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# ASSESSING NURSES, KNOWLEDGE, ATTITUDE, AND PRACTICES REGARDING MEDICAL WASTE MANAGEMENT AT A TEACHING HOSPITAL IN LAHORE

*Original Research*

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## ABSTRACT

**Background:** Biomedical waste poses serious health and environmental threats if not managed appropriately. It includes infectious materials such as used syringes, blood-soaked dressings, body fluids, pharmaceuticals, and radioactive substances. Inadequate segregation and disposal increase the risk of infection among healthcare workers and patients and contribute to environmental degradation. Effective biomedical waste management is essential for hospital safety and must be guided by the knowledge, attitude, and practices (KAP) of the healthcare providers responsible for waste handling.

**Objective:** To assess the knowledge, attitude, and practices regarding biomedical waste management among staff nurses and to evaluate the impact of training on these parameters at a teaching hospital in Lahore, Pakistan.

**Methods:** A descriptive cross-sectional study was conducted among 93 staff nurses selected through convenience sampling at a tertiary care teaching hospital. A structured questionnaire was used to evaluate demographic data and responses to KAP-related items. Data analysis was performed using IBM SPSS version 27. Independent t-tests were applied to compare the KAP scores between trained and untrained nurses. Frequencies and percentages were used to summarize the responses, and data were visualized using bar and pie charts.

**Results:** Out of 93 participants, 54.8% had received formal training in biomedical waste management. However, 58.1% lacked knowledge about proper segregation, 52.7% were unaware of associated health hazards, and 51.6% could not identify waste-related symbols. Attitudinally, 58.1% considered waste management an extra burden, while 57.0% expressed interest in continuous education. On the practice front, 58.0% reported absence of a color-coding system, and 52.7% failed to dispose of waste in designated containers. Trained nurses consistently demonstrated significantly better KAP scores ($p < 0.05$).

**Conclusion:** The study highlights critical deficiencies in biomedical waste handling among nurses and emphasizes the need for structured training programs, improved policy enforcement, and institutional accountability.

**Keywords:** Attitude, Biomedical Waste, Cross-Sectional Studies, Hospitals, Knowledge, Nursing Staff, Waste Management.

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## INTRODUCTION

Medical waste, also referred to as biomedical waste, encompasses a broad spectrum of materials generated through healthcare activities, including used syringes, soiled dressings, body parts, diagnostic specimens, pharmaceuticals, and radioactive substances (1). The handling and disposal of such waste carry significant implications for the health of medical personnel, patients, and the surrounding community. Improper management not only heightens the risk of injuries and infections among healthcare workers but also poses serious threats to public health and environmental safety (2,3). Hospitals, being the cornerstone of modern healthcare delivery, are responsible for treating individuals irrespective of demographic or socio-cultural differences. In doing so, they generate considerable amounts of biomedical waste, which includes pathological substances, human tissue, infectious materials, and sharps (4). With the global advancement in healthcare services, biomedical waste management (BMWM) has emerged as a critical issue of concern. The increasing complexity of medical procedures has led to the production of potentially hazardous waste that demands systematic handling to prevent cross-contamination and disease transmission (5). Effective BMWM encompasses a series of meticulously regulated steps: segregation, handling, mutilation, disinfection, storage, transport, and final disposal through methods such as incineration (6). Despite the existence of detailed protocols, lapses in compliance and awareness continue to undermine safety standards in healthcare facilities. The waste generated in hospitals is broadly categorized into eight distinct types: general, pathological, radioactive, chemical, infectious, sharps, pharmaceutical, and pressurized containers, all of which require specific handling and disposal strategies (7,8).

Evidence over the past decade underscores a growing emphasis on strengthening medical waste management systems as part of delivering high-quality healthcare. Among the key players in this process are nursing professionals, whose roles place them at the frontline of infection control and patient safety practices (9,10). However, knowledge gaps, attitudinal barriers, and inconsistencies in practice among nursing staff remain pressing challenges. Existing literature has inadequately addressed these behavioral dimensions, particularly in low-resource settings, highlighting a need for context-specific research. Therefore, this study aims to assess the knowledge, attitude, and practice of medical waste management among staff nurses at a teaching hospital in Lahore. By identifying gaps and behavioral trends, the findings of this study will serve as a foundation for informed policy-making and capacity-building initiatives to optimize biomedical waste handling in hospital settings.

