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Research Article

Knowledge and Practice for Bio-Medical Waste Management among Healthcare Personnel at Kabgayi District Hospital, Rwanda

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Abstract

Background

Globally, about 10 to 25% of the volume of bio-medical waste from hospitals and healthcare institutions presents serious health risks to patients, healthcare personnel, and anybody who comes in contact with it. The waste management practices in Rwanda healthcare facilities are poor and need improvement.

Objectives

To assess the knowledge and practices regarding bio-medical waste management among healthcare personnel at Kabgayi district hospital in Southern Province of Rwanda.

Materials and Methods

A cross-sectional study design was conducted. A total of 200 healthcare personnel were selected randomly out of 400 target population including doctors, nurses, social workers, and cleaners. A structured questionnaire was used to collect data. Descriptive analysis using frequency and proportions was used. A Chi-Square test was used to determine the association between the variables and the level of significance was set at $p \leq 0.05$.

Results

The study found that about half (49.0%) of healthcare personnel had good knowledge about waste management. We found that the majority of healthcare personnel 133 (66.5%) had poor practices towards bio-medical waste management. The factors associated with good practice were better knowledge on bio-medical waste management (p=0.013) and older age group (p=0.001).

Conclusion/Recommendations

The level of both knowledge and practice towards bio-medical waste management among healthcare personnel was low. Continuing education and training programmes and short courses on bio-medical waste management should be carried out to improve the knowledge and practices towards bio-medical waste management among healthcare personnel.

Keywords:
Bio-Medical Waste Management; Rwanda Healthcare Facilities; Healthcare Personnel; Knowledge; Practice

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Background of the Study

Bio-medical waste refers to material produced in the course of health protection, medical treatment and scientific research [1]. Bio-medical waste management is a current issue and inadequate management of bio-medical waste is a serious concern in many developing countries due to the risks posed to human health and the environment [2]. In these countries, the quantity of bio-medical wastes has sharply risen in recent years as a result of rapid population growth and increasing demand for healthcare services. Despite large investment in expanding public and private healthcare facilities in most developing nations [3], bio-medical wastes are usually rampantly disposed in the environment without any treatment [4]. Bio-medical waste management is the most neglected activity of most health service providers, resulting in significant exposure to occupational risks among healthcare personnel, high incidence and prevalence of nosocomial infections and environmental contamination [5].

Recognizing the gaps in knowledge of the environmental impacts of healthcare waste and services underscored the need for increased understanding among health professionals of the integral link between human and environmental health [4]. In East African countries, waste disposal has been reported to be problematic. Some of the waste is disposed of in open areas and some others into latrines and in rubbish pits. Various researchers found that wastes generated from healthcare activities are not well managed in East African countries [6], [7]. Despite the fact that the Ministry of Health and the government of Rwanda have empowered the healthcare services supporting waste management facilities, improper management of bio-medical waste management is still a public health concern.

Rwanda Ministry of Health and other health related sectors together with their different partners are working hard to improve healthcare services including environmental health. Compared to other healthcare programs, the management of waste generated from hospital activities is not strengthened. However, the types of these wastes, and their effects on healthcare personnel, patients and people around the health facilities have not been investigated. Generally, the report from National Institute of Statistics of Rwanda (NISR) showed that unhygienic sanitary facilities for excreta disposal, poor management of

solid and liquid wastes and inadequate hygienic practices are responsible for a great portion of Rwanda's disease burden [8]. As there is no study conducted in this area about the present topic, determining the level of knowledge and practice about bio-medical waste management among the healthcare personnel was paramount as to plan for intervention.

Materials and Methods

Study Design, Setting and Population

The design was a cross-sectional study. The study was conducted at Kabgayi District Hospital located in Southern Province of Rwanda. The latter is one of the five provinces that make Rwanda. It is in the South of Rwanda and has a common border with Kigali City to the North, Eastern Province to the East, Western Province to the West and Burundi to the South. It has an area of over 5701 km² and a population of 2,589,975. Kabgayi District Hospital was chosen because it is only one District hospital in Southern Province which provides general medical, surgical, pediatric, maternity, laboratory, pharmacy and TB follow-up unit. There are around 400 healthcare personnel including doctors, nurses, social workers, and cleaners working in selected health units of the Hospital.

Sample Size and Sampling Technique

The sample size was calculated using Yamane formula [9] ($n=N/1+N*e^2$) as the target population was less than 2000. After considering '*e*'at 5% margin of error and '*N*' target population of 400 healthcare personnel, the sample size calculated was 200 healthcare personnel. This study employed simple random sampling technique to select the respondents from each unit using the probability proportional to sample in each unit.

