



Pre And Post Training Assessment Of Knowledge, Attitude And Practices Of Biomedical Waste Management Among Nursing Staff And Nursing Students In A Tertiary Care Hospital, Bengaluru.

Dr. Denna Jacob¹, Dr. Sunitha B U²

¹Junior Resident (Post Graduate),

²Professor and HOD,

Department of Microbiology,

Shri Atal Bihari Vajpayee Medical College and Research Institute, Bangalore, Karnataka

***Corresponding Author:**

Dr. Denna Jacob

Junior resident (Post Graduate), Department of Microbiology,
Shri Atal Bihari Vajpayee Medical College and Research Institute

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Abstract

Background: Biomedical waste management (BMWM) is an essential component of infection prevention and environmental protection in healthcare settings. Nurses and nursing students are directly involved in the segregation, handling, and disposal of biomedical waste; therefore, their knowledge, attitudes, and practices significantly influence compliance with waste-management regulations and workplace safety.

Objectives: To evaluate the knowledge, attitude, and practices related to biomedical waste management among nursing staff and nursing students and to determine the effectiveness of a structured training intervention in a tertiary care teaching hospital in Bengaluru.

Methods & Materials A prospective interventional study was conducted among 144 nursing staff and third-year nursing students at a tertiary care institution between April and June 2026. Participants completed a structured questionnaire assessing knowledge, attitude, and practice regarding biomedical waste management before and after a training programme. Information on hepatitis B vaccination status, previous BMW training, and occupational safety practices was also collected. Data were analysed using descriptive statistical methods.

Results: Among the 144 participants, 56.3% had completed the hepatitis B vaccination schedule. Before training, excellent levels of knowledge, attitude, and practice were observed in 54.9%, 61.1%, and 84.7% of participants, respectively. Following the educational intervention, the proportion of participants demonstrating excellent knowledge increased to 93.7%, positive attitude to 82.6%, and satisfactory practice to 93.0%. Nursing staff who had received prior BMW training exhibited better baseline performance compared with nursing students.

Conclusion: The study demonstrated that a structured educational programme significantly enhanced knowledge, attitudes, and practices related to biomedical waste management among nursing personnel. Regular training sessions, continuous monitoring, and improved vaccination coverage are necessary to ensure sustained compliance with biomedical waste management guidelines and to promote a safer healthcare environment.

Keywords: Biomedical waste management, nursing staff, nursing students, knowledge, attitude, practice, training intervention

Introduction

Biomedical waste (BMW) generated during healthcare activities poses a significant threat to public health and the environment when not handled appropriately. The World Health Organisation estimates that nearly 15% of healthcare waste is hazardous and has the potential to transmit infectious agents or cause environmental contamination. Improper segregation, collection, transportation, and disposal of biomedical waste can lead to needle-stick injuries, spread of blood-borne infections, and pollution of air, water, and soil [1].

In India, the Biomedical Waste Management Rules, 2016, were introduced to strengthen waste segregation practices, improve occupational safety, and ensure environmentally sound disposal of hospital waste [2]. Effective implementation of these regulations depends largely on healthcare workers who are directly involved in waste generation and handling. Among them, nurses and nursing students constitute a substantial workforce and play a pivotal role in maintaining compliance with BMW management protocols [3].

Several studies conducted in India have reported varying levels of knowledge, attitude, and practices (KAP) regarding biomedical waste management among healthcare workers. Although awareness has improved over recent years, deficiencies in colour coding, segregation procedures, vaccination status, and post-exposure management continue to exist [4,5]. Previous studies have also demonstrated that structured educational interventions significantly enhance compliance with BMW management guidelines and improve safe waste-handling behaviour among healthcare personnel [6,7].

Continuous training and monitoring are therefore essential to bridge existing gaps between knowledge and actual practice. Assessing KAP among nursing staff and nursing students can help identify deficiencies and evaluate the effectiveness of educational interventions. Hence, the present study was undertaken to assess the knowledge, attitude, and practices regarding biomedical waste management among nursing staff and nursing students in a tertiary care teaching hospital in Bengaluru and to evaluate the

impact of a structured training programme on improving their awareness and compliance.

