

Biomedical Waste Management Practices in Health Centers in Chandigarh, India

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Abstract

Background: Any waste, 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 products, is defined as biomedical waste (BMW). The World Health Organization states that 85% of hospital waste is nonhazardous. Ten percent of the remaining waste is infectious and 5% is noninfectious but hazardous wastes. Thus, about 15%–35% of hospital waste is regulated as infectious waste. **Aim:** The aim of this study is to assess the awareness, attitude, and practices of medical officers and paramedical workers regarding BMW management. **Materials and Methods:** The present study was conducted in the dispensaries of Chandigarh city. The study participants included the medical officers and paramedical health workers working in the public health set up. **Results:** The knowledge of medical officers and paramedical workers regarding needle stick injury was 84.3% and 73.3%, respectively. 31.2% of doctors and 36.7% of paramedical workers had received training for BMW management, whereas 65.6% of doctors and 66.7% of paramedical workers had received hepatitis B immunization. Gloves and mask were most common protective devices used among doctors (68.8% and 53.1%) and paramedical workers (68.9% and 33.3%), respectively. Handwashing facility was present in all centers (100%) in Chandigarh. Knowledge regarding the disposal of radioactive waste was poor among all levels of health-care workers (28.1% among medical officers and 5% paramedical workers). **Conclusion:** The gap exists between the knowledge and practices of segregation of BMW. The importance of training regarding BMW management needs to be emphasized. Training of paramedical workers should be held at regular intervals.

Keywords: Biomedical waste, knowledge, practice, segregation

INTRODUCTION

With the aim of protecting and restoring health and saving lives and treating sick people, health-care services inevitably create waste which itself may be hazardous to health. Health care waste refers to all the waste generated by a health-care establishment.^[1]

Biomedical waste (BMW) is defined as “Any waste 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 products” is the BMW.^[2] The World Health Organization states that 85% of hospital waste is actually nonhazardous, whereas 10% is

infectious and 5% is noninfectious, but they are included in hazardous wastes. About 15%–35% of hospital waste is regulated as infectious waste. This range is dependent on the total amount of waste generated.^[3]

BMW management has recently emerged as an issue not only for hospital authorities but also to the environment.^[4] The BMWs generated from health-care units depend upon a number of factors such as waste management methods, type of health-care units, occupancy of health-care units, specialization

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of health-care units, ratio of reusable items in use, availability of infrastructure, and resources.^[5]

The proper management of BMW has become a worldwide humanitarian topic today. Although hazards of poor management of BMW have aroused the concern world over, especially in the light of its far-reaching effects on human health and the environment.

^[6] BMW collection and proper disposal is a significant concern for both the medical and the general community.^[7] Since the implementation of the BMW management and handling rules,^[8] every concerned health personnel is expected to have proper knowledge, practice, and capacity to guide others for waste collection and management and proper handling techniques, which is being mandated by the government also.^[9]

All health-care facilities (clinical, diagnostic, or research) have to ensure safe disposal and environmentally sound management of waste produced by them with provision of punishment with fine or imprisonment under the Environment Protection Act 1986 in case of violation.^[10] Major sources of BMW include hospitals, veterinary colleges, blood banks, and mortuaries. Minor sources include small clinics, vaccination centers, and slaughter houses.^[11]

Inadequate BMW management may be the source of environmental pollution, unpleasant smell, growth, and multiplication of vectors such as insects, rodents, and worms and may lead to the transmission of diseases such as typhoid, cholera, hepatitis, and Human Immunodeficiency Virus-Acquired Immunodeficiency Syndrome (HIV-AIDS) through injuries with infected syringes and needles.^[12] Rag pickers in the hospital while sorting out the garbage are at a risk of getting tetanus and AIDS infections.^[13,14] The incinerators used by some of the hospitals can pollute the environment because of improper segregation of the wastes before putting in incinerators.^[15] Such practices of waste management are posing serious threat of diseases to the people residing in the nearby areas.

The present study was undertaken to find the knowledge, attitude, and practices of the health care personnel working in public health centers regarding BMW management in Chandigarh city.

MATERIALS AND METHODS

The present study was conducted in health centers of Chandigarh, a Northern city of India. There are 41 dispensaries to cater the health needs of people in Chandigarh. Out of these, there are 15 civil dispensaries, 7 rural, 8 ayurvedic dispensaries, and 8 homeopathic dispensaries. Remaining three are the dispensaries of other organizations.

