



**Original Article:**

**Awareness and Practice of Biomedical Waste Management Among Different Health Care Personnel at Tertiary Care Centre, Rajkot, India.**

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**Abstract: Background:** Bio medical waste collection and proper disposal has become a significant concern for both the medical and general community. **Objective:** To know the awareness and practice of biomedical waste management (BMW) among health care personnel working at a tertiary care centre. **Methods:** The study was conducted from January 2013 to June 2013. It was a descriptive observational hospital based cross sectional study. Study participants included the resident and intern doctors, nursing staff, laboratory technicians, sanitary staff (ward boys, aaya and sweepers) working in the P D U Government Medical College and Civil Hospital, Rajkot who are dealing with BMW. The study was conducted by using pretested, semi-structured pro forma. **Results:** Total 282 health care personnel participated, including 123 resident and intern doctors, 92 nursing personnel, 13 laboratory technicians and 54 sanitary staff. Only 44.3% study participants received training for bio medical waste management. Except for doctors (98.4%), awareness regarding identification and use of color coded bags as per BMW act, was very poor among health care personnel. Record keeping for injuries related to biomedical waste was very poor for all health care personnel. Significant number of paramedics maintained record of BMW at work place, practiced disinfection and segregation of BMW at work place, used personal protective measures while handling BMW. Significant number of resident and intern doctors practiced correct method for collecting sharps and needles than paramedical staff. **Conclusion:** Intensive training program at regular time interval and a system of

monitoring and surveillance about practice of day to day BMW management should be evolved.

**Key Words:** Bio medical waste; Health care personnel; Awareness; Practice

**Introduction:**

Over the years, there have been tremendous advances in the health care system so it is ironic that health care settings, which restore and maintain community health, also threaten patients` well being.[1] One major threat arises from poor waste management practices, which pose a huge risk to the health of the public, patients and professionals and contribute to environmental degradation. Hospital waste is a special type of waste produced in small quantities carrying a high potential of infection and injury.[2] Inadequate and improper handling may have serious public health consequences and a significant impact on the environment.[3]

According to Bio-Medical Waste (management and handling) rules, 1998 of India, Bio Medical Waste (BMW) means any solid, fluid, or liquid waste including its containers and any intermediate product which is generated during the diagnosis, treatment, or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biological and includes ten categories for same.[4] Majority of waste (75-90%) produced by the healthcare providers is non-risk or general and it is estimated that the remaining (10-25%) of healthcare waste is regarded as hazardous and has the potential for creating a variety of health problems.[5]

Bio medical waste collection and proper disposal has become a significant concern for both the medical and general community.[6] Among all health problems, there is a particular concern with HIV/AIDS, Hepatitis B and C, for which there is a strong evidence of transmission through healthcare waste. The BMW rule applies to all those who generate, collect, receive, store, transport, treat, dispose or handle BMW in any manner and also to every institution that generate BMW. The bio medical waste should be segregated at source into color coded bags or containers and its collection and proper disposal should be a significant concern for both medical personnel and general community.[6] It is estimated that annually about 0.33 million tonnes of hospital waste is generated in India and, the waste generation rate ranges from 0.5 to 2.0 kg per bed per day.[7] Effective management of biomedical waste is not only a legal necessity but also a social responsibility. Hence, there is a need for resource material to help administrators, doctors, nurses and paramedical staffs. The purpose of BMW management is mainly to reduce waste generation, to ensure its efficient collection, handling, as well as safe disposal in such a way that it controls infection and improves safety for employees working in the system. For this, a conscious, coordinated and cooperative efforts has to be made from physicians to ward boys.[8] The present study was conducted with objective to know the awareness and practice of biomedical waste management among health care personnel working at P D U Government Medical College and Civil Hospital (tertiary care centre), Rajkot.

#### Material and Method

The study was conducted at P D U Government Medical College and Civil Hospital, Rajkot. The institute is a tertiary care centre serving not only the Rajkot city and district, but also the other districts of Saurashtra region. Patients visit this institute from different surrounding districts like Junagadh, Probandar, Jamnagar and Kutch. The study was conducted from January 2013 to June 2013. Ethical clearance was taken from the institutional ethical committee to conduct the study. It was a descriptive observational hospital based cross sectional study. Study participants included the resident doctors intern doctors, nursing staff, laboratory technicians, ward boys and sweepers working in the institute who were dealing with BMW. The study was conducted by using pretested, semi-structured pro forma.

