



Awareness about Biomedical Waste Management among Healthcare Professionals

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Abstract: Biomedical waste is the biggest challenge faced by healthcare sectors globally. The wastes are generated from all over the area of the hospital, and biomedical waste needs to be handled and discarded properly. The handling of biomedical waste (BMW) differs significantly from household or industrial trash. The collection and proper disposal of biomedical waste (BMW) has become a significant concern for the medical community. Effective Bio-Medical Waste management is both a legal and social responsibility. This study was undertaken to analyse hospital waste management knowledge and practices among healthcare providers in a tertiary care hospital and raise awareness about the management of biomedical waste from waste generation, handling, storage, proper treatment, and transport until the disposal of waste among the healthcare professionals. It was a questionnaire-based cross-sectional study conducted in Sree Balaji Medical College and Hospital from October 2020 to December 2020. The questionnaires were used to evaluate biomedical waste management knowledge, attitude, and practice (KAP) among doctors, laboratory technicians, non-technical staff, and undergraduate medical students. Pretest and post-test questions were designed. A questionnaire was used to conduct the pretest. A systematic teaching programme was developed following the pre-test, and a post-test was administered. It has been concluded that the health care professionals have a low level of Knowledge and awareness about biomedical waste management. The proper training, development, and implementation in biomedical waste management can improve healthcare sectors from polluting the environment and transmitting diseases. There should be regular, comprehensive BMW management training programmes for all employees, with tight implementation.

Keywords: Awareness, BMW, Biomedical waste, Healthcare professionals, Training

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I. INTRODUCTION

Healthcare is one of the most significant industries in the world, and it is proliferating in India. In the Healthcare system, hospitals, private clinics, and medical and dental universities all generate biomedical waste. This comprises human anatomical waste and treatment equipment like syringes and needles, as well as numerous materials utilized in the health industry for diagnosis, treatment, and research. During the diagnosis, cure, or immunisation of many diseases, biomedical waste is generated in hospitals, nursing homes, blood banks, and laboratories¹. The majority of waste produced by healthcare providers (75-90 percent) is non-hazardous or general, with the rest (10-25 percent) classified as hazardous, with the potential to cause a variety of health problems². Furthermore, waste that is not separated and appropriately processed will pollute the environment, impacting the community's health. Non-conformities were derived from waste audits conducted by a few NGOs at numerous hospitals, which can now be utilized and extrapolated for the entire country. These audits should only be carried out after healthcare facilities have received proper waste-segregation training. The implementation of biomedical waste regulations in many hospitals is unsatisfactory, which is a serious concern with current biomedical waste management. Bio-medical waste (BMW) collection and proper disposal have become a significant concern for the medical and general community.³ Improper waste disposal has resulted in a number of health risks, including sharps injuries, the spread of nosocomial infections in patients, including HIV, Hepatitis B and C, tuberculosis (TB) among healthcare workers, waste handlers, patients and their visitors, and the community where waste is discarded indiscriminately and even the development of resistant microorganisms.^{4,5} In India, around 0.33 million tonnes of hospital trash are generated annually, with waste generation rates ranging from 0.5 to 2.0 kilogramme per bed per day.⁶ Infections acquired in hospitals are estimated for 10% of all life-threatening diseases in Southeast Asia, and have been identified as one of the indications for waste management.⁷ BMW has its system of regulations for segregation and management. The law specifies that BMW treatment facilities such as incinerators, autoclaves, and

microwave systems for treatment of waste or that waste must be treated at a standard waste treatment facility or any other waste treatment facility.⁸ BMW's effective management is both a regulatory requirement and a social duty. In India, there is still a lack of awareness and practice when it comes to BMW management.⁹⁻¹¹ Since the implementation of the Biomedical Waste Management and Handling Rules (2016), 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. With this background, the current study was conducted to assess doctors', laboratory technicians', and Non-Technical staff, and Undergraduate medical students' knowledge and practises regarding BMW management in a teaching institution, which may aid the respective authorities and society in developing future strategies for improving the situation.

