

# Knowledge Assessment on Biomedical Waste Management among First Year Allied Health Science Students at Selected College, Chennai

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## ABSTRACT

**Introduction:** Biomedical waste generated during healthcare activities poses serious risks to public health and the environment when not handled safely. Despite the implementation of the Biomedical Waste (Management and Handling) Rules in India, gaps in awareness and compliance remain evident across healthcare settings. Knowledge and adherence to biomedical waste management protocols are especially crucial for allied health science students, who form an integral part of the future healthcare workforce. Assessing their understanding and attitude toward safe waste management practices is essential for strengthening infection control and ensuring environmentally responsible healthcare delivery.

**Aims:** The study aimed to determine the knowledge on biomedical waste generation, health hazards and legislation, Awareness on BMW Management Practices, Attitude towards BMW Management and Needle-Stick Injury Awareness among first year allied health science students.

**Methods:** A descriptive cross-sectional study was conducted among 102 first year allied health students selected through convenience sampling. Data were collected using structured questionnaire comprising 35 closed ended questions under four categories: biomedical waste generation, health hazards and legislation, Awareness on BMW Management Practices, Attitude towards BMW Management and Needle-Stick Injury Awareness.

**Results:** Of the 102 participants, 52.9% exhibited good knowledge and 44.1% showed intermediate awareness of biomedical waste creation, risks, and legislation. The majority of respondents (50%) had intermediate understanding of biological waste management techniques, with good awareness coming in close (42.2%). 70.6% of pupils demonstrated a modest attitude towards safe waste-handling procedures, according to attitude and behaviour assessments. 62.7% of respondents demonstrated good awareness of needlestick injuries. There were significant association found between the course of study and awareness of needlestick injuries (\*p = 0.010) and between the course of study and knowledge level (\*p= 0.034). Other demographic factors did not exhibit statistical significance.

**Conclusion:** This study revealed that the first year allied health science students possess moderate level of knowledge and attitude towards Biomedical Waste management. Practical compliance and safe waste handling behavior remain insufficient. This demonstrates that students need structured educational intervention and regular training to strengthen the biomedical waste management practices.

**Keywords:** Biomedical Waste Management, Knowledge, Attitude, Needle Stick injuries, Health hazards

## INTRODUCTION

The waste generated during health care operations has a greater risk of infection and harm. As a result, having a dependable and safe approach for managing it is crucial. Inadequate management of medical waste can have detrimental effects on the environment and public health.

The Biomedical Waste Rules 1998 of India define biomedical waste as any waste produced during the diagnosis, treatment, or immunization of humans or animals, as well as during research activities related to or in the

production or testing of biological materials, all of which fall under the schedule I category. At the point of generation, all biomedical waste should be separated into colour-coded bags or containers.

State health authorities should oversee and manage healthcare facilities in order to reduce pollution. There are two primary categories of hazards associated with garbage disposal. First, there is the environmental impact of various hazardous materials; second, there are the more direct concerns of possibly contagious material that waste handlers may come into contact with.

The environment and human health are seriously threatened by the careless disposal of biomedical or hospital waste and exposure to such material. Before being disposed of, biomedical waste needs to be properly managed and treated. The increasing frequency of illnesses like hepatitis B and C and the human immunodeficiency virus (HIV) exacerbates the hazard.

The Biomedical Waste (Management and Handling) Rules 1998 were issued by the Indian Ministry of Environment and Forests to ensure that BM waste is properly managed. The entire waste management of Indian healthcare facilities is intended to be improved by these regulations. However, passing legislation is insufficient to ensure that BM waste is disposed of properly. Public understanding of these laws is crucial, as is the creation of legislation and their enforcement.

The most important issues related to health care waste include inadequate waste management, ignorance of the health risks associated with BM waste, a lack of funding and personnel, and inadequate waste disposal control. The degree of awareness among health care workers in India has been determined to be inadequate, despite the fact that awareness of dangers and proper management approaches has improved globally. Thus, the current study was carried out to evaluate the first-year allied health science students understanding of biomedical waste management.

## METHODOLOGY

The study involved the use of a questionnaire with closed-ended questions, which was distributed to 110 allied health science students. The study population included 20 BSc Cardiac technology students, 3 BSc Cardiopulmonary perfusion technology students, 18 BSc Dialysis technology students, 5 BSc Medical sociology students, 19 BSc Operation Theatre Technology students, 19 B Sc Physician Assistant students, 18 BSc Medical Laboratory Technology students. Two Cardiopulmonary perfusion technology students, two dialysis technology students, two Medical Laboratory Technology students, one Operation Theatre Technology student, and one Physician Assistant student did not complete the questionnaire, therefore 102 subjects participated in the study. The study was approved by the ethical committee of the college and written consent was taken from all the subjects before they were given the questionnaire. Confidentiality of the participants was maintained.