The study included details of various socio-demographic variables, like age, sex, educational status, working experience, type of work, and other details regarding knowledge, attitude and practice for bio medical waste handling and its management. All the resident doctors, intern doctors, nurses and other health staff were invited individually to participate in the study after giving the informed consent. All the study participants were assured about their confidentiality and anonymity. Total 282 health care personnel participated in the present study. It included 123 resident and intern doctors, 92 nurses, 13 laboratory technicians, and 54 sanitary staff. The data was tabulated and interpretation was done by using percentages through Epi Info 3.5.1 software.[9]

#### Results

Total 282 health care personnel participated in present study. The study participants included were having age range of 21-44 years. Out of 282 study participants, 123 were resident and intern doctors, 92 nursing personnel, 13 laboratory technicians and 54 sanitary staff (Table 1). Majority of study participants belonged to 21-30 years (61%) of age group. More than two third of study participants were working in hospital from 1 to 5 years. Only 44.3% study participants received training for bio medical waste management.

Characteristics	Number (n=282)	Percentage
Age		
21-25 years	67	23.76
26-30 years	105	37.23
31-35 years	36	12.76
36-40 years	32	11.34
> 40 years	42	14.89
Sex		
Male	119	47.20
Female	163	57.80
Working status		
Doctors (residents & interns)	123	43.61
Laboratory technician	13	4.61
Nurses	92	32.62
Sanitary staff	54	19.15
Working in hospitals since		
< 1 year	1	00.35
1-5 years	191	67.73
6-10 years	52	18.43
> 10 years	38	13.47
Received any training for BMW management		
Yes	124	44.29
No	158	56.03
Heard about Bio Medical Waste (BMW)	269	95.4
Heard about BMW Rule/Act, 1998	145	51.4

Majority of health care personnel except sanitary staff, had heard about biomedical waste and BMW rule/act (Table 2). Though majority (79.6%) sanitary staff had heard about biomedical waste, only 3.7% were actually aware about the BMW act. Only 28.5% resident and intern doctors, and 25.9% sanitary staff had received training for BMW. Awareness related to various diseases transmitted by BMW among sanitary staff was poor. Majority of health care personnel were aware about availability of different colored bags used for BMW collection but for identification of color coded bags used as per BMW act, except doctors (98.4%) awareness among other health care personnel was very poor. Overall practice related to biomedical waste management was found to be good among the nursing staff and laboratory technicians (Table 3). Majority of doctors (89.4%), nurses (96.7%) and laboratory technicians (100%) were practicing segregation of BMW at work place. Similar findings were reported for disinfection of BMW before disposal among them. Use of personal protective measures while handling biomedical waste was inadequate among doctors (78.9%) and sanitary staff (74.1%). Record keeping for injuries related to biomedical waste was very poor for all health care personnel.

Comparison was made for awareness about biomedical waste management and its rule among doctors and paramedical workers including nursing staff and laboratory technicians (Table 4). Significant number of resident and intern doctors had heard about biomedical waste management act ( $p < 0.00$ ), were knowing all BMW categories ( $p < 0.00$ ), diseases transmitted by BMW like HIV ( $p < 0.00$ ), hepatitis B ( $p < 0.00$ ), tuberculosis ( $p < 0.00$ ), hepatitis C ( $p < 0.00$ ); identified all colored bags ( $p < 0.00$ ) and methods ( $p < 0.00$ ) used for BMW management as compared to the paramedical staff. Also they suggested regular educational

program/training requirement for biomedical waste management.

