

## Evaluation of Biomedical Waste Management Practices at Primary and Secondary Level of Healthcare Facilities of Saurashtra Region of Gujarat, India

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### Abstract:

**Background:** Biomedical waste (BMW) collection and proper disposal has become a significant concern for both the medical and the general community as improper management poses risks to the health care workers, patients, general community and largely the environment. In order to improve biomedical waste management, it is important to understand and evaluate the current practices in biomedical waste management, to identify the gaps and to address them.

**Objectives:** (i) Assessment of current Bio-medical waste management practices including collection, segregation, transportation, storage, treatment and disposal technologies in healthcare facilities of Bhavnagar district. (ii) Assessment of health and safety practices for the health care personnel involved in Bio-Medical Waste Management.

**Materials and Methods:** This was a cross-sectional study. The study employed random sampling. Two Primary health centers (PHC) were randomly selected from each taluka and all Community health centers (CHC) of Bhavnagar district were selected. Study participants included- doctors, staff nurses, laboratory technicians, pharmacists and sanitary staffs. So total 18 PHCs, 15 CHCs and 165 study participants were included in the study. The study was conducted by using pretested, semi-structured proforma. The study included details of various biosocial profiles, an observational checklist and other details regarding practice of biomedical waste management.

**Results:** Only 38.8% study participants had received training for bio medical waste management and poor biomedical waste management was observed at the primary and community health centres. The safety measures taken by health care workers was not satisfactory, it was basically due to un-awareness of health hazards which may occur because of improper waste management practices. There was significant association between practice of waste segregation and training of study participants.

**Conclusion:** Biomedical waste management practices were poor. Periodic training of health care personnel on BMW management needs to be emphasized to have a significant impact on BMW disposal and practices.

**Keywords:** Biomedical waste management, Evaluation, BMW training, Colored bins.

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### Introduction

Hospitals are one of the places which are frequented by people from every walk of life irrespective of age, gender, caste, race and religion. And with the ever increasing population in India and increasing health awareness the demand for healthcare need has increased significantly.

Simultaneously the number of healthcare facilities has increased in order to cater to the demands and needs of the people. Thereby the quantum of waste generated has also increased and mismanagement of bio medical waste can lead to spread of some of the

blood borne infections and pollution of air, water and land. Realizing this, Ministry of Environment & Forests, Government of India had notified the Bio-Medical Waste (Management & Handling) Rules 1998 under the Environment Protection Act 1971. The same has been amended and new rules have been notified in 2016. [1]

According to the World Health Organization (WHO), high-income countries generate on an average up to 0.5kg of hazardous waste per hospital bed per day and low-income countries generate

0.2kg per hospital bed per day. [2] Healthcare waste is a potential source of pathogenic micro-organisms and requires appropriate safe and reliable handling. It is ironic that the healthcare facilities which are meant to restore and maintain the community health, are also a threat to their well-being if not managed properly. Bio medical waste management includes all activities of segregation, disinfection before disposal, containment, storage and final disposal of waste. [3]

The absence of proper waste management, lack of awareness about the health hazards from biomedical waste, insufficient financial and human resources and proper control of waste disposal are the most critical problems connected with healthcare waste. [4]

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 present study had been taken up to assess the biomedical waste management at the primary and secondary healthcare facility of the Bhavnagar district and to recommend measures for improvement based on the findings of the study.

### Materials & Methodology

The study is an observational cross sectional study. The study was conducted from December 2015 to August 2016. The study employed random sampling. The rural area of Bhavnagar district is divided into nine Talukas. From these, two Primary health centers (PHC) were randomly selected from each taluka and all Community health centers (CHC) of Bhavnagar district were selected. Thus total 18 PHCs and 15 CHCs of Bhavnagar district were selected for the study. The study participants included doctors, staff nurses, laboratory

technicians, pharmacists and sanitary staffs. During the visit, five healthcare personnel from each healthcare facility were randomly selected for the study. Total 165 healthcare personnel were participated in present study. It included 33 doctors, 33 staff nurses, 33 laboratory technicians, 33 pharmacists and 33 sanitary staffs. Data was collected using pre-designed, semi structured questionnaire from study participants by interviewing them after informed consent was taken.

The questionnaire included 7 questions on waste segregation practices a score of 2 was given for correct practice, 1 for partial practice and 0 for incorrect practice. A total score of  $\leq 8$  was considered as unsatisfactory practice and  $\geq 9$  was considered as satisfactory practice. The study included details of various biosocial variables like age, sex, educational status, work experience, an observational checklist and other details regarding practice of biomedical waste management.

The data was coded and double checked into a work sheet on Microsoft excel 2013. Data compilation and analysis was done using software Epi info 7. Proportions and percentage were used to interpret the result. The results were analyzed with different statistical parameters like standard deviation, P value and Chi-square test.

