ORIGINAL RESEARCH

Assessment of knowledge, attitude and practice of biomedical waste management among nursing staff in a tertiary care teaching hospital

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Abstract

Objective: The management of biomedical waste (BMW) is a critical aspect of healthcare operations and it begins from the initial stage of waste generation, segregation at the source, storage at the site, disinfection, and transfer to the terminal disposal site/treatment site. Healthcare professionals, especially nursing staff, play a crucial role in biomedical waste management, given their direct involvement in patient care and waste handling activities. By understanding the current level of knowledge, attitudes, and practices (KAP) among nursing staff can help us identify gaps and curate plans for the future.

Methods: This is a cross-sectional study conducted among all the nursing staff working in a tertiary care teaching hospital. Data was collected through a structured questionnaire.

Results: Response rate was 93.5%. Majority of the nursing staff are knowledgeable about BMW management, however 16.4 % members lack the knowledge about BMW and its inclusions. Almost all the nursing staff held a positive attitude towards BMW management, but 8.86% of the nursing staff perceived reporting of needle stick injury as extra workload. While most nursing staff adhere to safe practices, 10.6% reported not knowing post-exposure prophylaxis protocol after needle stick injuries.

Conclusions: Overall analysis of the KAP study revealed that 91% of participants exhibited adequate knowledge, 93% had positive attitude, and 96% demonstrated safe practices. The overall study findings were satisfactory and it identified the areas needing improvement to provide a better quality of care, creating a safe and healthy environment to the hospital staff and general public.

Key words: Biomedical waste, infection control, public health, nursing staff, questionnaire, hospital

Introduction

Biomedical waste (BMW) (management & handling) rules, 1998 under environment protection act, 1986 (1) includes 10 categories namely-human anatomical waste, animal waste, microbiology and biotechnology waste, waste sharps, discarded medicines and cytotoxic drugs, solid waste-contaminated, solid waste-other wastes such as catheters, liquid waste, incineration ash, and chemical waste (2). To implement these rules more effectively and to improve the collection, segregation, processing, treatment and disposal of these BMW in an environmentally sound management thereby, reducing the BMW generation and its impact on the environment, the central government reviewed the existing rules; these rules may be called the BMW management rules, 2016 (3). According to these rules, BMW includes waste generated during diagnosis, treatment or immunization of human beings or animals or research activities or in production or testing of biologicals (3).

This may consist wholly or partly of human or animal tissue, blood or other body fluids, excretions, drugs or pharmaceutical products, swabs or dressings, syringes, and needles or other sharp instruments (4).

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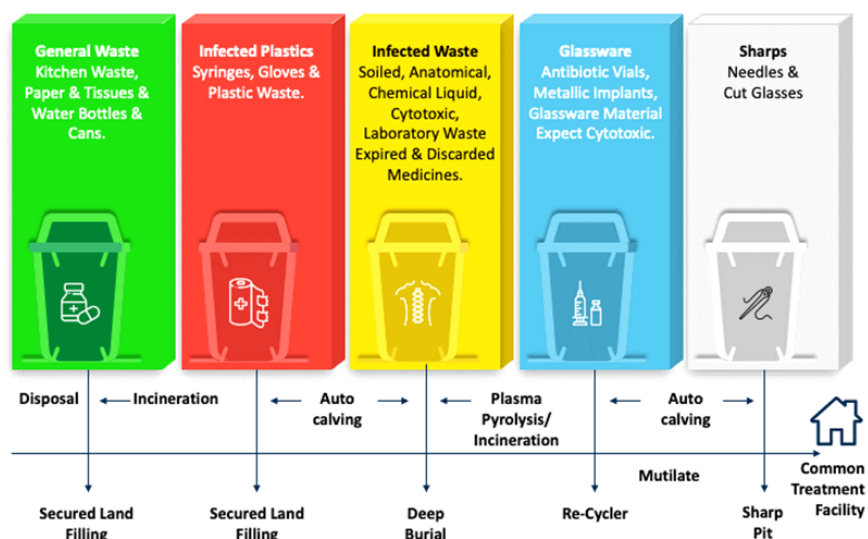
Of the total waste generated, 85% is general waste which is non-infectious and 15% is infectious and hazardous waste. This infectious and hazardous waste can be harmful for health workers, general public and environment (5), which includes needle stick injuries due to improper handling.

About 2 million workers worldwide sustain needle stick injuries annually. The human immunodeficiency virus (HIV), hepatitis B, hepatitis C, and other infections might spread through needle stick injury (6). The management of BMW is a critical aspect of healthcare operations and it begins from the initial stage of waste generation, segregation at the source, storage at the site, disinfection, and transfer to the terminal disposal site/treatment site.