There are two tertiary care hospitals (Government Medical College and Hospital [GMCH], Chandigarh and Postgraduate Institute of Medical Education and Research) and one secondary care hospital (Government Multispecialty Hospital). Two health centers attached to GMCH, Chandigarh as field centers for student teaching and research were also included. There are five veterinary dispensaries in Chandigarh. The present study was

conducted in all the dispensaries, including veterinary dispensaries under the Directorate of Health Services (DHS), Chandigarh, and the two health centers under Government Medical College, Chandigarh (15 civil dispensaries, 7 rural dispensaries, 5 veterinary dispensaries, and 2 health centres attached to Government Medical College, Chandigarh). Ayurvedic and Homeopathic dispensaries were not included in the study. The present study was conducted for 6 months commencing from September, 2015.

Study population

All the Health Dispensaries falling under Chandigarh Administration along with the Veterinary dispensaries were included in the study.

Study-design

It was a cross-sectional study conducted in all the dispensaries/health centers under Chandigarh Administration jurisdiction.

Study units

The study participants included the Medical Officers and paramedical health workers (staff nurses and laboratory technicians, etc.) working in the government setup.

Study variables

A survey was conducted using a scientifically prescribed questionnaire. The personnel handling and monitoring the BMW were interviewed to evaluate their knowledge and attitude toward BMW management. The practices of the participants regarding BMW handling were also assessed onsite and was evaluated according to the guidelines.^[8]

Information was collected using a predesigned and pretested semi-structured interview schedule during survey in the various dispensaries. Respondents were interviewed in privacy to collect the desired information. The interview was conducted in the dispensaries and centres at flexible time points keeping in view the working hours of respondents. All possible efforts like frequent visits were made to reduce nonresponses. Field problems faced by survey team members during data collection were discussed time to time and solved to the extent possible.

The data collected included their demographic details, awareness about infectiousness/communicability of diseases due to BMW, and methods of segregation, transport, and disposal of BMW. Three visits were made to each center. All those on duty were included in the study after taking written informed consent from them.

The participants were explained the purpose of the study in the vernacular language. After the survey of all the centers was completed, two workshops were conducted (one each for Medical Officers and Paramedical staff). In these workshops, the participants were made aware about the guidelines to handle BMW. They were explained about the proper segregation and disposal techniques of BMW along with the importance of immunizing themselves and taking universal precautions while handling BMW. The importance of training and re-training was also emphasized in the workshop.

Inclusion criteria

- All the medical and paramedical workers who were on duty during visit and have given their consent.

Exclusion criteria

- Trainees posted for short period of time
- Those who do not give consent.

Study was approved by the Institutional Research and Ethical Committee.

Statistical analysis

The data were entered in Microsoft Excel Spreadsheet and checked for errors. SYSTAT version 13.2 software for Windows (Systat Software, Inc, Point Richmond, CA) was used for the analysis. Qualitative data were presented as frequencies and proportions.

RESULTS

A total of 29 dispensaries and health centers were visited for observing BMW segregation techniques and practices of health-care workers. The knowledge of BMW management was assessed. 93.7% of medical officers claimed that they were following BMW management policy at their centres whereas 87.6% claimed that record of BMW was maintained properly. Table 1 shows knowledge of medical personnel regarding segregation and hazards of BMW.

Practices of waste segregation, immunization, and protective devices use among medical officers and paramedical workers are shown in Table 2.

Out of 60 paramedical staff who participated in the study, 28.3% each were in the age group of 31–40 and 41–50 years. Most of them (78.3%) were females. Regarding the education status, majority (65%) were diploma holders followed by 16.6% who had higher secondary education. Table 3 shows the BMW management practices of paramedical workers at health centres. Figure 1 shows the BMW management practices observed at health centres.

DISCUSSION

The objective and rationale of BMW management is to reduce waste generation, efficient collection and handling and disposal in such a way that it controls infection and provides safety to employees working in the system. It should also ensure cost effectiveness by avoiding penalties and fines imposed by regulatory authorities.

