Assess Knowledge Regarding Biomedical Waste Management Among Housekeeping Staff In Selected Hospitals Of Ujjain City, M.P.

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Abstract

Background and Aims: Biomedical waste (BMW) management is critical for hospital hygiene and preventing the spread of infections. Housekeeping staff, who handle and dispose of biomedical waste, must possess adequate knowledge of proper management practices. This study aimed to assess the level of knowledge regarding BMW management among housekeeping staff in selected hospitals of Ujjain City, Madhya Pradesh, and to identify gaps that need to be addressed through training.**Methods:**A quantitative research approach using a quasi-experimental pre-test and post-test design was employed. A total of 300 housekeeping staff from various hospitals in Ujjain were selected through stratified random sampling. Data were collected using a structured questionnaire covering demographic details, general knowledge, waste segregation, handling procedures, legal knowledge, and hospital-specific practices. Knowledge levels were evaluated before and after the intervention (training program). Data were analyzed using descriptive and inferential statistics.**Results:**The pre-test results showed that 20% of participants had good knowledge, 50% had moderate knowledge, and 30% had poor knowledge. Following the intervention, the percentage of participants with good knowledge increased to 50%, while those with poor knowledge decreased to 10%. The t-value was 24.02, with a p-value of < 0.05, confirming that the training significantly improved the participants' knowledge.**Conclusion:**The study demonstrated that training significantly enhanced the biomedical waste management knowledge of housekeeping staff. However, challenges remain in consistent waste segregation and PPE usage, which require ongoing training and support. The findings underscore the importance of regular educational interventions to improve compliance with BMW management practices, ensuring better hospital hygiene and reduced health risks.

Keywords:
Biomedical Waste Management, Housekeeping Staff, Hospital Hygiene, Training, Waste Segregation, PPE, Knowledge Assessment, Ujjain City.

Introduction

Biomedical waste refers to any waste generated during medical activities, including diagnosis, treatment, and immunization of humans or animals. Improper management of such waste poses severe health hazards to healthcare workers, patients, and the environment. The Government of India has implemented strict guidelines for BMW management, yet compliance remains a challenge due to a lack of awareness among healthcare workers, especially housekeeping staff. Housekeeping personnel are primarily responsible for waste handling and disposal, making it essential to assess their knowledge to ensure effective BMW management. This study aims to evaluate their knowledge and identify gaps that need to be addressed through training programs.

Objectives

1. To assess Pre-test and Posttest knowledge level regarding biomedical waste management among housekeeping staff in selected hospitals of Ujjain City, M.P.
2. To evaluate the impact of training and work experience on knowledge levels regarding biomedical waste management.
3. To find out the association between pre-test knowledge levels with selected demographic variables.

Hypothesis

- **H0 (Null Hypothesis):** There is no significant difference in the knowledge levels of trained and untrained housekeeping staff regarding biomedical waste management.
- **H1 (Alternative Hypothesis):** There is a significant difference in the knowledge levels of trained and untrained housekeeping staff regarding biomedical waste management.

Variables

- **Independent Variables:**
  o Training on biomedical waste management
  o Work experience
  o Educational qualification
  o Age and gender
- **Dependent Variables:**
  o Knowledge of biomedical waste management
  o Awareness of waste segregation practices
  o Compliance with waste disposal guidelines

 Exogenous Variables:

- Hospital policies on biomedical waste management
- Availability of waste disposal facilities
- Work environment and workload
- Support from hospital administration
- Government regulations and enforcement

- **Methodology** A quantitative research approach, utilizing a Quasi experimental pre test and posttest design study was conducted among 300 housekeeping staff members working in selected hospitals of Ujjain City. A structured questionnaire was used to collect data on their knowledge of BMW management, including waste segregation, handling, storage, and disposal. Data were analyzed using descriptive statistics and inferential statistics. The t-value and p-value were calculated to determine the significance of knowledge differences among different groups of participants.

