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Original Research Article

Awareness and practices of biomedical waste management in government health care facilities in Kamrup District, Assam

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ABSTRACT

Background: Biomedical waste (BMW) is waste generated in the course of healthcare activities. It is a matter of serious concern to health and environment agencies. Objectives of the study was to assess awareness and practice of healthcare personnels regarding biomedical waste management (BMWM) in government healthcare facilities (HCF) in Kamrup district and to assess training given to healthcare workers involved in BMWM.
Methods: The present study was undertaken in 109 HCF in Kamrup District, Assam. The study duration was for one year and the study population included were healthcare workers (HCW) with the help of a pretested interview schedule to elicit the knowledge of BMW management. An observatory checklist was also used to find out the practices.
Results: About one-fourth of 218 respondents belonged to age group 26-30 years. Half of the respondents were nurses, 17.9% were doctors, 12.8% were pharmacists and 8.3% were waste handlers. Majority (78.4%) were aware of BMWM rules. Awareness on hazardness of healthcare waste, segregation of waste, maximum storage time of hospital waste, awareness about availability of training on healthcare waste management were found to be more among the doctors (84.6%, 79.4%, 56.4%, 82.1% respectively) and less among waste handlers (44.4%, 33.3%, 38.9%, 44.4% respectively). Only 40.8% were trained. The practice of disposing BMW in specified colour coded containers were done by 56.4% HCW. Out of 18 waste handlers, only 16.7% had the practice of wearing all the personal protective equipments (PPE) while handling BMW. All total 59.6% HCW had been vaccinated against Hepatitis B.Tetanus vaccination was taken by 77.5% HCW.
Conclusions: Sensitization and training in accredited centres for HCW should be done regularly to develop awareness and motivation. Continuous monitoring and inspection of HCF need to be done.

Keywords: Awareness, Biomedical waste, Healthcare workers, Practice

INTRODUCTION

The hospitals are meant for treatment and management of patients but many are unaware about the untoward effects of the waste generated by these facilities on human health and environment. Biomedical wastes are any wastes generated during the diagnosis, treatment or immunization of human beings or animals or in the research activities pertaining thereto or in the production or testing of biologicals and including categories mentioned in schedule-1.1 BMW produced in the course of healthcare activities carries a higher potential for infection and injury than any other type of wastes. It is a matter of serious concern to national and international health and environment agencies. Aim of BMW is proper segregation, collection, transport, handling and disposal of waste in the manner safe for environment as well as community. BMWM is a universal phenomenon which if not handled properly may pose hazards to human health and environment in the form of fatal infections,

genotoxicity and cytotoxicity, physical injuries and public sensitivity.The absence of proper waste management, non-segregation of waste according to the required colour-coded system, mixing of all types of waste in one bag, lack of awareness about the health hazards from biomedical waste and proper control of waste disposal are the most critical problems connected with healthcare waste. In order to improve medical waste management, it is important to understand and evaluate the current practices in medical waste management to identify the gaps and to address them. The current position of BMWM is not very well known in primary HCF, especially in rural areas. As very few studies have been conducted regarding awareness and practice of biomedical waste in public healthcare system in Assam, the present study was thus intended to highlight the same.

METHODS

The study was a facility-based descriptive cross sectional study which was undertaken in government HCF of Kamrup district, Assam for one year duration (August 2018 to July 2019).The study population included were HCW (Doctors, nurses, pharmacists, laboratory technicians) and waste handlers from the selected CHC, PHC and subcentres of the district. Using the formula N=Z2PQ/l2 where N=required sample size, Z= confidence level at 95% (standard value of 1.96), P is taken as the proportion of primary HCF having poor BMW management=822, Q =100-P =18, l=relative error, 10% of p=8.2, the required sample size (N) was calculated to be 88. The list of total number of government healthcare facilities in Kamrup district, Assam was obtained from the office of Joint Director of Health Services. From the total no. of 12 CHC and 66 PHC, 50% were selected randomly (i.e., 6 CHC and 33 PHC) for the study. From 280 subcentres, 25% (i.e., 70 subcentres) were selected randomly. Thus a total number of 6 CHC, 33 PHC and 70 subcentres (Total 109 HCF) were selected for the study. Those HCW who gave consent to participate and were present at the time of study were included in the study. Information were collected by visiting the selected HCF with the help of a predesigned and pretested interview schedule to elicit the knowledge of BMW management. An observatory checklist is used to find out practices regarding BMW management prevailing in the selected HCF. On reaching the CHC and PHC, the medical officer (i/c) of the respective health facilities was interviewed regarding the biomedical waste management status of the hospital. If he/she is not available, the respective doctor who was in charge of the facility at that time was interviewed and approval for the study was taken. The purpose of the visit, the nature of the study and content of the schedule was briefed to the HCW of the corresponding facilities and consent was taken for the study. From every selected CHC and PHC, atleast one each from doctor, nurse, pharmacists, lab techs and waste handlers were interviewed. Each CHC and PHC were visited twice. However, after the second visit, data could be collected from 218 respondents. On reaching the subcentres, auxiliary nurse midwife (ANM) who provide primary care in the subcentre, was interviewed regarding the biomedical waste management. Observation was done regarding practice of biomedical waste segregation, colour coding, equipments availability and were noted. One ANM from each subcentre was included in the study. The data collected was entered in Microsoft office excel and analysed by using Graphpad Instat. Chi-square test was used for analysis of categorical variables. Criteria for significance used in the study was $p<0.05$.