2. MATERIAL AND METHOD

This study was a questionnaire-based cross-sectional study conducted from October 2020 to December 2020 in Sree Balaji Medical College and Hospital, among different healthcare professionals such as Doctors, Laboratory technicians, Non-Technical staff, and Undergraduate medical students. 80 healthcare professionals from the central laboratory participated in the study in that 42 lab technologists, 25 doctors, 10 Medical undergraduate students and five non-technical staff (waste handlers and attenders). All the willing participants were informed about the purpose of the study, and all study participants were assured of their identity and confidentiality. The information was collected with a pre-test questionnaire, which includes personal profile information about their age, gender, employment status, working location, and working period. A questionnaire was taken from a similar study conducted in India.^{12,13} This study contained 30 questions about Biomedical waste generation and waste management techniques. The questions were divided into three categories: (1) Biomedical waste generation, health hazard, and legislation, (2) waste management practices, (3) attitude analysis. It was distributed to 80 participants. Assessment of Biomedical Waste

Tick the appropriate answer:

Age : Gender : Employee status: Working location : Working duration :

Section I: Biomedical (BM) waste generation, hazards and legislation

1. Do you know about BM waste generation and legislation?

Yes ☐ No ☐ Not sure ☐

2. What agency(ies) regulate(s) wastes generated at health care facilities?

State ☐ Private ☐ Do not know ☐

3. Do you think it is important to know about BM waste generation, hazards and legislation?

Yes ☐ No ☐ Somewhat ☐

4. Biomedical Waste (Management & Handling) Rules were first proposed in:

☐ 1997 ☐ 1998 ☐ 1999 ☐ 2000

5. Amendments to the Biomedical Waste (Management & Handling) Rules were made in:

☐ 2000 ☐ 2001 ☐ 2003 ☐ 2004

6. Which statement describes one type of BM waste:

☐ Materials that may be poisonous, toxic, or flammable and do not pose disease-related risk.

☐ Waste that is saturated to the point of dripping with blood or body fluids contaminated with blood.

☐ Waste that does not pose a disease-related risk.

7. According to the Biomedical Waste (Management & Handling) Rules, waste should not be stored beyond:

☐ 12 hours ☐ 48 hours ☐ 72 hours ☐ 96 hours

8. One gram of mercury (source from dental amalgam) is enough to contaminate the following surface area of a lake:

☐ 20 acres ☐ 30 acres ☐ 25 acres ☐ 15 acres

9. Who regulates the safe transport of medical waste?

☐ Pollution Control Board of India.

☐ Transport Corporation of India.

☐ College Administration.

10. Do you need a separate permit to transport biomedical waste?

Yes ☐ No ☐ Cannot say ☐

Section 2: Biomedical waste management practice

11. Do you know about colour-coding segregation of BM waste?

Yes ☐ No ☐ Not sure ☐

12. Do you follow colour-coding for BM waste?

Yes ☐ No ☐ Sometimes ☐

13. Is the waste disposal practice correct in your hospital?

Yes ☐ No ☐ Cannot comment ☐

14. Objects that may be capable of causing punctures or cuts, that may have been exposed to blood or body fluids including scalpels, needles, glass ampoules, test tubes and slides, are considered biomedical waste. How should these objects be disposed of?

☐ Black bags ☐ Yellow bags ☐ Clear bags ☐ Sharps container

15. Documents with confidential patient information are to be disposed of into the paper recycling bins.

True ☐ False ☐ Do not know ☐

16. The colour code for the BM waste to be autoclaved, disinfected is:

☐ Red ☐ Black ☐ Yellow ☐ Blue/white

17. The approximate proportion of infectious waste among total waste generated from a health care facility is:

☐ 10-20% ☐ 30-40% ☐ 50-60% ☐ 80-90%

18. The colour code for disposal of normal waste from the college is:

☐ Red ☐ Black ☐ Yellow ☐ Blue

19. All the following steps should be followed after an exposure with infected blood/body fluid and contaminated sharps EXCEPT:

- ☐ Exposed parts to be washed with soap and water.
- ☐ Pricked finger should be kept in antiseptic lotion.
- ☐ Splashes to eyes should be irrigated with sterile irrigants.
- ☐ Splashes to skin to be flushed with water.

