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Original Research Article

KNOWLEDGE AND PRACTICES REGARDING BIO-MEDICAL WASTE MANAGEMENT AMONG STAFF NURSES IN TERTIARY CARE HOSPITAL

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Abstract: *Biomedical waste (BMW) management is a critical aspect of healthcare delivery, ensuring safety for healthcare workers, patients, and the environment. In Pakistan, the implementation of effective BMW management practices remains a significant challenge due to limited resources and inconsistent adherence to protocols.* ***Objective:*** *To evaluate the knowledge and practices of staff nurses regarding BMW management in a tertiary care hospital in Lahore, Pakistan.* ***Methods:*** *A descriptive cross-sectional study was conducted among 130 female nurses. Data were collected using a structured questionnaire assessing knowledge and practices related to BMW management. Descriptive statistics, including frequencies and percentages, were analyzed using SPSS version 26.* ***Results:*** *All participants (100%) were aware of BMW generation and legislation, and 96.9% adhered to colour-coded waste segregation. However, only 82.3% used puncture-proof containers for sharps disposal, and 87.7% were aware of the preparation of disinfectant solutions. Most nurses (99.2%) reported wearing PPE, and 92.3% were immunised against Hepatitis B. Despite these strengths, gaps in adherence to storage time limits and sharp disposal protocols were noted.* ***Conclusion:*** *While awareness and adherence to certain BMW management practices were high, significant gaps remain in compliance with critical protocols. Enhanced training, monitoring, and resource provision are essential to ensure safe and effective BMW management in healthcare settings in Pakistan.*

Keywords: Biomedical Waste Management, Knowledge, Practices, Nurses, Pakistan, Healthcare Safety

Introduction

Biomedical waste (BMW) refers to the waste generated during the diagnosis, treatment, or immunization of humans and animals, as well as related research activities. Improper management of biomedical waste poses significant health risks to healthcare workers, patients, and the environment, leading to the spread of infections, injuries from sharps, and contamination of soil and water resources. In Pakistan, where healthcare infrastructure is overburdened and resources are limited, the safe management of biomedical waste remains a pressing challenge (1, 2).

Globally, it is estimated that healthcare facilities generate millions of tons of biomedical waste annually, with a significant portion categorized as hazardous. In Pakistan, studies have shown that healthcare facilities often lack proper waste segregation and disposal systems, leading to unsafe practices such as open dumping and burning of waste. A survey conducted in Punjab revealed that less than 50% of healthcare facilities adhered to established waste management protocols (3, 4). Such practices not only endanger healthcare workers but also pose risks to waste handlers, the general public, and the environment.

Staff nurses play a critical role in the management of biomedical waste, as they are often responsible for the segregation, handling, and disposal of waste at the point of generation. Adequate knowledge and strict adherence to BMW management practices are essential for minimizing risks and ensuring compliance with regulatory standards. However, research in Pakistan has highlighted significant gaps in the knowledge and practices of nurses regarding BMW management. For instance, Ahmed et al. reported that while many nurses were aware of the basic principles of BMW management, their practices often fell short of recommended guidelines due to inadequate training and lack of institutional support (5).

International guidelines, such as those from the World Health Organization (WHO), emphasize the importance of comprehensive training programs and strict adherence to protocols for effective BMW management (6). However, the implementation of these guidelines in Pakistan is hindered by resource constraints, lack of awareness, and weak regulatory enforcement. Addressing these challenges requires targeted interventions, including regular training, monitoring, and the provision of necessary resources (7).

Despite the critical importance of proper BMW management, there is limited research on the knowledge and practices of nurses in tertiary care hospitals in Pakistan. This study aims to evaluate the knowledge and practices of staff nurses regarding biomedical waste management in a tertiary care hospital in Lahore. By identifying gaps and barriers, the findings will provide valuable insights to inform strategies for improving waste management practices in healthcare settings (8).

Methodology

The study employed a descriptive cross-sectional design to evaluate the knowledge and practices of biomedical waste (BMW) management among staff nurses in a tertiary care hospital in Lahore, Pakistan. This design was selected to provide a snapshot of the current awareness and behaviours of nurses regarding BMW management at a given point in time. The study population consisted of all female nurses working in various wards of the hospital. 130 participants

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were included, representing diverse age groups, educational qualifications, and job roles. Convenience sampling was used to recruit participants who met the inclusion criteria, which required them to be actively employed as ward nurses and willing to participate. Nurses working in administrative roles or those who declined to participate were excluded.