RESULTS

Respondent's profile

Table 1 showed that out of 218 respondents, nearly one-fourth (22.5%) belonged to age group 26-30 years. Majority (54.1%) were Hindus. About 53.7% were female. Majority (59.2%) of the respondents had worked for 1-5 years. Half (50%) of the respondents were nurses, 17.9% doctors, 11% pharmacists, 12.8% were lab tech and 8.3% were waste handlers.

Table1: Socio-demographic characteristics of respondents

Demographic variables		Total (n=218)	%
Age of respondent (years)	20-25	26	11.9
	26-30	49	22.5
	31-35	41	18.8
	36-40	37	17
	41-45	36	16.5
	>45	29	13.3
Gender	Male	101	46.3
	Female	117	53.7
	Total	218	100
Profession of respondent	Doctors	39	17.9
	Nurses	109	50
	Lab technician	24	11
	Pharmacist	28	12.8
	Waste handler	18	8.3
Working in hospitals since (years)	<1	19	8.7
	1-5	129	59.2
	6-10	32	14.7
	>10	38	17.4

Knowledge about biomedical waste management

Table 2 showed the training status on BMWM among the health care personnels. Out of 218 respondents, only 40.8% were trained. About 33.7% of the trained personnels received training in the current working place while others (66.3%) received training in different places. Majority (75.3%) did one-day training program on

BMWM. Only 18% of HCW attended BMWM workshop in last 1 year while 65.2% attended within 2 years. Only 16.9% HCW attended training workshop more than 2 years back.

Table 2: Status of training program on BMWM among the health functionaries.

Training status	Variables	Total (%)
Training on BMWM taken	Trained	89 (40.8)
	Untrained	129 (59.2)
	Total	218 (100)
Place of training	Current working place	30 (33.7)
	Received training in different places	59 (66.3)
	Total	89 (100)
Training period	1 day	67 (75.3)
	1-3 day	16 (18)
	>3 day	6 (6.7)
	Total	89 (100)
BMWM workshop attended	Attended in last 1 year	16 (18)
	In last 2 years	58 (65.2)
	>2 years back	15 (16.9)

Table 3 showed the awareness of government health functionaries about biomedical waste management. Out of 218 respondents, 78.4% respondents were aware of the BMWM rules. Majority (79.4%) of the doctors, 48.6% nurses, 58.3% lab technicians, 53.6% pharmacists, 33.3% waste handlers were aware of the revised categories of BMW management while 84.6% doctors, 85.3% nurses, 62.5% lab technicians, 53.6% pharmacists, 38.9% waste handlers were aware of colour coding for biomedical waste segregation. About 82.1% doctors, 56.9% nurses, 54.2%lab technicians, 50% pharmacists and 44% waste handlers aware about separate bag used for waste disposal. Awareness on segregation of waste, maximum storage time of hospital waste, availability of training on healthcare waste management were found to be more among the doctors (79.4%, 56.4%, 82.1% respectively) and less among waste-handlers (33.3%, 38.9%, 44.4% respectively). About 82.1% doctors, 81.7% nurses, 58.3% lab technicians, 39.3% pharmacists and 33.3% waste handlers were aware of reporting of needle stick injury (NSI). Regarding benefits of PPE, 77.1% respondents were aware. The awareness regarding revised categories of BMWM, colour codings for waste segregation, hazardness of healthcare waste and segregation of waste were found to be significantly associated with profession of health functionaries. Also, there is significant association between awareness on maximum storage time of hospital waste, reporting of NSI, availability on training on HCWM with the occupation of the healthcare workers.

