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Original Research Article

Assessing The Knowledge and Practices of Nurses Regarding Biomedical Waste Management in Tehsil Headquarter Hospital Wazirabad

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Name of Author:
Rodha Waseem[1], Rubina Inam[2] , Tayyba Shahzadi[3], Sanam Riaz[4], Aqsa Nazir[5], Ayesha Tariq[6]

Affiliation: *[1]Lecture, Nursing Department University of Chenab Gujrat Pakistan*
[2]Principal, Nursing Department University of Chenab Gujrat Pakistan
[3]Post RN Student, Nursing Department University of Chenab Gujrat Pakistan
[4]Post RN Student, Nursing Department University of Chenab Gujrat Pakistan
[5]Post RN Student, Nursing Department University of Chenab Gujrat Pakistan
[6]Post RN Student, Nursing Department University of Chenab Gujrat Pakistan.

Corresponding Author:
Rodha Waseem

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Abstract: ***Background:*** Biomedical waste (BMW) refers to waste generated during the diagnosis, treatment, or immunization of humans and animals, as well as from research activities related to these processes. ***Methodology***: A descriptive cross-sectional study was conducted at Tehsil Headquarter Hospital Wazirabad over four months (August–November 2025) to assess nurses' knowledge and practices regarding biomedical waste management. A sample of 109 registered nurses directly involved in patient care and waste handling was selected using convenient sampling. Data were collected through a structured, validated questionnaire covering demographic information, knowledge, and practices, administered during duty hours with informed consent. Knowledge was assessed with 15 multiple-choice questions and practice with 10 yes/no items, both scored and categorized into poor, moderate, or good/adequate levels. Data were coded, entered into SPSS version 24, and analyzed using frequencies and percentages to evaluate knowledge and practice levels and their association with demographic variables. ***Results:*** The study included 109 nurses, predominantly younger and male, with 44% aged 20–30 years and 92.7% male. Most participants held a Post RN BScN degree (52.3%), and they were distributed across various clinical areas, with the majority working in the Critical Care Unit (26.6%). Half of the nurses (50.5%) had less than one year of experience, indicating a relatively early-career workforce. Regarding biomedical waste management, 40.4% of nurses had poor knowledge, 33.9% moderate, and only 25.7% good knowledge, highlighting a need for further training. In terms of practices, 47.7% demonstrated good practices, 39.4% moderate, and 12.8% poor practices, suggesting that while adherence is generally acceptable, there is still scope for improvement through ongoing education and supervision. ***Conclusion***: The study concludes that most nurses were young, male, and early in their careers, with a majority demonstrating insufficient knowledge but generally moderate to good practices regarding biomedical waste management. This highlights the need for targeted training to improve knowledge and ensure consistent safe practices.

Keywords: Biomedical Waste Management; Nurses; Infection Control; Personal Protective Equipment

INTRODUCTION

Biomedical waste (BMW) refers to waste generated during the diagnosis, treatment, immunization, or research related to human and animal health and includes items such as syringes, needles, dressings, body parts, and laboratory materials (World Health Organization [WHO], 2014). If improperly managed, BMW poses serious risks to health care workers, patients, waste handlers, and the community by facilitating the transmission of infections such as HIV and hepatitis B and C (WHO, 2024). The WHO estimates that approximately 10–15% of health care

waste is hazardous or infectious, underscoring the importance of proper biomedical waste management as a critical component of safe and sustainable health care delivery (WHO, 2014).

Globally, regulatory frameworks emphasize segregation at the point of generation, use of color-coded containers, staff training, and adherence to infection prevention protocols as the foundation of effective BMW management (WHO, 2014). Despite these guidelines, implementation remains inadequate in many developing countries due to limited resources, insufficient training, and weak policy enforcement. In Pakistan, hospital waste management is regulated through frameworks such as the Hospital Waste Management Rules 2005 and the Punjab Hospital Waste Management Compendium 2023; however, studies indicate that compliance and practical adherence remain inconsistent, particularly at the facility level (Government of Punjab, 2023; Government of Sindh, 2014).