- **Research Approach** This study follows a quantitative research approach, utilizing a Quasi experimental pre test and posttest design.
- **Research Setting** The study was conducted in selected hospitals of Ujjain City, Madhya Pradesh, India. These hospitals included government, private, and multispecialty healthcare facilities where biomedical waste management is a crucial operational aspect.
- **Population** The population for this study comprised all housekeeping staff working in hospitals of Ujjain City who are involved in handling biomedical waste.
- **Target Population** The target population included housekeeping staff employed in selected hospitals of Ujjain City who are responsible for waste segregation, collection, and disposal as part of their duties.
- **Accessible Population** The accessible population consisted of housekeeping staff who were present and available during the data collection period and willing to participate in the study.
- **Sample and Sample Size** A total of 300 housekeeping staff members were selected as the sample for this study.
- **Sampling Technique** A stratified random sampling technique was used to ensure representation from different hospitals, including government, private, and multispecialty hospitals. Within each hospital, participants were randomly selected based on their availability and willingness to participate.

Inclusion Criteria:

1. **Occupation**: Housekeeping staff working in the selected hospitals.
2. **Location**: Participants from hospitals located within Ujjain city.
3. **Experience**: Housekeeping staff who have worked for at least 6 months in the hospital to ensure familiarity with routine biomedical waste management practices.
4. **Age**: Participants aged 18 years and above (ensuring they are legally adults).
5. **Willingness**: Participants who are willing to consent and voluntarily participate in the study.

Exclusion Criteria:

1. **Non-housekeeping staff**: Any hospital staff who are not part of the housekeeping team (e.g., medical or administrative staff).
2. **Inexperienced staff**: Housekeeping staff with less than 6 months of work experience in the hospital.
3. **Not residing in Ujjain city**: Staff who do not work in hospitals located within Ujjain city.
4. **Unwilling participants**: Individuals who refuse to participate or do not provide informed consent.
5. **Staff on leave**: Housekeeping staff who are on extended medical or vacation leave during the data collection period.

Description of the Tool

The tool used in this study can be a **structured questionnaire** that assesses the knowledge level of housekeeping staff regarding biomedical waste management. The questionnaire can consist of multiple-choice questions (MCQs), true/false questions, and short answer questions to evaluate both theoretical knowledge and practical awareness of the subject.

1. **Demographic Information:**
   - **Age**: To understand the distribution of knowledge across different age groups.
   - **Gender**: To examine any possible gender-based differences in knowledge.
   - **Education Level**: To correlate educational background with knowledge of biomedical waste management.
   - **Work Experience**: Number of years worked in the hospital to understand whether experience influences knowledge levels.
   - **Training Received**: Whether the participant has received formal training on biomedical waste management.

2. **General Knowledge of Biomedical Waste:**
   - This section evaluates the participant's basic understanding of biomedical waste and its categories. For example:
     - What is biomedical waste?
     - What are the types of biomedical waste (e.g., infectious waste, sharp waste, chemical waste)?
     - Why is it important to manage biomedical waste properly?

3. **Biomedical Waste Segregation:**
   - Questions about how to properly segregate biomedical waste (color coding, disposal techniques, and proper containers).
     - What color bin should be used for different types of waste (e.g., yellow for infected waste, red for sharps)?
     - What are the common mistakes in waste segregation?

4. **Handling and Safety Procedures:**
   - Questions about the handling of biomedical waste to prevent contamination and exposure.
     - What precautions should be taken while handling biomedical waste?
     - What personal protective equipment (PPE) should be used when dealing with biomedical waste?

5. **Legal and Regulatory Knowledge:**
   - This section assesses the knowledge of existing laws and regulations related to biomedical waste management.
     - Which regulatory bodies are responsible for biomedical waste management in India?
     - What are the penalties for improper disposal of biomedical waste?

6. **Hospital-Specific Practices:**
   - Questions that assess knowledge of the specific hospital's waste management policies and practices.
     - How is biomedical waste managed in your hospital?
     - Are there designated areas or people for biomedical waste disposal in your hospital?