Data Collection Methods

Data was collected using a structured questionnaire. It captured the following information: socio-demographic characteristics, knowledge about the bio-medical waste characterization and management and bio-medical waste management practice. The questionnaire used in this study was constructed based on the previously published studies and WHO protocol for bio-medical waste management in the healthcare settings [2], [10].

Data Analysis Procedure

Data was checked for completeness and consistency, coded and entered in computer using SPSS (Statistical Package for Social Scientist) version 22 for data analysis. The data was analyzed and interpreted according to the objectives of the study. Frequency and proportion were used to describe the variables. Pearson's chi-square test was used to establish the association between variables of demographic characteristics, knowledge and practice on bio-medical waste management. A p-value of less than 0.05 was considered statistically significant.

The level of knowledge and practice on bio-medical waste management was assessed using a score. The score for the overall knowledge ranged between 0 and 3 and was classified as good knowledge (9 -13 score), as average knowledge (6-9 score) and as poor knowledge (less than 6score). Similarly, the total score for practices was 16, and respondents with scores 8 and above were classified as having good practices while those who scored less than 8 were classified as having poor practices.

Ethical Consideration

A research clearance certificate was sought and obtained from the Research and Ethical Clearance Board of Mount Kenya University. Approval and issuance of authorization letters from the District Hospital and Ministry of Health were obtained. Moreover, a written consent form was provided and all respondents signed before data collection.

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Results

Demographic Characteristics of Respondents

The highest percentage (39.0%) of respondents were aged between 35 and 45 years. Female healthcare personnel were dominant (56.0%). About half (47.0%) of respondents were married and the highest number (43.0%) were nurses. According to work experience, 47% of the respondents worked for 11-15 years. Of the 200 participants, the majority (78%) had received training about waste management and 52% of them had training twice in a year (Table 1).

Table 1. Socio-demographic characteristics of respondents

Variables	Frequency	Percentage
Age group in years		
18-25	37	18.5
25-35	59	29.5
35-45	78	39.0
45-55	18	9.0
55+	8	4.0
Gender		
Male	88	44.0
Female	112	56.0
Marital status		
Single	88	44.0
Married	94	47.0
Divorced/separated	12	6.0
Widower	6	3.0
Professional		
Doctors	20	10.0
Nurses	86	43.0
Lab Scientist	48	24.0
Sanitary worker	46	23.0
Worker experience (years)		
1-5	50	25.0
6-10	26	13.0
11-15	94	47.0
16-20	13	6.5
20+	17	8.5

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Table 1 (continued)

Variables	Frequency	Percentage
Received training about waste management		
Yes	156	78.0
No	44	22.0
Number of training (n=156)		
Once a year	47	30.1
Twice a year	81	52.0
Thrice a year	28	17.9

Knowledge of Healthcare Personnel on Bio-medical Waste Management

(Table 2) shows that more than half (52.0%) of respondents knew about bio-medical waste management process in the hospital. Of 200 participants, 53.0%, 61% and 54.0% knew that HIV/AIDs, Hepatitis B and Hepatitis C can be transmitted through poor handling of bio-medical waste. Similarly, 37.0% knew that microwave can be used to handle bio-medical waste management, 51% knew that land can be used correctly to handle bio-medical waste. Most of the respondents (66.0%) were aware of the universal precaution rule about bio-medical waste management. The majority (61.0%) also knew that the storage time for infectious waste can be 10 to 11 minutes. The results show that nearly a half (49.0%) of respondents demonstrated a good knowledge about bio-medical waste management control.

The Practices of Healthcare Personnel on Bio-medical Waste Management

Respondents were asked whether they use colour coding to dispose of non-infectious wastes and only 22.0% use colour coding all the time. Out of 200 participants, more than half (53.0%) of respondents use colour coding to dispose of infectious waste, 55.5% segregate general waste from bio-medical waste, and 46.5% daily collect bio-medical waste and transport to the designated storage site. A total of 107 (53.5%) temporarily treat and dispose hospital waste for one day. Most (60.0%) were using weight handler and keep a record of generated waste and 67.5% use wheeled for waste transport. The majority of respondents (66.5%) use personal protective equipment (PPE) when handling bio-medical wastes. Regarding the compliance with safety precautions, the highest number (35.5%) always comply with safety precautions (Table 3).

