Original article

Awareness and Practices on Infectious Medical Waste Management among Healthcare Workers Working in Tertiary Level Hospital in Dhaka City

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Abstract

Background: In Bangladesh, incongruous management of medical waste is alarming and seriously endangers the public health. A major health threat as well as environmental issues can result from improper treatment of infectious medical waste. Healthcare workers (HCWs), patients, and the general population all have the potential to develop serious diseases.

Methods: This hospital based cross-sectional study was carried out to assess the level of awareness and practices of infectious medical waste management among HCWs working in Dhaka Medical College Hospital from January 2022 to December 2022.

Results: The mean age of the HCW was 33.5±9.7 years and working experience was 8.4±8.8 years. About two-thirds of the workers (63.7%) had an adequate level of awareness on infectious medical waste management. The HCW's sex, education, work experiences and workplace were statistically significant with their level of awareness (P<0.005). Female HCWs (72.7%) who completed B.Sc. level (88.8%) and worked in the Surgery department (76.1%) for 5-14 years (77.4%) had an adequate level of awareness of infectious medical waste management. Training attended on infectious medical waste management, knowledge on infectious medical waste and knowledge on regulations of infectious medical waste management were statistically significant with their level of awareness (P<0.005).

Conclusion: The results of the study will provide relevant information regarding future steps that need to be taken to ensure occupational safety of the healthcare workers handling infectious medical waste, improve their working environment, knowledge and also ensure patient's safety. The healthcare institutions provided logistics, such as distinct colored bins, and a thorough MWM-related training program for HCWs.

Keywords: Infectious medical waste, Management, Healthcare workers, Dhaka.

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Introduction

Medical waste is hazardous and infectious waste, which poses major risks to environmental health. Pathological and infectious materials, sharps, and chemical wastes are the most dangerous substances.[1] The wastes produced during the processes of diagnosis, treatment, operation, immunization, or research operations.[2] HCWs, waste workers, hospital visitors, patients, surrounding communities, and ultimately the environment are threatened by poor management and improper disposal of diverse wastes.[3] Cleaning staffs and workers reported that the greatest rates of occupational injuries.[1] Nurses made up 26% of all injury incidents in Australian hospitals.[4]

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The medical institutions use a range of techniques to get rid of waste. These included disposal in municipal bins, burying, selling, dumping, and burning. To separate wastes and guarantee their proper disposal, there is no explicit guideline. Most hospitals gather all wastes into one pile and dispose of it there. These locations include hospital surroundings, municipal corporate dustbins, and the corporation's drum. Waste is thrown away, sold, or poured down the drain and into the main sewer.[3,5] HCWs working in developing countries have distinct risk perceptions and different practices for managing infectious wastes. According to the World Health Organization (WHO), blood borne diseases like hepatitis B & C, and HIV/AIDS are more prevalent among the HCWs.[6,7]

The WHO estimates that the general and hazardous waste kinds make up around 85% and 15% of total medical waste respectively.[8] The quantity of waste produced per patient in healthcare facilities around the world has substantially increased.[9] It is suggested that to dispose through deep burial, landfill disposal, or incineration.[8] Medical waste management (MWM) situations at hospitals in Bangladesh are not satisfactory.[1] It is necessary to carry out many procedures and operations include the right labeling of containers, adequate segregation, proper storage, and ultimately disposal. The receptacles' color-coding for this process improves it.[10]

This risk is heightened by the possibility that inappropriate MWM will result in a variety of illnesses, both infectious and non-infectious, as well as workplace accidents. Because of the potential detrimental effects of improperly managing medical waste itself, both on people and the environment, MWM in hospitals is of utmost importance. Other potential infectious risks may include the spread of drug-resistant micro-organisms from health-care establishments into the environment.[11]

Globally, public awareness about the management of medical wastes has grown significantly in recent years, and serious efforts have been made to ensure the proper and safe disposal of infectious medical waste. A committed waste management team, effective administration, thorough planning, excellent organization, supporting legislation, sufficient funding, and complete employee engagement are other requirements for good MWM in hospitals.[12,13]

In Bangladesh, good MWM is a relatively recent phenomenon, and the government is working to create a fresh, contemporary strategy to deal with medical waste effectively. With funding from the Canadian International Development Agency (CIDA), Project in Agriculture, Rural Industry, Science and Medicine (PRISM-Bangladesh), a reputable national NGO in Bangladesh, recently created a disposal facility for low-cost medical waste treatment and management in Dhaka City.[14,15] This study regarding awareness of infectious MWM to reduce the hazards and circumstances which can affect the health of HCWs, patients, environment and general population in large.