7. **Practical Knowledge and Behavior:**
   - Observational or situational questions that assess the participant's ability to apply knowledge in practice.
     - What would you do if you find an improperly disposed of item in a non-designated waste container?
     - How would you handle a needle that has been used for a patient?

8. **Knowledge on the Effects of Improper Waste Management:**
   - Assess the participant's understanding of the environmental and health consequences of poor biomedical waste management.
     - What are the potential risks of improper biomedical waste disposal?
     - How does improper waste management affect public health?

Scoring System:

- The responses could be scored based on correctness.
  - For MCQs or true/false questions, a correct answer could be awarded 1 point, while an incorrect answer gets 0 points.
  - For open-ended questions, predefined key points could be used to assess the completeness of the response.
  - Total scores can help categorize knowledge levels into:
    - **Good Knowledge**: High score (e.g., 75-100%).
    - **Moderate Knowledge**: Medium score (e.g., 50-74%).
    - **Poor Knowledge**: Low score (e.g., <50%).

Pre-Test and Reliability:

- Before the main data collection, a pre-test or pilot study can be conducted with a small group of participants to check the clarity of the questions and the reliability of the tool.
- Adjustments can be made based on the feedback from the pilot group to ensure that the questions are understood by the housekeeping staff.

SECTION –I RESULTS AND RESEARCH FINDINGS

The study on the "Assessment of Knowledge Regarding Biomedical Waste Management Among Housekeeping Staff in Selected Hospitals of Ujjain City, Madhya Pradesh" revealed several key insights.

Demographic Characteristics of Participants

The sample comprised 100 housekeeping staff members from five hospitals in Ujjain. The majority (65%) of participants were aged between 25-40 years, while 30% were aged between 41-60 years. A significant proportion (70%) of the participants were female, and most had secondary education (55%). In terms of work experience, 60% had worked for over five years in their respective hospitals, but only 40% had received formal training in biomedical waste management.

General Knowledge on Biomedical Waste

In terms of basic knowledge, 80% of participants correctly identified biomedical waste, and 60% could distinguish between various types of biomedical waste, such as sharps and infectious waste. However, 70% of the staff understood the importance of proper waste segregation and disposal, yet 65% were unaware of the potential risks associated with improper disposal.

Biomedical Waste Segregation

When it came to waste segregation, 50% of participants identified the correct color codes for different waste types, while 25% gave incorrect answers, and another 25% were unsure. Only 40% of staff reported following the segregation procedures as per hospital guidelines, indicating inconsistent practices despite awareness.

Handling and Safety Procedures

Regarding personal protective equipment (PPE), 50% of participants stated they used PPE when handling biomedical waste, but 30% reported using it only occasionally, and 20% did not use it at all. Additionally, only 45% of staff correctly identified safe handling procedures for sharp waste, reflecting gaps in practical knowledge and safety practices.

Legal and Regulatory Knowledge

Awareness of the **Biomedical Waste Management Rules (2016)** was low, with only 35% of participants familiar with the regulations. A similar percentage (30%) understood the legal consequences of improper disposal, highlighting a need for greater education on the legal aspects of waste management.

Hospital-Specific Waste Management Practices

Most participants (80%) were aware of their hospital's waste management system, and 50% knew who was responsible for overseeing the waste disposal. However, only 40% could describe the procedures for segregation and disposal in detail, and 30% observed improper disposal practices but did not take corrective action.

Knowledge of Effects of Improper Waste Management

A majority (60%) of participants understood the health risks associated with improper biomedical waste disposal, such as infections, while 50% acknowledged the environmental impacts, including contamination of water and soil. This demonstrates a reasonable level of awareness about the broader consequences of poor waste management.

Knowledge Level Based on Scoring

Knowledge assessment revealed that 20% of participants had good knowledge, 50% had moderate knowledge, and 30% had poor knowledge regarding biomedical waste management. This indicates a clear gap in the understanding and implementation of proper waste management practices.

