SSR Institute of International Journal of Life Sciences
ISSN (O): 2581-8740 | ISSN (P): 2581-8732
Rakh *et al*., 2025
doi: 10.21276/SSR-IIJLS.2025.11.2.30

Original Article

open access

Study on the Waste Disposal Practices in a Tertiary Care Hospital in Western Maharashtra

Vishal Ashruba Rakh[1], Vinod Genu Bagade[2], Shyam Bhaurao Kale[3], Jalindar P. Baravakar[4]*, S Shruti[5]

[1]Assistant Professor, Department of Community Medicine, Mansarovar Medical College and MGU Hospital, Sehore, Madhya Pradesh, India

[2]Associate Professor, Department of Community Medicine, Dr. Balasaheb Vikhe Patil Rural Medical College, PIMS-DU, Loni, Maharashtra, India

[3]Assistant Professor, Department of Community Medicine, Dr B S Kushwah Institute of Medical Sciences, Kanpur, Uttar Pradesh, India

[4]Associate Professor, Department of Community Medicine, Dr. Vitthalrao Vikhe Patil Foundation's Medical College and Hospital, Ahilyanagar Maharashtra, India

[5]Associate Professor, Department of Rasashastra and Bhaishajya Kalpana, Sri Ganganagar College of Ayurvedic Sciences and Hospital, Sri Ganganagar, Rajasthan, India

***Address for Correspondence:** Dr. Jalindar P. Baravakar, Associate Professor, Department of Community Medicine, Dr. Vitthalrao Vikhe Patil Foundation's Medical College and Hospital, Ahilyanagar-414111, Maharashtra, India
E-mail: jpbaravakar.22@gmail.com

Received: 28 Oct 2024/ Revised: 19 Dec 2024/ Accepted: 24 Feb 2025

ABSTRACT

Background: Biomedical waste (BMW) in healthcare settings poses significant health and environmental risks if not managed properly. Despite comprising only 15–25% of total hospital waste, BMW requires specialized disposal to prevent the spread of infections, including HIV, HBV, and HCV. This study assesses the BMW management practices in a private hospital in Western Maharashtra.

Methods: An observational study was conducted in 2024, with six non-consecutive visits to different hospital areas, including OPD, Labour Room, Operation Theatres, and Inpatient Wards. Data were collected using a pre-tested questionnaire, focusing on waste segregation, bin availability, personal protective equipment (PPE) usage, and disposal methods.

Results: Yellow and red waste bins were available in 100% of hospital areas, while black bins were found in 80% and puncture-proof bins in 60% of areas. Waste bins were properly covered in 40% of areas, and biohazard symbols were present on all bins. Posters guiding waste handling were displayed in 60% of hospital areas. Incineration was the most common treatment method (40%), followed by deep burial (30%), autoclaving (20%), and recycling (10%). Major gaps identified included a lack of proper waste segregation, designated storage, PPE use, and trained staff for BMW management.

Conclusion: The study highlights poor compliance with BMW guidelines, increasing occupational and environmental risks. Addressing these gaps requires strict regulatory enforcement, staff training, and infrastructural improvements to ensure safe waste segregation, storage, and disposal, ultimately reducing infection risks and environmental contamination.

Key-words: Biomedical waste, Waste segregation, Hospital waste management, Infection control, Healthcare waste disposal

How to cite this article
Rakh VA, Bagade VG, Kale SB, Baravakar JP, Shruti S. Study on the Waste Disposal Practices in a Tertiary Care Hospital in Western Maharashtra. SSR Inst Int J Life Sci., 2025; 11(2): 7200-7205.

Access this article online
https://iijls.com/

INTRODUCTION

In healthcare settings, various patient care activities generate waste that can potentially harm both human health and the environment. This waste includes items such as soiled cotton, bandages, hypodermic needles, syringes, intravenous tubing, and urinary catheters. In India, such waste is commonly referred to as BMW, though it is also known as clinical waste, medical waste, or healthcare waste in different regions worldwide.

doi: 10.21276/SSR-IIJLS.2025.11.2.30

Despite BMW constituting only 15–25% of the total waste produced in hospitals, the remaining portion comprises general waste, including paper, drug wrappers, cardboard, and leftover food. General waste is managed by local municipal authorities in the same manner as household waste. However, BMW requires specialized handling and treatment to prevent harm to human health and the environment [1].

