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Awareness About Biomedical Waste Management among Health Care Personnel in a Tertiary Care Hospital in Srikakulam, South India

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Abstract
The amount of biomedical waste being generated is increasing along with the significant expansion of healthcare facilities in our country. The spread of highly contagious diseases and damage to the environment is the consequence of improper management of biomedical waste. To assess the level of awareness regarding biomedical waste handling and disposal among healthcare personnel in a tertiary care hospital in Srikakulam. To make evidence-based recommendations regarding biomedical waste handling and disposal. After taking written informed consent the doctors, nurses, lab technicians, pharmacists and class 4 employees working in a tertiary care hospital in Srikakulam were included. Data was collected using a pre designed questionnaire. Data analysis was done using Epi info and results were interpreted into frequency and percentages. The study was conducted among 270 participants. All the participants had good knowledge of biomedical waste disposal. The percentages of lab technicians, pharmacists and class 4 employees who reported positive attitude were comparatively lower as compared to doctors and nurses. The practice of biomedical waste disposal was lower among the lab technicians. There must be a continuous training programed for all the health personals with special focus on lab technicians about the biomedical waste management.

INTRODUCTION

Biomedical waste (BM) management is a critical component of environmental safety and public health. Inadequate disposal of BM poses significant threats, necessitating stringent management and awareness among healthcare providers. This study focuses on tertiary care hospital, assessing the awareness and practices of BWM among its healthcare workforce.

The management of BM waste is not only a legal requirement but also a moral obligation to prevent the spread of infections and protect the environment. The Biomedical Waste Management Rules, 2016, by the Government of India, provide a framework for the proper handling, segregation, transportation, and disposal of BM waste[1,2]. Despite these regulations, gaps in awareness and adherence to these practices persist, especially in resource-limited settings.

Biomedical waste, if not properly managed, can spread highly contagious diseases and harm the environment[3]. Of the total garbage generated, 80-85% is regular, non-infected waste, whereas 15% is infectious and hazardous waste. This infectious and hazardous waste may be dangerous to health personnel, the general public and the environment[4,5]. In India, hospitals generate an average of 0.33 million tonnes of garbage each year, with rates ranging from 0.5-2.0 kg per bed/day[6]. BMW's growth rate is predicted to be around 8% annually[7]. Improper BMW handling can spread a variety of diseases, the most dangerous of which are Hepatitis B, Hepatitis C and AIDS. It can also pollute water, air and land[8].

The aim of the study is to assess the level of awareness regarding biomedical waste (BMW) handling and disposal among healthcare personnel in a tertiary care hospital.

Objectives:

- To assess the level of awareness regarding biomedical waste handling and disposal among healthcare personnel in a tertiary care hospital in Srikakulam.
- To make evidence-based recommendations regarding biomedical waste handling and disposal.

MATERIALS AND METHODS

It is a descriptive hospital based cross sectional study which was conducted in a tertiary care hospital among 270 participants in Srikakulam in the month of March and April 2024. The study population included 71 doctors, 66 nurses, 25 lab technicians, 23 pharmacists and 85 class IV employees working in that institution and were selected through convenient sampling technique. A pre-designed validated questionnaire (google forms) was used for data collection.

The study was pretested on a small number of participants comprising 5 from each group (doctors, nurses, laboratory technicians and class IV employees) who were requested to report any question which they could not understand. The data was collected by approaching the participants in person through an interview. The questionnaire consisted of 28 questions comprising questions on socio-demographic characteristics, 9 questions related to knowledge and 5 questions related to attitude and 10 questions related to practice.

Inclusion Criteria:

- Healthcare personnel (doctors, nurses, pharmacists, lab technicians, class 4 workers) working in Government general hospital who will give consent.

Exclusion Criteria:

- Participants with severe illness/psychotic illness.
- Participants who were absent after 3 visits.

Confidentiality of participants was strictly maintained. Data entry was done in Microsoft Excel. Data was analysed using Epi info software and results were interpreted into percentages. Ethical clearance was taken from the Institutional Ethics Committee before the start of the study. Informed consent was taken from all the participants. Permission was sought from the medical superintendent and nursing superintendent.