20. All of the following statements about hazardous waste containers are true, except for:

- ☐ Containers must be closed except when removing or adding waste.
- ☐ Containers must be clean on the outside.
- ☐ Contents must be compatible with the type of waste containers.
- ☐ Any type of container, including food containers, can be used to contain hazardous waste

Section 3: Attitude analysis towards biomedical waste

21. Safe management of health care waste is not an issue at all.

Agree ☐ Disagree ☐ Cannot comment ☐

22. Waste management is team work/no single class of people is responsible for safe management. Agree

☐ Disagree ☐ Cannot comment ☐

23. Safe management efforts by the hospital increase the financial burden on management.

Agree ☐ Disagree ☐ Cannot comment ☐

Safe management of health care waste is an extra burden on work.

Agree ☐ Disagree ☐ Cannot comment ☐

24. Do you think that the college should organise separate classes or a continuing dental education programme to upgrade existing knowledge about biomedical waste management?

Yes ☐ No ☐ Cannot comment ☐

25. Will you like to attend voluntarily programmes that enhance and upgrade your knowledge about waste management?

Yes ☐ No ☐ Cannot comment ☐

26. Do you think that infectious waste should be sterilised from infections by autoclaving before shredding and disposal?

Yes ☐ No ☐ Cannot comment ☐

27. Do you think that an effluent treatment plant for disinfection of infected water should be set up in dental colleges?

Yes ☐ No ☐ Cannot comment ☐

28. Do you think it is important to report to the Pollution Control Board of India about a particular institution if it is not complying with the guidelines for biomedical waste management?

Yes ☐ No ☐ Cannot comment ☐

29. Do you think that labelling the container before filling it with waste is of any clinical significance?

Yes ☐ No ☐ Cannot comment ☐

2.1 Aim

To evaluate the awareness about biomedical waste management among healthcare professionals

2.2 Objectives

1. To evaluate how healthcare practitioners understand BMW, its classification, colour coding, and management in a tertiary care hospital how healthcare practitioners understand BMW, its classification, colour coding, and management in a tertiary care hospital
2. To educate about the management of BMW by health care professionals in a tertiary care institution.

3. STATISTICAL ANALYSIS:

The characteristics of study participants are summarized using percentage in excel. Using Epi Info 3.5.1 software, the data was tabulated and the results were interpreted using percentages.

4. RESULT

Of all the participants involved in this study 42 lab technologist, 25 doctors, 10 medical undergraduate students and 5 non-technical staffs, waste handlers and attenders responded with answers for the questionnaire

Table 1: Biomedical waste generation, hazards and legislation						
Biomedical waste generation, hazards and legislation						
Health care personnels	Scoring criteria					
	Excellent		Good		Poor	
	Pre	Post	Pre	post	Pre	Post
Doctors	42 %	93 %	56 %	07 %	02%	0 %
Lab Technologist	38 %	84%	52 %	16 %	10 %	0 %
Undergraduate medical students	36 %	82 %	48 %	18 %	16 %	0 %
Non-Technical persons	21 %	62 %	39 %	38 %	40 %	0 %

Table 1, shows the result of Knowledge of biomedical waste generation, hazards and legislation - pre-test , Doctors scored 42% Excellent , 56% Good & 0% Poor. Lab technologist 38 %Excellent , 52% Good, 10% Poor. Undergraduate medical students 36% Excellent , 48% Good , 16% Poor. Non-technical persons 21% Excellent , 39% Good , 40% poor. Table 1, shows the result of Knowledge of

biomedical waste generation, hazards and legislation - post-test , Doctors scored 93% Excellent , 07% Good & 0% Poor. Lab technologist 84 %Excellent , 16% Good, 0% Poor. Undergraduate medical students 82% Excellent , 18% Good , 0% Poor. Non-technical persons 62% Excellent , 38% Good , 0% poor.