Despite the existence of regulatory frameworks and institutional guidelines, challenges persist in effectively managing BMW within healthcare settings. The problem is fueled further by the lack of awareness about health hazards from BMW, financial and manpower constraints (7). Knowledge, attitude and practice (KAP) among health care workers are the three determinants used to assess the effective functioning of BMW management system in the institution (8). Healthcare professionals, especially nursing staff, play a crucial role in BMW management, given their direct involvement in patient care and waste handling activities. A significant volume of emergency situations involving direct contact of healthcare workers with blood and other biological fluids occur specifically when handling medical waste. Enhancing the knowledge regarding safe handling of medical waste and preventing such emergency situations is an urgent and important task for healthcare organizations. By understanding the current level of knowledge, attitudes, and practices among nursing staff, healthcare facilities can develop tailored training programs, reinforce compliance with waste management protocols and enhance overall patient and staff safety.

The aims of the study were:

1. To assess the knowledge, attitude and practices (KAP) on BMW among nursing staff of various departments in a tertiary care teaching hospital.

2. To identify areas of gaps in their Knowledge, attitude and practices.

Methods

Study design and population

Study design: A descriptive cross-sectional study.

Study participants and setting

The study was conducted among nursing staff in Government General Hospital, Kakinada, Andhra Pradesh, over a period of 3 months from January 2024 to March 2024.

Inclusion criteria: All nursing staff (regular, contract & outsourcing) working in the tertiary care teaching hospital was included in the study. Exclusion criteria: Nursing staff who were absent during the knowledge and practice assessment due to various reasons like long leave, maternity leave, child

care leave, staff on deputation etc. were excluded from the study.

Ethical considerations: Institutional ethical committee approval was obtained from Rangaraya medical college , Andhra Pradesh. The participants were also informed that participation was voluntary and anonymity was ensured.

The questionnaire

The questionnaire was comprised of 2 sections. First section consisted 6 questions about the demographic details (age, sex, experience etc.) of the participants and the second section consisted 5 questions each testing KAP of biomedical waste segregation. The multiple-choice questions were of "yes" or "no" type and "correct" or "wrong" type. The questionnaire was designed to test the KAP of nursing staff about BMW management as per Biomedical Waste Management Rules, 2016, formulated under the Environment (Protection) Act, 1986, given by Ministry of Environment, Forests and Climate Change (MoEF&CC) 2016, that specifies the categories of BMW and the procedures for their safe management to protect public health and the environment.

Data collection

The questionnaire was printed and administered to 593 nursing staff working in outpatient department, intensive care units, wards, operative room etc. of the tertiary care teaching hospital in all 3 shifts over a span of 2 weeks, during which the participants were briefed about the purpose and nature of the study and were requested to fill out the questionnaire completely and truthfully in order to assess their KAP regarding BMW. The participants were also informed that participation was voluntary and anonymity was ensured.

Statistical analysis

The collected data underwent analysis in a spreadsheet, employing descriptive statistics such as mean, SD and percentages. Results were presented via tables and graphs, enhancing clarity and facilitating insights into nursing staff's knowledge, attitudes, and adherence to BMW. Statistical analysis was conducted using SPSS version 26.0

Results

The questionnaire was given to 593 nursing staff out of which 553 responded. Response rate = 93.5%.

Table 1 indicates that out of 553 nursing staff members, 549 were female, representing 99.3% of the total, while only 4 were male, accounting for 0.7%. The largest age group was 26 to 35 years, comprising 184 i.e. 33.3% of the total nursing staff, followed by 36 to 45 years age group at 172 which is 31.1%. In terms of work experience, 173 i.e. 31.3% nursing staff had 5 to 10 years of experience, and 149 i.e. 26.9% nursing staff had 10 to 15 years. The mean age was 39.8 years with SD = 11.11 and mean experience was 12.26 with SD = 5.91.

Table 1. Demographic details of the participants			
Variables	**Categories**	**Number (n=553)**	**%**
Gender	Male	4	0.7
	Female	549	9.93
Age group, years	<25	37	6.7
	26-35	184	33.3
	36-45	172	31.1
	46-55	102	18.4
	> 56	58	10.5
Experience, years	< 5	52	9.4
	5 to 10	173	31.3
	10 -to 15	149	26.9
	15 to 20	108	19.5
	>20	71	12.8

Knowledge of nursing staff regarding BMW management

Analysis of knowledge of nursing staff about BMW (Fig.1) revealed that the majority of nursing staff are knowledgeable about BMW. However, 46.21% of the overall nursing staff i.e. 256, provided incorrect answers to at least one of the five questions in the knowledge section. Notably, 16.4% (91 nursing staff) incorrectly believed that BMW includes only materials contaminated with blood and bodily fluids.

