



EVALUATION OF KNOWLEDGE AND DISPOSAL OF BIOMEDICAL WASTE MANAGEMENT PRACTICES AMONG HEALTH CONCERN EMPLOYEES IN TERTIARY CARE HOSPITAL

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ABSTRACT **BACKGROUND:** Biomedical waste (BMW) generated at hospitals needs proper segregation and disposal to prevent hazardous diseases. Adequate knowledge, awareness and disposal practices (KAP) among healthcare personnel are prerequisite for handling of BMW. Several previous studies had stated that KAP about BMW management among healthcare persons in hospitals were not satisfactory and recommended further training for BMW management. Present study was conducted to evaluate the KAP about BMW management among various categories of healthcare employees working in a tertiary care teaching hospital.

METHODS: Total 267 employees were selected by random sampling method. All the participants were asked to answer the pretested, predesigned structured closed ended questionnaire 8 each for knowledge, awareness and disposal practices individually. Data was analysed using student paired T test, Chi-square test at 95% confidence limits and p value <0.05 was considered as statistically significant.

RESULTS: Nearly 72%, 85% and 88% of total participants scored more than average marks for knowledge, awareness and disposal practices respectively. For knowledge and awareness the p values (p<0.001) were highly significant between resident doctors and housekeeping staff; whereas for disposal practices p values were not significant (p>0.05), when compared between resident doctors and nursing staff/ technicians or housekeeping staff.

CONCLUSIONS: Overall KAP about BMW management was satisfactory in all categories of study participants. Theoretical knowledge and awareness scores were higher among resident doctors and nursing staff vice versa the disposal practices scores were higher in technicians and housekeeping staff.

KEYWORDS : Biomedical waste, knowledge, awareness, disposal practices

INTRODUCTION

Globally enormous advancement and rising expectations of people about medical facilities leads to the unprecedented production of medical equipments with simultaneous increase in numbers of hospitals. This sky-scraping number of hospitals invariably increased the generation of biomedical waste per patient per healthcare units as hospital biomedical waste production.^[1] According to the Ministry of environment and Forests notification in the Bio-Medical Waste (Management and handling) rules, 1998; 'Biomedical waste' means any waste which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining there to or in the production or testing of biological.^[2]

Biomedical waste (BMW) which is generated by hospitals can be grouped as nonhazardous or general and biohazardous wastes. General waste comprises about 75-85% and biohazardous waste comprises remaining 15-25% of total hospital biomedical wastes.^[3,4]

Nonhazardous waste from hospitals may contain noninfected plastics and cardboards, stationary and paper or broken infrastructure materials. Biohazardous waste again can be divided as infectious waste and noninfectious waste. Infectious biohazardous waste comprises of human secretions, liquids, sharp objects, body parts, blood and related materials etc. Noninfectious biohazardous waste consists of radioactive materials, mercury from medical equipments, chemical wastes, incinerated waste, cytotoxic materials and discarded glass wastes etc.^[5]

Healthcare personnel at risk of getting health hazards via BMW includes the front liner hospital employees such as doctors, nursing staff, technicians and housekeeping staff. Several previous studies showed that there is a huge lack of awareness and poor knowledge about the BMW management among health care personnel especially in multispecialty hospitals or tertiary care hospitals in our country.^[6-9]

These studies stated that the theoretical knowledge about waste segregation and disposal of BMW was better among teaching staff or doctors as compared to nonteaching staff, but practical aspects were better among nursing staff and technicians.^[10-13]

With this background our study was designed to evaluate the knowledge, awareness and disposal practices regarding biomedical waste management amid health concern employees in a tertiary care teaching hospital of North India. Hence the present study was planned to evaluate the knowledge and awareness regarding BMW management and its hazards in health concern employees of tertiary care teaching hospital and to obtain the details about the disposal practices of BMW amid these study participants.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted at tertiary care teaching hospital of North India over a study period of six months. In our sampling frame presuming an estimated KAP about BMW as 50% with an error of precision 6% and confidence interval of 95% the sample size calculated was 267. Using random sampling method total 267 study participants were included and divided into four different categories according to their designations, consisting 54 resident doctors, 106 nursing staff, 45 technicians and 62 housekeeping employees. Ethical clearance to conduct study was obtained from Institutional Ethics Committee with reference no. RMRI/ IEC/ 2020/ 007 dated 26/08/2020.

The data collection was done by using a pretested, predesigned structured closed ended questionnaire containing questions about knowledge, awareness and disposal practices of biomedical waste management. The structured questionnaire was constructed in two parts: Part A to record demographic data and part B included 8 questions each in sections on knowledge, awareness and disposal practice on BMW management. Knowledge questions were based on theoretical knowledge about the colour coding for segregation with symbols identifications, GOI rules for BMW, needle and sharp infected waste treatment etc. Awareness questions included the participant's awareness about BMW hazards, categories of BMW, hospital policies for disinfection and the willingness for training on BMW. Disposal practices of BMW questions were mainly on use of Personal Protective Equipments (PPE) and methods of disposal at hospital along with the need of further training on BMW management. These questionnaires were made both in English and local language so that HK staff or any other employee faces no difficulty in answering.