Table 3: Awareness of government health functionaries on biomedical waste management.

Awareness regarding BMW management	Doctors n=39 (%)	Nurses n=109 (%)	Lab technician n=24 (%)	Pharmacist n=28 (%)	Waste handlers n=18 (%)	Total n=218 (%)	χ^2, p-value
Implementation of BMWM Rules 2016.	33 (84.6)	88 (80.7)	18 (75)	19 (67.8)	9 (50)	171 (78.4)	9.908, 0.042
Revised categories of BMW management	31 (79.4)	53 (48.6)	14 (58.3)	15 (53.6)	6 (33.3)	119 (54.6)	12.808, 0.0123
Colour codings for waste segregation of BMW	33 (84.6)	93 (85.3)	15 (62.5)	15 (53.6)	7 (38.9)	163 (74.8)	29.307, 0.001
Bag used for waste disposal	32 (82.1)	62 (56.9)	13 (54.2)	14 (50)	8 (44.4)	129 (59.2)	11.527 0.212
Hazardness of healthcare waste	33 (84.6)	78 (71.6)	18 (75)	16 (57.1)	8 (44.4)	153 (70.2)	12.220 0.0158
Segregation of BMW	31 (79.4)	24 (22)	15 (62.5)	12 (42.9)	6 (33.3)	88 (40.4)	47.309 0.0001
Maximum storage time of hospital waste	22 (56.4)	20 (18.3)	12 (50)	10 (35.7)	7 (38.9)	71 (32.6)	23.904 0.0001
Reporting of needle stick injury(NSI)	32 (82.1)	89 (81.7)	14 (58.3)	11 (39.3)	6 (33.3)	152 (69.7)	35.210 <0.01
Benefits of PPE	39 (100)	78 (71.6)	18 (75)	19 (67.9)	14 (77.7)	168 (77.1)	
Availability of training for clinical staff on HCWM	32 (82.1)	45 (41.3)	13 (54.2)	11 (39.3)	8 (44.4)	119 (54.6)	21.012 0.0003

**multiple responses present*

Table 4: Correct practices of government health functionaries for BMWM.

Practices regarding BMW management	Doctor n=39 (%)	Nurse n=109 (%)	Lab technician n=24 (%)	Pharmacist n=28 (%)	Waste handlers n=18 (%)	Total n=218 (%)	χ2, df, p-value
Disposal of waste in specified color coded containers	26 (66.7)	70 (64.2)	13 (54.2)	7 (25)	7 (38.9)	123 (56.4)	17.90, 0.0013
Disposal of sharps in puncture proof containers	32 (82.1)	81 (74.3)	15 (62.5)	13 (46.4)	6 (33.3)	147 (67.4)	21.565, 0.0002
Use any plastic bags for waste segregation	6 (15.4)	27 (24.8)	11 (45.8)	12 (42.9)	8 (44.4)	64 (28.4)	
Recap the used needle	15 (38.5)	43 (39.4)	7 (29.2)	10 (35.7)	7 (38.9)	82 (37.6)	0.9538, 0.9167
Wearing of gloves by HCW while handling BMW	19 (48.8)	43 (39.4)	9 (37.5)	7 (25)	12 (66.7)	90 (41.3)	2.786, 0.5942
Wash hands before and after handling BMW	33 (84.6)	89 (81.7)	11 (45.8)	9 (32.1)	8 (44.4)	150 (68.8)	31.312, 0.0001

N.B. n= Waste handlers who use PPE inadequately

Table 5: Vaccination status of health care functionaries.

Diseases vaccinated against	Doctor n=39 (%)	Nurses n=109 (%)	Lab tech n=24 (%)	Pharmacist n=28 (%)	Waste handler n=18 (%)	Total n=218 (%)	χ2, p-value
Hepatitis B	31	77	8	6	8	130	37.423,
	-79.50%	-70.60%	-33.30%	-21.40%	-44.40%	-59.60%	<0.001
Tetanus	33	92	15	18	11	169	12.794,
	-84.60%	-84.40%	-62.50%	-64.30%	-61.10%	-77.50%	0.0123
Both	31	72	7	6	6	122	37.545,
	-79.50%	-66.10%	-29.20%	-21.40%	-33.30%	-56%	<0.001
None	2 (5.1)	9 (8.3)	3 (12.5)	5 (17.9)	2 (11.1)	21 (9.6)	

Practice about biomedical waste management

Table 4 showed the correct practices of government HCF for biomedical waste management. Out of 218 respondents, practice of disposing BMW in specified colour coded containers were done by 56.4% participants. Overall, 28.4% HCWs use any plastic bag for waste segregation. Overall 37.6% HCWs including 38.5% doctors, 39.4% nurses, 29.2% lab technicians recap the used needle. However, only 41.3% wore gloves while handling BMW. Majority (68.8%) of the participants had the practice of washing hands before and after handling BMW. There is significant association between practice of proper waste segregation, sharps disposal and handwashing with the occupation of the healthcare workers.