RESULTS AND DISCUSSIONS

The study involved a total of 270 participants, comprising 71 doctors, 66 nurses, 25 lab technicians, 23 pharmacists, and 85 class IV employees.

(Fig. 1) displays the age distribution, highlighting a predominant age range of 33-54 years within the sample. (Fig. 2) depicts the gender composition, with females representing 64% of the participants. (Fig. 3) shows the designation distribution among the participants.

(Table 1) shows knowledge of health personnel regarding BMW management. (Table 2) shows the attitude of health personnel regarding BMW Management. (Table 3) shows practices of health personnel on BMW Management.

Majority (98.8%) knew the primary source of biomedical waste generation. Eighty four percent (84.07%) had knowledge about the biomedical waste management handling rules, while only a small fraction (8.8%) knew about the regulating body for safe transport of such waste. The biohazard symbol was recognized by nearly all participants (99.2%).

Color-coded segregation of biomedical waste was known to 98.1%, and 97% were aware of the correct color-coded container for disposing of human tissues, organs and body parts. Knowledge about the designated container for urine bags and IV sets was slightly lower at 94.4%. Steps to follow after exposure to infected body fluids or contaminated sharps were known to 97.4% and the same proportion (97%) they knew that hepatitis B could be transmitted through biomedical waste.

Majority (99.6%) agreed that safe disposal of biomedical waste is necessary, although a relatively lower percentage (88.8%) considered it teamwork. Nearly one-third (32.2%) felt that biomedical waste management created an extra burden on their work, while over one-third (35.5%) felt it as a financial burden on hospitals. A large proportion (89.6%) expressed willingness to attend voluntary programs to upgrade their knowledge on the subject.

Concerning practices, 62.2% reported recapping used needles, whereas a higher percentage (91.4%) discarded such needles in a needle destroyer. Alarmingly, 49.2% had sustained injuries from sharps, although most (80.7%) claimed to report such injuries to occupational health or their supervisor. Proper disposal of biomedical waste in specific color-coded containers was practiced by 98.5%, and 95.5% disposed of scalpels and blades in the designated white container. Use of personal protective equipment (PPE) while handling biomedical waste was reported by 97.4% and 98.5% discarded PPE after use. Adherence to hand hygiene before and after procedures was high at 98.8%. However, only 72.5% had received vaccination against hepatitis B.

All the participants in this study (doctors, nurses, lab technicians, pharmacists and class 4 employees) had excellent knowledge about biomedical waste management in which 7 out of 9 were answered correctly regarding the knowledge component. Regarding attitude, the percentage of lab technicians, pharmacists and class 4 employees who had a positive attitude were relatively lower compared to doctors and nurses. The percentage of lab technicians who were following the correct practices were lower (76%) as compared to doctors, nurses, pharmacists and class 4 employees.

The study was conducted to assess the level of awareness regarding BMW handling and disposal among health care personnel in a tertiary care hospital. Knowledge regarding the primary source of BMW which are hospital and healthcare was correctly identified by 98.8%. Among the participants in our study 84.07% of them knew that BMW should not be stored beyond 48 hours. This finding is similar to one which is found in a study conducted by Malini[9]. Only 8% of the participants knew about the authority which regulates the safe transport of BMW. Hundred percent correct identification of biohazard symbol was reported by doctors, nurses and pharmacists and it was also correctly identified by 96% of lab technicians and 97% of class 4 employees.

In a study by Malini *et al.*, they reported 100% right identification of biohazard symbol by both doctors and lab technicians. Only 21% of multipurpose workers could correctly identify the biohazard symbol. In a study by Anand P *et al.*, 50% of the nurses properly identified the biohazard symbol[10]. In our study 100% of the doctors knew about the colour coding segregation of BMW. This is comparable to the findings of study by Anand P *et al*. where 93.5% of doctors knew about the colour coded segregation of biomedical waste. In a study by Madhu Kumar *et al.* 96% of the study population knew about colour coding[11]. Ninety four percent of the class 4 employees in our study knew about the colour coding segregation of BMW. This is contrary to the study conducted by Malini *et al.* where multipurpose workers reported a low knowledge of colour coding.