Knowledge section had multiple choices with single correct answers and awareness and disposal practice section had to be answered either yes or no. Two marks were awarded for each yes response or correct answer making a maximum score of 16 marks in each section. KAP of participants about BMW management was evaluated using scoring system; where score ≥ 12 represented good, 7-11 score was average and ≤ 6 score was considered as poor. The sheets of these structured questionnaires were distributed to all the participants individually and were collected after they completed the answers.

Statistical Analysis:

Data was analyzed using descriptive statistics like percentage, mean, and SD (standard deviation). Student paired T test and Chi-square test was used to compare frequencies at 95% confidence interval and the analyzed data is presented in the form of tables, diagrams and graphs. P value 0.05 was considered as statistically significant.

Table 1: Demographic characteristics and vaccination status of study participants

Characteristics	Resident doctors (n= 54)	Nursing staff (n= 106)	Technicians (n= 45)	Housekeeping staff (n= 62)	Total (n= 267)
Sex distribution M:F	37: 17	12: 94	25: 20	34: 28	108: 159
Age (Mean±SD)	26.537±1.840	29.301±5.039	27.244±3.113	31.177±6.532	28.831±4.995
Working period >6 months	26	63	14	5	108(40.45%)
> 1 year	24	17	5	28	74(27.71%)
>2 years	4	26	26	29	85(31.8%)
Vaccination TT	54	97	42	40	233(87.26%)
Hepatitis B	50	97	38	22	207(77.5%)

Table 2: Distribution of knowledge, awareness and disposal practice questionnaire scores among different categories of study participants

	Score	Resident doctors (n=54)	Nursing staff (n=106)	Technicians (n=45)	Housekeeping staff (n=62)	Total (n=267)
Knowledge about BMW	Good	30(55.55%)	45(42.46%)	20(44.44%)	6(9.6%)	101(37.82%)
	Average	18(33.34%)	36(33.96%)	15(33.34%)	22(35.4%)	91(34.08%)
	Poor	6(11.11%)	25(23.58%)	10(22.22%)	34(54.8%)	75(28.08%)
Awareness about BMW	Good	40(74.07%)	56(52.83%)	30(66.66%)	12(19.35%)	138(51.68%)
	Average	12(22.22%)	32(30.18%)	11(24.44%)	32(51.61%)	87(32.58%)
	Poor	2(3.7%)	18(16.98%)	4(8.88%)	18(29.03%)	42(15.73%)
Disposal Practice about BMW	Good	26(48.14%)	58(54.71%)	32(71.11%)	34(54.8%)	150(56.17%)
	Average	22(40.70%)	36(33.96%)	11(24.44%)	18(29.03%)	87(32.58%)
	Poor	6(11.11%)	12(11.32%)	2(4.44%)	10(16.12%)	30(11.23%)

Table 3: Participants response as yes for awareness questionnaire

Sl no	Questionnaire for awareness / attitude	Resident doctors 54	Nursing staff 106	Technicians 45	Housekeeping staff 62	Total 267
1	Aware about generation and legislation rules of BMW	50(92.59%)	82(77.35%)	38(84.44%)	40(64.5%)	210(78.65%)
2	Know that BMW and general waste are treated separately	48(88.89%)	90(84.9%)	36(80%)	47(75.8%)	221(82.78%)
3	Heard of color coding for BMW	52(96.29%)	96(90.5%)	41(91.11%)	32(51.61%)	221(82.78%)

4	Aware of site for BMW treatment at your hospital	38(70.37%)	70(66.3%)	34(75.55%)	45(72.58%)	187(70.03%)
5	Aware of various categories of BMW	42(77.78%)	71(66.98%)	30(66.67%)	22(35.48%)	165(61.79%)
6	Do you think that improper disposal of BMW can cause hazardous diseases	52(96.29%)	82(77.35%)	39(86.66%)	36(58.06%)	209(78.27%)
7	Is your knowledge about BMW satisfactory	24(44.45%)	46(43.39%)	24(53.33%)	14(22.58%)	108(40.04%)
8	Are you willing to take BMW training if provided by hospital	47(87.03%)	90(84.9%)	30(66.67%)	45(72.58%)	212(79.4%)