## METHODS

This study employed a descriptive cross-sectional design to evaluate the knowledge, attitudes, and practices (KAP) regarding medical waste management among staff nurses working at a teaching hospital in Lahore. The cross-sectional nature of the design allowed for a comprehensive snapshot of current waste management behaviors and attitudes within the nursing workforce, offering valuable insight into potential gaps and deficiencies. The setting, a large tertiary care teaching hospital known for delivering specialized healthcare services, was selected due to its high volume of biomedical waste generation, which makes it an appropriate context for examining nursing practices related to waste handling and disposal. The target population consisted of registered staff nurses actively working in clinical settings at the hospital during the data collection period. Nurses were included if they had at least six months of professional experience and were directly involved in patient care and routine handling of medical waste. Nurses in purely administrative roles or those on extended leave were excluded. A non-probability convenience sampling technique was used to recruit participants, accounting for the unpredictable nature of nursing schedules and shift duties. This method facilitated practical access to participants while minimizing disruption to hospital operations.

The sample size was determined using Taro Yamane's formula, resulting in a final target of 94 participants. A total of 93 self-administered questionnaires were physically distributed to eligible participants, and 88 completed responses were received, yielding a response rate of approximately 95%. Prior to data collection, ethical approval was obtained from the Institutional Review Board (IRB) of the concerned hospital. All participants were briefed about the study objectives, assured of confidentiality, and informed written consent was obtained. The data collection tool was a structured questionnaire comprising both demographic and KAP-related items. Demographic variables included age, gender, qualification, and years of experience, and were summarized using descriptive statistics such as frequencies and percentages. The responses to the knowledge, attitude, and practice items were recorded on ordinal scales. IBM

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SPSS Statistics version 27 was used for all analyses. The distribution of the data was assessed and found to be non-normal; hence, non-parametric statistical tests were applied. Specifically, the Independent t-test was mentioned for comparison purposes, although such use may be inappropriate for non-normally distributed data. Graphical representations including bar charts and pie charts were used to visualize demographic trends.

## RESULTS

The study surveyed a total of 93 staff nurses at a teaching hospital in Lahore. The age distribution revealed that the largest proportion of participants fell in the 35 to 45 years category (41.9%), followed by those aged 45 years and above (34.4%), and 25 to 35 years (23.7%). In terms of work experience, the majority had between 6 to 10 years (44.1%), while 32.3% reported over 15 years of experience, and 23.7% had 11 to 15 years. Educational qualifications were dominated by diploma holders in nursing (94.6%), with minimal representation from BSN (2.2%) and Post RN (3.2%) nurses. The sample was almost evenly distributed by marital status, with 52.7% married and 47.3% unmarried, and a nearly equal representation from urban (50.5%) and rural (49.5%) backgrounds. In the assessment of knowledge related to biomedical waste management, 54.8% of nurses reported having received training. However, only 49.5% recognized biomedical waste symbols, and 52.7% lacked knowledge regarding associated health hazards. About 54.8% were familiar with biomedical waste categories, but only 41.9% understood correct segregation methods. Additionally, 54.8% demonstrated awareness of personal protective measures, while knowledge regarding color coding and needle stick injury policies was reported by 48.4% of participants. Although 52.7% indicated awareness of recycling practices at the hospital, 53.7% were not consistently aware of the types of waste they handled.