Table 5 showed the vaccination status of health care functionaries. It had been observed that 79.5% doctors, 70.6% nurses, 33.3% lab technicians, 21.4% pharmacists and 44.4% waste handlers had been vaccinated against hepatitis B. About 77.5% HCWs were vaccinated against tetanus. Only one-third of waste handlers got vaccinated against both the diseases.

Table 6 showed the practice of using PPE by waste handlers while handling BMW. Two-third waste handlers wore gloves while handling BMW. One-third waste handlers wore masks. Only 22.2% and 16.7% waste handlers respectively had the practice of wearing aprons and boots. Out of 15 waste handlers who use PPE inadequately, non-availability (40%) and lack of awareness (40%) were expressed as the main reason while handling BMW.

Table 6: Practice of using PPE by waste handlers while handling BMW.

PPE used during handling of BMW	No. of waste handlers (N=18)			
	Yes	%	No	%
Gloves	12	66.7%	6	33.3
Masks	6	33.3%	12	66.7
Gloves and masks	5	27.8%	13	72.2
Aprons	4	22.2%	14	77.8
Boots	3	16.7%	15	83.3
All PPE	3	16.7%	15	83.3

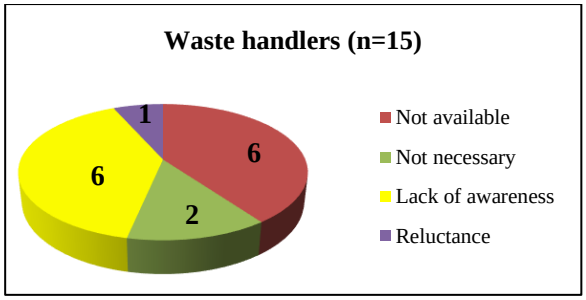

Figure 1: Reasons for inadequate use of personal protective equipment (PPE) by waste handlers while handling BMW.

DISCUSSION

A descriptive, institution-based study was conducted among 218 healthcare providers comprising of doctors, nurses, pharmacists, technicians and waste handlers of selected HCF of a district to assess the knowledge and practice regarding BMW and its management. Out of 218 respondents, majority (22.5%) belonged to age group 26-30 years. Majority (39.9%) of the respondents had worked for 0-5 years and half of the respondents were nurses.

Almost 78.4% were found to be aware of implementation of biomedical waste management rules. Awareness in this regard was 72%, 80%, 75%, 67.8%, 94.4%, 51.4% and just 30.8% in studies conducted in Kothamangalam, Amritsar, Delhi, Khammam, West Bengal, Rajkot and Siliguri respectively.[3-9] Majority (84.6%) of doctors and half of waste handlers were aware of the BMWM rules. Similarly, in a study done at SKIMS and SMHS hospital, it was found to be highest (94.3% and 96% respectively) among doctors and lowest among sanitary staff (26.6% and 25% respectively).[10] However, a study done by Biswas et al found 36% of the nurses have poor knowledge of BMWM.[9]

Nearly 54.6% of study participants were aware of the revised categories of BMW management. Similar findings were found in two studies conducted in Khammam and West Bengal where 52.2% and 55.9% of the study population respectively have correct knowledge of the same.[6,7] It was only 38.5% and 40.4% in study conducted in Bangalore and in Rajkot.[8,11]

Only 44.4% waste handlers were aware on hazardness of healthcare waste. This was in conformation to the study in three apex government hospitals and at district hospital of Agra, where 46% and 33.33% waste handlers respectively were aware of the risk involved in biomedical waste handling.[4,12] In contrast, study at SMHS hospital, Mysore found only 4% waste handlers were aware of risks involved in biomedical waste handling.[13] Only 40% were aware that BMW had to be segregated at source. This was in contrast to the study done by Devi et al and in Meerut, where 91.8% and 90% of the HCW knew that wastes have to be segregated.[14,15] About 77.1% HCWs were aware of benefits of PPE. In a study done in West Bengal, it was found that 70.2% of respondents knew the use of gloves and mask together.[7]