Awareness	Doctors (n=123) No. (%)	Nurses (n=92) No. (%)	Laboratory technicians (n=13) No. (%)	Sanitary staff (n=54) No. (%)
Heard about Bio Medical Waste (BMW)	121 (98.4)	92 (100.0)	13 (100.0)	43 (79.6)
Heard about BMW Rule/Act, 1998	94 (76.4)	41 (44.6)	8 (61.5)	2 (3.7)
Received any training for BMW management	35 (28.5)	67 (72.8)	8 (61.5)	14 (25.9)
Know about Bio Hazard Symbol	115 (93.5)	90 (97.8)	13 (100)	29 (53.7)
Is present hospital generates BMW	123 (100)	92 (100)	13 (100)	43 (79.6)
Know all BMW management categories	93 (75.6)	18 (19.6)	2 (15.4)	1 (1.2)
Is any BMW management disposal policy there in present hospital	117 (95.1)	89 (96.7)	13 (100)	25 (46.3)
Any health hazard associated with BMW	122 (99.2)	92 (100)	13 (100)	46 (85.2)
<b>Diseases transmitted by BMW</b>				
HIV	110 (89.4)	71 (77.2)	9 (69.2)	15 (27.8)
Hepatitis B	100 (81.3)	49 (53.3)	3 (23.1)	4 (7.4)
Tuberculosis	17 (13.8)	4 (4.3)	0 (0.0)	2 (3.7)
Hepatitis A	23 (18.7)	3 (2.4)	0 (0.0)	0 (0.0)
Other infectious diseases	77 (62.6)	55 (59.8)	6 (46.2)	12 (22.2)
Are different colored bags used to dispose BMW	122 (99.2)	92 (100)	13 (100)	45 (83.3)
Regular educational program/training needed for BMW	120 (97.6)	86 (93.5)	9 (69.2)	37 (68.5)
Any guideline provided for color coding at work area	110 (89.4)	84 (91.3)	12 (92.3)	23 (42.6)
Identified all colored bags used for BMW collection	121 (98.4)	18 (33.3)	2 (3.7)	1 (1.9)
Identified methods for BMW management	118 (95.9)	80 (87.0%)	7 (53.8%)	26 (48.1)

Practice	Doctors (n=123) No. (%)	Nurses (n=92) No. (%)	Laboratory technicians (n=13) No. (%)	Sanitary staff (n=54) No. (%)
Maintaining BMW records at work place	88 (71.5)	89 (96.7)	13 (100)	19 (35.2)
Segregation of BMW done at work place	110 (89.4)	89 (96.7)	13 (100)	19 (35.2)
Disinfection of BMW done before disposal at work place	108 (87.8)	87 (94.6)	13 (100)	31 (57.4)
Using personal protective measures while handling BMW	97 (78.9)	90 (97.8)	13 (100)	40 (74.1)
Personal protective measures procured for handling BMW	90 (73.1)	90 (97.8)	13 (100)	43 (79.6)
Proper storage facility provided for collecting BMW at work place	111 (90.2)	91 (98.9)	13 (100)	33 (61.1)
Provided with hub cutter for needles and syringes	112 (91.1)	89 (96.7)	12 (92.3)	32 (59.3)
Any record available for injuries related to BMW	25 (20.3)	19 (20.7)	2 (15.4)	4 (7.4)
Know the place where BMW treated	68 (55.3)	43 (46.7)	4 (30.8)	8 (14.8)
Practicing correct method for collecting used disposable plastic items	104 (84.6)	85 (93.4)	10 (76.9)	26 (48.2)
Practicing correct method for collecting soiled dressings/ plaster casts/linen	86 (69.9)	66 (71.7)	12 (92.3)	25 (46.3)
Practicing correct method for collecting sharps and needles	100 (81.3)	52 (56.5)	3 (23.1)	20 (37.0)
Practicing correct method for collecting human anatomical waste	108 (87.8)	75 (81.5)	7 (53.9)	9 (16.7)

**Table 4: Awareness about bio medical waste management among doctors and paramedical workers (including nurses and laboratory technicians)**