Attitudinal responses revealed that 52.7% of nurses believed safe healthcare waste management was solely the government's responsibility, whereas 47.3% regarded it as a shared duty. A significant proportion (58.1%) felt that biomedical waste management increased the hospital's financial burden and added to their workload. While 57.0% expressed interest in ongoing training, 43.0% reported barriers such as lack of time. Perceptions of waste segregation were mixed, with 50.5% disagreeing about its importance, but 52.7% agreed that active healthcare worker participation was essential. Practice-related findings indicated substantial gaps. A majority (58.0%) reported that no color-coding system was in place for waste segregation. Furthermore, 52.7% did not place waste in designated containers immediately after use, and 50.5% observed that medical and non-medical waste was often mixed in inappropriate containers. Although 59.1% agreed that the hospital had waste management policies in place, 40.9% perceived poor compliance. Half of the respondents (50.5%) reported experiencing negative outcomes such as increased infection risks due to improper waste management. Additionally, 54.8% of the respondents stated they had participated in the development of hospital waste management policies. Statistical analysis demonstrated that nurses who had received formal training in biomedical waste management consistently scored higher in knowledge, attitude, and practice domains ($p < 0.05$). Subgroup analysis based on age revealed that nurses aged 35–45 demonstrated the highest proportion of adequate knowledge (71.8%), compared to other age groups. Similarly, those with 6–10 years of experience exhibited the strongest knowledge scores (63.4%). This suggests a possible association between both age and professional experience with knowledge levels concerning biomedical waste management among staff nurses.

**Table 1: Demographic Variables**

| Variable | Frequency (n) | Percentage (%) |
|---|---|---|
| Age Group | | |
| 25 to 35 years | 22 | 23.7 |
| 35 to 45 years | 39 | 41.9 |
| 45 years and above | 32 | 34.4 |
| Experience | | |
| 11 to 15 years | 22 | 23.7 |
| 6 to 10 years | 41 | 44.1 |
| More than 15 years | 30 | 32.3 |

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**Table 2: The table presents the responses from the study regarding nurses' knowledge about biomedical waste management**

| Sr. No | Questionnaire | Yes | No |
|---|---|---|---|
| 1 | Do you receive training of biomedical waste? | 51 | 42 |
| 2 | Do you have Knowledge about symbol? | 46 | 47 |
| 3 | Do you have Knowledge about health hazards wit biomedical waste? | 44 | 49 |
| 4 | Do you have Knowledge about biomedical waste products segregation? | 39 | 54 |
| 5 | Do you have Knowledge about biomedical waste categories? | 51 | 42 |
| 6 | Do know usage of personal protective measures? | 51 | 42 |
| 7 | Do you have Knowledge about color coding biomedical waste? | 45 | 48 |
| 8 | Do you know about the policies in the hospital about needle stick injuries? | 45 | 48 |
| 9 | Are you aware if recycling of medical waste is done at this hospital? | 49 | 44 |
| 10 | Do you know always what type of waste you are dealing with? | 43 | 50 |

**Table 3: Key Findings**

| Variable | Key Findings | Statistical Significance |
|---|---|---|
| Knowledge | 58.1% unaware of segregation, 52.7% uninformed about health hazards, 51.6% unable to recognize symbols. Trained nurses demonstrated better knowledge. | Trained nurses showed significantly better KAP ($p<0.05$) |
| Attitudes | 58.1% viewed waste management as a burden, 52.7% attributed responsibility to government, 57.0% desired continual training. | Trained nurses showed significantly better KAP ($p<0.05$) |
| Practices | 58.0% reported no color-coding system, 52.7% neglected designated containers, 50.5% observed mixed waste. Trained nurses demonstrated better practices. | Trained nurses showed significantly better KAP ($p<0.05$) |

**Table 4: Subgroup Analysis: Age vs. Knowledge**

| Age Group | Adequate Knowledge (n) | Total (n) | Adequate Knowledge (%) |
|---|---|---|---|
| 25–35 | 12 | 22 | 54.5% |
| 35–45 | 28 | 39 | 71.8% |
| 45+ | 20 | 32 | 62.5% |

**Table 5: Subgroup Analysis: Experience vs. Knowledge**

| Experience | Adequate Knowledge (n) | Total (n) | Adequate Knowledge (%) |
|---|---|---|---|
| 6–10 yrs | 26 | 41 | 63.4% |
| 11–15 yrs | 10 | 22 | 45.5% |
| >15 yrs | 15 | 30 | 50.0% |