Methods

Study design and settings

This hospital based cross-sectional study was commenced to assess the level of awareness and practices on infectious medical waste management among healthcare workers working in a tertiary level hospital named Dhaka Medical College Hospital.

Sample selection

Three hundred twenty-five healthcare workers (nurse, lab technician, ward boy, cleaner and pharmacist) were selected conveniently who had at least 6 months of working experience.

Data collection procedures

The studied HCWs were interviewed by a pretested semi-structured questionnaire through the face-to-face interview. The questionnaire consists of questions on socio-demographic characteristics and questions related to awareness. Observation in the hospital premises by an observational checklist.

Statistical analysis

The data were analyzed into IBM SPSS v26. Descriptive statistics such as mean, standard deviation and percent were computed for continuous variables of the participants. Chi-square was used to assess the significance of associations between two nominal variables and a p-value of <0.05 at a 95% confidence interval was taken as significant. The results were presented in tables and charts.

Ethical approval

Informed written consent was obtained from each participant. Ethical approval was obtained from the Institutional Review Board (IRB) of the National Institute of Preventive and Social Medicine (NIPSOM), Dhaka 1212, Bangladesh. (NIPSOM/IRB/2017/09)

Results

Table 1 depicts the particulars of the HCWs. The mean age of the 325 respondents of the Dhaka Medical College Hospital was 33.5±9.7 years and more than half (53.8%) of them were in the age group ≥30 years. Two-thirds of the respondents were female (67.7%) among the attending HCWs. One-fourth of the HCWs (25.8%) had secondary & bellow level of education and the rest completed graduation and above. The mean of the working experience was 8.4±8.8 years with a wide range 1-40 years. The majority of the workers (49.8%) was placed in the medicine and allied departments. Figure 1 portrays the designation of the HCWs working in the studied hospital.

Table 1: Particulars of the HCWs (n=325)

Particulars		Frequency (n)	Percent (%)
Age groups (years)	<30	150	46.2
	30-39	94	28.9
	40-49	46	14.2
	≥50	35	10.8
	Mean±SD		33.5±9.7
Sex	Male	105	32.3
	Female	220	67.7
Education	Primary	29	8.9
	Secondary	55	16.9
	B.Sc and above	80	24.6
	Diploma	139	42.8
	Diploma in Lab Technology	22	6.8
Work experiences (years)	<5	154	47.4
	5-14	106	32.6
	15-24	44	13.5
	25-34	14	4.3
	≥35	7	2.2
	Mean±SD		8.4±8.8
Work place (Department)	Medicine and allied	162	49.8
	Surgery and allied	71	21.8
	Emergency	24	7.4
	Obstetrics & Gynaecology	39	12.0
	Laboratory	23	7.1
	Pharmacy	6	1.8

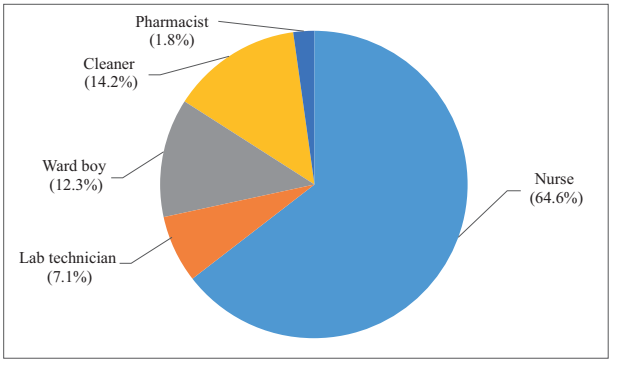

Figure 1: Designation of the HCWs (n=325)

Table 2: Awareness of infectious medical waste management among the HCWs (n=325)