Additionally, 11.75% (65 nursing staff) mistakenly believed that the blue waste category is used for the disposal of expired medicines, whereas it is actually designated for broken and contaminated glass, including vials and ampoules (except those contaminated with cytotoxic wastes), and metallic body implants.
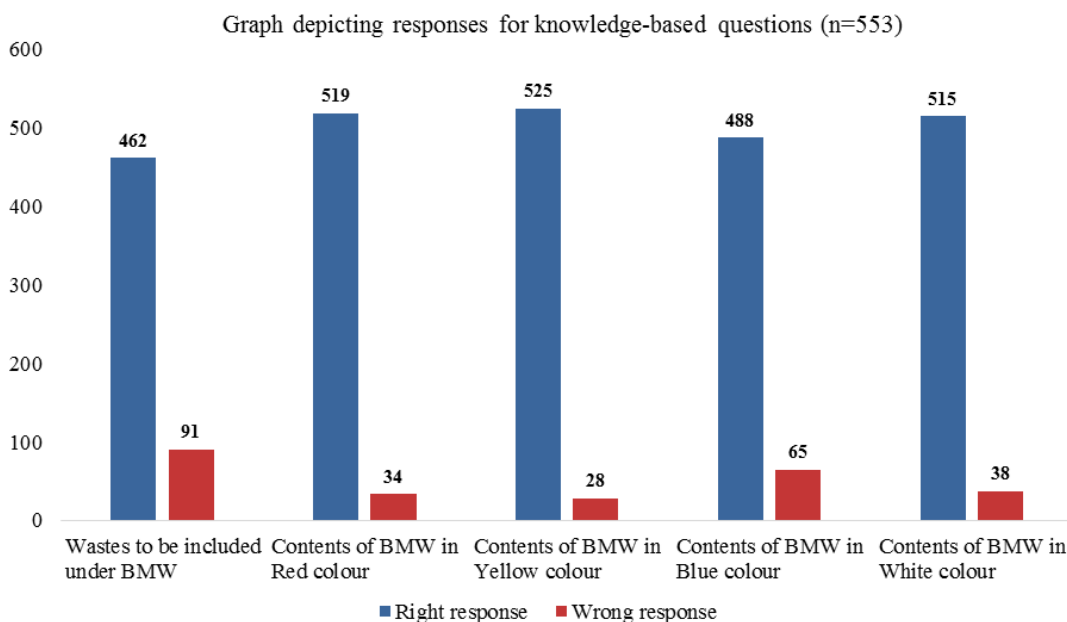
Graph depicting responses for knowledge-based questions (n=553)

Figure 1. Responses of nursing staff to knowledge-based questions

Attitude of nursing staff towards BMW management

Analysis of attitudes of nursing staff towards BMW (Fig.2) revealed that almost all the nursing staff held a positive attitude. However, 8.86% i.e. 49 nursing staff perceived reporting needle stick injuries as an extra workload and 9.2% (51 nursing staff) lacked awareness of the public health risks from improper waste handling, and around 5.4% (30 nursing staff) felt they didn't need to separate BMW at the point of origin.
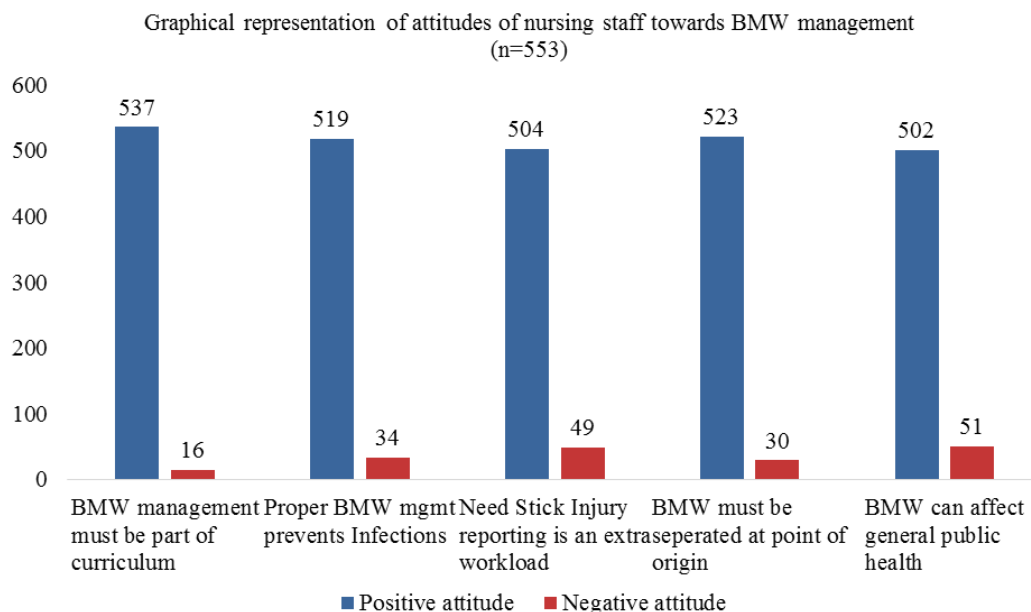
Graphical representation of attitudes of nursing staff towards BMW management (n=553)