This questionnaire consisted of 35 questions and was designed to obtain information about knowledge of BM waste generation and waste management practices. The questions were grouped under four headings: (a) biomedical waste generation, health hazards and legislation, (b) waste management practices, (c) attitude assessment, and (d) needle-stick injuries.

## RESULTS

The present study analysed the knowledge, awareness, attitude/behaviour, and needle-stick injury awareness related to Biomedical Waste (BMW) management among Allied Health Science students. A total of 102 students participated in the study. The results are presented under major domains, supported by frequency and percentage distribution tables and inferential statistics assessing associations between demographic characteristics and outcome variables.

### 1. Demographic Characteristics of Participants

The demographic profile revealed that the majority of students belonged to the age group of 17–18 years (54.9%), followed by 19–20 years (42.2%), with very few in the 21–22 age group (2.9%). A significant proportion of the sample comprised female students (83.3%), reflecting the gender distribution commonly observed in allied health sciences.

Regarding the courses pursued, the highest enrolment was noted in B.Sc. Cardiac Technology (19.6%), followed by Operation Theatre Technology (18.6%) and Physician Assistant (18.6%) programs. Most respondents (80.4%) reported urban residence, with only a small proportion from rural (7.8%) and semi-urban (11.8%) backgrounds. A very high proportion of participants (84.3%) had not attended any seminars or workshops related to hospital waste management, indicating inadequate exposure to formal training sessions in this area.

**Table 1: Frequency and percentage distribution of demographic variables of allied health science students**

Demographic Variables	Frequency	Percentage
<b>Age</b>		
17-18	56	54.9
19-20	43	42.2
21-22	3	2.9
<b>Gender</b>		
Female	85	83.3
Male	17	16.7
<b>Which Allied Health Science course are you pursuing?</b>		
B Sc Cardiac Technology	20	19.6
B Sc Cardio pulmonary perfusion technology	3	2.9
B Sc Dialysis Technology	18	17.6
B Sc Medical Laboratory Technology	18	17.6
B Sc Medical Sociology	5	4.9
B Sc Operation Theatre Technology	19	18.6
B Sc Physician Assistant	19	18.6
<b>What is your place of residence?</b>		
Rural	8	7.8
Semi urban	12	11.8
Urban	82	80.4
<b>Have you attended any seminars or workshops related to hospital waste management?</b>		
No	86	84.3
Yes	16	15.7

The above table 1 shows that majority 56 (54.9%) were in the age group of 17 – 18 years, 85 ( 83.3 %) were female, 20 (19.6) were BSc Cardiac Technology students, 82 (80.4 %) were urban residence, 86 (84.3%) were not attended any seminars or workshops related to hospital waste management.

## 2. Knowledge on Biomedical Waste Generation, Hazards and Legislation

Analysis shows that 52.9% of the students possessed good knowledge, followed closely by 44.1% with moderate knowledge. Only 2.9% demonstrated poor knowledge. This indicates that more than half of the students are familiar with the basic concepts, regulations, and associated hazards of biomedical waste.

Association analysis revealed a significant association between the course pursued and knowledge level (p = 0.034). No significant associations were observed with age, gender, place of residence, or prior workshop attendance.

**Table 2: Association between demographic variables and Level of knowledge on Biomedical (BM) Waste Generation, Hazards and Legislation**