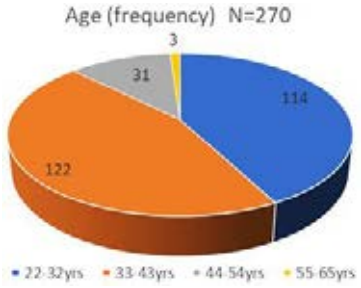

Fig. 1: A pie chart showing age distribution among the study participants (N = 270)

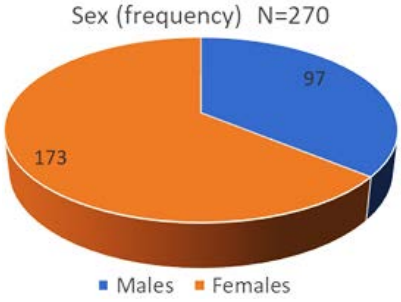

Fig. 2: A pie chart showing sex distribution among study participants (N = 270)

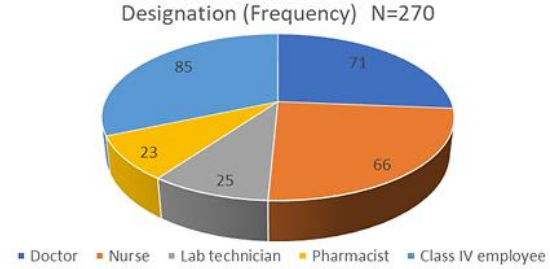

Fig 3: A pie chart showing designation distribution among study participants (N = 270)

Table 1: Knowledge of health personnel regarding BMW management

Knowledge on BMW management	Doctors N = 71 N(%)	Nurses N = 66 N(%)	Lab technicians N = 25N(%)	Pharmacists N = 23 N(%)	Class IV employees N = 85 N(%)
Primary source of biomedical waste	71 (100)	66 (100)	25 (100)	23 (100)	82 (96.4)
BMW storage	66 (92.9)	60 (90.9)	15 (60)	14 (60.8)	72 (84.7)
Safe transport of BMW	8 (11.2)	1 (1.5)	5 (20)	3 (13)	7 (8.2)
Biohazard symbol	71 (100)	66 (100)	24 (96)	23 (100)	84 (98.8)
Color coded segregation	71 (100)	66 (100)	25 (100)	23 (100)	80 (94.1)
Color coded disposal of human tissues, organs	70 (98.5)	63 (95.4)	23 (92)	21 (91.3)	85 (100)
Color coded disposal of urine bags, i.v. sets	69 (97.1)	60 (90.9)	24 (96)	19 (82.6)	83 (97.6)
Universal precautions	68 (95.7)	66 (100)	24 (96)	20 (86.9)	85 (100)
Diseases transmitted by BMW	71 (100)	66 (100)	24 (96)	22 (95.6)	79 (92.9)

Table 2: Attitude of health personnel regarding BMW management

Attitude on BMW management	Doctors N = 71 N(%)	Nurses N = 66 N(%)	Lab technicians N = 25 N(%)	Pharmacists N = 23 N(%)	Class IV employees N = 85 N(%)
Safe disposal of BMW is necessary	71 (100)	66 (100)	25(100)	23 (100)	84 (98.8)
BMW management is a team work	67 (94.3)	61 (92.4)	24 (96)	22 (95.6)	66 (77.6)
BMW creates an extra burden on work	26 (36.6)	13 (19.6)	11 (44)	4 (17.3)	33 (38.8)
BMW is a financial burden on hospitals	24 (33.8)	28 (42.4)	9 (36)	8 (34.7)	27 (31.7)
Upgrade knowledge on BMW	67 (94.3)	64 (96.9)	14 (56)	23 (100)	74 (87)