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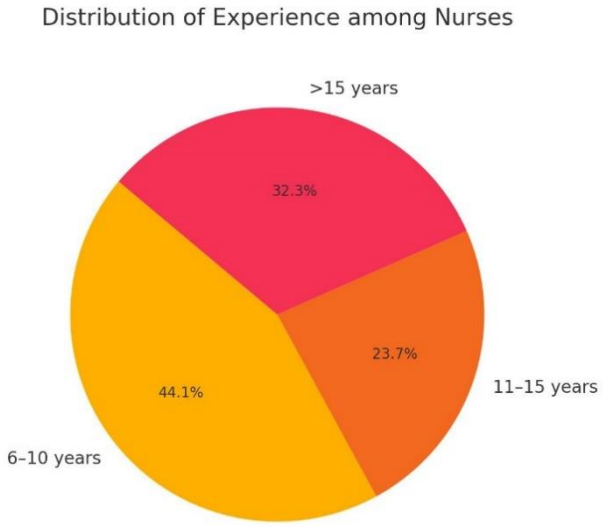



*Figure 1 Distribution of Experience among Nurses*

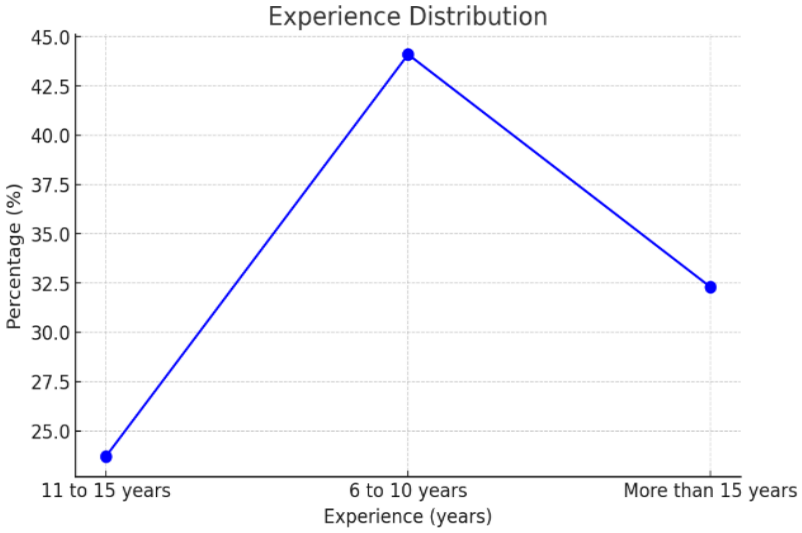



*Figure 2 Experience Distribution*

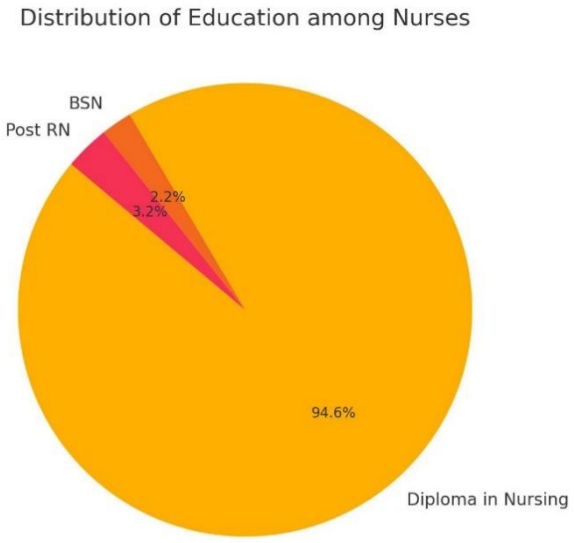



*Figure 3 Distribution of Education among Nurses*

## DISCUSSION

The findings of this study underscore persistent gaps in knowledge and suboptimal practices related to biomedical waste management among nursing staff, consistent with trends observed in similar healthcare settings across South Asia and the Middle East. A substantial proportion of nurses in the current study lacked essential knowledge in key areas such as waste segregation, symbol recognition, and associated health risks. This aligns with prior research in Bangladesh, where a significant deficit in waste segregation knowledge among nursing professionals was also noted (11,12). Likewise, studies from India demonstrated that while healthcare workers often reported a

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positive attitude towards waste management, their actual practices frequently deviated from standard protocols, mirroring the inconsistencies identified in this study (13). Further corroborating these observations, research conducted in tertiary hospitals in Egypt revealed that although nurses generally performed better than physicians in terms of compliance, knowledge deficits persisted, particularly concerning waste categorization and associated hazards (14,15). These findings reflect the outcomes of this study, where despite some awareness and willingness to participate in educational initiatives, there were still considerable lapses in practical implementation. Moreover, while more than half of the respondents expressed interest in continuous education, a significant number failed to consistently adhere to safe disposal practices, reinforcing the conclusion drawn by other investigations in the region that theoretical knowledge alone does not guarantee behavioral compliance (16,17).