Nurses play a pivotal role in BMW management because they handle waste directly at the point of generation, and their knowledge and practices strongly influence infection control and environmental safety (Saini et al., 2021). Evidence from Pakistan shows a persistent gap between nurses' knowledge and actual practices, with studies reporting inadequate adherence to segregation and disposal protocols despite awareness of policies (Ali et al., 2021; Shah et al., 2020). Assessing nurses' knowledge and practices is therefore essential to identify gaps, guide targeted training, and strengthen monitoring systems, ultimately improving patient safety and environmental protection (WHO, 2024).

MATERIAL AND METHODS

A descriptive cross-sectional study was conducted at Tehsil Headquarter Hospital Wazirabad over a period of four months from August 2025 to November 2025. The study population consisted of registered nurses working in the hospital, and a sample size of 109 was calculated using Slovin's formula with a 5% margin of error. Participants were selected through a convenient sampling technique. Registered nurses of either gender who were directly involved in patient care and biomedical waste handling, had at least six months of work experience, and were willing to provide informed consent were included, while nurses on long-term leave, administrative staff, trainee nurses, interns, and those working exclusively in non-clinical departments were excluded. Data were collected after obtaining ethical approval and formal permission from hospital administration using a structured, validated questionnaire comprising demographic information and adopted knowledge and practice questionnaires related to biomedical waste management. Knowledge was assessed using a 15-item multiple-choice questionnaire, with scores categorized as poor (<50%), moderate (50–75%), and good (>75%), while practices were evaluated using a 10-item yes/no questionnaire and classified as inadequate (<50%), moderate (50–74%), or adequate (≥75%). Questionnaires were administered in person during duty hours, and completed forms were collected immediately to ensure completeness; limited discreet observation was also conducted to validate self-reported practices. Data were coded, kept confidential, and analyzed using SPSS version 24, with frequencies and percentages calculated for categorical variables. Ethical principles were strictly maintained by ensuring voluntary participation, anonymity, confidentiality of data, and participants' right to withdraw from the study at any stage without any risk or penalty.

RESULTS

Demographic Characteristics of Participants

Table 1: Demographics characteristics of participants

Demographic Variables	Category	Frequency (f)	Percentage (%)
Age	20–30 Year	48	44.0
	31–40Year	27	24.8
	41–50 Year	24	22.0
	>50 Year	10	9.2
Gender	Female	8	7.3
	Male	101	92.7
Qualification	Diploma in Nursing	30	27.5
	Post RN BScN	57	52.3
	Generic BScN	22	20.2
Ward	Medical Unit	16	14.7
	Surgical Unit	19	17.4
	Critical Care Unit	29	26.6
	Paediatric Unit	24	22.0
	Accident & Emergency	21	19.3

Experience	Less than 1 year	55	50.5
	1–5 Year	33	30.3
	> 5 Years	21	19.3

Table 1 presents the demographic characteristics of the participants (n = 78). Most participants were aged 20–30 years (44.0%), followed by those aged 31–40 years (24.8%). The majority were male (92.7%), while a small proportion were female (7.3%). Regarding educational qualification, more than half of the participants had Post RN BScN (52.3%), followed by diploma in nursing (27.5%) and Generic BScN (20.2%). Participants were working in various wards, with the highest proportion from critical care units (26.6%), followed by paediatric units (22.0%) and accident and emergency departments (19.3%). In terms of work experience, half of the participants had less than one year of experience (50.5%), while 30.3% had 1–5 years and 19.3% had more than five years of experience.

Knowledge of Nurses Regarding Biomedical Waste Management

Table 2. Overall knowledge of nurses regarding Biomedical Waste Management

Level of Knowledge	Frequency	Percentage
Poor Knowledge	44	40.4
Moderate Knowledge	37	33.9
Good Knowledge	28	25.7
Total	109	100.0

Table 2 shows the overall knowledge of nurses regarding biomedical waste management. Most nurses had poor knowledge (40.4%), followed by moderate knowledge (33.9%), while only 25.7% demonstrated good knowledge, indicating a need for further education and training in this area.