Table 3: Practice of health personnel regarding BMW management

Practice of BMW management	Doctors N = 71 N(%)	Nurses N = 66 N(%)	Lab technicians N = 25 N(%)	Pharmacists N = 23 N(%)	Class IV employees N = 85 N(%)
Recap used needles	41 (57.7)	52 (78.7)	10 (40)	13 (56.5)	52 (61.1)
Discard used needles in a needle destroyer	70 (98.5)	59 (89.3)	24 (96)	22 (95.6)	72 (84.7)
Ever sustained injury due to sharps	23 (32.3)	35 (53)	14 (56)	12 (52.1)	49 (57.6)
Injury reporting	69 (97.1)	59 (89.3)	20 (0.8)	22 (95.6)	48 (56.4)
Disposal of BMW in specific color-coded containers	70 (98.5)	65 (98.4)	25 (100)	23 (100)	83 (97.6)
Colour coded disposal of scalpels/blades	69 (97.1)	63 (95.4)	24 (96)	20 (86.9)	82 (96.4)
Use of PPE while handling BMW	71 (100)	64 (96.9)	23 (92)	21 (91.3)	84 (98.8)
Discard all PPE after handling Biomedical waste	71 (100)	65 (98.4)	24 (96)	23 (100)	83 (97.6)
Follow proper hand hygiene before and after every procedure	71 (100)	65 (98.4)	23 (92)	23 (100)	85 (100)
Hepatitis B vaccination done	51 (71.8)	42 (63.6)	23 (92)	19 (82.6)	65 (76.4)

The awareness of the correct colour-coded container for disposing of human tissues, organs and body parts among healthcare personnel in our study stands at 97%. When compared to current literature, our findings show a significant improvement in awareness levels. A comprehensive review of BWM in the time of COVID-19 highlighted the importance of segregation at the source and the need for heightened awareness and precautions at all steps of the waste-cycle[12]. The awareness of the designated containers for urine bags and IV sets among healthcare personnel in our study is commendable at 94.4%. This is particularly significant given the stringent regulations and the potential risks associated with improper disposal of such waste. The guidelines given by central pollution control board emphasise the importance of proper segregation and disposal of biomedical waste to prevent the spread of infections, especially in the wake of the COVID-19 pandemic and highlight the need for dedicated containers for different types of waste, including those for urine bags and IV sets[13]. This aligns with the findings of the present study, indicating that the increased focus on biomedical waste management during the pandemic may have contributed to better knowledge and practices among healthcare workers.

Ninety seven percent of participants knew about the steps to follow after exposure to infected body fluids or contaminated sharps, which is a critical component of occupational health and safety. When compared to previous research, a study conducted by Bansodh H S *et al*. highlighted the importance of proper training and protocols for handling such exposures, emphasising that immediate and correct actions are vital for healthcare workers' safety[14]. Another review on biomedical waste management stressed the need for dedicated education regarding the management of sharps and exposure events[15]. The understanding that hepatitis B can be transmitted through biomedical waste, as indicated by 97% of the participants in our study, is a significant finding. This awareness is crucial for healthcare workers who are at risk of exposure to infectious agents through biomedical waste. Comparing this result with meta-analysis conducted by Arafa and Eshak, it was found that medical waste handling was associated with higher odds of hepatitis B virus (HBV) infection compared to non-medical waste handling, with a pooled odds ratio of 2.881. This supports the importance of the high level of awareness observed in our study, as it underscores the occupational hazard posed by HBV in healthcare settings, particularly for those involved in waste management[16].

The participants feel like the high agreement on the necessity of safe BMW disposal (99.6%) in our study surpasses the awareness levels reported by Datta, Mohi and Chander, who emphasise the social and legal responsibilities of BMW management[17]. Participants perceive BMW management as teamwork (88.8%), which is slightly lower than the findings by Bansod and Deshmukh, who highlight the importance

of collective efforts in effective BMW management[18]. Participants view BMW management as an extra workload (32.2%), which aligns with Patil and Pokhrel's observations, suggesting that integrating BMW management into daily routines remains a challenge for healthcare workers[19]. Participants see BMW management as a financial burden (35.5%), consistent with Sharma's analysis, which discusses the economic challenges of BMW management in healthcare facilities across India[20]. Participants express a willingness to upgrade knowledge on BMW management (89.6%), indicating a proactive attitude among healthcare workers, which is crucial as per Mathur, Patan and Shobhawat's review on the need for continuous education in BMW management practices[21].