Table 2:Biomedical Waste Management Practice						
Biomedical waste management practice						
Health care personnels	Scoring criteria					
	Excellent		Good		Poor	
	Pre	Post	Pre	post	Pre	Post
Doctors	53 %	96 %	47 %	04 %	0 %	0 %
Lab Technologist	41 %	79 %	52 %	21 %	7 %	0 %
Undergraduate medical students	59 %	86 %	34 %	14 %	7 %	0 %
Non-Technical persons	38 %	66 %	43 %	54 %	19 %	0 %

Table 2, shows the result of Level of awareness on biomedical waste management practice - pre-test , Doctors scored 53% Excellent , 47% Good & 0% Poor. Lab technologist 41 %Excellent , 52% Good, 07% Poor. Undergraduate medical students 59 % Excellent , 34% Good , 07 % Poor. Non-technical persons 38 % Excellent , 43 % Good , 19 % poor. Table 2, shows the result of Level of

awareness on biomedical waste management practice - post-test , Doctors scored 96 % Excellent , 04 % Good & 0% Poor. Lab technologist 79 %Excellent , 21 % Good, 0% Poor. Undergraduate medical students 86% Excellent , 14 % Good , 0% Poor. Non-technical persons 66% Excellent , 54% Good , 0% poor.

Table 3: Attitude analysis towards biomedical waste						
Attitude analysis towards biomedical waste						
Health care personnels	Scoring criteria					
	Excellent		Good		Poor	
	Pre	Post	Pre	post	Pre	Post
Doctors	48 %	98 %	52%	02 %	0%	0 %
Lab Technologist	34 %	76 %	58 %	21 %	08 %	0 %
Undergraduate medical students	38 %	83 %	50 %	17 %	12 %	0 %
Non-Technical persons	23 %	73 %	46 %	25 %	31 %	0 %

Excellent: 8 out of 10 Good : 4-7 correct out of 10 Poor: <4 correct out of 10

Table 3 shows the result of Attitude analysis towards biomedical waste - pre-test , Doctors scored 48% Excellent , 52% Good & 0% Poor. Lab technologist 34 %Excellent , 58% Good, 08% Poor. Undergraduate medical students 38% Excellent , 50% Good , 12% Poor. Non-technical persons 23% Excellent , 46% Good , 31% poor. Table 3 , shows the result of Attitude analysis towards biomedical waste - post-test , Doctors scored 98% Excellent , 02% Good & 0% Poor. Lab technologist 76 %Excellent , 21% Good, 0% Poor. Undergraduate medical students 83% Excellent , 17% Good , 0% Poor. Non-technical persons 73% Excellent , 46% Good , 0% poor.

5. DISCUSSION

Biomedical wastes (BMW) generated from medical laboratories are harmful and can harm persons and the environment. Biomedical wastes that are highly infectious are commonly generated at an excessively high rate in health laboratories in developing countries. According to the WHO fact sheet, hazardous waste accounts for about 20% of waste generated by various health care units.¹⁴ As a result of rapid urbanisation and population increase, there are an increasing number of hospitals and private clinics. As the number of healthcare facilities develops, so does the volume of biomedical wastes generated. Because of the toxicity and unavailability of dumping grounds for such wastes, a more serious issue may occur in the future.¹⁵ BMW management's aim is to ensure that it is properly collected, handled, and disposed of. Health-care workers are equipped to learn how to properly segregate and dispose of BMW. Health centres are currently becoming a hub for spreading infections, improper biological waste management, lack of awareness, and underestimation, which is why this study was conducted. The present study was conducted among the healthcare professionals in various categories at tertiary care hospital. The study participants include Doctors, Lab technologist, Undergraduate medical students, and Non-technical personnels. Total 80 persons actively participated in this study. The majority of the doctors (70 percent) have adequate Knowledge of BMW management. This could be due to their daily dealings with BMW, or it could be related to a topic in the MBBS curriculum. The Undergraduate medical MLT students posted in a lab, understanding was excellent, and similar explanations can be attributed to this (60- percent). The 60% lab technologist also has a good knowledge of biomedical waste management because of their day-to-day routine work in the healthcare laboratory. Regrettably, only 35% of class IV employees (Non-technical personnel) have the required experience. The results were similar to the results of Verma et al.¹⁶ The current study's findings are consistent with those of Yadavannavar et al.¹⁷ and Bala et al.¹⁸ The lack of Knowledge among class IV personnel may be attributable to the fact that most of them work on a contract basis and do not have the same incentives for repeated training as Doctors, Undergraduate medical students. and Lab technologist. The study's results are consistent with prior studies. According to research¹¹ done in New Delhi, India, most of the 64 doctors who were teachers at Government colleges were unaware of the required clinical waste management rules. Similar findings were reported in a survey of hospital medical workers in Agra²⁷, which revealed a lack of understanding and awareness about BM waste legislation, and in a research of dental hospitals and clinics in Amritsar²⁸ Another research