Practices of Nurses Regarding Biomedical Waste Management

Table 3. Overall Practices of nurses regarding Biomedical Waste Management

Level of Practices	Frequency	Percentage
Poor Practices	14	12.8
Moderate Practices	43	39.4
Good Practices	52	47.7
Total	109	100.0

Table 3 shows that nearly half of the nurses (47.7%) demonstrated good practices regarding biomedical waste management, while 39.4% had moderate practices. However, 12.8% of nurses still exhibited poor practices, indicating room for improvement through regular training and supervision.

DISCUSSION

The present study highlights important demographic, knowledge, and practice-related findings regarding biomedical waste management (BMWM) among nurses. The majority of participants were young, with 44% aged 20–30 years and most being under 40 years. Similar age distributions have been reported in previous studies conducted in tertiary care hospitals, where the nursing workforce was predominantly young, reflecting recent recruitment and expansion of healthcare services (Mathur et al., 2011; Hakim et al., 2014). Younger nurses are often more adaptable to guidelines; however, limited experience may affect depth of knowledge and consistent practice.

A marked male predominance (92.7%) was observed in this study. This finding contrasts with studies from many countries where nursing is female-dominated but aligns with several Pakistani studies reporting higher proportions of male nurses in public and tertiary care settings (Ali et al., 2017; Khan et al., 2020). Gender itself has not been consistently shown to influence BMWM knowledge, but workforce composition reflects local sociocultural and institutional trends.

Regarding educational qualifications, more than half of the nurses held a Post RN BScN degree, indicating an overall satisfactory academic background. Similar findings were reported by Sharma et al. (2013), who noted that nurses with bachelor-level education generally demonstrated better awareness of waste management principles. Despite this, gaps in knowledge in the current study suggest that formal education alone may not be sufficient without continuous in-service training.

Ward-wise distribution showed higher participation from critical care, paediatric, and emergency units, areas that generate a large amount of biomedical waste. Previous literature indicates that nurses working in high-acuity areas are more exposed to

BMW and are expected to follow strict waste segregation practices (Yadavannavar et al., 2010). However, high workload and stress in these units may negatively impact compliance.

Clinical experience data revealed that over half of the nurses had less than one year of experience. This finding is consistent with studies reporting that junior nurses often have limited practical exposure to BMWM protocols, which may explain observed deficiencies in knowledge (Bathma et al., 2012). Experience has been positively associated with better understanding and adherence to waste management guidelines in several studies (Saini et al., 2005).

In terms of knowledge, a substantial proportion of nurses demonstrated poor (40.4%) to moderate (33.9%) knowledge regarding BMWM, with only one-quarter showing good knowledge. These findings are comparable to studies by Mathur et al. (2011) and Pandit et al. (2005), which reported inadequate knowledge among nursing staff, particularly regarding color coding, segregation, and disposal methods. This consistent knowledge gap emphasizes the need for structured and repeated educational interventions.

Interestingly, despite suboptimal knowledge levels, practice findings were relatively better, with 47.7% of nurses demonstrating good practices and only 12.8% showing poor practices. Similar discrepancies between knowledge and practice have been reported in earlier studies, where nurses followed routine practices based on ward protocols or supervision rather than conceptual understanding (Sharma et al., 2013; Hakim et al., 2014). This suggests that institutional policies, peer influence, and supervision play a key role in ensuring acceptable practices even when knowledge is limited.

Overall, the findings indicate that while biomedical waste management practices among nurses are generally satisfactory, underlying knowledge deficits remain significant. Consistent with previous literature, regular in-service training, refresher courses, visible guidelines in wards, and continuous monitoring are essential to bridge the gap between knowledge and practice and to ensure safe and effective biomedical waste management (WHO, 2014; Ali et al., 2017).

CONCLUSION

The study concluded that the nursing workforce was predominantly young, male, and academically qualified at the bachelor's level, with most nurses having less than one year of clinical experience. Despite the relatively low knowledge levels regarding biomedical waste management—where 40.4% had poor knowledge—practices were comparatively better, with nearly half demonstrating good adherence. These findings highlight the need for ongoing education, training, and supervision to strengthen knowledge and ensure consistent safe practices in biomedical waste management.

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