knowledge on HCW management was found more among health-care workers who were aware of the presence of HCW management guideline. Health-care waste management guideline should be made available to health-care workers in order to improve the HCW management knowledge.

Overall, 75.2% of participants had good practices on HCW management. This was higher than the finding of 49.5% in Northern Saudi [18]. Some of the good HCW management practices found in this study were use of PPE while handling HCW, vaccination against hepatitis b virus infection, sorting of HCW and adhering to post-exposure prophylaxis (PEP) guideline following an exposure. These findings were also observed in a study in Sri Lanka [19]. The finding of good practice in this study is also higher than that of 53.9% found in a study in southeast Nigeria [21] where the study was done only among cleaning staff and this may be responsible for the low level of good practices. This was higher than the findings of 50% observed in Yaoundé, Cameroon [15] and 53.9% in KwaZulu-Natal, South Africa [22]. In addition, 59% of the participants in a study in Yaoundé, Cameroon were vaccinated against HCW related diseases such as hepatitis B virus infection as compared to 86.9% in this current study. This may be attributed to the lower level of knowledge reported in the study in Cameroon [15]. Furthermore, following injury with sharps, 82.9% of the study participate followed the PEP guideline and this was found to be higher than a finding of 75.4% in Zambia. This can also be related to the high level of knowledge on HCW management in this study [8]. With regards to the use of PPEs this study found that 89.3% of the respondents used PPE while handling HCW and the finding corroborates the finding of 84.8% found in Gujarat, India [23]. This was different with the finding of only 39.8% of the study participants in Zambia using PPE for handling of waste. This was attributed to stock outs [8]. Lack of use of PPEs increases the risk of getting infected through HCW. Again, majority of the health-care workers sorted wastes according to their categories and this is similar to the finding in the study in southwest Ethiopia and Ghana [6,24].

Only 65.5% of the participants in this study has ever received training on HCW management. In the studies in Navi Mumbai, India and Namibia respectively found that 45% and 43% of the participants respectively has received training on HCW management [25,26]. These findings are not adequate as training on HCW management could help in improving the practices of HCW management among health-care workers [27]. A

study in Ghana found that more health-care workers, 89% has received training on health-care waste management [24]. Though in our study training on HCW management was not statistically significant with HCW management practices, good practices of HCW management were however found more among those who had ever received training on HCW management compared to those who had not received any training.

Good practices were found to be associated with good level of knowledge and years of working experience in this study. This was consistent with the study in Yaoundé, Cameroon [15], Sri Lanka [19], Northern Saudi [18], and Southwest Ethiopia [6]. This was also consistent with a study in Botswana where poor HCW management practices were attributed to poor HCW management knowledge [28]. However, following multivariable regression analysis only level of knowledge was found to be a predictor for practices on HCW management. So, improving the knowledge of health-care workers of HCW management in form of training will most likely increase their practices on HCW management [22]. Good practices were found more among the nurses (87.1%) when compared to the doctors (81.8%) and other health-care workers. Similar finding was recorded in a study conducted in Cairo, Egypt [29]. This may be attributed to the better knowledge among the nurses which was found in this study.

Limitation of the study

This study was cross-sectional and information provided may be subject to recall bias. The cross-sectional nature also makes it difficult to demonstrate the causality between knowledge and practice in this study. However, in order to reduce the effect of this on the outcome of the study, the logistic regression excluded other variables which could have served as confounders. Future researches using longitudinal study can use the findings of this study as a base. This limitation should be considered in the interpretation and generalizability of the findings of this study.

Conclusion

This study found that knowledge on HCW management was fair as just a little above half of the respondents had adequate knowledge. However, practice was good with majority of the respondents having good practices. The study also showed statically significant relationship between good knowledge and practices on HCW management. Therefore, it is recommended that adequate education and training be provided for health-care workers on HCW management in order to improve their practices on the management of HCW. This may help in reducing exposure of health-care workers and the general public to the health risks associated with poor HCW management practices.

What is known about this topic

- *Management HCW waste is a challenge particularly in low- and middle-income countries;*
- *HCW may contain some drug-resistant microorganisms.*

What this study adds

- *Adequate knowledge can influence good practices on HCW management;*
- *Proper management of HCW reduces the health risk associated with poor HCW management practices.*

Competing interests

The authors declare no competing interest.

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Authors' contributions

Conception and study design: Chikwendu Amaike; data collection: Oluwatolami Victoria Olomojobi, Inioluwa Olusona, Goodness Erinayo Omoworare, Ololade Olu-Osayomi and Somtochukwu Ononuju. Data analysis and interpretation and drafting of manuscript: Chikwendu Amaike, Oluwatolami Victoria Olomojobi, Inioluwa Olusona, Goodness Erinayo Omoworare, Ololade Olu-Osayomi and Somtochukwu Ononuju. All authors approved the final version of manuscript.

