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ORIGINAL RESEARCH

A cross-sectional study of Knowledge, Attitude and Practices regarding Biomedical waste management among the healthcare workers at a tertiary care teaching hospital in Northern India.

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ABSTRACT

Background: Effective management of biomedical waste (BMW) is essential for healthcare workers (HCWs) and the environment. Proper knowledge, attitude, and practices (KAP) are crucial for the safe handling and disposal of waste. This study assesses the KAP of healthcare workers in a tertiary care teaching hospital in Udhampur, Northern India. **Objective:** To assess the knowledge, attitude, and practices regarding BMW management among doctors, nurses, laboratory technicians, and sanitary staff. **Materials and Methods:** A cross-sectional study was conducted using a structured self-administered questionnaire among 150 HCWs, including doctors, nurses, technicians, and sanitation workers.

Results:

- **Knowledge:** 70% of doctors, 75% of nurses, and 50% of technicians had a reasonable understanding of BMW management rules. Only 30% of sanitation workers were aware of the regulations.
- **Attitude:** 100% of all groups believed that teamwork was essential for BMW management, and 100% agreed that proper disposal prevents infection transmission. However, 87.5% of nurses and 50% of technicians felt that BMW management increased their workload.
- **Practice:** Segregation of BMW was inconsistent across groups, with only 50% of doctors, 80% of nurses, and 70% of technicians consistently segregating waste. Alarmingly, only 25% of doctors and 15% of sanitation workers used personal protective equipment (PPE) when handling BMW.

Conclusion: There is a need for enhanced training, especially for sanitation staff, to improve both the knowledge and practices related to BMW management. Continuous training and proper monitoring are critical for improving compliance with BMW management protocols.

Keywords: Biomedical Waste Management, Knowledge, Attitude, Practices, Healthcare Workers.

INTRODUCTION

The term “biomedical waste “has been defined as “any waste that is generated during diagnosis, treatment or immunization of human beings or animals, or in the research activities pertaining to or in the production or testing of biological and includes categories mentioned in schedule I of the Government of India’s Biomedical Waste (Management and Handling) Rules 1998”. (1) The management of biomedical waste (BMWM) is a crucial and critical matter that affects hospitals, the environment, law enforcement, the media, and the general public. The issue is getting worse as the medical industry expands. However, there has been relatively little research done on this important topic, and future planning and policy decisions will greatly benefit from knowing more about it. (2) Healthcare services invariably produce waste, which may be harmful to health in and of itself, in the process of reducing health issues, removing potential risks, and

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treating sick patients. Compared to other waste types, the waste generated during healthcare operations has a greater risk of infection and harm. Inadequate and inappropriate handling knowledge of medical waste can have detrimental effects on one's health as well as the environment. It is estimated that annually about 0.33 million tons of hospital waste is generated in India and, the waste generation rate ranges from 0.5 to 2.0 kg per bed per day. (3) It is estimated that 10-25% of the healthcare waste generated is hazardous and presents physical, chemical and/or microbiological risk to the general population and healthcare workers associated with handling, treatment and disposal of waste. (4) Additionally, a number of studies have shown that healthcare professionals are at risk for health problems when hospital waste is handled and disposed of improperly. (5) Following the Biomedical Waste Management and Handling Rules' (2018) implementation, all relevant health personnel are expected to possess the necessary training, experience, and ability to advise others on proper waste collection, management, and handling techniques. (6) Health care waste is an ever-changing mix that is extremely challenging to manage. One of the biggest challenges related to current biomedical waste management is the fact that many hospitals dispose of their waste in an inappropriate, disorganized and uncoordinated way which can lead to the spread of serious diseases such as hepatitis, HIV etc. This study was conducted with the aim to assess knowledge, attitude and practices among the healthcare professionals in a tertiary care teaching hospital at Udhampur in the UT J&K.

Aims and objectives of the study were to know the existing knowledge regarding biomedical waste management (BMW) among healthcare professionals to assess their knowledge, attitude and practices related to biomedical waste management (BMW).