### Results

The data presented in Table I shows the biosocial characteristics of the study participants. Almost half (49%) were in the age group of 22 to 35 years. And among the participants 66% were males, 12.1% were postgraduates and 70% were graduates. Of the total, 20% were doctors, 20% nurses, 20% lab technicians, 20% pharmacists and 20% sanitary staffs. And 49% had a work experience of less than 5 years.

**Table 1: Biosocial characteristics of study participants (n=165)**

Characteristics	Healthcare facility		Total N=165 (%)	
	PHC N=90 (%)	CHC N=75 (%)		
Age	<25	22 (24.5)	11 (14.6)	33 (20.0)
	26-35	36 (40.1)	30 (40.1)	66 (40.0)
	36-45	22 (24.5)	26 (34.5)	48 (29.1)
	> 46	10 (10.9)	08 (10.8)	18 (10.9)
Gender	Male	60 (66.7)	49 (65.3)	109 (66.0)
	Female	30 (33.3)	26 (34.7)	56 (34.0)
Educational status	Postgraduate	05 (05.5)	15 (20.0)	20 (12.1)
	Graduate	69 (76.7)	48 (64.0)	117 (70.1)
	Intermediate and below	16 (17.8)	12 (16.0)	28 (17.8)
Occupational status	Doctor	18 (20.0)	15 (20.0)	33 (20.0)
	Staff nurse	18 (20.0)	15 (20.0)	33 (20.0)
	Lab technician	18 (20.0)	15 (20.0)	33 (20.0)
	Pharmacist	18 (20.0)	15 (20.0)	33 (20.0)
	Sanitary staff	18 (20.0)	15 (20.0)	33 (20.0)
Work experience (years)	<1 year	02 (02.2)	03 (04.0)	05 (03.1)
	1-5 years	36 (40.0)	40 (53.3)	76 (46.1)

	6-10 years	34 (37.8)	20 (26.7)	54 (32.8)
	>10 years	18 (20.0)	12 (16.0)	30 (18.2)

**Table 2: Practices of study participants in relation to Biomedical waste management (n=165)**

Questions	Healthcare facility		Total N=165 (%)
	PHC N=90 (%)	CHC N=75 (%)	
Received training on BMW management	36 (40.0)	28 (37.3)	64 (38.8)
Hepatitis-B vaccination	47 (52.2)	33 (44.0)	80 (48.5)
Injection TT	72 (80.1)	58 (77.3)	130 (78.9)
*Satisfactory segregation practices	49 (54.4)	36 (48.0)	85 (51.5)

\*Satisfactory- No mixing of infectious and non-infectious wastes, Good- No mixing of wastes Poor- Mixing of infectious and non-infectious waste

Only 38.8% of the participants had received training on BMW management and 51.5 % showed satisfactory waste segregation practices. 48.5% and 78.9% had received HBV and injection TT respectively. The safety practices were adopted by

the healthcare personnel for collection of Bio-Medical waste were not upto mark as per the guidelines.

This was basically because of less availability of Personal Protective equipment's as well as unawareness of health hazards to which they are exposed to while handling such waste (Table II)

**Table 3: Observation of Health Care Facilities (HCF) for Biomedical waste management (n=33)**

Observation of HCF	Healthcare facility		Total N=33 (%)
	PHC N=18 (%)	CHC N=15 (%)	
Infection control committee exists	10 (55.5)	11 (73.3)	21 (63.6)
Availability of color coded bins	14 (77.8)	12 (80.0)	26 (78.8)
Functional Hub cutter	16 (88.8)	14 (93.3)	30 (90.9)
Adequate supply of Personal Protective Equipment (PPE)	12 (66.6)	11 (73.3)	23 (69.6)
Posters displayed	10 (55.5)	10 (66.6)	20 (60.6)
Disinfection of sharp before disposal	16 (88.8)	14 (93.3)	30 (90.9)
Spill Management protocol present	10 (55.5)	09 (60.0)	19 (57.6)
Injury register	10 (55.5)	11 (73.3)	21 (63.6)

**Table 4: Observation of Health Care Facilities (HCF) at level of Transportation and Storage of Biomedical waste management (n=33)**

Observation of HCF	Healthcare facility		Total N=33 (%)
	PHC N=18 (%)	CHC N=15 (%)	
General and Infectious waste are not mixed	11 (61.1)	10 (66.6)	21 (63.6)
Dedicated Storage facility is available for biomedical waste	10 (55.5)	12 (80.0)	22 (66.6)
Storage facility is located away from the patient area and is secured	08 (44.4)	10 (66.6)	18 (54.5)
Waste not stored for more than 48 hours	17 (94.5)	14 (93.3)	31 (93.9)
Biomedical waste bins are covered	09 (50.0)	10 (66.6)	19 (57.6)
Transportation of biomedical waste is done in closed container/trolley	09 (50.0)	10 (66.6)	19 (57.6)
Biohazard sign is prominently displayed at storage area	10 (55.5)	12 (80.0)	22 (66.6)

**Table 5: Association between Training of biomedical waste management and practice of waste segregation. The Chi square table is given below (n=165)**