Table 4: Participants response as yes for disposal practice questionnaires

Sl no	Questionnaire for disposal practices	Resident doctors 54	Nursing staff 106	Technicians 45	Housekeeping staff 62	Total 267
1	Do you use PPE during BMW handling	30(55.56%)	82(77.35%)	40(88.89%)	40(64.5%)	192(71.9%)
2	Dispose BMW in different color bags	38(70.37%)	70(66.03%)	41(91.11%)	36(58.06%)	185(69.28%)
3	Is untreated BMW stored for a max period of 48 hours (GOI rules)	34(62.96%)	80(75.47%)	40(88.89%)	44(70.96%)	198(74.15%)
4	Do you discard used needles into needle destroyer	42(77.78%)	96(90.5%)	40(88.89%)	40(64.5%)	218(81.64%)
5	At hospital the BMW is disinfected before disposal	20(37.03%)	70(66.03%)	34(75.55%)	44(70.96%)	168(62.92%)
6	BMW records are maintained regularly and audited periodically	40(74.07%)	76(71.69%)	38(84.44%)	31(50%)	185(69.28%)
7	Is your training for BMW management is inadequate	34(62.96%)	82(77.35%)	28(62.22%)	41(66.12%)	185(69.28%)
8	Do you need further training in BMW management	36(66.66%)	80(75.47%)	30(66.67%)	40(64.5%)	186(69.66%)

Table 5: Mean±SD for awareness, knowledge and disposal practice among various categories of study participants

		Resident doctors	Nursing staff	Technicians	Housekeeping staff
Mean ±SD	Awareness	12.228±3.051	10.509±3.621	11.466±3.448	9.064±3.487
	Knowledge	11.148±3.40	9.754±3.721	9.777±3.843	7.258±3.715
	Disposal practice	10.703±3.564	11.037±3.383	11.822±2.790	10.903±4.092

Table 6: p-values for awareness, knowledge and disposal practice are compared between various categories of participants with resident doctors (highly significant, *significant and † not significant)**

Study categories	p-value		
	Awareness	Knowledge	Disposal practice
Resident doctors Vs Nursing staff	p<0.05*	p>0.05 †	p>0.05 †

Resident doctors Vs Technicians	p>0.05†	p>0.05†	p>0.05†
Resident doctors Vs Housekeeping staff	p<0.001**	p<0.001**	p>0.05†

RESULTS

Total 267 study participants included 108 (40.45%) males and 159 (59.55%) females with mean age of 28.831±4.995. Among the total study participants 40.45% were working since >6 months duration whereas 31.8% of participants were working for more than 2 years duration. Majorities (87.26%) of the study participants were immunized with TT and more than 3/4th of total participants were immunized with Hepatitis B vaccine. [Table 1].

Good theoretical knowledge (≥ 12 score) about BMW management rules and health related hazards was found in 55.55% resident doctors, 42.46% nursing staff, 44.44% technicians and only 9.6% HK staff. Nearly 1/3rd of participants in all categories had an average knowledge score (7-11) about the BMW management; whereas about 55% HK staff and 28% of total study participants scored poor marks (≤ 6) for knowledge. 74% resident doctors, more than 50% nursing staff and 2/3rd technicians scored good (≥ 12) marks for awareness about the BMW legislation, treatment, color coding, categories and disinfection. Nearly 1/3rd of total participants scored an average (7-11) marks for awareness about the BMW. 29% HK staff and 17% nursing staff with only 2 doctors, and 4 technicians scored poor (≤ 6) marks for awareness about the BMW. In disposal practice of BMW 71.11% technicians, 54.7% nursing and HK staff and 48.14% resident doctors scored good (≥ 12) marks. 32.58% and only 11.23% of total participants scored an average (7-11) and poor (≤ 6) marks in disposal practice of BMW, respectively. [Table 2].

Nearly 82% of total study participants were aware that BMW and general waste are treated separately and also heard of color coding for separation. About 79% of total study participants were aware about the legislation and rules of BMW, thought that BMW can cause hazardous diseases. Only 22% HK staff and 40% of the total study participants thought that their knowledge about BMW management was satisfactory; whereas 79% of total participants were willing to take the BMW training if provided by the hospital. [Table 3].

About 89% technicians and 77% nursing staff were using PPE during BMW handling; however 65% HK staff and only 55% resident doctors used PPE during BMW handling. Almost 70% of total study participant disposes BMW in respective color bags with maintenance of regular records. Similarly 70% of total study participants feel their training on BMW is inadequate and hence require further training on BMW management. Nearly 90% technicians, nursing staff and 82% of the total participants discard the needles in needle destroyers. [Table 4].

Mean score for awareness (12.228±3.051) and knowledge (11.148±3.40) was highest in resident doctors, followed by technicians than nursing staff. HK staff had lowest score of 9.064±3.487 and 7.258±3.715 for awareness and knowledge respectively. However the mean score for disposal practices was seen highest among technicians (11.822±2.790) and lowest in resident doctors (10.703±3.564). [Table 5].