Outlines		Frequency (n)	Percent (%)
Training attended on infectious MWM	Yes	235	72.3
	No	90	27.7
Knowledge about infectious medical waste	Yes	264	81.2
	No	61	18.8
Knowledge of regulations on infectious MWM	Yes	235	72.3
	No	90	27.7
Knowledge about biohazard symbol	Yes	85	26.2
	No	240	73.8
Familiar with the guidelines provided for color coding in the workplace	Yes	257	79.1
	No	68	20.9
Knowledge about the correct bin for disposal of infectious medical waste	Yes	238	73.2
	No	87	26.8
Uses of color of bin	Yellow	154	64.7
	Red	84	35.3
Knowledge about Hepatitis B and C transmission through infectious medical waste	Yes	284	87.4
	No	41	12.6
Knowledge about use of PPE are necessary while handling infectious medical waste	Yes	304	93.5
	No	21	6.5
Knowledge about methods for infectious MWM	Yes	177	54.5
	No	148	45.5
Knowledge about the necessity of disinfection of infectious medical waste	Yes	255	78.5
	No	70	21.5
0.5% bleaching solution is used for disinfection of infectious medical waste	Yes	123	37.8
	No	202	62.2
Awareness about maximum time for infectious medical to be kept in the hospital premises	Yes	296	91.1
	No	29	8.9

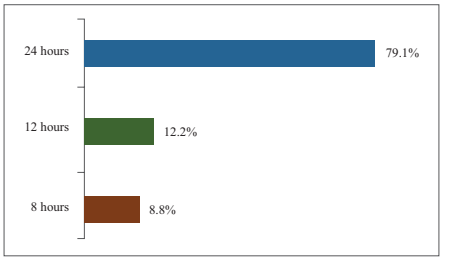

Figure 2: Time for infectious medical waste kept in hospital premises (n=325)

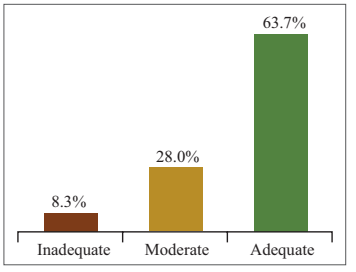

Figure 3: Level of awareness among the HCWs (n=325)

Table 2 evaluates the awareness of infectious medical waste management among the HCWs. The majority of the workers had a good awareness of infectious MWM. Figure 2 represents that four out of five HCWs (79.1%) were aware that infectious medical waste can be kept in the hospital premises for 24 hours.

Figure 3 demonstrates the level of awareness among the HCWs. About two-thirds of the workers (63.7%) had an adequate level of awareness on infectious MWM; and less than one of the tenth workers (8.3%) level of awareness was inadequate and ward boys, cleaners and pharmacists were representing this group.

Table 3 interprets the HCW's socio-demographic eminence with the level of awareness of infectious MWM. HCWs' sex, education, work experiences and workplace, training attended on infectious medical waste management were statistically significant with their level of awareness (P<0.005). Female HCWs (72.7%) who completed B.Sc. level (88.8%) and worked in the Surgery department (76.1%) for 5-14 years (77.4%) had an adequate level of awareness of infectious MWM. Table 4 interprets that training attended on infectious MWM, knowledge of infectious medical waste and knowledge on regulations of infectious MWM were statistically significant with their level of awareness (P<0.005).