Concerning the use of safe disposal of sharps, 42.5% always use safe disposal of sharps, 41.0% do it often while 16.5% do it sometimes. Respondents were also asked when they wear overall safety protection while handling wastes and about one third (36.5%) do it always. Regarding the types of PPE used by respondents, 39.0% always wear gloves, 43.0% always wear gowns, 69 (34.5%) always wear caps, and 46.5% always wear masks when handling bio-medical waste. The highest percentage (35.5%) used to wash their hands always with bacterial acid agent after handling bio-medical waste. Regarding the overall practice score, only 33.5% demonstrated a good practice towards bio-medical waste management (Table 3).

Table 2. Knowledge of healthcare personnel on bio-medical waste management

Indicators of knowledge	Frequency	Percentage
Knowledge about bio-medical waste management process in the hospital		
Yes	104	52.0
No	96	48.0
Knew about diseases which can be transmitted through poor handling of bio-medical waste		
HIV/AIDs (yes)	106	53.0
Hepatitis B (yes)	122	61.0
Hepatitis C (yes)	108	54.0
Knew universal precaution rule about bio-medical waste management		
Yes	132	66.0
No	68	34.0
Knew the correct method used to handle bio-medical wastes based on their categories		
Microwave	74	37.0
Incineration	80	40.0
Land	102	51.0
Chemical	85	42.5
Autoclave	87	43.5
Knew **storage time for infectious waste**		
10 to 11 minutes	122	61.0
Don't know	78	39.0
Level of knowledge		
Good knowledge	98	49.0
Average knowledge	37	18.5
Poor knowledge	65	32.5

Table 3. The practices of healthcare personnel on bio-medical waste management

Variables	Indicators	Frequency	Percentage
Use of color coding to dispose the non-infectious waste	All the time	44	22.0
	Sometimes	46	23.0
	Rarely	92	46.0
	Not at all	18	9.0
Use of color coding to dispose infectious waste	Yes	106	53.0

Table 3 (continued)

Variables	Indicators	Frequency	Percentage
	No	94	47.0
Segregation of general waste from bio-medical waste	Yes	111	55.5
	No	89	44.5
Daily bio- medical waste collection and transport to the designated storage site	Yes	93	46.5
	No	107	53.5
Temporary treatment and disposal of hospital waste	Yes (1 day)	101	50.5
	No	99	49.5
Weight handler and keep record of generated waste	Yes	120	60.0
	No	80	40.0
The use of waste transport	Wheeled trolleys	135	67.5
	Carts	34	17.0
	Containers	31	15.5
Use of personal protective equipment in handling bio- medical wastes	Yes	133	66.5
	No	67	33.5
Compliance with safety precautions	Always	70	35.0
	Often	58	29.0
	Sometimes	20	10.0
	Never	52	26.0
Use of safe disposal of sharps	Always	85	42.5
	Often	82	41.0
	Sometimes	33	16.5
Wear overall safety protection while handling wastes	Always	73	36.5
	Often	61	30.5
	Sometimes	29	14.5
	Never	37	18.5
Wear gloves while handling bio- medical waste	Always	78	39.0
	Often	60	30.0
	Sometimes	25	12.5
	Never	37	18.5
Wear gowns	Always	86	43.0
	Often	73	36.5
	Sometimes	19	9.5
	Never	22	11.0
Wear caps	Always	69	34.5
	Often	61	30.5

Table 3 (continued)

Variables	Indicators	Frequency	Percentage
	Sometimes	28	14.0
Wear masks	Always	93	46.5
	Often	47	23.5
	Sometimes	30	15.0
	Never	30	15.0
Hand washing with bactericidal agent after handling wastes	Always	71	35.5
	Often	61	30.5
	Sometimes	25	12.5
	Never	43	21.5
Overall practices towards waste management	Good practices	67	33.5
	Poor practices	133	66.5

Factors Associated with Practices Towards Bio-medical Waste Management among Healthcare Personnel

The findings presented in Table 4 showed that age was the only demographic factor significantly associated with good practices towards bio-medical waste management (p=0.007). Overall knowledge score about waste management was significantly associated with practices of bio-medical waste management (p=0.013) where most of the respondents with good practices had good knowledge about bio-medical waste management (Table 4).