Materials And Methods

This interventional observational study was conducted at Shri Atal Bihari Vajpayee Medical College and Research Institute and Shri Atal Bihari Vajpayee Institute of Nursing, Bengaluru, Karnataka, India, over a period of three months from April 2026 to June 2026. The study population comprised nursing staff and third-year B.Sc. nursing students working or studying at the institution during the study period. After obtaining clearance from the institutional ethical committee, a total of 144 eligible participants who provided written informed consent were enrolled. Data was collected using a structured questionnaire developed based on the Biomedical Waste Management Rules, 2016 and previous published studies [6–9]. Intervention was given in the form of an active interactive session for all the enrolled participants. Data collection was done as a pre-intervention test and post intervention test under four sections – demographic details, knowledge, attitude and practice. Collected data will be entered into Microsoft Excel and then data will be exported to SPSS version 22.0. Data were analyzed using descriptive statistics such as mean, median with standard deviation for continuous variables; frequencies with percentages for categorical variables. After checking for normality of data Relevant tests of significance will be applied. Test will be considered statistically significant when $p < 0.05$.

Inclusion Criteria

1. Nursing staff and 3rd year BSC nursing students
2. All nursing staff and nursing students who give consent to the study

Exclusion Criteria:

1. Above mentioned staff and students on long term leave or absent during data collection period
2. Incomplete or inadequately filled questionnaire (>20%)
3. Those who do not give consent to the study

Results

TABLE 1: Participants' - staff vs students

Participants	Percentage (%)
Staff	68
Students	76

TABLE 2: Participants' years of work experience

Participants	Percentage (%)
<5yrs	65.3
5-10 yrs	19.4
>10 yrs	15.3

TABLE 3: Participants' HBV immunisation status

HBV vaccination status	Percentage (%)
Completed	56.3
Incomplete	35.1
Not vaccinated	8.6

TABLE 4: Participants' previous training in BMW

Participants	Previously attended	Percentage (%)
Staff	65	95.5
Students	42	55.2

TABLE 5: Participants' knowledge of biomedical waste management

	Knowledge (>50%)		Knowledge (<50%)	
	Pre-test	Post- test	Pre- test	Post - test
Staff	37	63	31	5
Students	42	72	34	4

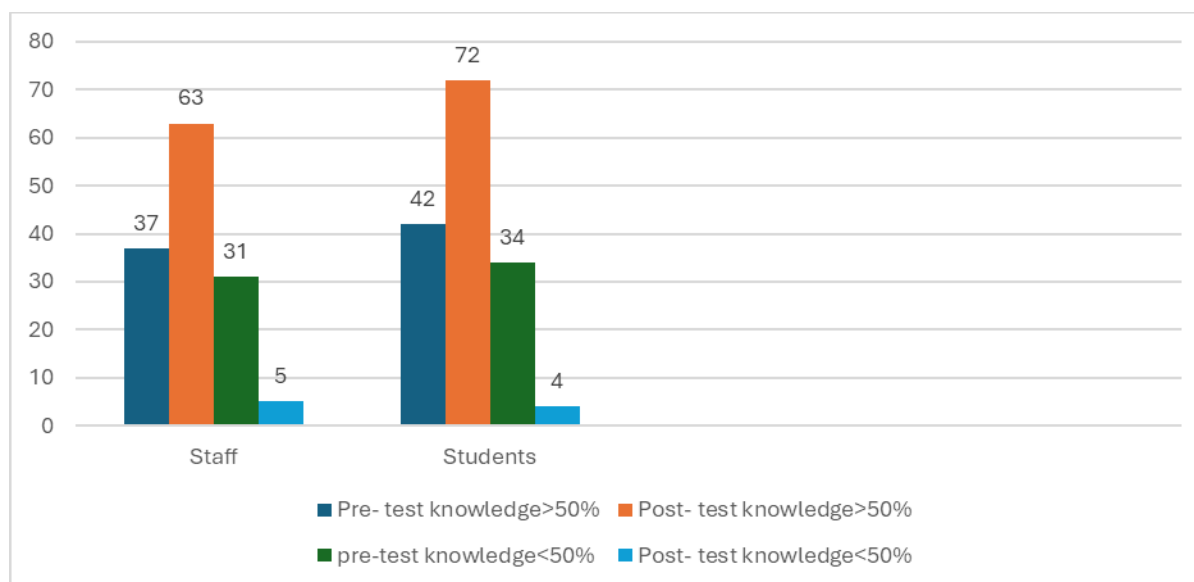


TABLE 6: Participants' pre- test attitude of biomedical waste management

Participants	Strongly Agree	Agree	Neutral	Strongly disagree	Disagree
Staff	29	13	2	3	21
Students	37	9	5	6	19