Data were collected using a structured questionnaire developed based on national and international guidelines for BMW management. The questionnaire was divided into two sections: demographic information and knowledge and practices related to BMW management. Demographic variables included age, qualification, and job designation. The knowledge section assessed participants' awareness of BMW generation, legislation, waste segregation, and disposal methods. The practices section focused on adherence to safety protocols, use of personal protective equipment (PPE), waste segregation practices, and post-exposure prophylaxis (PEP).

The questionnaire was pre-tested on a small sample of nurses to ensure clarity and reliability. Modifications were made based on the feedback received to enhance the validity of the instrument. Ethical approval was obtained from the institutional review board of the hospital. Participants were briefed on the study's objectives, and written informed consent was obtained. Confidentiality and anonymity were ensured throughout the study.

Data collection was conducted over one month, during which participants completed the questionnaires under the supervision of the research team. Completed questionnaires were reviewed for completeness and entered into a secure database for analysis.

Data analysis was performed using SPSS version 26. Descriptive statistics, including frequencies and percentages, were used to summarise demographic characteristics, knowledge, and practices. The results were presented in tables to facilitate a clear understanding of the findings.

Results

This study evaluated the knowledge and practices of biomedical waste (BMW) management among staff nurses in a tertiary care hospital in Lahore, Pakistan. The study included 130 participants, all female nurses. Most participants (33.8%) were aged 23–25 or 25–30 years, followed by those aged 30–40 years (24.6%). A significant proportion held post-RN qualifications (43.1%), followed by diploma nurses (39.2%). Only 17.7% were BSN graduates. Among the participants, 95.4% were ward staff nurses, while 4.6% were ward in-charge nurses (Table 1).

The majority of nurses demonstrated awareness of BMW generation and legislation, with 100% reporting knowledge of its existence. However, gaps in understanding specific aspects were evident. For instance, 80.8% were aware of the proportion of infectious waste among total healthcare waste, and 96.9% knew the colour codes for waste segregation. Notably, 98.5% reported awareness of needle stick injury consequences, and 92.3% were familiar with autoclaving as a method for BMW treatment (Table 2).

While most nurses reported good practices in handling BMW, significant gaps remained. For example, 99.2% wore personal protective equipment (PPE) while handling waste, and 98.5% followed colour coding for waste segregation. However, 87.7% knew how to prepare a 1% hypochlorite solution, and 91.5% adhered to post-exposure prophylaxis (PEP) following needle stick injuries. The use of puncture-proof containers for sharps disposal was reported by 82.3% (Table 3).

The results highlight a high level of general awareness of biomedical waste management among staff nurses, with gaps in specific knowledge and inconsistent adherence to certain practices. While protective measures such as wearing PPE and adhering to colour coding for waste segregation were widely followed, knowledge about preparation methods for disinfectant solutions and adherence to PEP protocols showed room for improvement. These findings emphasize the need for enhanced training programs and the implementation of standardized practices to ensure safe and effective BMW management in healthcare settings.

Table 1: Demographic Characteristics of Participants

Variable	Category	Frequency (n)	Percentage (%)
Age	20-22 years	7	5.4
	23-25 years	44	33.8
	25-30 years	44	33.8
	30-40 years	32	24.6
Qualification	Diploma	51	39.2
	BSN	23	17.7
	Post RN	56	43.1
Designation	Ward In-Charge	6	4.6
	Ward Staff	124	95.4

Table 2: Knowledge of Biomedical Waste Management

Question	Yes (n, %)	No (n, %)
Do you know about BMW generation and legislation?	130 (100.0)	0 (0.0)
Which statement describes BMW?	129 (99.2)	1 (0.8)
Waste should not be stored beyond the specified time	103 (79.2)	27 (20.8)
Proportion of infectious waste	105 (80.8)	25 (19.2)
Consequences of Needle Stick Injury	128 (98.5)	2 (1.5)
Colour coding for waste segregation	126 (96.9)	4 (3.1)
Autoclaving of BMW	120 (92.3)	10 (7.7)

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Table 3: Practices in Biomedical Waste Management