MATERIALS & METHOD

It was a hospital based cross-sectional study carried out among the doctors, nurses, technicians and sanitation workers. Structured, pre-designed, pretested, questionnaire was administered to 245 HCWs of hospital. Questionnaire was prepared with the help of through literature review. A pilot study was carried out on 20 HCWs to check validity and reliability of questionnaire. Questionnaires were translated into local language and were administered to all HCWs of hospital.

Questionnaires were divided in three parts as below:

1. Part 1 consisted of 5 questions on "Assessment of knowledge of knowledge of biomedical waste management." (Annexure-1)
2. Part 2 included 5 questions on Assessment on attitude towards biomedical waste management. (Annexure-2)
3. Part 3 had 10 questions on Assessment on practices related to biomedical waste management. (Annexure-3)

Duration: The present study was conducted for 3 months.

Sample size calculation: Based on the assumption that healthcare workers possess 50% knowledge with a 95% confidence interval and 5% error, a sample size of 150 was obtained.

Sampling method: The sample size was calculated using Cochran formula. The questionnaire was given to 245 HCWs, out of which 145 were doctors, 65 nurses, 15 technicians and 20 sanitation workers. Using the Cochran formula for sample size calculation, a size of 150 was calculated out of which 80 were doctors, 40 nurses, 10 technicians and 20 sanitation workers and sample selection from each stratum was done by a simple random technique.

Inclusion criteria

- Subject willing to taking part in the current study.
- Participants who were present at the facility when the current study was carried out.

Exclusion criteria

- Participants unwilling to take part in the current investigation.
- Participants who were not present or on leave at the time the current study was carried out.
- Subjects who did not filled out the questionnaire in its entirety.
- Participants who participated in pilot study

Data collection: A pre-written, structured, self-administered questionnaire was used to collect data. The questionnaire was designed to evaluate knowledge, attitude, and practice on various topics related to BMW, including its hazards, regulations, management, color coding for segregation, and disposal methods. The questionnaire was structured as follows:

1. **Part I,** included five questions of BMWM knowledge (aware BMWM Rules, know segregation principle, listen color coding system of bags and ascertain in which bag is for which waste?
2. **Part II,** contain five statements of attitude (BMWM Rules should be followed strictly, Color coding system is a simple mode of segregation of hospital waste, BMWM is helpful in reducing spread of infections and BMWM system is beneficial to HCWs).
3. **Part III,** comprises ten practices of BMWM such as (Do you wear gloves while handling bio-medical waste? Do you put non-infectious waste in black container; do you sort out bio-medical waste at source? And do you dispose sharp waste in blue bag?)

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Procedure for data collection: Once written consent for the study was obtained, the questionnaire was administered in person and the healthcare professionals were provided with an explanation regarding the purpose of the study and instructions on how to complete the questionnaire. It was stressed that the confidentiality of their responses would be rigorously upheld.

Data analysis: The data was compiled and analyzed with the assistance of SPSS version 23.0 software. Results were interpreted using proportions and percentages. Responses were classified as either correct or incorrect. Each correct response was assigned a score of one, and the total score was calculated for each section. Grading was based on the scores obtained, with categories including good (>80%), average (60-80%), and poor (≤60%).

Consent for the study: Consent was taken from the participants.

RESULTS

This study assessed the knowledge, attitudes, and practices (KAP) of healthcare workers regarding biomedical waste management (BMWM) at a tertiary care teaching hospital in Udhampur. A total of 150 healthcare workers participated, consisting of doctors (80), nurses (40), technicians (10), and sanitation workers (20). The socio demographic profile of the participants and their responses to the knowledge, attitude, and practice questions are presented below.

Socio demographic Profile of Participants

Table 1 provides the distribution of study participants by gender, work experience, and training in biomedical waste management. The majority of participants were female (56.6%), with a smaller proportion of male participants (43.3%). In terms of work experience, the highest number of participants had 1–5 years of experience (53.3%), followed by 6–10 years (26.6%), and more than 10 years (13.3%). Only 33.3% of the healthcare workers had received formal training in biomedical waste management.