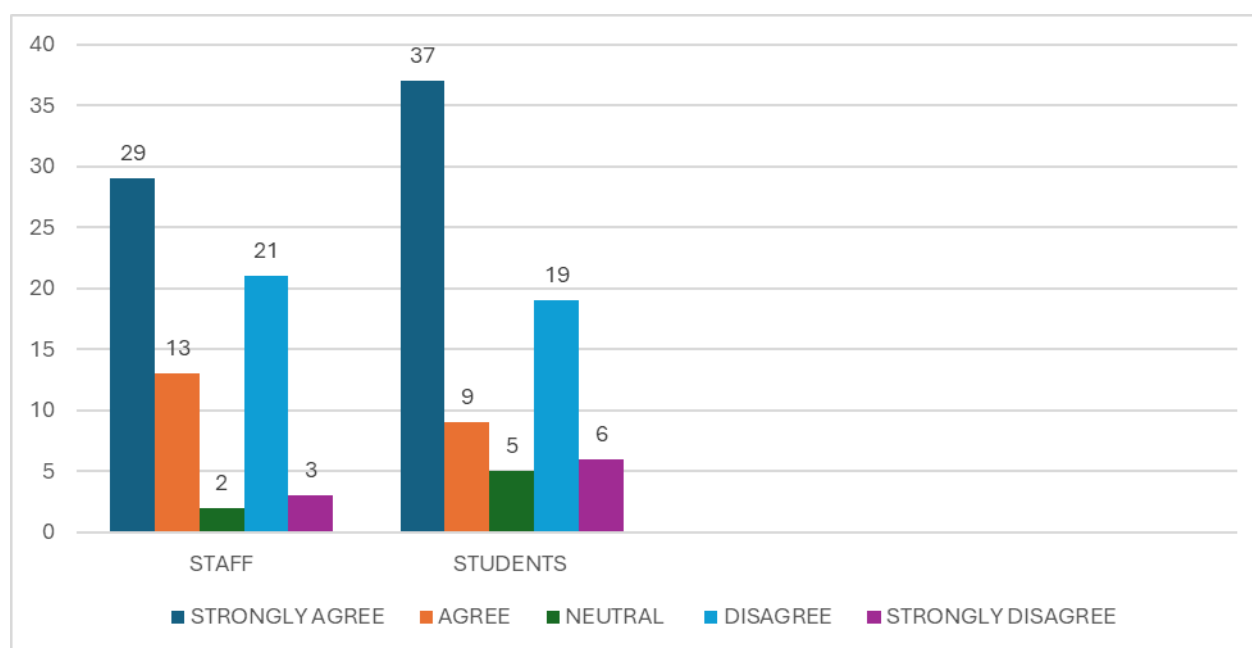
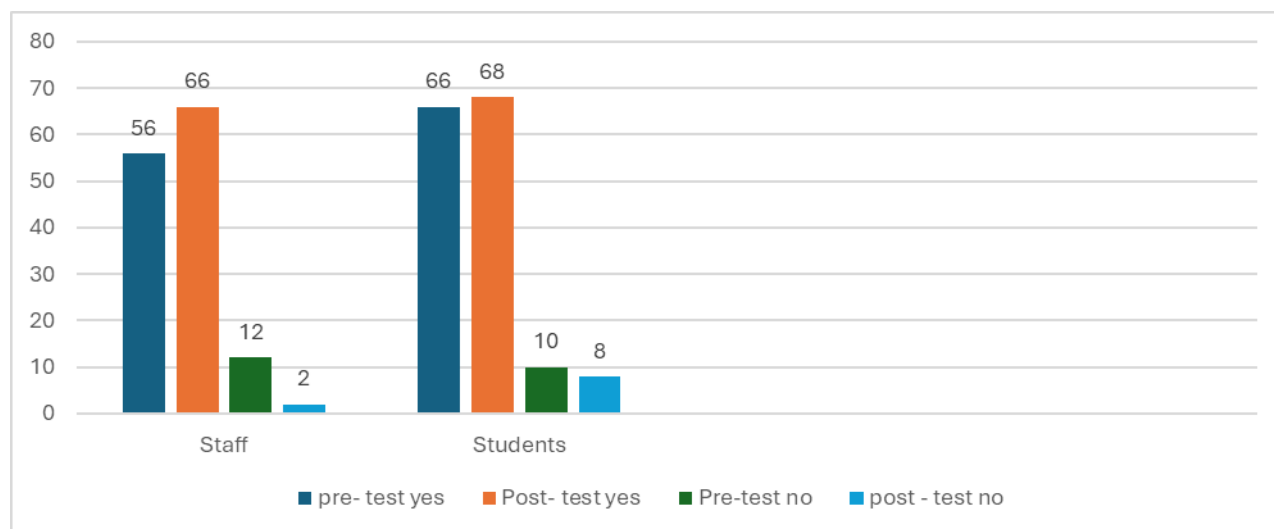