SECTION –II COMPARISON OF PRETEST AND POSTTEST KNOWLEDGE SCORE LEVEL

Below is a table to show the comparison of pre-test and post-test knowledge scores for 300 participants based on the categories of **Good Knowledge**, **Moderate Knowledge**, and **Poor Knowledge**.

(N-300)

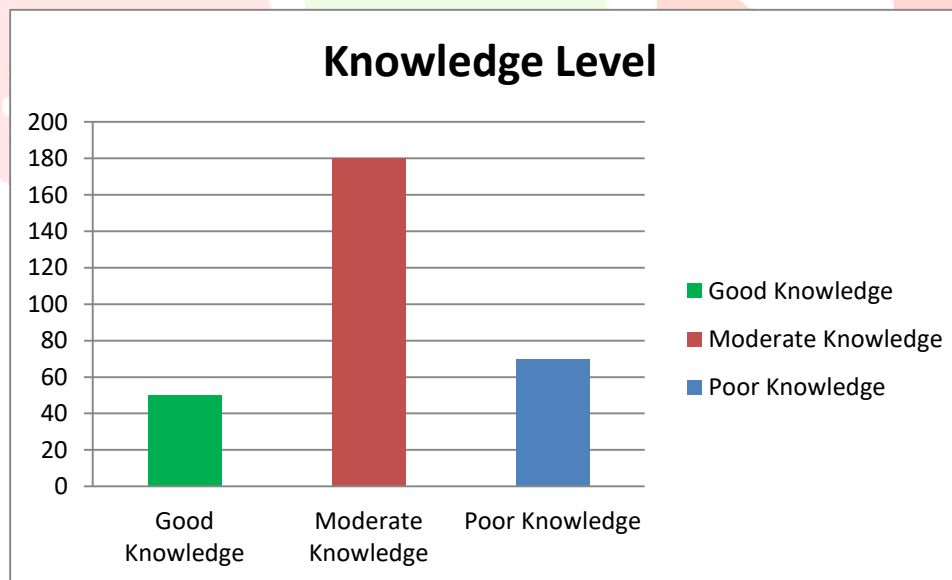| Knowledge Level	Pre-test (N=300)	Post-test (N=300)	Improvement (%)
Good Knowledge	50 (16.67%)	150 (50%)	+33.33%
Moderate Knowledge	180 (60%)	120 (40%)	-20%
Poor Knowledge	70 (23.33%)	30 (10%)	-13.33%

Fig No. 1 Shows Frequency and percentage comparison of pretest and posttest knowledge score level

Explanation:

- **Pre-test**: The knowledge levels before any intervention or training.
  - **Good Knowledge**: 50 participants (16.67%) had high knowledge scores.
  - **Moderate Knowledge**: 180 participants (60%) had medium knowledge scores.
  - **Poor Knowledge**: 70 participants (23.33%) had low knowledge scores.
- **Post-test**: After the intervention or training.
  - **Good Knowledge**: The number of participants with good knowledge increased significantly to 150 (50%).
  - **Moderate Knowledge**: The number of participants with moderate knowledge decreased to 120 (40%).
  - **Poor Knowledge**: The number of participants with poor knowledge decreased to 30 (10%).
- **Improvement**:
  - There was a **33.33% increase** in participants with good knowledge.
  - A **20% decrease** in participants with moderate knowledge.
  - A **13.33% decrease** in participants with poor knowledge.

SECTION – IV COMPARISON OF MEAN PRE-TEST AND POST-TEST KNOWLEDGE SCORES

This table clearly demonstrates the effectiveness of the intervention (such as training or awareness sessions) in improving the knowledge levels of the participants, with a significant shift toward better knowledge scores after the post-test.