Table 3: Association of socio-demographic factors with level of awareness

Factors	Level of awareness				$\chi 2$ value	p-value
	Inadequate	Moderate	Adequate	Total		
	n(%)	n(%)	n(%)	n(%)		
Age groups (years)						
<30	11(7.3)	45(30.0)	94(67.2)	150(100)	4.525	0.606
30-39	7(7.4)	25(26.6)	62(60.0)	94(100)		
40-49	3(6.5)	13(26.6)	30(65.2)	46(100)		
≥50	6(17.1)	8(22.9)	21(60.0)	35(100)		
Sex						
Male	15(14.3)	43(41.0)	47(44.8)	105(100)	24.694	*0.000
Female	12(5.5)	48(21.8)	160(72.7)	220(100)		
Education						
Primary	8(27.6)	12(41.4)	9(31.0)	29(100)	79.977	*0.000
Secondary	7(12.7)	33(60.0)	15(27.3)	55(100)		
B.Sc and above	0(0)	9(11.3)	71(88.8)	80(100)		
Diploma	12(8.6)	30(21.6)	97(69.8)	139(100)		
Diploma in Lab Technology	0(0)	7(31.8)	15(68.2)	22(100)		
Work experiences (years)						
<5	15(9.7)	57(37.0)	82(53.2)	154(100)	43.523	*0.000
5-14	4(3.8)	20(18.9)	82(77.4)	106((100)		
15-24	3(6.8)	7(15.9)	34(77.3)	44(100)		
25-34	1(7.1)	6(42.9)	7(50.0)	14(100)		
≥35	4(57.1)	1(14.3)	2(28.6)	7(100)		
Working place (Department)						
Medicine and allied	14(8.6)	36(22.2)	112(69.1)	162(100)	109.453	*0.000
Surgery and allied	3(4.2)	14(19.7)	54(76.1)	71(100)		
Emergency	4(16.7)	17(70.8)	3(12.5)	24(100)		
Obstetrics & Gynaecology	0(0.0)	16(34.8)	23(65.2)	39(100)		
Laboratory	0(0.0)	8(34.8)	15(65.2)	23(100)		
Pharmacy	6(100)	0(0)	0(0)	6(100)		

*Statistically significant value

Table 4: Association of factors related to the awareness with level of awareness

Factors		Level of awareness				χ2 value	p-value
Inadequate		Moderate	Adequate	Total			
	n(%)	n(%)	n(%)	n(%)			
Training attended on infectious medical waste management	Yes	27(11.5)	72(30.6)	136(57.9)	235(100)	16.963	*0.000
	No	0(0)	19(21.1)	71(78.9)	90(100)		
Knowledge on infectious medical waste	Yes	2(0.8)	55(20.8)	207(78.4)	264(100)	79.977	*0.000
	No	25(41.0)	36(59.0)	0(0)	61(100)		
Knowledge on regulations of infectious medical waste management	Yes	0(0)	31(13.2)	204(86.8)	235(100)	208.158	*0.000
	No	27(30.0)	60(66.7)	3(3.3)	90(100)		

*Statistically significant value

Table 5: Observation checklist of infectious medical waste management in the hospital

Parameters	Observations					
	Medicine	Surgery	Emergency	Gynae & Obs.	Laboratory	Pharmacy
Condition of waste receptacles						
Is yellow colour waste bin available in ward?	Yes	Yes	No	Yes	No	No
Has yellow bag been placed lining the inner side of the yellow bin?	No	No	No	No	No	No
Is yellow bag securely fitted with the bin?	No	No	No	No	No	No
Are waste bins covered?	Yes	Yes	No	Yes	No	No
If covered, is the cover foot-operated?	No	No		No	No	No
Is the biohazard symbol imprinted over waste bin?	No	No	No	No	No	No
Are posters to guide users displayed near waste bins?	Yes	Yes	No	Yes	No	No
Segregation of infectious waste						
Does the yellow bin contain only infectious waste?	No	Yes	No	Yes	No	No
Transportation of infectious medical waste						
Appropriate on-site transport of infectious medical waste used?	Yes	Yes	Yes	Yes	No	No
Is transportation of infectious medical waste done during non-busy hours?	No	No	No	No	No	No
Are infected and general waste transported separately?	No	Yes	No	Yes	No	No

Table 5 shows that the clinical departments like Medicine, Surgery, Obstetrics & Gynaecology had shown more compliance regarding infectious MWM. In the Medicine department, the yellow bins were present but it was not filled with yellow bag securely. The waste bins were not foot operated and the biohazard signage was absent as well. The Surgery and Obstetrics & Gynaecology department found the same compliance. The utilities provided there were maintained grossly in clinical areas. Transportation process analysis has revealed that the infected wastes were not transported in non-busy hours and did not use separate routes for this purpose. The Emergency department has shown a gross lacking in terms of compliance, knowledge and orientation. The bin was not present in the department. The waste management process was non-compliant here. The Laboratory and Pharmacy have shown the same non-compliance as the Emergency department. Bins were not available in these areas too.