Table 1: Socio demographic profile

Variables	N (%)
Male	65(43.3%)
Female	85(56.6%)
Work experience in year	
less than 1	10(6.6%)
01 to 05 year	80(53.3%)
06 to 10year	40(26.6%)
more than 10year	20(13.3%)
Occupation	
Doctor	80
Nurses	40
Technicians	10
Sanitation worker	20
Training received on BMW management	
yes	50(33.3%)
No	100(66.6%)

Knowledge of Biomedical Waste Management

The level of knowledge about biomedical waste management was assessed across different categories: awareness of BMWM rules, segregation by color coding, storage times, handling of infectious waste, and recognition of biohazard symbols. Doctors and nurses showed a higher level of awareness compared to technicians and sanitation workers.

Table2: Knowledge of Healthcare workers on BMW management

Sr No.	Knowledge on BMW management	Doctors (N= 80) N%	Nurses (N=40) N%	Technicians (N=10) N%	Sanitation worker (N= 20) N%
1	Awareness of BMW management rules	56(70%)	30(75%)	5(50%)	6(30%)
2	Segregation of BMW as per color coding	80(100%)	40(100%)	10(100%)	17(85%)
3	Time of storage of BMW in hospital?	25(31.25%)	20(50%)	1(10%)	0
4	% of Infectious waste in total BMW?	10(12.5%)	10(25%)	1(10%)	0
5	Symbol of Bio Hazard?	70(87.5%)	31(38.75%)	69(6%)	0

Interpretation

- The knowledge of BMWM rules was better among doctors and nurses, with 70% of doctors and 75% of nurses aware of the BMW management rules. However, only 30% of sanitation workers had this knowledge.

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- Knowledge regarding the segregation of BMW was uniformly high across all healthcare workers, with 100% of doctors, nurses, and technicians, and 85% of sanitation workers aware of the color-coding system.
- Awareness about the time of storage of BMW was found to be inadequate, with only 31.25% of doctors and 50% of nurses aware of the recommended storage time. Technicians and sanitation workers showed even lower awareness.

Attitude Towards Biomedical Waste Management

The attitude of healthcare workers toward BMWM was generally positive. All participants agreed on the importance of teamwork for effective BMW management and recognized the need for proper disposal to prevent infection transmission. However, a significant proportion of nurses (87.5%) and technicians (50%) felt that BMW management increased their workload.

Table: 3 Attitude of heath care workers on BMW management.

Sr No.	Attitude on BM management	Doctors (N= 80) N%	Nurse s (N= 40) N%	Technicians (N= 10) N%	Sanitation worker (N= 20) N%
1	Proper BMW Management is an issue	36(45%)	8(20%)	2(20%)	11(55%)
2	BMW management need team work	80(100%)	40(100%)	10(100%)	20(100%)
3	BMW management increase work burden	14(17.5%)	35(87.5%)	5(50%)	8(40%)
4	Using a color code for waste disposal is a must?	80(100%)	40(100%)	10(100%)	20(100%)
5	Proper BMW disposal can prevent infection transmission	80(100%)	40(100%)	10(100%)	20(100%)

Interpretation

- The majority of healthcare workers agreed that teamwork is crucial for BMW management (100% of all groups).
- A significant proportion of nurses (87.5%) and technicians (50%) felt that BMW management added to their work burden, which could be a barrier to optimal implementation.
- All participants recognized the importance of color coding for waste disposal and understood that proper BMW disposal helps prevent infection transmission.

Practices Regarding Biomedical Waste Management

When it comes to actual practices, there was variability in adherence to recommended procedures. The practice of segregating BMW at the point of generation was suboptimal, with only 50% of doctors and 80% of nurses and technicians consistently practicing proper segregation. Notably, sanitation workers had the lowest compliance, with only 80% practicing segregation. Additionally, injury reporting and the use of personal protective equipment (PPE) were less than ideal across all groups.

Table 4: Practices of healthcare workers on BMW management.