In the present study, the knowledge of segregation was found to be better among MO's of health centres as compare to the MOs of veterinary centres. The correct knowledge regarding proper disposal of stationary items, sharps and infectious waste was 90.6%, 62.5% and 56.2% respectively whereas only 33.3% had the correct knowledge of disposal of human anatomical waste. Those were the doctors who have worked in centres

Table 1: Knowledge regarding segregation and hazards of biomedical waste among medical personnel

| Variables | Medical officers (n=32), n (%) | Paramedical workers (n=60), n (%) |
|------------------------------------|-----------------------------------|--------------------------------------|
| Knowledge of segregation of BMW | | |
| Stationary | 29 (90.6) | 57 (95) |
| Sharps | 20 (62.5) | 34 (56.7) |
| Cotton/dressing | 18 (56.2) | 47 (78.3) |
| Infectious waste | 18 (56.2) | 41 (68.3) |
| Radioactive waste | 9 (28.1) | 3 (5) |
| Knowledge regarding hazards of BMW | | |
| Environment pollution | 27 (84.4) | 40 (66.7) |
| Bad odour | 18 (56.2) | 22 (36.7) |
| Chocking of drains | 3 (9.4) | 8 (13.3) |
| HIV/AIDS | 21 (65.6) | 11 (18.3) |
| Tetanus | 13 (40.6) | 37 (61.7) |
| Hepatitis B | 16 (50) | 5 (8.3) |
| Infections | 10 (31.3) | 41 (68.3) |
| Needle stick injuries | 27 (84.3) | 44 (73.3) |

BMW: Bio-medical waste

Table 2: Correct practices of segregation/self-protection of bio-medical waste by health personnel

| Variables | Medical officers (n=32), n (%) | Paramedical workers (n=60), n (%) |
|--------------------------|-----------------------------------|--------------------------------------|
| Plastic items | 13 (40.6) | 29 (48.3) |
| Soiled dressings | 12 (37.5) | 36 (60) |
| Needles | 10 (31.2) | 40 (66.7) |
| Human tissues | NA | NA |
| Immunization | | |
| Hepatitis B | 21 (65.6) | 40 (66.7) |
| Tetanus | 32 (100) | 48 (80) |
| Attended training on BMW | 10 (31.2) | 22 (36.7) |
| Had needle stick injury | 3 (9.4) | 8 (13.3) |
| Protective devices | | |
| Gloves | 22 (68.8) | 41 (68.9) |
| Mask | 17 (53.1) | 20 (33.3) |
| Apron | 18 (56.2) | 30 (50) |

BMW: Bio-medical waste, NA: Not available

Table 3: Practices of paramedical workers regarding biomedical waste management at health centers (n=60)

| Practices | n (%) |
|---------------------------------------|-----------|
| Correctly placed bins | 53 (88.3) |
| Labelled bins | 7 (11.7) |
| Frequency of replacing bags | 22 (26.7) |
| Record of waste maintained | 38 (63.3) |
| Guideline charts displayed | 45 (75) |
| Displayed at correct place | 32 (53.3) |
| Functional needle destroyer available | 54 (90) |
| Sharps destroyed individually | 51 (85) |
| Sufficient disinfectant available | 51 (85) |
| Monitor waste bins | 48 (80) |

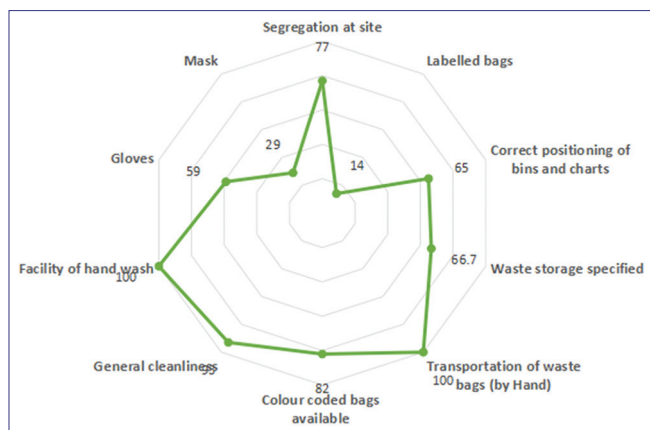


Figure 1: Radar chart showing observations (%) of biomedical waste management practices done at health centres ($n=29$)

where deliveries are conducted. This is comparable with a study done in Ludhiana^[16] and Mysuru.^[17] Another study by Devi *et al.* revealed that 80% and 47.5% in public and private sector health care centres knew correctly about the disposal of sharp waste.^[18] About the diseases incriminated due to BMW, only about two-third of medical officers had adequate knowledge about disease transmitted by BMW (HIV/Tetanus, hepatitis-B). In another study by Mathew *et al.* much better knowledge was seen among doctors (98%).^[16]