BMW has been identified as a potential source of infection transmission, with over 40 pathogens documented to spread through it. Notably, the risk of transmitting three major pathogens—Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), and Hepatitis C Virus (HCV)—underscores the importance of strict handling and disposal measures. To mitigate these risks, many countries have enacted legislation mandating proper biomedical waste management in healthcare facilities. In India, the Ministry of Environment and Forests introduced the Biomedical Waste (Management and Handling) Rules in 1998, with revisions made in 2016, to regulate waste disposal practices and ensure safety in healthcare institutions [2,3].

Despite stringent regulations, improper waste management in healthcare facilities continues to pose significant health and environmental risks. While government agencies oversee waste disposal, private healthcare institutions must also comply with these regulations. Improper disposal also leads to increased working hours for healthcare workers [4]. Inefficient waste handling can contribute to shifts in microbial ecology and the spread of antibiotic resistance. Therefore, the primary objective of waste disposal should be to minimize the release of toxic substances from medical facilities into the environment [5].

As of January 2025, the CPCB has released multiple technical guidelines and advisories related to biomedical waste management, including methodologies for conducting gap analyses in waste generation and treatment, performance monitoring of Common Biomedical Waste Treatment Facilities (CBWTFs), and the implementation of bar code systems for effective waste management [6].

Personal hygiene and environmental sanitation of the healthcare workers and work environment are disturbed because of biomedical waste [7,8]. Considering these concerns, this study is conducted in a hospital in Western Maharashtra. The primary aim is to assess and evaluate the waste management processes, handling practices, and treatment methods adopted by this private healthcare institution.

MATERIALS AND METHODS

Study location- The observational study was conducted at Dr. Vitthalrao Vikhe Patil Foundation's Medical College and Hospital which is a teaching institute in Western Maharashtra.

Study period- The observation was made in 2024. Each area was visited on any 3 non-consecutive days in the study period. No visit was made on Sundays and on Public Holidays. Areas were visited during morning hours between 10 am to 1 pm and evening hours of the same day between 7 pm and 9 pm. Thus, a total of 6 visits were made to each area. The chosen timings were such when maximum BMW is generated in a patient care area as this was the time when blood samples of patients were taken and medication injections were given. Although medication injections were also given during evening hours and night hours, such a period was excluded from the study due to operational difficulties in collecting data during these times.

Data collection- The data was collected using a pre-tested questionnaire.

Sampling method- The observation was made in different parts of the hospital namely the OPD, Labour room, Operation theatres, and in-patient ward during the study period.

Support System:

Equipment- The equipment is owned by the hospital owner and is maintained regularly in optimum working conditions.

Supplies- The hospital supplies like Cotton rolls, catheters, etc are ordered from a local supplier. The reusable materials like bed sheets, and metallic surgical instruments are autoclaved in the autoclave machine owned by the hospital.

Drugs- The emergency drugs are procured from a local pharmacy nearby and the additional drugs if required, are asked to get by the patient's relative.

doi: 10.21276/SSR-IIJLS.2025.11.2.30

Vehicle- The hospital does not own an ambulance and is dependent on outside resources for the transportation of the patient.

Questionnaire- Data were recorded on a researcher-made checklist covering various aspects of BMW management at the source of generation of waste. Placement of 4 colour-coded i.e. black, yellow, red, and puncture-proof waste bins which are lined on the inner side by similarly colored waste bags; Segregation of waste in such waste bags i.e. general waste like waste paper, the wrapper of drugs, cardboard, left-over food etc. is to be put into black; soiled infected waste like dressing material, cotton swabs etc. is to be put into yellow; plastic waste like plastic syringes, dextrose bottles, intravenous sets, Ryle's tubes, urinary catheters etc. is to be put into red and sharps like hypodermic needles, surgical blades, glass etc. is to be put into blue bags. Availability of PPE for the handling of the BMW. If a designated person was evaluating the proper management of BMW and providing training from time to time. Satisfactory level of knowledge.