Training status

Only 40.8% respondents had formal training on BMW management. About 33.7% of the trained personnels received training in the current working place while others (66.3%) received training in different places. Majority (75.3%) did one-day training program on BMWM. Only 18% of HCW attended BMWM workshop in last 1 year while 65.2% attended within 2 years. Only 16.9% HCWs attended training workshop more than 2 years back. The findings were similar to the study done in Rajkot, Delhi and Chennai city where only 44.7%, about half and 46.4% of the health workers respectively were trained.[4,16] Observations made in Chennai found that 39.3% respondents from government and private hospital were trained from different places and majority (24.3%) of government and private hospital respondents received training for the period of 1-15 days. The finding was in contrast to the study done on hospitals in Mysore city and in Kothamangalam, where it was found that 7.27% and 16.3% respectively of the health workers underwent training.[3,13] A study done in major hospitals in Srinagar city found that no specific training and awareness programs on BMW were organized by hospital authorities.[10]

Practice

The practice of disposing BMW in specified colour coded containers were done by about 56.3% HCW. Overall, 28.4% HCWs use any plastic bag for waste segregation. A study done in Surat found that >50% has faulty practice regarding disposal of BMW.[17] In a study done in Kothamangalam, BMW management according to color coding is found to be nil among the study subjects.[3] However, in studies done in Chennai and in Davangere it was found that 28%, and 27% respondents respectively chose any plastic bag for segregation of BMW.[18,19]

Overall 37.6% HCWs recap the used needle. Only 41.3% wore gloves while handling BMW. Majority (68.8%) had the practice of washing hands before and after handling BMW.

Out of 18 waste handlers, 12 (66.7%) wore gloves while handling BMW. One-third of them wore masks. Only 4 (22.2%) and 3 (16.7%) respectively had the practice of wearing aprons and boots. Similarly, out of 10 waste handlers, in Lady Lyall Maternity Hospital, Agra, 8 (80%) wore gloves during waste handling, only 1 (10%) reported to wore apron, 1 (10%) used boots and 1 (10%) used mask while 2 (20%) did not use any PPE during waste handling. Out of 6 waste handlers at district hospital, Agra, 2 (33.33%) wore gloves during waste handling while the remaining 4 (66.67%) did not use any

PPE. Chudasama et al in Rajkot found that 84.8% used PPM while handling BMW.[8]

Out of 15 waste handlers who use PPE inadequately, non-availability 6 (40%) and lack of awareness 6 (40%) were expressed as the main reason while handling BMW. In a study done by Sharma et al in Agra, out of total 54 waste handlers, 17 (31.48%) reported that only gloves are available during waste handling.[12]

Nearly 169 (77.5%) and 130 (59.6%) of HCP had been vaccinated against tetanus and hepatitis B. About 122 (56%) got vaccinated against both the diseases while 21 (9.6%) did not received any vaccination at all. These findings were in contrary to the study done in nursing homes in Delhi where it was found that in 53 (88.3%) workers in south and 46 (82.1%) in east zone received both Tetanus and hepatitis B vaccination, 3 (5%) in south and 3 (5.4%) in east zone received only Tetanus and only hepatitis B vaccination respectively, 1 (1.7%) in south zone and 3 (5.4%) in east zone did not received any vaccination.[5]

CONCLUSION

The study revealed that majority were aware of Biomedical waste management rules. The awareness regarding revised categories of BMWM, colour codings for waste segregation, storage and hazardness of healthcare waste, reporting of needle stick injury(NSI) were found to be significantly associated with occupation of healthcare personnels. Also, there is significant association between practice of proper waste segregation, sharps disposal and handwashing before and after handling BMW with the occupation of the healthcare workers. Very few HCWs were trained and vaccination against both Tetanus and hepatitis B was not adequate. The association between vaccination status with the profession of healthcare functionaries was found to be statistically significant. Only about one-fourth of waste handlers wore both gloves and masks while handling BMW.

Recommendations

Strict implementation of BMW management and handling rules is essential in all healthcare institutions for efficient segregation and management of waste. Sensitization and training in accredited centres for health care functionaries should be done regularly and at frequent intervals to develop awareness and motivation among health care workers and waste handlers. Continuous monitoring and inspection of HCF should be done by designated officials from PCB to ensure compliance towards the rules.

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