Sr No.	Practice on BMW management	Doctors (N= 80) N%	Nurses (N= 40) N%	Technicians (N= 10) N%	Sanitation worker (N=20) N%
1	Practicing segregation of BMW at work site?	40(50%)	32(80%)	7(70%)	16(80%)
2	Reporting of injuries due to improperly disposed sharps?	12(15%)	20(50%)	03(30%)	02(10%)
3	Are you practicing handhygiene?	67((83.5%)	35(87.5%)	08(80%)	17(85%)
4	Disposal of plastics/ catheters / IV sets/ nylon sutures tubing's/mask/ gloves have to be into which colored bag?	34(42.5%)	21(52.5%)	04(40%)	11(55%)
5	Disposal of infectious sharps and needle has to be into which colored bag?	23(28.75%)	35(87.5%)	7(70%)	15(75%)
6	Disposal of human anatomical waste/infected cotton /infected linen has to be into which colored bag?	76(95%)	30(75%)	6(60%)	10(50%)
7	Broken glassware is discarded in which color container?	56(70%)	29(72.5%)	5(50%)	15(75%)
8	Disposal of expired medicines is done in which color bag?	21(26.25%)	11(27.5%)	2(20%)	2(10%)
9	Do you use PPE kit while handling BMW?	20(25%)	11(27.5%)	2(20%)	3(15%)
10	Do you use properly labelled and color coded trolley while transporting BMW?	23(28.75%)	22(55%)	3(30%)	5(25%)

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Interpretation

- Segregation of BMW at the point of waste generation was not consistently practiced, with only 50% of doctors and 80% of nurses and technicians adhering.

DISCUSSION

Biomedical waste (BMW) management is an essential component of healthcare facility operations, ensuring that waste generated from medical practices is properly handled, segregated, and disposed of to mitigate health risks and environmental hazards. The present study aimed to assess the knowledge, attitude, and practices (KAP) of healthcare workers regarding BMW management at GMC Udhampur, a tertiary care hospital. Our findings highlight significant differences in the understanding and implementation of BMW management across different occupational groups, particularly between technically trained staff (doctors and nurses) and non-technical staff (sanitation workers). These results underscore the importance of targeted training and education to bridge knowledge gaps and improve BMW management practices. In this study, the knowledge regarding BMW management was found to be high among doctors, nurses, and laboratory technicians but comparatively lower among sanitation workers. These findings are consistent with previous studies, which have documented similar trends in knowledge disparities across healthcare personnel. Anand et al. (2015) conducted a study in a tertiary care hospital and found that doctors and nursing staff demonstrated superior knowledge regarding BMW management regulations compared to sanitation workers, a pattern echoed in our study. Specifically, 100% of doctors and nurses in our study were aware of the color-coding system for BMW segregation, while only 85% of sanitation workers demonstrated similar knowledge. (5) This result is in line with the findings of Mathur et al. (2012), who reported that sanitation workers showed a lack of awareness regarding color-coding and segregation of waste in their study (7). The attitude of healthcare workers toward BMW management was largely positive across all occupational groups. Consistent with previous studies, most participants recognized the importance of teamwork in effective BMW management. In our study, 100% of doctors, nurses, and technicians, and 100% of sanitation workers acknowledged the need for teamwork to manage BMW efficiently. This finding mirrors that of Anand et al. (2015), who similarly found a strong agreement among healthcare workers on the importance of collaboration for BMW management (5). However, a notable concern emerged regarding the perceived increase in workload due to BMW management. In our study, 87.5% of nurses and 50% of technicians reported that BMW management increased their work burden. This aligns with the results of Malini et al. (2011), who found that a significant proportion of nursing staff viewed BMW management as an additional burden on their responsibilities (6). The perception of increased workload may serve as a barrier to optimal BMW management practices, especially when resources are limited or when healthcare workers are not adequately compensated for the extra effort involved. Our study revealed significant gaps in the practical application of BMW management protocols. While segregation of waste was widely practiced among doctors, nurses, and technicians (80% or more), only 50% of doctors and 80% of nurses and technicians consistently segregated waste at the point of generation. This is a critical issue, as the effectiveness of any BMW management system hinges on proper segregation at the point of origin. The use of personal protective equipment (PPE) while handling BMW was found to be suboptimal across all groups. Only 25% of doctors, 27.5% of nurses, and 20% of technicians reported using PPE regularly, and even fewer sanitation workers (15%) adhered to this practice. These findings are consistent with the study by Mathur et al. (2012), which also highlighted poor compliance with PPE usage among sanitation workers (7). The lack of adequate PPE usage is a significant concern, as it exposes workers to potential health hazards, including needle-stick injuries and infection transmission. Our study's findings regarding the overall KAP of healthcare workers on BMW management align with several previous studies conducted in India and internationally. The study by Anand et al. (2015) found that healthcare professionals in India had a high level of knowledge about BMW management, but this was not always reflected in their practices (5). Similar to our study, their research also identified significant gaps in injury reporting and PPE usage, particularly among sanitation workers. The findings of Lavanya et al. (2014) regarding low accident reporting among housekeeping staff were reflected in our study, where sanitation workers exhibited a marked deficiency in injury reporting and adherence to proper BMW handling procedures (8). This emphasizes the need for targeted training and awareness programs specifically for sanitation workers to improve their knowledge and practices in BMW management.