Question	Yes (n, %)	No (n, %)
Wear PPE while handling BMW	129 (99.2)	1 (0.8)
Use puncture-proof containers for sharps	107 (82.3)	23 (17.7)
Follow colour coding for waste segregation	128 (98.5)	2 (1.5)
System for reporting injuries/accidents	124 (95.4)	6 (4.6)
Immunization against Hepatitis B	120 (92.3)	10 (7.7)
Preparation of 1% hypochlorite solution	114 (87.7)	16 (12.3)
Adherence to PEP after needle stick injury	119 (91.5)	11 (8.5)

Discussion

This study evaluated the knowledge and practices of staff nurses regarding biomedical waste (BMW) management in a tertiary care hospital in Lahore, Pakistan. The findings revealed significant strengths in general awareness of BMW management but highlighted gaps in specific knowledge and inconsistent adherence to certain practices. These results align with and expand upon findings from previous studies conducted in similar settings.

The study demonstrated that 100% of participants were aware of the existence of BMW generation and legislation. This high level of awareness is consistent with the findings of Ahmed et al., who reported that healthcare workers in tertiary care hospitals in Pakistan are generally aware of the basic principles of BMW management due to exposure to training sessions and institutional guidelines (9). However, gaps in specific knowledge, such as the proportion of infectious waste and proper disposal methods, echo the findings of Ali and Kuroiwa, who noted similar deficiencies among healthcare staff in public hospitals in Lahore (10).

Regarding colour-coded waste segregation, 96.9% of nurses reported adherence to this practice, a figure comparable to Mahmood et al., who observed high compliance among healthcare workers in public hospitals in Punjab (11). Despite this strength, knowledge about specific practices, such as the preparation of disinfectant solutions (87.7%), showed room for improvement. Similar challenges were highlighted by Asad et al., who emphasized the need for regular and comprehensive training sessions to address these gaps (12).

In terms of practices, the use of personal protective equipment (PPE) was reported by 99.2% of participants, and 98.5% adhered to colour coding for waste segregation. These findings are consistent with WHO guidelines, which emphasize the importance of PPE and proper segregation for minimizing risks associated with BMW management (13). However, the study found that only 82.3% used puncture-proof containers for sharps disposal, indicating a gap in adherence to safety protocols. Zaidi et al. also reported variability in the use of safety measures in healthcare facilities in Pakistan, attributing it to inadequate monitoring and resource constraints (14).

The study also revealed high compliance with immunization against Hepatitis B (92.3%) and adherence to post-exposure prophylaxis (PEP) following needle stick injuries (91.5%). These figures align with findings from Ahmed et al., who noted similar adherence rates among healthcare workers in tertiary hospitals (9). However, the relatively lower compliance in other areas, such as waste storage time limits (79.2%), reflects the need for stricter policy enforcement and regular audits to ensure consistent practices (15).

Gender and educational differences were not explicitly explored in this study but have been highlighted in prior research as potential influencers of BMW management practices. For instance, Zaidi et al. found that healthcare workers with higher education levels demonstrated better compliance with BMW management protocols, suggesting the need for tailored training programs (14).

In conclusion, while the study highlighted commendable strengths in awareness and certain practices, it also identified critical gaps that need to be addressed through targeted interventions. Regular training, provision of adequate resources, and strict enforcement of standardized protocols are essential to ensure safe and effective BMW management in healthcare settings in Pakistan. Future studies should explore the impact of these interventions on compliance and patient safety outcomes.

Conclusion

This study highlights the significant strengths and gaps in biomedical waste (BMW) management among staff nurses in a tertiary care hospital in Lahore, Pakistan. While general awareness and adherence to key practices such as personal protective equipment (PPE) usage and waste segregation were commendable, critical gaps in knowledge and practices regarding waste storage, sharp disposal, and preparation of disinfectant solutions remain. These findings emphasize the need for targeted training, resource provision, and strict enforcement of standardized BMW management protocols to enhance safety and compliance. Addressing these gaps is vital for minimizing risks to healthcare workers, patients, and the environment.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-SNU-02333/23)

Consent for publication

Approved

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Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

MEERAB ILYAS (BSN (Student)
Study Design, Review of Literature, data collection
HUMAIRA SADDIQUE
Coordination of collaborative efforts.
SYEDA SIDRA TASNEEM
Coordination of collaborative efforts.

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