Segregation of BMW at the site of generation is the key to whole hospital waste management process. Poor segregation not only results in risk to staff and public but may also considerably increase handling and disposal cost of hospital waste. Although segregation of waste by Medical Officers was limited but only one third of the doctors were doing the correct practice of disposing the waste as per the guidelines available and were following the colour coding. Study done in Punjab by Devi *et al.* found that 21.8% and 28.7% health facilities in public and private sectors in the primary care settings with appropriate collection and safe storage of BMW.^[18] A study done by Mathur *et al.* revealed that 77.3% doctors, 73.3% nurses, and mere 24.2% sanitary staff were practicing correct disposal of BMW in color-coded containers.^[19]

About two third of the respondents in the present study had knowledge about needle stick injury occurring from BMW but when asked specifically about HIV and hepatitis-B, a poor response was received (18.3% and 8.3%, respectively). Mathur *et al.*^[19] found that 93.3% doctors, 91.6% nurses, 75.6% laboratory technicians, and only 27.1% sanitary staff had knowledge of transmission of diseases through BMW. Lack of knowledge among sanitary staff shows the gap in training which needs to be done at regular basis. Also, poor knowledge may lead to unwarranted exposure and injuries to the sanitary staff as well as healthcare workers.

As per the observation made by the visiting team in centres, coloured coded containers for BMW were placed at the right places but only 11.7% bins were labelled properly as per guidelines. In veterinary dispensaries ($n = 5$) there were no

BMW management charts displayed and even the proper bins were not available. Majority of the other dispensaries (75%) had guidelines charts for BMW segregation displayed with the bins. Verma *et al.* in their study among nursing homes in Delhi found that the BMW guideline charts were not sufficiently placed at right place.^[20] On the other hand, Bhagawati *et al.* reported that only 17% of healthcare workers were aware of categories of BMW.^[21]

Tetanus was the most commonly received vaccination by paramedical workers (80%) whereas hepatitis-B vaccination was comparatively less than. The proportion of vaccination among veterinary inspectors was very poor (40% and 30% for Tetanus and Hepatitis B respectively). This shows the poor awareness of workers involved in BMW management regarding protective immunization against preventable hazards.

Regarding the observation made about disposal of BMW, it was seen that most of the centres had segregation of waste done at site of generation with poor labelling of waste bag and bins. In all of the health centres, the practice of closing the waste bags by tying knots was done and the bags were transported by hand only to the site of pickup. Contrary to this finding, carts were used to transport waste bags in a study by Soliman and Ahmed^[22] and Abdulla *et al.*^[23] Log book was maintained in all the centers. The cleanliness was maintained to good effect in all the centers and the proper facilities for hand wash were also available. Study by Rao *et al.* in Mysuru city found that 83% nurses and 69% doctors had adequate BMW segregation practices.^[17] Manar *et al.* in Lucknow reported that 50.5% and 37.5% of facilities didn't have colored dustbins and maintenance of records.^[24]

Workers in half of the health dispensaries were using gloves while working and less than one third of paramedical workers were using masks to protect themselves. Gloves were the only personal protective devices which were freely available in most of the centres. Disinfectant and functional needle destroyers were available in most of the centres except in veterinary dispensaries. The study in Punjab found that 26.2% and 39.3% health workers in public and private health centres did not use any personal protective equipment. The usage of mask and gloves was found to be 60.6% and 22.9% in public and private health care centres.^[18] Kumar *et al.* also observed poor compliance regarding wearing of personal protective equipment among waste segregators (1.22%–1.84%).^[25] In a study in Shimla,^[26] sufficient disinfectant and functional needle destroyers were available at all the health centres which is comparable to the findings of present study. Management of sharps was found to be satisfactory in the present study.

CONCLUSION

The present study concludes that there exists a gap between knowledge and practices of segregation of BMW. It is envisaged that continuous monitoring and evaluation should be done to ensure that policies and procedures are followed. Even

a small proportion of badly managed waste can be potentially dangerous. The World Health Organization acknowledges this as a problem and observes that the human element is as important as technology in the waste management. The importance of training regarding BMW management needs to be emphasized, and it should be made compulsory for health-care facilities to get their health-care personnel trained. These trainings should not be merely one-time activity but should be continuous one.

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Conflicts of interest

There are no conflicts of interest.

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