Discussion

The overall objective of this study was to assess the knowledge and practice regarding bio-medical waste management among healthcare personnel at a District Hospital. A total of 200 healthcare personnel participated in the study. The findings from this study showed that about a half of respondents (49.0%) had good knowledge about bio-medical waste management process. This is in agreement with a study conducted in India among 100 nurses where 47% had excellent knowledge about bio-medical waste management[11]. Similarly, a study in Tanzania revealed that the knowledge level in management of medical waste was low among healthcare personnel[12]. However, the figure (49.0%) was low compared to the recent study conducted in Nigeria which reported that respondents in the various facilities had adequate knowledge of medical waste collection and handling [13]. These differences could be probably the sample size and source of the target population.

The study revealed that 53.0% healthcare personnel use color coding to dispose infectious waste, 55.5% segregate general waste from bio-medical waste, and 46.5% daily collect bio-medical waste. These findings are supported by a systematic review of six studies which reported that color coding of wastes was not done by 67% of the subjects [14]. Another study found that almost one out of every three respondents (35.7%) did not know that a symbol had been assigned to indicate bio-hazardous wastes. Another study also found that only 57.7% of respondents were aware of all four color codes (Blue/White-Black-Red-Yellow) used for the bags into which bio-medical wastes are segregated [15]. This shows that there is a need for refresher trainings to ensure sustainability and further improvement.

The overall practice in this study was very low where only 33.5% had good practice on bio-medical waste management. This was similar to the study done in Ethiopia which reported 31.5% [16]. However, the result is lower than the study done in Pakistan where 94.3% of the study participants had adequate practice [17]. This difference could be explained due to low enforcement or monitoring by the regulatory body in the health facilities.

Bio-medical waste management knowledge and bio-medical waste management practices were significantly associated in the present study where adequate practice was higher among respondents with

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Table 4. Factors associated with practices towards bio-medical waste management among healthcare personnel

Variables	Practices towards bio-medical waste management		Chi-Square	P-value
	Good, n(%)	Poor, n(%)		
Age group in years			25.47	**0.007**
18-25	13(19.4)	24(18.0)		
25-35	8(11.9)	51(38.3)		
35-45	38(56.7)	40(30.1)		
46+	8(30.7)	18(69.2)		
Gender			1.83	0.176
Male	25(37.3)	63(47.4)		
Female	42(62.7)	70(52.6)		
Marital status			6.17	0.123
Single	18(26.9)	70(52.6)		
Married	43(64.1)	51(38.3)		
Divorced/separated/widowed	6(33.3%)	12(66.7)		
Worker experience in years			4.27	0.37
1-5	17(25.4)	33(24.8)		
6-10	12(17.9)	14(10.5)		
11-15	26(38.8)	68(51.1)		
16-20	6(9.0)	7(5.3)		
20+	6(9.0)	11(8.3)		
Received training about waste management			0.98	0.322
Yes	55(82.1)	101(75.9)		
No	12(17.9)	32(24.1)		
Knowledge about waste management			8.62	**0.013**
Good knowledge	28(41.8)	70(52.6)		
Average knowledge	20(29.9)	17(12.8)		
Poor knowledge	19(28.4)	46(34.6)		

good knowledge. This is similar to a study carried out in India, which revealed lack of knowledge about waste management significantly affects the safe practices for management [11]. This demonstrates that improved knowledge can lead to as accepted practice. It is captivating to imagine a knowledge threshold where theoretical knowledge transcends into practice.

Among the socio-demographic factors, only age group was significantly associated with good practice of bio-medical waste management. The age group of 35 to 45 years had significantly more likely to

exercise good practice compared to those aged between 18 and 25 years. This could be indirectly related to the years of experience as it is believed that increased experience will increase safer practices.

Limitation

Like other cross-sectional studies, the present study does not provide a causal relationship between the variables and cannot be generalized nationwide because the study area is small and contains only one district hospital. Another limitation was self-report to assess the practice regarding bio-medical waste management among healthcare personnel. However, the purpose of the study was explained to the respondents and the information was obtained by trained research assistants.

Conclusion and Recommendation

Our study found that the knowledge and practice about bio-medical waste management were low at 49.0% and 33.5% respectively. Age group and knowledge were significantly associated with good practice of bio-medical waste management among healthcare personnel.

Therefore, we recommend that the Ministry of health and District Hospitals should undertake vigorous and regular training programs on bio-medical waste management for healthcare personnel. Many improvements and efforts should be made in strengthening and enforcing sanitation policies and practices whereby availing bio-medical waste management regulations and guidelines and their accessibility at all levels. Moreover, proper waste segregation at the source must be implemented and color-coding must work hand-in-hand with segregation.

Competing Interests

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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