Figure 2. Responses of nursing staff to attitude-based questions on BMW management

Practice of BMW management by nursing staff

The interpretation from Figure 3 about BMW practices of nursing staff indicates that although most adhere to safe practices, a significant number, specifically, 10.6% (59 nursing staff) were unaware of post-exposure prophylaxis protocols following needle stick injuries, and approximately 3.07% (17 nursing staff) were not fully immunized against Hepatitis B. This highlights the urgent need for hospital administration to prioritize needle stick injury protocols, ensure proper post-exposure prophylaxis training, and enforce complete vaccination among nursing staff.
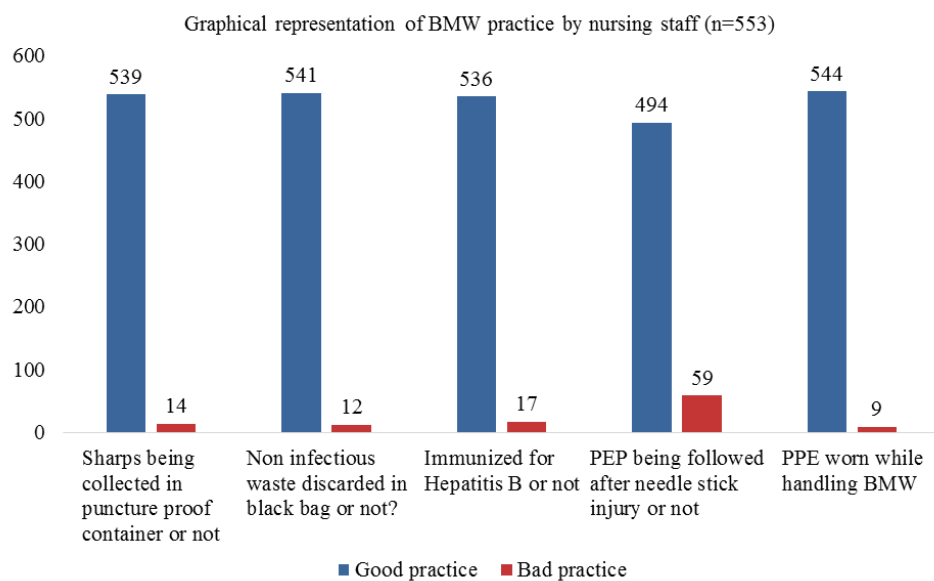
Figure 3. Responses of nursing staff to practice-based questions

Discussion

The study introduces novel insights into the assessment of KAP of biomedical waste management among nursing staff in a tertiary care teaching hospital. Complementing few previous studies, our research offers a comprehensive demographic analysis, revealing how variables such as age and experience influence KAP in BMW management. This detailed breakdown allows for a more nuanced understanding of the factors impacting BMW management practices. The study identified specific misconceptions, such as the incorrect belief held by 16.4% of participants that BMW includes only materials contaminated with blood and bodily fluids, and the misidentification of the blue waste category by 11.75% of respondents. These findings highlight the need for targeted educational interventions to address these gaps.

Additionally, the attitudinal barrier where 8.86% of participants viewed needle stick injury reporting as an extra workload emphasizes the necessity for attitudinal shifts through training. But 94.6% of participants rightly felt that BMW must be segregated at the point of origin which is relatively better than findings from study by Odonkor et al. (9) on only 47.5% of the respondents to practice waste segregation at the sources of waste generation. Our study also revealed that the participants had positive attitude towards BMW management which aligns with the study by Olaifa et al., (10) that reported over half of the healthcare workers interviewed to have a good attitude towards the appropriate disposal of healthcare waste.