TABLE 7: Participants' post - test attitude of biomedical waste management

	Strongly Agree	Agree	Neutral	Strongly disagree	Disagree
Staff	42	16	4	1	5
Students	47	14	5	3	7

TABLE 8: Participants' pre- test practices of Biomedical waste management

	Yes		No	
	Pre- test	Post- test	Pre- test	Post- test
Staff	56	66	12	2
Students	66	68	10	8



Discussion

Biomedical waste management is a critical component of hospital infection prevention programmes and environmental safety. The present interventional study assessed the impact of a structured training programme on the knowledge, attitude, and practices of biomedical waste management among nursing staff and nursing students. The findings demonstrated substantial improvement across all domains following the educational intervention, highlighting the effectiveness of continuous training in strengthening BMW management practices.

In the present study, knowledge of biomedical waste management increased from 54.9% during the pre-test to 93.7% following training. This finding suggests that targeted educational interventions can effectively improve understanding of waste segregation, colour coding, transportation, storage, and disposal procedures. Similar observations were reported by Sachan et al., who demonstrated a significant increase in BMW awareness among nursing personnel following structured training sessions [8]. Mathur et al. also reported that healthcare workers who received regular training exhibited significantly better knowledge and compliance with biomedical waste management guidelines than those without formal

training [3]. The improvement observed in the present study supports the recommendation to integrate periodic refresher programmes into routine hospital training activities.

Attitude towards biomedical waste management also improved considerably following the intervention, with attitude scores increasing from 61.1% to 82.6%, indicating a more positive shift. Most participants agreed that biomedical waste management is an essential professional responsibility and that regular training programmes are necessary. Positive attitudes among healthcare workers are important because they influence adherence to recommended waste-management practices and contribute to both patient and occupational safety. Similar findings were reported by Patel and Patel, who observed positive attitudes towards biomedical waste management among nursing professionals and emphasised the importance of continuous educational reinforcement [9].

The practice component showed relatively high baseline compliance, with 84.7% of participants demonstrating satisfactory waste-management practices before training. Following the intervention, this increased to 93%. The relatively high baseline practice score may be attributed to institutional infection-control measures, availability of colour-coded containers, and routine supervision. Comparable findings have been reported by Palai et al., who observed satisfactory BMW practices among nursing personnel despite deficiencies in certain knowledge domains [10]. The further improvement noted after training indicates that educational interventions not only enhance awareness but also reinforce safe workplace behaviours.

An important finding of the present study was that only 56.3% of participants had completed the hepatitis B vaccination schedule. Healthcare workers involved in biomedical waste handling remain at increased risk of occupational exposure to blood-borne pathogens, including hepatitis B virus, hepatitis C virus, and human immunodeficiency virus. Therefore, complete immunisation coverage is essential for occupational safety. Similar concerns regarding inadequate hepatitis B vaccination coverage among healthcare workers have been reported by Datta et al., who highlighted the need for institutional vaccination policies and periodic monitoring programmes [4].

The study also observed that nursing staff with previous BMW training demonstrated better baseline performance than nursing students. This finding is consistent with previous reports indicating that professional experience and prior exposure to training programmes contribute significantly to improved awareness and compliance with biomedical waste regulations [3,8]. Therefore, to improve waste-management practices, the incorporation of BMW modules into nursing curricula with a regular competency-based training programme.

The findings of the present study demonstrated that structured educational interventions are more effective in improving knowledge, attitude, and practices related to biomedical waste management among health-care personnel. Continuous training, regular audits, supportive supervision, and strict implementation of the Biomedical Waste Management Rules, 2016, remain essential for ensuring long-term compliance and promoting safe healthcare environments.

Conclusion

The present study demonstrated that nursing staff and nursing students possessed moderate baseline knowledge, attitude, and practices regarding biomedical waste management, which improved significantly following a structured educational intervention. Post-intervention assessment of knowledge, showed an increase from 54.9% to 93.7%, a positive shift in attitude from 61.1% to 82.6%, and improved practice from 84.7% to 93%. This indicates the effectiveness of regular training programmes in enhancing compliance with biomedical waste management guidelines.

Despite these encouraging findings, incomplete hepatitis B vaccination among a considerable proportion of participants highlights the need for strengthening occupational health measures within healthcare institutions. Regular refresher training, practical demonstrations, periodic monitoring, and mandatory immunisation programmes should be implemented to sustain improvements and ensure adherence to the Biomedical Waste Management Rules, 2016.

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