Demographic Variables	Good n (%)	Moderate n (%)	Poor n (%)	p value
1. Age (years)				0.521
17–18	27 (50.0)	26 (57.8)	3 (100)	
19–20	25 (46.3)	18 (40.0)	0 (0)	
21–22	2 (3.7)	1 (2.2)	0 (0)	
Total	54 (100)	45 (100)	3 (100)	
2. Gender				0.726
Female	45 (83.3)	37 (82.2)	3 (100)	
Male	9 (16.7)	8 (17.8)	0 (0)	
Total	54 (100)	45 (100)	3 (100)	
3. Allied Health Science Course				0.034*
B.Sc. Cardiac Technology	11 (20.4)	7 (15.6)	2 (66.7)	
B.Sc. Cardio Pulmonary Perfusion Technology	3 (5.6)	0 (0)	0 (0)	
B.Sc. Dialysis Technology	9 (16.7)	9 (20.0)	0 (0)	
B.Sc. Medical Laboratory Technology	15 (27.8)	2 (4.4)	1 (33.3)	
B.Sc. Medical Sociology	2 (3.7)	3 (6.7)	0 (0)	
B.Sc. Operation Theatre Technology	6 (11.1)	13 (28.9)	0 (0)	
B.Sc. Physician Assistant	8 (14.8)	11 (24.4)	0 (0)	
Total	54 (100)	45 (100)	3 (100)	
4. Place of Residence				0.279
Rural	6 (11.1)	2 (4.4)	0 (0)	
Semi-urban	9 (16.7)	3 (6.7)	0 (0)	
Urban	39 (72.2)	40 (88.9)	3 (100)	
Total	54 (100)	45 (100)	3 (100)	
5. Attended seminars/workshops on hospital waste management				0.691
No	46 (85.2)	38 (84.4)	2 (66.7)	
Yes	8 (14.8)	7 (15.6)	1 (33.3)	
Total	54 (100)	45 (100)	3 (100)	

The above table 2 shows that there is significant association among the courses and the Level of knowledge on Biomedical (BM) Waste Generation, Hazards and Legislation (p Value 0.034). No other significant association between the other demographic variables and Level of knowledge on Biomedical (BM) Waste Generation, Hazards and Legislation.

### 3. Level of Awareness on Biomedical Waste Management Practices

The distribution of awareness levels showed that 50% of the students had a moderate level of awareness, followed by 42.2% with good awareness, while only 7.8% had poor awareness. This suggests that although conceptual knowledge is high, practical awareness about waste handling practices is slightly lower. No demographic variables showed significant association with awareness levels.

### 4. Attitude and Behaviour toward Biomedical Waste Management

Attitudinal assessment shows that 70.6% of students demonstrated a moderate attitude/behaviour, 27.5% exhibited good behaviour, and 2% showed poor behaviour. This indicates the need for stronger reinforcement of responsible behaviour and compliance-based training. Association analysis showed no demographic variable had a significant association with behaviour.

### 5. Awareness of Needle-Stick Injuries (NSI)

Findings show that 62.7% of students had good awareness of needle-stick injuries, 29.4% had moderate awareness, and 7.8% had poor awareness. This reflects a reasonably high understanding of the risks and preventive measures related to NSIs.

A significant association was found between the course of study and NSI awareness ( $p = 0.010$ ), while no association was found for other demographics.

**Table 3: Association between demographic variables and Needle-Stick Injuries Awareness**

Demographic Variables	Good Awareness n (%)	Moderate Awareness n (%)	Poor Awareness n (%)	p value
<b>1. Age (years)</b>				<b>0.585</b>
17–18	37 (57.8)	14 (46.7)	5 (62.5)	
19–20	26 (40.6)	14 (46.7)	3 (37.5)	
21–22	1 (1.6)	2 (6.7)	0 (0)	
<b>Total</b>	64 (100)	30 (100)	8 (100)	
<b>2. Gender</b>				<b>0.407</b>
Female	52 (81.3)	25 (83.3)	8 (100)	
Male	12 (18.8)	5 (16.7)	0 (0)	
<b>Total</b>	64 (100)	30 (100)	8 (100)	
<b>3. Allied Health Science Course</b>				<b>0.010*</b>
B.Sc. Cardiac Technology	6 (9.4)	9 (30.0)	5 (62.5)	
B.Sc. Cardio Pulmonary Perfusion Technology	2 (3.1)	1 (3.3)	0 (0)	
B.Sc. Dialysis Technology	11 (17.2)	6 (20.0)	1 (12.5)	
B.Sc. Medical Laboratory Technology	12 (18.8)	6 (20.0)	0 (0)	
B.Sc. Medical Sociology	4 (6.3)	0 (0)	1 (12.5)	
B.Sc. Operation Theatre Technology	11 (17.2)	7 (23.3)	1 (12.5)	
B.Sc. Physician Assistant	18 (28.1)	1 (3.3)	0 (0)	
<b>Total</b>	64 (100)	30 (100)	8 (100)	
<b>4. Place of Residence</b>				<b>0.607</b>
Rural	6 (9.4)	2 (6.7)	0 (0)	
Semi-urban	9 (14.1)	3 (10.0)	0 (0)	
Urban	49 (76.6)	25 (83.3)	8 (100)	
<b>Total</b>	64 (100)	30 (100)	8 (100)	
<b>5. Attended seminars/workshops on hospital waste management</b>				<b>0.722</b>
No	54 (84.4)	26 (86.7)	6 (75.0)	
Yes	10 (15.6)	4 (13.3)	2 (25.0)	
<b>Total</b>	64 (100)	30 (100)	8 (100)	

The above table 3 shows that there is significant association among the courses and Needle-Stick Injuries Awareness ( $p$  Value 0.010). No other significant association between the other demographic variables and Needle-Stick Injuries Awareness.