Despite the revelation that 10.6% of nursing staff were unaware of post-exposure prophylaxis protocols and that 3.07% were not fully immunized against Hepatitis B which underscores the need for mandatory immunization and comprehensive training programs, the BMW practices by the nursing staff was deemed satisfactory complementing

the findings by Assemu et al., (11) indicating 65% of the total respondents to have good practice of healthcare waste management. Our study also found that significant proportion of nursing staff who had insufficient knowledge about BMW management and protocols were newly appointed nursing staff, which complements the study done by Ajmera et al. (12), which showed newly appointed nurses used color coded bins inappropriately. Another major finding from the study is that the experienced nursing staff had better BMW practices which aligns with the study by Nagaraju et al. (13), where elderly and experienced healthcare workers had better awareness regarding BMW management compared to the younger and less experienced ones and also complements the findings of the study by Akkajit et al. (4) that showed the duration of experience to be a significant factor influencing medical waste management practice.

These insights suggest that continuous education, regular workshops on post-exposure protocols, and improved compliance measures are essential to enhance BMW management practices, ultimately ensuring a safer and more efficient healthcare environment, or not-for-profit sectors.

While a majority demonstrates commendable knowledge and positive attitudes towards BMW management, our results highlight critical areas requiring attention to improve both hospital safety and public health. Nearly half of the nursing staff i.e. 46.21%, provided at least 1 incorrect answer on key aspects of BMW. This lack of accurate understanding poses risks to both staff and patients. Misconceptions about waste categories and handling protocols can lead to improper disposal practices, potentially exposing healthcare workers and the community to infectious hazards. While most nursing staff exhibited positive attitudes, significant percentages i.e. 8.86% (49 nursing staff) perceived reporting needle stick injuries as burdensome and 9.2% lacked awareness of

the health risks associated with improper waste handling, reveal that these attitudes could hinder timely reporting and appropriate management of incidents, increasing the risk of infections among healthcare workers and compromising patient care quality. Around 5.4% perceived separating BMW at the source as unnecessary. A notable portion of nursing staff i.e. 10.6%, were unaware of post-exposure prophylaxis protocols following needle stick injuries and a small but significant proportion 3.07%, were unvaccinated against Hepatitis B. These gaps in practice directly impact staff safety and could contribute to the transmission of blood-borne diseases within the healthcare setting. Continuous improvement in the knowledge and skills of medical workers regarding the safe handling of medical waste is one of the primary responsibilities of the quality committee in any healthcare organization. Identifying the issues related to the safe handling of medical waste and developing preventive measures holds significant practical importance.

The study depicts significant association between demographic variables (age, experience) and KAP scores.

The level of knowledge and adherence to safe practices in BMW among nursing staff is influenced by age, experience, and ongoing training. Staff aged 26-45 years with 5-15 years of experience demonstrated the highest compliance.

Younger staff (<25 years) typically had lower levels of knowledge and adherence, while older staff (> 56 years) may have outdated, practices highlighting the importance of continuous training. Targeted training programs can bridge gaps in various age and experience groups. Young, less experienced staff need structured induction and mentorship, while middle-aged staff with moderate experience are ideal for leading training. Older, experienced staff require regular refresher courses to align with current practices. By addressing these factors, healthcare organizations can improve BMW, ensuring a safer environment for workers and patients.

Study limitations

The limitations of the study are:

1. Self-reported data: subject to possible respondent interpretation and recall bias.

2. Cross-sectional design: limits establishing causality and tracking changes in knowledge, attitude and practice of BMW management over time.

3. Limited scope of questions: focused primarily on specific aspects of BMW management.

Conclusions

Overall analysis of the KAP study revealed that 91% of participants exhibited adequate knowledge, 93% had positive attitude, and 96% demonstrated safe practices. The overall study findings were satisfactory and it identified the areas needing improvement to provide a better quality of care, creating a safe and healthy environment to the hospital staff and general public.

Recommendations:

1. Continuous Education: Provide regular training on BMW management protocols. a. Induction training -for new joiners b. On job training: every sixth monthly/ yearly for existing staff.

2. Supervision: Implement monitoring systems to ensure compliance with the help of infection control nursing staff.

3. Standard Operating Procedures: Develop clear standard operating procedures (SOPs) for waste handling and needle stick injuries.

4. Training and creating awareness regarding health hazards due to improper management of BMW

5. Regular workshops on post exposure prophylaxis following a needle stick injury.

6. Ensure that all staff working in the hospital are fully immunized against Hepatitis B.

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