Statistical Analysis- The data collected in this study were analyzed using descriptive and inferential statistical methods. Descriptive statistics such as mean, standard deviation, and percentage distribution were used to summarize the findings. Chi-square tests were applied to examine associations between categorical variables, while t-tests were conducted for continuous variables where applicable. p-value<0.05 was considered statistically significant. Data analysis was performed using SPSS software.

RESULTS

Depending on the places of waste generation, we divided the hospital into different areas- Outpatient Department (OPD), Labour Room (LR), Inpatient Department (IPD)-General, Inpatient Department- Private & Operation Theatre (OT). In our study, yellow and red waste bins were available in all hospital areas, with 100% coverage. Black waste bins were present in 80% of areas, while puncture-proof waste bins had the lowest availability, found in 60% of hospital areas (Table 1).

Table 1: Percentage of hospital areas with availability of Biomedical Waste Bins

Biomedical Waste Bins	Percentage (%)
Black Waste Bins	80
Yellow Waste Bins	100
Red Waste Bins	100
Puncture Proof Waste Bins	60

Waste bins were properly covered only in OPD, there was no covering on the waste bins in the rest of the hospital areas. That is only 40% of the hospital area bins are covered, the covers were waterproof. All the waste bins in the hospital were imprinted with biohazard symbols wherever applicable, which is 100% coverage of biohazard notification on waste bins. Posters to guide users in handling waste were displayed in only 3 out of 5 hospital areas, that is 60% hospital area coverage and the left-out areas were LR & OT (Table 2).

Table 2: Percentage of hospital areas with Different biomedical waste criteria

Criteria	Percentage (%)
Waste Bins Properly Covered	40
Biohazard Symbol	100
Posters for Handling Waste	60

Out of the other different recommendations for Hospital waste management, there were no criteria laid down by the hospital management for segregation and collection of waste, storage of waste before disposal, use of personal protective measures, designated staff for waste handling or waste management strategy. The hospital under study was lacking in all these criteria. The only positive findings in our study were that the workers were given proper training and instructions for biomedical waste handling.

The negative findings encountered in our study are:

- The collected waste was not stored differently.
- There was no place designated for storage of the waste out of the hospital campus.
- The designated place of storage of waste was not a restricted site.
- No personal protective devices were used by the hospital waste managing staff like coats, masks and boots while collecting, segregating, storing and

doi: 10.21276/SSR-IIJLS.2025.11.2.30

disposing of wastes, Gloves were the only protective devices used by them too not regularly.

- Workers designated for handling the waste were not restricted to only waste handling purposes, they were also involved in other patient care works.

In our study, incineration was the most adopted treatment method, accounting for 40% of cases. Deep burial was the next most frequent method, used in 30% of cases. Autoclaving was employed in 20% of cases, while recycling was the least utilized method, comprising 10% of the total treatment approaches (Table 3).

Table 3: Treatment Methods adopted

Treatment Methods	Percentage (%)
Autoclaving	20
Incineration	40
Deep Burial	30
Recycling	10

The knowledge of the healthcare workers was tested, and it was found that among doctors, 80% had Satisfactory knowledge, 90% of Nurses and 60% of the Rest of the Hospital Support Staff had satisfactory knowledge regarding handling Biomedical Waste. Their knowledge was significantly higher than the non-medical workers, who were controls with 20% satisfactory knowledge. ($p<0.05$) (Fig. 1).