Discussion

In this study, the mean age of the 325 HCWs of the Dhaka Medical College Hospital was 33.5±9.7 years and more than half (53.8%) of them were in the age group ≥30 years. In the study in Bhutan among HCPs, the average age was 32.2±7.3 years[16] and in Bangladesh the mean age was 32.3±8.0 years.[2] Two-thirds of the respondents were female (67.7%) among the attending HCWs. In a similar study showed that female respondents were predominant (71.5%).[10] One-fourth of the HCWs (25.8%) completed the secondary level of education and the rest completed graduation and above. The findings of this study are similar to the studies.[10,16]

In the current study, 72.3% of respondents took training on infectious MWM. Similar study showed that, 84.0% of respondents received training on biomedical waste management.[17] 81.2% has adequate knowledge on infectious medical waste and 72.3% were aware of regulations on infectious MWM. A study from Bhutan showed that 98.5% heard about medical waste, 69.7% are aware of regulation on MWM.[16] Only 26.2% respondents identified biohazard symbol. This finding are different from the study in Northwest Ethiopia (57.1%) and in Delhi (91.0%).[18,19] 79.1% respondents are familiar with color coding in the workplace. Similar study showed that, 80.0% of the study participants aware of color coding segregation.[18]

The study revealed that among 325 respondents 73.2% has knowledge about the correct color bin for disposal of infectious medical waste. The result of this study is similar to the study (83.9%).[16] 64.7% mentioned that yellow color bin is used for disposal of infectious medical waste. Similar study showed that, 69.1% of respondents were able to identify that; infectious wastes should be disposed of in yellow color bin.[18] 87.4% of respondents have knowledge about transmission of Hepatitis B and C through infectious medical waste. A study in Northwest Ethiopia showed that, awareness on Hepatitis B transmission through improper management of healthcare waste and it was revealed that 84.6% of HCWs agreed that it could be transmitted. The result of this study is consistent to the study.[6] 93.5% respondents have knowledge about use of PPE while handling infectious medical waste. Study by Letho et al. showed that 35.4% complied with the use of appropriate PPE which is dissimilar with our study.[16]

In this study, 54.5% respondents have knowledge about methods for infectious MWM and 78.5% of respondents have knowledge about the necessity of disinfection of infectious medical waste. Study by Letho et al. showed that 44.7% respondents have knowledge about the methods for MWM and 90.0% believe that the disinfection of medical waste is necessary.[16] 37.8% mentioned that 0.5% bleaching solution is used for disinfection of infectious medical waste. Study by Letho et al. showed that 72.9% were aware that a bleaching solution of 0.5% is used for the disinfection of infectious medical waste. The results of this study are different to the study.[16] 91.1% are aware about maximum time for infectious medical to be kept in the hospital premises. Similar study showed that, 88.0% of the healthcare personnel were aware.[17]

In this study, about two-thirds of the workers (63.7%) had an adequate level of awareness on infectious MWM; and less than one of the tenth workers (8.3%) level of awareness was inadequate and ward boys, cleaners and pharmacists were representing this group. Study by Yenesew, Moges and Woldeyohannes showed that 30.0%, 38.0% and 31.9% had higher, moderate and lower level of awareness respectively.[6]

Conclusion

It is crucial that infectious medical waste is handled and disposed of properly. The study revealed that majority of the respondents had adequate awareness of infectious MWM. Majority of the respondents had knowledge about the correct color bin for disposal of infectious medical waste. They all know about the necessity of use of personal protective measures while handling infectious medical waste and they were aware about maximum time for infectious medical waste to be kept in the hospital premises. Regarding practices on infectious MWM, the clinical departments had shown more compliance, but improvement is required. Lack of knowledge and awareness for the process of infectious MWM were observed. The Emergency department and the supporting services (like Laboratory, Pharmacy) have shown gross lacking in terms of compliance, knowledge and orientation. Training programs on segregation of infectious medical waste at source according to color-coded guidelines may be conducted among all the healthcare workers. Continuous scrutiny inspection on infectious MWM practice by authorities may help to reduce mixture of infectious and non-infectious medical waste.

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