

## Assessment of level of knowledge regarding biomedical waste management among healthcare workers in tertiary care hospital in Western India

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### Abstract

**Background:** Biomedical waste management is integral part of medical microbiology and infection control program in any healthcare institute. Proper management of the waste generated in the healthcare facilities needed to be carried out in accordance with the BMWM Rules, 2016. Any loophole in this management can lead to hazardous consequences.

**Material and Method:** more than 100 health care workers participated in this study. A pre formed questionnaire was used to assess the knowledge of all study participants. Also major demographic and occupational variables were recorded and analyzed in this study.

**Result:** most of the participants were having average and good knowledge of BMW. Mean score recorded for this study was 17.82 out of 30 with standard deviation of 5.61. Also majority of participants including housekeeping staff knows about colour coding in BMW management.

**Conclusion:** In conclusion, BMW training should be integral part of continuous medical education in each health care facility.

**Keywords:** Biomedical waste management (BMW), Knowledge, Healthcare workers, Hospital.

### Introduction

Biomedical waste management is integral part of medical microbiology and infection control program in any healthcare institute. "Bio-medical waste" means any waste, which is generated during the diagnosis, treatment or immunisation of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps.<sup>1</sup> Among total waste generated in hospital, 85% of them is general waste only 15% is biomedical waste. There are different locations and points from where biomedical waste is generated in hospitals e.g. Laboratory /operation theatres / wards / labour rooms, Dressing rooms, Injection rooms, Intensive Care Units, Dialysis room. Health Care Facilities (HCFs) are primarily responsible for management of the healthcare waste generated within the facilities, including activities undertaken by them in the community. The health care facilities, while generating the waste are responsible for segregation, collection, in-house transportation, pre-treatment of waste and storage of waste, before such waste is collected by Common Bio-medical Waste Treatment Facility (CBWTF) Operator. Thus, the technical requirements of waste handling and proper management of the waste generated in the healthcare facilities are needed to be understood and practiced by each category of the staff in accordance with the BMWM Rules, 2016.<sup>2</sup> Biomedical waste management rules came into legislation in 1998 with periodic amendments; in 2000, 2003 with latest revision of rules in 2016 and its amendment in 2018.

The biomedical waste in healthcare facilities carries a higher potential for risk of infection and injury than any other type of waste if not disposed of correctly. Extension of healthcare facilities in terms of implementing modern technologies plus recent trend of using disposables has been responsible for production of high burden of biomedical wastes. Since the couple of decades, unregulated handling

of BMW is has emerged as a serious danger to human health and safety.<sup>3,4</sup>

A major problem related to current Bio-Medical waste management is to be short of knowledge in segregation practices that results in mixing of hospital wastes with general waste thus making the whole waste stream hazardous. Inadequate Bio-Medical waste management may cause environmental pollution, unpleasant smell, growth and multiplication of vectors leads to the transmission of infectious diseases like typhoid, cholera as well as transmission of blood borne diseases like hepatitis and AIDS through injuries from syringes and needle contaminated with human blood.<sup>5</sup>

### Objectives

The objective of this study to assess the knowledge and Awareness of biomedical waste management among healthcare workers and professionals. So that we can identify critical loop holes in BMW practices and rectify accordingly.

### Materials and Methods

A study was conducted in a Department of Microbiology, GMERS Medical college and hospital, Vadnagar, Gujarat. This is a tertiary level healthcare facility and a referral center in north Gujarat. The tool used for collection of data was structured self-administered questionnaire which was developed through a review of the available scientific literatures and national BMWM guidelines. Total more than 100 healthcare workers were voluntarily participated in this study and anonymity of participants were throughout maintained in the study. The participants included were junior doctors, nursing staff, laboratory technicians and Housekeeping staff. A separate set was prepared in local language Gujarati for Housekeeping staff in this study. Basic profile of the participants containing details of various

sociodemographic variables, such as age, gender, residence, working status, working place, and working period was collected and then a predesigned questionnaire was given to all participants and were asked to fill the questionnaire based on their current knowledge. Knowledge regarding existence of medical waste management and handling rules 2016, Color coding, segregation and handling of biomedical waste in the hospital premises, Disadvantage of Improper biomedical waste management, Recognition of the international biohazard sign was assessed by this tool. Level of knowledge was compared with selected demographic variables.

**Results**

More than 100 healthcare workers from different areas in hospital had participated voluntarily and had filled questionnaire and submitted. A total 30 questions consist of multiple choice questions has been asked. Scoring was based on the number of right answers and the knowledge level is categorized as Good, Average and Poor. Different demographic and occupational parameters were recorded and analysed which is demonstrated in table 2.

**Table 1:** Color coding and type of biomedical waste<sup>1,2</sup>

Yellow	Red	White	Blue
Human Anatomical Waste	Wastes generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes without needles, fixed needle syringes with their needles cut, vacutainers and gloves	Waste Sharps including metals Needles, scalpels, blades, or any other contaminated sharp object that may cause puncture and cuts	Broken or discarded and contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes.
Animal Anatomical Waste			
Soiled Waste			
Expired or Discarded Medicines			
Chemical Solid Waste			
Chemical Liquid Waste			
clinical laboratory waste			

**Table 2:** Details of participants in relation to job and other demographic data

Variables	Category	Numbers	Percentage (%)
Age of respondents in years	<25	47	44.76
	25-35	44	41.90
	36-50	14	13.33
	>50	0	0.00
Education level	Medical	17	16.19
	paramedical	59	56.19
	layperson	29	27.62
Job category	Resident doctors	17	16.19
	Nurses	37	35.24
	Lab tech	22	20.95
	Housekeeping staff	29	27.62
Work experience	<1 year	33	31.43
	1-5 years	43	40.95
	6-10 years	16	15.24
	>10 years	13	12.38
Training on BMW in past	yes	79	75.24
	no	26	24.76
Gender	Male	38	36.19
	Female	62	59.05

Among all participants, knowledge level was assessed on the basis on right answer. Form total of 30 questions, performance of right answers of at least 22 questions was considered as good while score between 12-22 was considered average and less than 12 score was considered as poor performer. Data of score related variables has been illustrated in Table 3 & Table 4.