The p values were compared between resident doctors with the nursing staff, technicians, and HK staff for mean scores of KAP about the BMW management. For awareness and knowledge the p values were highly significant (p<0.001**) between resident doctors and HK staff. Significant p value (p<0.05*) was also found between resident doctors and nursing staff for awareness; however the p values for awareness, knowledge and disposal practices were not significant (p>0.05†) when compared between resident doctors and technicians [Table 6].

96% resident doctors, 83% nursing staff, 91% technicians and 71% HK staff scored more than average marks (≥ 7) for awareness questionnaires; whereas for knowledge questionnaires 89%, 76%, 78% and 45% of resident doctors, nursing staff, technicians and HK staff, respectively scored ≥ 7 score. 95% technicians, 89% of resident doctors / nursing staff and 84%, HK staff scored more than average marks for disposal practice questionnaires. [Fig 1].

DISCUSSION

Poor knowledge, less awareness and lack of proper BMW disposal increases the risk of transmission of several critical health problems like HIV/AIDS, Hepatitis B and HCV. [14 - 16] Government of India implemented Biomedical Waste (management and handling) Rules 1998 to minimize the risk of transmission from BMW and also gave

five step management guidelines for the BMW management. [2]

In this context our study was conducted to evaluate the KAP for BMW by the health care employees of different categories working in our tertiary care teaching hospital of North India.

In our study more than 50% doctors and more than 40% nursing staff / technicians; whereas only 9.6% HK staff, scored good marks for theoretical knowledge about BMW management. Several previous studies also stated that BMW management knowledge was highest among doctors followed by nursing staff, technicians followed by HK staff or sanitary staff well in accordance with their respective theoretical edification levels. [3,7,10,17]

Majority of our study participants in all categories were aware of the generation and legislation rules of BMW. On contrary Alok *et al.* [18] concluded that the knowledge and awareness level of doctors, nurses, technicians and class IV employees was poor about BMW generation, legislation and management. More than 90% of resident doctors, nursing staff, technicians and only 50% HK staff were aware about the color coding for various waste categories. Similar observations were found by Bhaskar *et al.* [11], Rawat *et al.* [12] and Rajesh *et al.* [4] that most of the participants were aware of segregation and safe collection of BMW; whereas Mathur *et al.* [6] concluded that knowledge about color coding of containers and waste segregation was high in technically qualified staff compared to sanitary staff. On contrary Sangeetha *et al.* [16] showed that less than 40% of health care personnel in all categories were aware of color coding bags.

In present study for awareness about BMW 3/4th of resident doctors, 2/3rd of technicians, half of nursing staff and 1/5th of HK staff scored good marks; the mean score was highest among resident doctors followed by technicians, nursing staff and HK staff. Statistically significant difference for mean awareness score was found between resident doctors vs. nursing staff (p<0.05) and resident doctors vs. HK staff (p<0.001). Pallavi *et al.* [7] also assessed that regarding general information about BMW 100% doctors, 70% nursing staff and only 22% housing staff scored good; whereas average score was highest in doctors followed by nursing staff and housing staff. This clearly indicated that the educational level and technical training is directly related to the BMW handling.

Our study found that more than 90% technicians / nursing staff, 70% resident doctors and 60% HK staff disposes the BMW in respective color bags and needles into needle destroyers, this differs from previous studies by Malini A & Eshwar B [3], Mathur *et al.* [6], Sangeetha *et al.* [16]. In this study 75%, 70% and 62% participants knew the storage period, use of PPE and disinfection of BMW before disposal, respectively. On contrary Amal *et al.* [5] study showed that 76% respondents either don't know the storage place and/or storage time of BMW at their hospital. In present study on disposal practice about BMW management 71% technicians and almost 50% resident doctors, nursing staff and HK staff scored good marks with mean score of about 11/16 in all categories. P values were not statistically significant (p>0.05) when compared among various study groups. Higher disposal practice score among technicians, nursing staff and HK staff was found because they carry the greater responsibility of disposal of BMW compared to doctors. These observations were similar to the studies done by Divya *et al.* [10] and Pallavi *et al.* [7] they also found a higher score for disposal practices among HK staff and nursing staff compare to doctors.

More than 75% of our study participants including 92% resident doctors, 91% nursing staffs, 82% technicians and 35% HK staff were immunized with Hepatitis B vaccine. Similarly Nitika *et al.* [8] found that 86% doctors, 80% nursing staff, 54% paramedical staff and only 10% class IV staff were vaccinated against Hepatitis B.

CONCLUSIONS

Present study concludes that at our hospital the KAP about BMW management among health care personnel was present in satisfactory percentage of study participants in all categories. About the BMW management the theoretical knowledge was higher among resident doctors/ nursing staff and vice versa the practical aspects were better among technicians and HK staff.

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