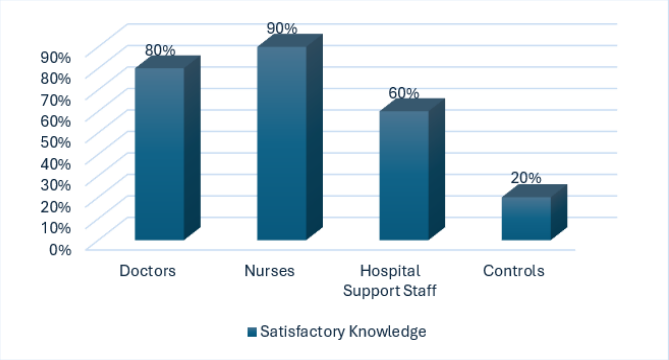

Fig. 1: Satisfactory Knowledge of Medical Staff Regarding BMW Handling

DISCUSSION

This study identified several gaps in hospital waste management practices. Despite stringent regulations, enforcement at the operational level remains inconsistent. Similar findings have been documented by Gupta *et al.* [8], where inadequate segregation and improper disposal of BMW in healthcare facilities contributed to significant health hazards, including the spread of infections like HIV and hepatitis due to exposure to contaminated waste. The study findings revealed that while yellow and red bins were available in all areas, black bins were absent in certain sections such as the labor room (LR) and operation theatre (OT), leading to the mixing of non-medical dry waste with infectious waste. Puncture-proof containers were also unavailable, which resulted in the improper disposal of sharps like needles and scalpels in red bins. Such practices increase the risk of needlestick injuries and transmission of bloodborne infections among healthcare workers and waste handlers. Gupta *et al.* [8] similarly observed that mixing infectious and non-infectious waste within healthcare settings led to increased health risks for waste handlers and rag pickers, ultimately contributing to environmental contamination. Patil *et al.* [9] reported similar findings.

Another major concern highlighted in this study was the lack of awareness among nursing and housekeeping staff regarding proper biomedical waste disposal protocols. The absence of adequate training was evident, particularly in the improper handling of sharp waste, where personnel were unaware of the updated BMW rules. This aligns with findings from Mundhe *et al.* [10], who reported that while doctors, nurses, and laboratory technicians demonstrated better knowledge and adherence to BMW guidelines, the housekeeping staff exhibited poor awareness and compliance, necessitating targeted educational programs. Additionally, the use of PPE was found to be inadequate. Housekeeping staff primarily relied on gloves and masks while handling waste, with essential protective gear like coats, boots, and face shields missing. In contrast, a study by Patil *et al.* [9] found that trained personnel working under proper supervision adhered to standard BMW handling procedures, including the use of complete PPE, thereby reducing risks associated with infectious waste exposure.

The study also revealed lapses in waste storage and disposal. The hospital lacked a designated area outside its premises for biomedical waste storage, leading to its disposal alongside general waste. Additionally, the internal storage site within the hospital was not restricted, allowing unauthorized access, which further increased health risks. Similar issues were reported by

doi: 10.21276/SSR-IIJLS.2025.11.2.30

Gupta *et al.* [8] in Balrampur Hospital, where BMW was mixed with general waste, stored in open bins, and later disposed of with municipal waste, making it easily accessible to rag pickers and increasing the risk of disease transmission. Another issue was the dual responsibility of staff members, who were engaged in both patient care and waste management. Ideally, designated personnel should exclusively handle BMW to ensure adherence to safety protocols. Patil *et al.* [9] observed that in settings where trained personnel were exclusively responsible for waste management, compliance with regulations was significantly higher, reducing health risks and ensuring proper waste disposal. We observed that the Nurses had the best knowledge regarding handling biomedical waste followed by the Doctors and the rest of the Hospital support staff, similar findings were reported by other studies [11,12]. The findings of this study underscore the urgent need for strict adherence to BMW guidelines, proper training of staff, adequate waste segregation measures, designated storage areas, and mandatory use of PPE to mitigate the risks associated with biomedical waste disposal. Many other authors reported many problems in BMW handling [13,14].

CONCLUSIONS

The study highlights significant gaps in biomedical waste management, emphasizing the need for better compliance with guidelines. Despite BMW's disposal rules, inconsistent implementation leads to improper segregation and disposal of waste. The absence of black bins, lack of puncture-proof containers, and inadequate protective equipment increase occupational hazards and environmental contamination. Insufficient training among staff further exacerbates improper waste handling, raising disease transmission risks. These findings align with previous studies, showing persistent challenges in Indian hospitals. Addressing these deficiencies requires strict regulatory enforcement, continuous training, and infrastructural improvements. Hospitals must designate trained personnel for waste management, provide protective equipment, and establish dedicated storage areas away from patient zones. Strengthening waste management protocols can mitigate health risks for healthcare workers and the public while promoting a cleaner, safer environment.