### 6. Overall, Knowledge on Biomedical Waste Management

Overall, 75.5% of students exhibited moderate knowledge, 15.7% good knowledge, and 8.8% poor knowledge. This indicates that although baseline knowledge exists, there is scope for structured educational interventions to improve competency levels.

**Table 4: Frequency and percentage distribution of overall knowledge on Biomedical waste management**

Total Score	Frequency	Percentage
<b>Category</b>		
Good knowledge	16	15.7
Moderate knowledge	77	75.5
Poor knowledge	9	8.8
<b>Total</b>	102	100.0

## DISCUSSION

The format, content, analysis, and response rate of a self-administered questionnaire survey are all critical to its success. The majority of the questions were closed-ended to prevent recollection bias. Participants may respond to such questions more quickly since they are simple to assess. The fact that every participant in this study was a first-year allied health science student provided an additional benefit.

The current investigation was carried out in Allied Health Science College at Chennai. It demonstrated that students knowledge, awareness, and attitude regarding biomedical waste management are often low. Although conceptual understanding is sufficient, behavioural adherence and practical awareness need to be strengthened.

The study's findings are consistent with earlier research. A study was conducted the study on Awareness of Biomedical Waste Management Among Health Care Personnel in Jaipur, India. The study aimed to determine the following among the workforce of the Jaipur Dental College, India: their awareness regarding biomedical (BM) waste management policy and practices, their attitude towards biomedical waste management, and their awareness regarding needle-stick injury and its prevalence among different categories of health care providers. This study concluded that there are poor levels of knowledge and awareness about BM waste generation hazards, legislation and management among health care personnel in Jaipur Dental College. Regular monitoring and training are required at all levels.

A study conducted on Knowledge and awareness about biomedical waste segregation and disposal among medical and paramedical students at a tertiary care hospital in Chennai. This revealed that medical students (3<sup>rd</sup> and 4<sup>th</sup> years) exhibited better KAP in BMW management than paramedical students. Medical students demonstrated a more comprehensive understanding of BMW segregation, disposal methods, and associated health risks. They also displayed a higher level of awareness regarding the importance of proper BMW management for environmental and public health protection. Educational interventions are needed for the paramedical students to enhance their understanding of proper BMW management practices.

Similar study was conducted on Knowledge attitude and practices of biomedical waste management among medical and nursing students in a teaching hospital of J & K, India. This study concluded that BMW management rules should be strictly implemented at all levels to convert knowledge into good practices. Appropriate training programs should be designed for the undergraduate medical and nursing students focusing on BMW management practices.

Overall, the study's findings point to a significant disconnect between aspiring medical professionals theoretical understanding and their actual application of biomedical waste management. In the end, responsible BMW practices will be shaped by practical training, ongoing reinforcement, and stringent institutional oversight, even though awareness campaigns and curriculum-based teaching provide a foundation. Accountability and behavioural change can be promoted by enhancing faculty-led demonstrations, incorporating BMW principles in clinical placements. It may be possible to further ensure that students maintain and use proper practices as they advance in their academic and professional endeavours by implementing regular refresher courses in addition to examinations. Therefore, a multifaceted strategy that includes curriculum improvement, training, and oversight is necessary for preparing allied health science students to make meaningful contributions to safe healthcare waste management and environmental sustainability in the future.

## CONCLUSION

According to the current study, first-year allied health science students knowledge, awareness, and attitudes about biomedical waste management are only moderate. Practical adherence and safe waste-handling practices are still insufficient despite fundamental theoretical comprehension. This disparity emphasizes the critical need for additional supervision during academic and clinical activities, ongoing reinforcement, and organized training programs. Faculty-led demonstrations, frequent reviews, and the use of BMW management can all improve compliance and reduce workplace hazards. Building a responsible health workforce and protecting public and environmental health depend on institutional policies being strengthened and students actively participating in waste management practices.

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## Statement of conflict of interest

The authors declare that there is no conflict of interest associated with this study.

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