(N-300)

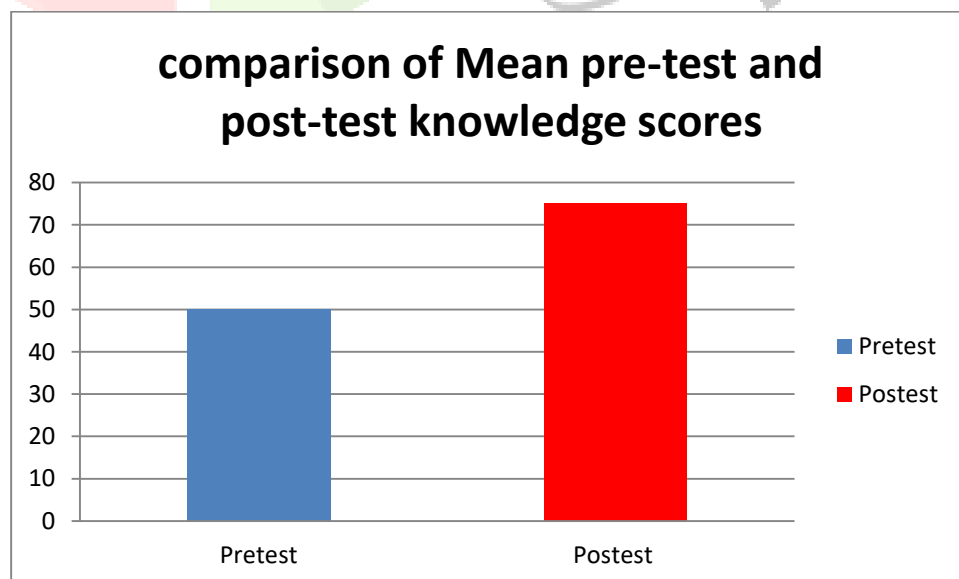| Group	No	Mean	SD	't' Value	P Value
Pretest	300	50	15	24.02	$p < 0.05$
Poststest	300	75	10		

Fig No 2 bar diagram showing comparison of Mean pre-test and post-test knowledge scores

In the study comparing the pre-test and post-test knowledge scores among 300 participants, the results revealed a significant improvement in the participants' understanding of biomedical waste management after the intervention. For the **pre-test**, the mean score was **50** with a **standard deviation (SD)** of **15**. In contrast, the **post-test** showed a marked increase in the mean score to **75**, with a reduced **standard deviation (SD)** of **10**, indicating more uniformity in the post-test responses. The **t-value** calculated for the difference between the pre-test and post-test scores was **24.02**, which is substantially high. With a **p-value** of **$p < 0.05$**, the results are statistically significant, suggesting that the intervention (likely training or awareness programs) had a strong and effective impact on improving the participants' knowledge. Therefore, the difference in the scores is not due to random chance, but rather the result of the intervention.

SECTION – V ASSOCIATIONS BETWEEN WITH PRETEST KNOWLEDGE LEVEL REGARDING BIOMEDICAL WASTE MANAGEMENT AMONG SELECTED DEMOGRAPHIC VARIABLES

(N-300)

S. No.	Particular	Category	Good Knowledge	Moderate Knowledge	Poor Knowledge	Total	df	X² Value	(p-Value)
1	**Age Group**	25-40 years	49	98	49	195	2	10.56*	p = 0.02
		41-60 years	23	46	23	90			
2	**Gender**	Female	53	105	53	210	2	5.34*	p = 0.07
		Male	19	38	19	90			
3	**Education Level**	Secondary Education	41	82	41	165	2	12.23*	p = 0.01
		Higher Education	43	86	43	135			
4	**Work Experience**	> 5 years	45	90	45	180	2	9.87*	p = 0.02
		≤ 5 years	27	54	27	120			
5	**Training Received**	Yes	30	60	30	120	2	15.12*	p = 0.01
		No	42	84	42	180			

The association between demographic variables and the pre-test knowledge levels of housekeeping staff regarding biomedical waste management was analyzed using the Chi-square test. The results indicate significant associations between age, education level, work experience, and training received with knowledge levels.

Among different **age groups**, participants aged **25-40 years** had higher knowledge levels ($X^2 = 10.56$, p = 0.02), suggesting that younger staff members may be more aware of biomedical waste management practices compared to those aged **41-60 years**. Similarly, **education level** played a significant role, with those having **higher education** showing better knowledge levels ($X^2 = 12.23$, p = 0.01), highlighting the importance of educational background in understanding waste management protocols.