The attitudinal dimension presented a mixed picture. Although a majority of nurses were inclined toward ongoing training opportunities, many viewed waste management as an added workload and a financial burden on the institution. These perceptions are widely documented in the literature and reflect the operational realities of many healthcare settings where waste management is perceived as peripheral to core clinical duties (18,19). Concerns regarding financial implications are not unfounded, given the costs associated with specialized disposal, infrastructure, and personnel. However, the long-term benefits of effective biomedical waste management—including reduced infection risks, improved workplace safety, and compliance with regulatory standards—outweigh these costs, emphasizing the need for a paradigm shift that recognizes waste management as a central component of patient care and institutional accountability (20,21). Despite the existence of policies and protocols in most healthcare institutions, their implementation remains inconsistent. This study revealed that a substantial proportion of nurses were either unaware of or non-compliant with existing hospital policies related to waste segregation and needle stick injury protocols. This mirrors global findings where operational challenges such as inadequate resources, absence of clear procedural guidelines, and insufficient policy monitoring have contributed to poor adherence. It is evident that infrastructural reinforcement, alongside periodic audits and performance-based assessments, are critical to ensuring policy compliance (22,23).

A key strength of this study lies in its focus on a specific and high-impact group—staff nurses—who are primary handlers of biomedical waste and pivotal to infection control practices. The use of a standardized questionnaire and the high response rate contribute to the reliability of the data. However, several limitations should be acknowledged. The study was conducted in a single institution, which may limit the generalizability of the findings. Additionally, the use of convenience sampling introduces the possibility of selection bias, and the reliance on self-reported data may be influenced by social desirability or recall bias. Future studies should consider multicenter designs to capture broader regional variations and include objective observational assessments of practices in addition to self-report measures. Investigations into the institutional barriers affecting compliance—such as workflow constraints, logistic gaps, and managerial support—would provide a more comprehensive understanding. Incorporating qualitative methods such as interviews or focus groups could further uncover the nuanced perceptions and behavioral drivers behind biomedical waste handling. Overall, the findings support the urgent need for regular, targeted training programs, robust policy implementation strategies, and behavioral change communication interventions. Only through a multidimensional approach can healthcare institutions ensure that biomedical waste is managed safely, sustainably, and in a manner that protects both healthcare workers and the wider community.

## CONCLUSION

This study concluded that despite a baseline awareness of biomedical waste management among staff nurses at a teaching hospital in Lahore, substantial deficiencies remain in critical areas such as waste segregation, symbol recognition, and policy compliance. These gaps compromise not only occupational safety but also public and environmental health. The findings underscore the urgent need for enhanced training programs, improved infrastructure, and stricter policy enforcement to elevate current practices. Strengthening these areas would enable the hospital to move toward international standards and ensure a safer, more efficient healthcare environment for both workers and patients.

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**AUTHOR CONTRIBUTION**

| Author | Contribution |
|---|---|
| Muhammad Sufyan Ali* | Substantial Contribution to study design, analysis, acquisition of Data<br>Manuscript Writing<br>Has given Final Approval of the version to be published |
| Muhammad Tayyab | Substantial Contribution to study design, acquisition and interpretation of Data<br>Critical Review and Manuscript Writing<br>Has given Final Approval of the version to be published |
| Muhammad Abdullah | Substantial Contribution to acquisition and interpretation of Data<br>Has given Final Approval of the version to be published |
| Muhammad Arslan | Contributed to Data Collection and Analysis<br>Has given Final Approval of the version to be published |
| Matthew Abraham | Contributed to Data Collection and Analysis<br>Has given Final Approval of the version to be published |
| Mishal Liaqat | Substantial Contribution to study design and Data Analysis<br>Has given Final Approval of the version to be published |

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