found that one-third of the personnel at a tertiary level hospital were unaware of where the hospital's waste was disposed of. However, in this study, knowledge of biomedical waste generation, hazards and legislation, the result of Level of awareness on biomedical waste management practice & Attitude analysis towards biomedical waste - pretest, Doctors, Lab technologist, Undergraduate medical students were good Non-technical person result was poor. Though the study participants' overall Knowledge improved after effective training on Biomedical waste management , there is still a need for regular, high-quality training to improve their current Knowledge of BMW, with a particular emphasis on training sanitary workers at regular intervals, as discussed in studies by Mathur et al.¹⁸ and Kishore et al.¹⁹ and Anand P et al.²⁰. Compared to class IV personnel (Non-technical personnels), Knowledge of BMW management among doctors, undergraduate medical students, and lab technologists was determined to be satisfactory, as documented in earlier studies.²¹⁻²⁵ This low level of understanding of BMW management among class IV personnel could be responsible for the lack of formal training provided to them as a result of contract-type services. The study's findings are consistent with earlier research, Basu M et al., A study Only 29.5 percent of junior doctors (future physicians) knew about various methods of final disposal of BM waste, and only 76.4 percent knew about various types of color-coded bags for BM waste collection, according to a study²⁶ conducted in a tertiary care hospital in West Bengal to assess Knowledge and awareness about various aspects of BM waste management among junior doctors (future physicians). As a result, the authors concluded that all employees, with a specific emphasis on junior doctors²⁸, require significant training programs and continuous monitoring at regular intervals. The following steps can be implemented like biomedical waste management, to improve general knowledge and practice related to BMW management and handling. Health care facilities should be mandated to have their health care professionals trained by accredited training centres; these training centers should not be a one-time activity, but rather a continual process based on patient input in various health care facilities; The importance of sanitation staff training should be emphasized, and it should be ensured that injuries to health-care workers are reported to the person in charge of biomedical waste management or the biomedical waste management committee.

6. CONCLUSION

The study found good Knowledge among doctors, undergraduate medical students, lab technologists, but a lack of awareness among sanitary workers because they work on a contract basis. Based on the observations, the importance of training in biomedical waste management can also be overstated, as there is a significant improvement in Knowledge and awareness following training, hence the need for induction training for newer health care personnel, continuous in-service training programs, and periodic evolution of the health care personnel. Medical personnel must be trained to raise awareness and foster responsibilities for preventing waste exposure and improper disposal. Furthermore, medical workers must strictly adhere to all laws and regulations enacted by the relevant regulating organizations.

7. AUTHORS CONTRIBUTION STATEMENT

This study was done by Ms.M.Mahalakshmi under the guidance of Dr.V.S.Kalaiselvi. Pre-test and post-test conducted by Ms.M.Mahalakshmi, Ms.v.P.Nivedhini and Mr.E.Vasudevan. Training was conducted by Dr.V.S.Kalaiselvi. Analysis was done by Ms.M.Mahalakshmi. Review of literature was done by Dr.V.S.Kalaiselvi.

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9. ETHICAL STANDARDS

The study involved human participants following the ethical standards of the tertiary health care institution where the study was conducted.

10. CONFLICT OF INTEREST

Conflict of interest declared none.

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