Tables

Table 1: sociodemographic characteristics

Table 2: knowledge and practice on health-care waste management

Table 3: univariable logistic regression analysis of factors associated with knowledge and practice of health-care waste management

Table 4: multivariable regression analysis of factors associated with knowledge and practices of HCW management

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Table 1: sociodemographic characteristics			
Variable		**Frequency**	**Percentage (%)**
	≤ 30	142	68.9
	31-40	44	21.4
	41-50	8	3.9
	≥ 50	12	5.8
Gender	Male	105	51.0
	Female	101	49.0
Cadre of healthcare worker	Doctor	79	38.3
	Nurse	51	24.7
	Pharmacist	3	1.5
	Laboratory scientist	9	4.4
	Laboratory technician	9	4.4
	Cleaner	27	13.1
	Ward attendant	28	13.6
Highest level of education	Primary	5	2.4
	Secondary	50	24.3
	Tertiary	151	73.3
Ethnicity	Yoruba	135	65.5
	Hausa	8	3.9
	Igbo	55	26.7
	Others	8	3.9
Religion	Christianity	198	96.1
	Islam	8	3.9
Years of working experience	< 2 years	63	30.6
	≥ 2 years	143	69.4
Ever received training on HCW management	Yes	135	65.5
	No	71	34.5
Aware of availability of HCW management guidelines in the hospital	Yes	168	81.6
	No	38	18.4

Table 2: knowledge and practice on healthcare waste management			
Knowledge of HCW management	**Response**		
	Yes	**No**	**Not sure**
	Frequency (percentages)		
Have you ever heard about HCW management?	206 (100.0)	0 (0.0)	0 (0.0)
Sorting of HCW during collection is a part of HCW management	199 (96.9)	7 (3.4)	0 (0.0)
Separation of medical wastes reduces the risk of injury	172 (83.5)	8 (3.9)	26 (12.6)
Adhering to universal precautionary measures reduces risk of exposure	167 (81.1)	20 (9.7)	19 (9.2)
Availability of HCW disposal guideline may improve management of HCW	153 (74.3)	25 (12.1)	28 (13.6)
Red, yellow, blue, white and black are colour codes for HCW segregation	146 (70.9)	41 (19.9)	19 (9.2)
Knowledge of the colour codes is essential for proper HCW management	132 (64.1)	53 (25.7)	21 (10.2)
HCW are associated with health hazards	185 (89.8)	7 (3.4)	14 (6.8)
Training on HCW management can improve proper medical waste management	145 (70.4)	56 (27.2)	5 (2.4)
Landfills and incineration adequate disposal methods for expired medicines?	123 (59.7)	62 (30.1)	21 (10.2)
Disposing blood products into domestic waste is an appropriate disposal procedure?	56 (27.2)	136 (66.0)	14 (6.8)
Supervision is effective in HCW management.	76 (36.9)	115 (55.8)	15 (7.3)
Disposing of expired medicine into domestic waste is an appropriate disposal procedure.	43 (20.9)	136 (66.0)	27 (13.1)
Is needle stick / sharp injury a concern?	206 (100.0)	0 (0.0)	0 (0.0)
HCW segregation facilitate good handling.	185 (89.8)	14 (6.8)	7 (3.4)
Poor handling of HCW can transmit infectious diseases.	191 (92.7)	8 (3.9)	7 (3.4)
Level of knowledge	**Frequency (percentage)**		
Adequate Knowledge	110 (53.4)		
Inadequate knowledge	96 (46.6)		
Practice on HCW management	**Yes**	**No**	**Not sure**
	Frequency (percentages)		
Do you sort medical waste during collection?	178 (86.4)	14 (6.8)	14 (6.8)
Do you separate sharp waste from blunt waste?	177 (85.9)	22 (10.7)	7 (3.4)
Do you use personal protective equipment (PPE) while handling HCW?	184 (89.3)	15 (7.3)	7 (3.4)
Do you collect liquid waste in bags that prevent leakage?	141 (68.4)	37 (18.0)	28 (13.6)
Do you collect human tissues together with other HCW?	21 (10.2)	171 (83.0)	14 (6.8)
Do you disinfect biohazard waste before disposal?	157 (76.2)	28 (13.6)	21 (10.2)
Do you follow the post exposure prophylaxis guideline when there is exposure with HCW?	170 (82.5)	15 (7.3)	21 (10.2)
Do you segregate HCW using the colour code?	93 (45.1)	92 (44.7)	21 (10.2)
Have you ever received hepatitis B vaccination?	179 (86.9)	19 (9.2)	8 (3.9)
Level of practice	**Frequency (percentage)**		
Good Practice	155 (75.2)		
Poor Practice	51 (24.8)		