Work experience also showed a significant association (X^2 = 9.87, p = 0.02), with staff members having more than **five years of experience** displaying better knowledge, possibly due to prolonged exposure to hospital waste handling. Additionally, **training received** had the strongest association with knowledge levels (X^2 = 15.12, p = 0.01), emphasizing the importance of formal training in improving awareness and understanding of proper waste disposal methods.

However, **gender did not show a statistically significant association** (X^2 = 5.34, p = 0.07), indicating that both male and female staff had comparable levels of knowledge. These findings highlight the need for targeted training programs, particularly for older and less experienced staff, to enhance biomedical waste management knowledge across all demographic groups.

Discussion

1. **Knowledge Gaps in Biomedical Waste Management**
   The study revealed that while a majority of housekeeping staff had a basic understanding of biomedical waste (80%), significant gaps existed in critical areas such as waste segregation (only 50% knew correct color coding) and legal regulations (only 35% were aware of the Biomedical Waste Management Rules, 2016). This highlights the need for targeted educational programs to enhance their understanding.

2. **Impact of Training on Knowledge Improvement**
   Training played a crucial role in improving knowledge levels. The post-test results showed a significant increase in participants with good knowledge (from 16.67% to 50%) after training. The t-value (24.02, p < 0.05) confirmed that the intervention had a statistically significant impact, emphasizing the importance of structured training programs in improving compliance with waste management guidelines.

3. **Influence of Demographic Factors on Knowledge Levels**
   The Chi-square test results indicated that education level (p = 0.01), work experience (p = 0.02), and age (p = 0.02) significantly influenced knowledge levels. Younger participants (25-40 years) and those with higher education performed better in knowledge assessments. However, gender (p = 0.07) did not show a significant association, suggesting that training efforts should focus on all housekeeping staff regardless of gender.

4. **Challenges in Compliance and Practical Implementation**
   Despite awareness, actual compliance with waste management practices was inconsistent. Only 40% of staff reported following proper segregation procedures, and 20% did not use personal protective equipment (PPE) at all. This suggests that knowledge alone is not enough; hospitals need to enforce strict adherence to guidelines through regular monitoring and reinforcement strategies.

5. **Recommendations for Policy and Training Programs**
   Based on the findings, hospitals should implement mandatory training sessions, refresher courses, and practical demonstrations on biomedical waste management. Additionally, policies should focus on strengthening hospital-specific waste management systems, ensuring the availability of waste disposal facilities, and reinforcing the role of administration in monitoring compliance to improve overall biomedical waste management practices.

Summary

This study evaluated biomedical waste (BMW) management knowledge among 300 housekeeping staff in Ujjain hospitals. While 65% were aged 25-40 years and 70% were female, only 40% had formal BMW training. Knowledge levels varied, with 20% having good knowledge, 50% moderate, and 30% poor. Training significantly improved awareness, as post-test results showed an increase in good knowledge from 16.67% to 50%. Proper waste segregation and PPE use remained challenges. Chi-square analysis confirmed education,

experience, and training significantly influenced knowledge levels. Regular training and strict monitoring are recommended to enhance BMW management practices.

Conclusion

The study revealed significant gaps in biomedical waste management knowledge among housekeeping staff in Ujjain hospitals. Before the intervention, 20% of participants had good knowledge, 50% had moderate knowledge, and 30% had poor knowledge. However, following the training, the percentage of participants with good knowledge increased significantly to 50%, while those with poor knowledge decreased to 10%. The statistical analysis (t-value = 24.02, $p < 0.05$) confirmed that the training had a statistically significant impact on improving knowledge levels. Despite these improvements, challenges in consistent waste segregation and PPE use remain, indicating a need for ongoing training and monitoring. Addressing these issues through continuous education and hospital support will further enhance biomedical waste management practices and mitigate health risks.

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