**Table 3:** Distribution of mean, median, standard deviation and range scores of knowledge on BMW

Over All Score	Mean	Median	SD	Min Value	Max Value
Knowledge	17.82	18	5.61	5	28

**Table 4:** Distribution of knowledge scores of regarding bio-medical waste management

Level of Knowledge	Score Range	Frequency	Percentage
Good	>22	27	25.71
Average	12-22	64	60.95
Poor	<12	14	13.33

More than 85% of study population was having more than average knowledge regarding biomedical waste management. Among them more than 25% were having sound knowledge of Biomedical Waste management. Only around 13% of study population was having poor knowledge on BMW.

Knowledge on use of different coloured bag and regarding key different areas Biomedical waste management was assessed and analysed separately from data which is mentioned in Table no 5 & 6 below.

**Table 5:** Knowledge about colors used in BMW management

Colour	Frequency	Percentage (%)
Yellow	89	84.76
Red	91	86.67
White	72	68.57
Blue	78	74.29
Knowledge not satisfactory	5	4.76

**Table 6:** Frequency of study participants regarding knowledge on key areas of BMW

Important areas in Biomedical Waste Management	Doctors	Nursing staff	Laboratory technicians	House keeping staff
Need of Segregation of biomedical waste at the point of generation	14	36	18	9
Existence of new biomedical waste guideline 2016	12	31	15	7
Knows four colour codes of BMW	17	37	22	25
Aware about Guidelines provided for color coding in workplace	11	32	19	10
Maximum time of BMW can be kept in hospital premises (48 h)	09	28	14	4
Disposal of cytotoxic drug in yellow bag	10	30	3	2
Recognition of the international biohazard sign	15	37	20	26
Knowledge about protocols after spillage of blood/biohazardous materials	10	31	19	16
Knowledge about protocols after needlestick/sharp injury	12	33	18	12
Improper disposal can lead to transmission of disease like HIV, Hepatitis B, etc,	17	37	22	25
Willingness to attend programs that enhance and upgrade knowledge on BMW management	17	37	22	29
Knowledge about phase out of use of chlorinated bads in BMW management	9	24	14	3

## Discussion

Maximum number of health care providers were under the age of 35 (n=91). Majority of health care providers were (n=62) females and 38 were males. As far as educational qualification concerns, 17 were doctors, 37 were nurses, 22 were laboratory technicians and 29 were Housekeeping staff. Among them 33 had work experience less than 1 year, 43 were having 1-5 years of experience, 16 were in 6-10 years of experience and remaining 13 were having more than 10 years of experience. 79 of participants had official training on BMW in past while 24 new comer staff still had not taken detailed training on BMW. All these demographic and occupational data depends on local as well as administrative factors which is having no use of comparing

them with others. As Biomedical waste management is integral part of infection control measures in any hospital, it is expected that all staff who is in concern with generation and handling of BMW, should have sound knowledge regarding this. In this study overall scoring was based on right answers they had given. Out of total 30 questions asked, knowledge was assessed on scoring >22 as good, 12-22 as average and <12 as poor performance. Majority of participants (more than 85%) were having above average knowledge of BMW. Average score for this study was 17.82 with 18 and 5.61 as median and standard deviation value respectively. Value for this study ranges from 5 to 28 in the data collected. This data is quite comparable with other study done previously.<sup>6</sup> Different studies has been carried out on the same objective nationwide previously.

Though methodology and assessment tools used in those studies were having variations, still they all carried same objective of scrutiny of knowledge of BMW among health workers.<sup>7-12</sup> In this study majority of health care workers were having knowledge regarding segregation of BMW in accordance with colour code. Highest knowledge was about use of red bag (86.67%) followed by yellow (84.67%), white (74.29%) and blue (68.57%). Only 5 of Housekeeping staff who recently joined hospital were not having satisfactory knowledge about colour coding in BMW. Among all questions asked, knowledge on key areas on BMW was assessed separately and summarized in table 6. Nursing staff were having highest knowledge of BMW while housekeeping staff had less knowledge regarding BMW as compared to other groups though majority of them carry basic important awareness about BMW. On comparing key areas, health workers had least knowledge regarding use of yellow bags for discarding cytotoxic drugs, storage time of BMW at facility as well as phase out of chlorinated bags in BMW management. In spite of exposure to training on BMW in past, many of the healthcare workers were lacking sound knowledge of BMW which shows the need of repeated training as a part of continuous medical education program time by time.

### Conclusion

In this study we had assessed knowledge regarding Biomedical waste management among different healthcare workers and analysed according to their demographic and occupational variables. Though majority of them had knowledge regarding basics of BMW, they failed to address some important points on BMW management. Also some of them had not exposed to training of new BMW guidelines 2016. It shows that training on BMW should be integral part of induction program for all new joined staff as well as this training should be conducted at regular intervals as part of continuous medical education at each healthcare facility.

**Conflict of Interest:** None.

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