Awareness	Doctors (n=123) No. (%)	Paramedics (n=105) No. (%)	p value	95% CI
Heard about Bio Medical Waste (BMW)	121 (98.4)	105 (100)	--	--
Heard about BMW Rule/Act, 1998	94 (76.4)	49 (46.7)	0.00*	2.1-6.5
Received any training for BMW management	35 (28.5)	75 (71.4)	0.00*	0.1-0.3
Know about Bio Hazard Symbol	115 (93.5)	103 (98.1)	0.09	0.1-1.3
Is present hospital generates BMW	123 (100.0)	105 (100.0)	--	--
Know all BMW management categories	93 (75.6)	20 (19.0)	0.00*	7.0-25.9
Is any BMW management disposal policy there in present hospital	117 (95.1)	102 (97.1)	0.43	0.1-2.4
Any health hazard associated with BMW	122 (99.2)	105 (100.0)	--	--
Is BMW transmits any disease	123 (100.0)	101 (96.2)	--	--
Diseases transmitted by BMW				
HIV	110 (89.4)	80 (76.2)	0.00*	1.5-7.3
Hepatitis B	100 (81.3)	52 (49.5)	0.00*	2.7-9.2
Tuberculosis	17 (13.8)	4 (3.8)	0.00*	1.3-12.7
Hepatitis C	23 (18.7)	3 (2.9)	0.00*	2.3-27.5
Other infectious diseases	77 (62.6)	61 (58.1)	0.48	0.7-2.1
Are different colored bags used to dispose BMW	122 (99.2)	105 (100.0)	--	--
Regular educational program/training needed for BMW	120 (97.6)	95 (90.5)	0.02*	1.1-15.7
Any guideline provided for color coding at work area	110 (89.4)	96 (91.4)	0.61	0.3-1.9
Identified all colored bags used for BMW collection	121 (98.4)	95 (90.5)	0.00*	1.4-29.8
Identified methods for BMW management	118 (95.9)	87 (82.9)	0.00*	1.8-13.7

\* indicates p<0.05

On assessment of practices related biomedical waste management among doctors and paramedical staff (Table 5); significant number of paramedics maintains record of BMW at work place (p<0.00), practices disinfection (p<0.05) and segregation of BMW at work place (p<0.05), and were using personal protective measures while handling BMW (p<0.00). Significant number of resident and intern doctors were practicing correct method for collecting sharps and needles (p<0.00) than paramedical staff.

**Table 5: Practice regarding bio medical waste management among doctors and paramedical workers (including nurses and laboratory technicians)**

Practice	Doctors No. (%)	Paramedics No. (%)	p value	95% CI
Maintaining BMW records at work place	88 (71.5)	102 (97.1)	0.00*	0.0-0.2
Segregation of BMW done at work place	110 (89.4)	102 (97.1)	0.02*	0.1-0.9
Disinfection of BMW done before disposal at work place	108 (87.8)	100 (95.2)	0.04*	0.1-1.0
Using personal protective measures while handling BMW	97 (78.9)	103 (98.1)	0.00*	0.0-0.3
Personal protective measures procured for handling BMW	90 (73.1)	103 (98.1)	0.00*	0.0-0.2
Proper storage facility provided for collecting BMW at work place	111 (90.2)	104 (99.1)	0.00*	0.0-0.7
Provided with hub cutter for needles and syringes	112 (91.1)	101 (96.2)	0.12	0.1-1.3
Any record available for injuries related to BMW	25 (20.3)	21 (20.0)	0.95	0.5-2.0
Know the place where BMW treated	68 (55.3)	47 (44.8)	0.11	0.9-2.6
Practicing correct method for collecting used disposable plastic items	104 (84.6)	95 (90.5)	0.18	0.3-1.3
Practicing correct method for collecting soiled dressings/plaster casts/linen	86 (69.9)	78 (74.3)	0.46	0.5-1.4
Practicing correct method for collecting sharps and needles	100 (81.3)	55 (52.4)	0.00*	2.2-7.2
Practicing correct method for collecting human anatomical waste	108 (87.8)	82 (78.1)	0.05	1.0-4.1

\* indicates p<0.05

#### Discussion

Today, hospitals/clinics use a wide variety of drugs including antibiotics, cytotoxics, corrosive chemicals, radioactive substances, which ultimately become part of hospital waste. The introduction of disposables in hospitals has brought in its wake many ills such as inappropriate recycling, unauthorized and illegal re-use, and an increase in the quantity of waste.[1] Concern regarding BMW is mainly due to the presence of pathogenic organisms and organic substances having adverse effect on human health. There could be significant numbers of organisms in the waste, including virulent strains of viruses and pathogenic bacteria. Hospital practices involve many hazardous exposure and this calls for proper segregation and disposal of biomedical waste.

The biomedical waste generated by hospitals and clinics can be broadly categorized as general waste, infectious waste, and non-infectious but hazardous waste. About 75-85% of waste generated in hospitals is a non-risk or general waste, which constitutes paper, cardboard boxes, plastic packaging, and kitchen waste. Infectious waste, which includes human anatomical wastes, infectious disposable plastic items, and sharps accounts for only remaining 10-15% of total volume of waste generated in a hospital. Non infectious but hazardous waste includes chemical waste, genotoxic waste,

and radioactive waste which comprises of about 5-10% of total volume of generated hospital waste.[10]

To protect the environment and community health from hazards of infected waste in India, the Bio Medical Waste rules were promulgated in 1998 by the Ministry of Environment and Forest, Government of India, under Environment Protection Act 1986.[11,12] For effective implementation of these rules in health care settings, the health care professionals and auxiliary staff should possess adequate knowledge with respect to the source of BMW and its appropriate disposal.[13] The present study was conducted among health care personnel of different level working at a tertiary care hospital. Total 282 health care personnel participated in the study.