In contrast, the study by Mathur et al. (2012) highlighted that sanitation workers showed a significant lack of knowledge and practice in waste segregation and PPE usage, which is consistent with our findings (7).

CONCLUSION

This study underscores the critical role of healthcare workers in ensuring effective BMW management. While knowledge and attitudes towards BMW management were generally positive, significant gaps in practice were identified, particularly in the use of PPE, injury reporting, and waste segregation at the point of generation. Addressing these gaps through targeted training, resource allocation, and continuous monitoring will enhance the overall efficacy of BMW

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management systems and reduce the associated health risks. Future research should focus on evaluating the effectiveness of training interventions and exploring innovative strategies for improving BMW management in healthcare settings.

RECOMMENDATIONS

Our findings suggest that while doctors and nurses generally possess adequate knowledge and have positive attitudes toward BMW management, there is a significant knowledge gap among sanitation workers. These gaps in knowledge can be attributed to a lack of formal education and specialized training programs for non-technical staff. To address this, we recommend the following:

1. **Targeted Training Programs:** Regular training and educational workshops on BMW management should be provided to all healthcare workers, particularly sanitation workers. This training should focus on the importance of proper segregation, injury reporting, and the correct use of PPE.
2. **Improved Awareness Campaigns:** Awareness campaigns aimed at reinforcing the importance of proper waste segregation, injury reporting, and PPE usage should be conducted, with special emphasis on non-technical staff.
3. **Enhanced Resources and Support:** Healthcare institutions should ensure that sufficient resources, such as color-coded bins, trolleys, and PPE, are available to all staff members, particularly sanitation workers. Additionally, the allocation of adequate time and support for BMW management tasks will help reduce the perceived burden.
4. **Monitoring and Evaluation:** Regular audits and monitoring of BMW management practices should be implemented to ensure compliance with guidelines. Feedback should be provided to staff, and corrective actions should be taken if necessary.

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REFERENCES

1. Patil AD, Shekdar AV. Health-care waste management in India. Journal of environmental management. 2001 Oct 1;63(2):211-20.
2. Safe management of waste from health care activities. WHO, Geneva. 1999./ Li CS, Jenq FT. Physical and chemical composition of hospital waste. Infect Control Hosp Epidemiol. 1993;14:145- 50.
3. Chowdhary A. Study of knowledge, behaviour and practice of biomedical waste among health personnel. Int J Community Med Public Health 2018;5(8):3330.
4. Das P, Pal R, Basu M. Assessment of future physicians on biomedical waste management in a tertiary care hospital of West Bengal. J Natural Sci Biol Med. 2012;3(1):38.
5. Anand P, Jain R, Dhyani A (2016) Knowledge, attitude and practice of biomedical waste management among health care personnel in a teaching institution in Haryana, India. Int J Res Med Sci 4:4246-4250.
6. Malini A, Eshwar B (2015) Knowledge, attitude and practice of biomedical waste management among health care personnel in a tertiary care hospital in Puducherry. Int J Biomed Res 6(3):172-176
7. Mathur V, Dwivedi S, Hassan MA, Mira RP (2011) Knowledge, attitude, and practices about biomedical waste management among healthcare personnel: a cross- sectional study. Indian J Community Med 36(2):143-145.https://doi.org/10.4103/0970-0218.84135.
8. Lavanya KM, Majhi P (2018) Knowledge, attitude and practices (KAP) about biomedical waste management among hospital staff- a crossectional study in a tertiary care hospital, Andra Pradesh, India. J Commun Health Manag 5(1):32-36.