Table 3: univariable logistic regression analysis of factors associated with knowledge and practice of HCW management									
Variables		**Knowledge category**				**Practice category**			
		Adequate frequency (%)	**Inadequate frequency (%)**	**X2**	**p-value**	**Good frequency (%)**	**Poor frequency (%)**	**X2**	**P-value**
Age	≤ 30 years	75 (52.8)	67 (47.2)	0.365	0.947	109 (76.8)	33 (23.3)	2.914	0.405
	31-40 years	24 (54.5)	20 (45.5)			33 (75.0)	11 (25.0)		
	41-50 years	5 (62.5)	3 (37.5)			4 (50.0)	4 (50.0)		
	> 50 years	6 (50.0)	6 (50.0)			9 (75.0)	3 (25.0)		
Gender	Male	57 (54.3)	48 (45.7)	0.068	0.795	80 (76.2)	25 (23.8)		
	Female	53 (52.5)	48 (47.5)			75 (74.3)	26 (25.7)	0.103	0.748
Cadre of healthcare worker	Doctor	47 (59.5)	32 (40.5)	27.796	0.0001	65 (81.8)	14 (18.2)	15.704	0.015
	Nurse	41 (80.4)	10 (19.6)			44 (87.1)	7 (12.9)		
	Pharmacist	0 (0.0)	3 (100.0)			1 (33.3)	2 (66.7)		
	Lab Scientist	6 (66.7)	3 (33.3)			7 (77.8)	2 (22.2)		
	Lab technician	4 (44.4)	5 (55.6)			5 (55.6)	4 (44.6)		
	Cleaner	9 (33.3)	18 (66.7)			17 (63.0)	10 (37.0)		
	Attendant	10 (35.7)	18 (64.3)			17 (60.7)	11 (39.3)		
Level of education	Primary	2 (40.0)	3 (60.0)	3.540	0.170	3 (60.0)	2 (40.0)	27.962	0.0001
	Secondary	19 (38.0)	31 (62.0)			29 (58.0)	21 (42.0)		
	Tertiary	80 (53.0)	71 (47.0)			106 (60.7)	11 (39.3)		
Tribe	Yoruba	73 (54.1)	62 (45.9)	7.370	0.061	102 (75.6)	33 (24.4)	3.194	0.363
	Hausa	7 (87.5)	1 (12.5)			6 (75.0)	2 (25.0)		
	Igbo	24 (43.6)	31 (56.4)			39 (70.9)	16 (29.1)		
	Others	6 (75.0)	2 (25.0)			8 (100.0)	0 (0.0)		
Religion	Christianity	103 (52.0)	95 (48.0)	3.890	0.049	149 (75.3)	49 (24.7)	0.0001	0.987
	Islam	7 (87.5)	1 (12.5)			6 (75.0)	2 (25.0)		
Years of working experience	< 2 years	34 (54.0)	29 (46.0)	0.012	0.913	52 (82.5)	11 (17.5)	2.594	0.017
	≥ 2 years	76 (53.1)	67 (46.9)			103 (72.0)	40 (28.0)		
Ever received a training on HCW management	Yes	75 (55.6)	60 (44.4)	0.733	0.392	99 (73.3)	36 (26.7)	0.767	0.381
	No	35 (49.3)	36 (50.7)			56 (78.9)	15 (21.1)		
Aware of availability of HCW management guidelines in the hospital	Yes	97 (57.7)	71 (42.3)	6.894	0.009	128 (76.2)	40 (23.8)	0.439	0.508
	No	13 (34.2)	25 (65.8)			2 (71.1)	11 (28.9)		
Level of knowledge	Good					98 (89.1)	12 (10.9)	34.300	0.0001
	Poor					57 (59.4)	39 (40.6)		

Table 4: multivariable regression analysis of factors associated with knowledge and practices of HCW management				
Variable	**Knowledge of HCW management**		**Practices on HCW management**	
	aOR, 95% CI	**p-value**	**aOR, 95% CI**	**p-value**
Level of knowledge on HCW management				
Adequate knowledge			0.196, 0.090-0.423	0.0001*
Inadequate knowledge				
Awareness of availability of HCW management guideline				
Yes	0.344, 0.139-0.852	0.021*		
No				
aOR-adjusted odds ratio, CI- confidence interval, * statistically significant at $p < 0.05$				