Majority of participants (95.4%) had heard about the bio medical waste, like other reported studies from India.[8,14] Present study reported that only 51.4% study participants had heard about the BMW (Management and Handling) rule/act 1998, as compare to other studies.[8,14,15] In current study, significant number of (76.4%) resident and intern doctors ( $p < 0.00$ ) had heard about BMW rule/act, almost similar to study conducted at Delhi.[14] But other study at Agra reported lack of knowledge about the legislation among health personnel.[16] One study reported 54.88% paramedical staff were aware about BMW rule [17] while in this study, 44.6% Nursing staff and 61.5% laboratory technicians were aware about the same. Only 44.29% study participants had actually received training about BMW management, which indicates significant requirement of good quality training related to BMW management at regular interval ( $p < 0.05$ ). [18,19]

Knowledge about bio hazard symbol was very high among all the health care personnel as compared to the previous study (67.9%).[8] Significant ( $p < 0.00$ ) number of doctors (75.6%) knew all the categories of BMW compared to 55.9% in West Bengal.[8] Present study reported 19% paramedical workers knew all the BMW categories compared to 1.6% in Andhra Pradesh.[20] The knowledge about various categories of BMW reported is still low, indicating the requirement of teaching and training of paramedical workers regarding BMW management.

Awareness about different health problems due to BMW was assessed among doctors and paramedical workers. Significant number of doctors had good perception about different diseases transmitted by BMW like other studies.[15,20-22] Including present study, various other studies also reported that improper management of BMW causes different health hazards like infections (HIV, Hepatitis B and C), injuries, and also environmental pollution. In this study like others, a need to periodically acquaint the participants with the updated BMW management and handling rules was felt.[8,16]

Identification of different color coded bags used was one of the important aspect for BMW management. Significant ( $p < 0.00$ ) number of doctors and paramedical workers correctly identified different color coded bags used for segregation like other [21], but higher than previously reported studies.[8,17] Higher number of doctors (95.9%) and paramedical workers (82.9%) identified various methods of final disposal of BMW likewise in Bijapur [23], but higher than in West Bengal.[8]

Significant number of paramedical workers ( $p < 0.00$ ) were maintaining BMW records at work place, performing disinfection ( $p < 0.05$ ) and segregation ( $p < 0.05$ ) of BMW at work place, were using personal protective measures ( $p < 0.00$ ) while handling BMW. The practice of reporting of injuries resulting from improperly disposed biomedical waste was found to be very low (20%) both among doctors and paramedical workers like others.[18,24] Low reporting of injuries may be attributed to the fact that most of the doctors

and other technical and nontechnical staff are unaware about a formal system of injury reporting which should be established within all the health facilities.[18]

To improve overall knowledge and practice related to BMW management and its handling following steps can be taken [18] like, strict implementation of bio medical waste management rules; it should be made compulsory for health care facilities to get their health care personnel trained from accredited training centres, these training should not become merely a one time activity but should be a continuous process depending upon the patient input in different health care facilities; training of sanitary staff should be specially emphasized; it should be ensured that the injuries happening to the health care personnel are reported to the person in charge of bio medical waste management or to the bio medical waste management committee, and they report it in the prescribed format to the pollution control board. Information about the risks linked to BMW can be displayed by posters in hospitals giving instructions for segregation. Statutory public health guidelines for BMW management alone cannot achieve the desired goal, if we cannot motivate and monitor with the help of behavior change communication (BCC) and change in mind set in all strata of medical practice.[8]

#### Conclusion

The importance of training regarding bio medical waste management cannot be overemphasized. Lack of proper and complete knowledge about bio medical waste management affects the correct practices of appropriate waste disposal. Intensive training program at regular time interval for all staff working in hospitals and clinics, and a system of monitoring and surveillance about practice of day to day BMW management should be evolved.

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