Training of biomedical waste management	Practice of Segregation		Total
	Yes	No	
Yes	40 (63%)	24(37%)	64 (100%)
No	45 (46%)	56(54%)	101 (100%)
Total	85 (52%)	80 (48%)	165 (100%)

Chi-square = 5.051, DF = 1, p = 0.0123

Observation of health care facilities (HCF) for biomedical waste management practices were in

table-3. It showed poor biomedical waste management. Waste segregation at the point of

generation was satisfactory in only half (52%) of the HCFs. Availability of Colored bins was inadequate as the bins were not present according to necessity. Bin for general waste was present in all the HCFs and color coded bins was present only at 78% of PHCs and 80% of CHCs. Even though color coded bins were available the waste content was not as per the biomedical waste management rules and in some bins mixing between infectious and non-infectious wastes was observed. Infection control committee and injury register were present only around half (55%) of PHCs and 73% of CHCs. Disinfection of sharps before disposal to HCFs was quite good. Majority 88% of PHCs and 90% of CHCs were doing it as per the criteria.

Table 4 shows the observation of the health care facilities (HCF) for the storage of Biomedical waste, dedicated storage facility, BMW bins covered or not, and Transportation of BMW at HCFs and to the final disposal site. There was very good practice observed of HCFs about storing of BMW, and almost all 95% PHCs and 94% CHCs were not stored BMW more than 48 hours at their facility as per the BMW rules. The practice of covering the BMW Bins and Transportation of biomedical waste in closed container/trolley were observed in very less number of HCFs. Only 50% PHCs and 66% CHCs were doing it properly. The Bio-Medical waste generated was transported by manual lift by the waste handlers to the agency workers given contract for the waste treatment. The waste was transported usually in the morning hours, however there was no separate route for proper transportation of waste for final disposal site.

Table-5, shows the association between training of biomedical waste management and practice of waste segregation by the chi-square test. Out of 64 trained professionals, 63% practiced segregation of bio medical waste at the point of generation, while 37% did not practiced segregation in spite of getting trained. This difference was statistically significant. ( $p < 0.05$ ) O.R. = 2.07, 95% CI = (1.09-3.93). So there was 2.07 times higher practice of waste segregation at point of generation in trained health care personnel compared to non-trained health care personnel.

### Discussion

The present study was conducted among health care personnel of different level working at a PHCs and CHCs of Bhavnagar district. The study participants included doctors, nursing staffs, laboratory technicians, pharmacists and sanitary staffs. Total 18 PHCs, 15 CHCs and 165 health care personnel were included in the study.

In this study only 38.8% of the HCWs at the primary and community health centres had received training on BMW management. Similar findings in a study by Sanjeev R et al. [4] in dental colleges showed that only 16% had received training on

biomedical waste management. Chudasama R.K. et al. [5] in their study showed that only 28.5% resident and intern doctors, and 25.9% sanitary staff had received training for BMW.

In this study 48.5% and 78.9% had received HBV and injection TT vaccination respectively. Similar findings were seen in a study by Wicker S et al. [6] showed that number of HBV vaccinated HCWs were 563(78.2%) and around 90% were vaccinated for tetanus toxoid (TT).

As observed in the primary and community health centres, there was poor biomedical waste management. At many of the centres there were no rules or regulations for biomedical waste management. There was inadequate availability of color coded bins for different types of wastes and poor waste management practices was observed. Similar findings were found in a study by Muluken A et al. [7] from observational checklists revealed that all surveyed HCFs didn't have appropriate and adequate color coded containers and plastic bags for healthcare wastes collection. Pullishery F et al. [8] found that there was no effective method of segregation, collection, transportation, and disposal system in most of the health care settings

It was observed in the present study that the efficiency of transportation and storage also need improvement. Disinfection of waste at the point of generation reduces the chances of transmission of infections among health care personnel and general public at large but was not practiced many of the health care facility. Bio Medical waste management is beyond just compilation of the data on process and enforcement of regulations; it has to be supported by appropriate education, training, commitment of health care staff within an effective policy frame work. [9,10]

### Conclusion

Only a few of the HCWs had received training on biomedical waste management. Biomedical waste management practices were poor. Emphasis should be made on creating awareness among the healthcare personnel about biomedical waste management. Segregation at source of generation being the heart of waste management processes needs to be strengthened by regular monitoring. Training and retraining on biomedical waste should be planned and implemented.

All healthcare personnel should be vaccinated against tetanus and Hepatitis-B.

**Recommendations:** Following recommendations were made for improving the waste management practices of the HCFs.

- Segregation should start at the source of generation and by the generator itself.

- Sensitization of waste generators and health care providers should be done more frequently, and separate sensitization programs should be organized for sanitary staff in local language emphasizing the importance of using personal protective measures and immunization for Hepatitis B and TT.
- Transportation of wastes should be done in closed trolleys and by separate route
- Most important is effective implementation of rules by surprise visits and inspection by appropriate authorities and fixing accountability of each and every person involved in management of Bio Medical waste.

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