CONTRIBUTION OF AUTHORS

Research concept- Vinod Genu Bagade, Jalindar P. Baravakar, S Shruti

Research design- Vishal Ashruba Rakh, Shyam Bhaurao Kale

Supervision- Vinod Genu Bagade, S Shruti

Materials- Vishal Ashruba Rakh, Shyam Bhaurao Kale

Data collection- Vishal Ashruba Rakh, Shyam Bhaurao Kale

Data analysis and Interpretation- Vinod Genu Bagade, Jalindar P. Baravakar, S Shruti

Literature search- Vishal Ashruba Rakh, Shyam Bhaurao Kale

Writing article- Vishal Ashruba Rakh, Jalindar P. Baravakar

Critical review- Jalindar P. Baravakar, S Shruti

Article editing- Vishal Ashruba Rakh, Shyam Bhaurao Kale

Final approval- Vinod Genu Bagade, Jalindar P. Baravakar

REFERENCES

[1] Kumar SR, Abinaya NV, Venkatesan A, Natrajan M. Bio-medical waste disposal in India: From paper to practice, what has been effected. Indian J Health Sci Biomed Res Kleu., 2019; 12(3): 202-10.

[2] Goswami M, Goswami PJ, Nautiyal S, Prakash S. Challenges and actions to the environmental management of Bio-Medical Waste during COVID-19 pandemic in India. Heliyon, 2021; 7: 3.

[3] Singh S, Dhillon BS, Shrivastava AK, Kumar B, Bhattacharya S. Effectiveness of a training program about bio-medical waste management on the knowledge and practices of health-care professionals at a tertiary care teaching institute of North India. J Educ Health Promot., 2020; 9(1): 127.

[4] Swami A, Kumar S, Patel A, Undhad H, Netragaonkar R. Increased working hours per day and its impact on health of the workers: A review. GAIMS J Med Sci., 2023; 3(2): 16-20.

[5] Kumar R, Gupta AK, Aggarwal AK, Kumar A. A descriptive study on evaluation of bio-medical waste management in a tertiary care public hospital of North India. J Environ Health Sci Eng., 2014; 12: 1-7.

[6] Dsouza MR, Naji KM, Ramaiah MK, Patil SJ. Revolutionizing Biomedical Waste Management: Embracing Innovative Technologies for a Healthier Future. In: Solid Waste Management: A Roadmap for

doi: 10.21276/SSR-IIJLS.2025.11.2.30

Sustainable Environmental Practices and Circular Economy. Cham: Springer Nature Switzerland, 2025; pp. 173-96.

[7] Chandrachood M, Swami A. Assessing Personal Hygiene Practices of Food Handlers in a Tertiary Care Hospital: A Cross-sectional Study in Western Maharashtra. GAIMS J Med Sci., 2023; 3(2): 55-60.

[8] Gupta S, Boojh R. Biomedical waste management practices at Balrampur Hospital, Lucknow, India. Waste Manag Res., 2006; 24(6): 584-91.

[9] Patil GV, Pokhrel K. Biomedical solid waste management in an Indian hospital: A case study. Waste Manag., 2005; 25(6): 592-99.

[10] Mundhe BA, Agatrao Lomte A, Kulkarni DM, Jadhav AG. Biomedical waste management: An assessment of knowledge, attitude, and practice among healthcare workers in rural tertiary care hospital in Maharashtra. J Cardiovasc Dis Res., 2023; 14(12): 1911-18.

[11] Shrikrishna Bhat V, Shrikrishna Bhat T, Balasaheb Chougule M. Biomedical waste analysis in the rural area of Warananagar-Kodoli, Maharashtra, India. Environ Health Eng Manag J., 2024; 11(4): 429-40.

[12] Mathur P, Patan S, Shobhawat AS. Need of biomedical waste management system in hospitals: An emerging issue: A review. Curr World Environ., 2012; 7(1): 117.

[13] Saini R, Pithon MM, Singh HK, Popoff DV. Knowledge of biomedical waste management among the students of Rural Dental College, Maharashtra, India. Int J Exp Dent Sci., 2013; 2(1): 24. doi: 10.5005/jp-journals-10029-1034.

[14] Kulkarni M, Yeravdekar R. Situational assessment of functional elements, practices adopted & concerns related to biomedical waste management in City of Pune, India. Hosp Top, 2020; 98(1): 7-15. doi: 10.1080/00185868.2019.1710633.