Sixty two percent of the study participants practiced the recapping of used needles, which contrasts with the recommendations from the study by Datar *et al.*, which emphasises the risks associated with needle recapping[22]. Ninety one percent of the study participants discarded the used needles in a needle destroyer which coincides with the findings of Kim *et al.*, who reported that the introduction of Automatic Needle Destroyers in emergency departments significantly reduced the time for needle disposal[23]. The percentage of the study participants who ever sustained injury due to sharps in the present study is forty nine percent which is consistent with the findings of Yun *et al.*, who highlighted the vulnerability of medical students and early-year resident physicians to sharps injuries[24].

The fact that 80.7% of workers report sharps injuries is higher than the reporting rates observed in the study by Mohamud *et al.*, which found that a significant number of needlestick and sharps injuries went unreported[25]. The adherence to colour-coded disposal systems (98.5% for BMW and 95.5% for scalpels and blades) is exemplary and aligns with the systematic review by Bansod and Deshmukh, which highlights the importance of proper segregation to prevent cross-contamination[18]. The reported use of PPE (97.4%) and its proper disposal (98.5%) are critical for protecting healthcare workers from exposure to hazardous materials and infections. This is consistent with the study by Jalal *et al.*, which assessed the knowledge, practice and attitude about BMW management among healthcare professionals during the COVID-19 crisis[26]. The high compliance with hand hygiene (98.8%) is consistent with the global emphasis on hand hygiene as the most important measure to prevent the spread of infections in healthcare settings, as reported by Tartari[27]. The hepatitis B vaccination rate among healthcare personnels in the present study is 72.5% which suggests the room for improvement. This rate is higher than the findings of Garzillo *et al.*, who reported that 20% of healthcare workers had an anti-HB antibody titre <10 IU/L, indicating a need for booster doses[28].

Limitations:

- The convenient sampling technique which is employed in the study may limit the generalizability of findings.
- Since it is a cross-sectional study casual relationships cannot be drawn.
- Recall bias.

Recommendations:

- Further research with larger and more diverse participant groups across different healthcare settings is recommended.
- Continuous monitoring of healthcare personnel regarding biomedical waste disposal is required.

CONCLUSION

The percentage of lab technicians who were following the correct practices were lower as compared to doctors, nurses, pharmacists and class 4 employees in spite of excellent knowledge in the present study. It is imperative that biomedical waste should be segregated and disposed of in a safe manner to protect the environment as well as human health. There must be a continuous training programed for all the health personnel with special focus on lab technicians about the biomedical waste management and strict implementation of biomedical waste management rules.

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REFERENCES

1. GIMEF., 1998. Bio-medical waste (management and handling) rules. Ministry of Environment and Forests, Government of India, New Delhi, India, http://igims.org/DataFiles/CMS/file/waste%20management/BIO-MEDICAL_WASTE__MANAGEMENT___HANDLING__RULE_-_1998.pdf.
2. MoHFW., 2002. National guidelines on hospital waste management based upon the bio-medical waste (management and handling) rules, 1998. Government of India, Ministry of Health and Family Welfare, New Delhi, India.
3. Sachan, R., M.L. Patel and A. Nischal, 2012. Assessment of the knowledge, attitude and practices regarding biomedical waste management amongst the medical and

paramedical staff in tertiary health care centre. Int. J. Sci. Res. Pub., 2: 1-6.
4. CPCB., 2000. Manual on hospital waste management. Central pollution control board, Delhi, India.
5. Haider, S., S. Kumari, V. Kashyap, S. Sunderam and S.B. Singh, 2015. A study on knowledge and practice regarding biomedical waste management among staff nurses and nursing students of Rajendra Institute of Medical Sciences, Ranchi. Indian J. Comm. Health, 27: 135-138.
6. Patil, A.D. and A.V. Shekdar, 2001. Health-care waste management in India. J. Environ. Manag., 63: 211-220.
7. Mathur, V., S. Dwivedi, M. Hassan and R. Misra, 2011. Knowledge, attitude and practices about biomedical waste management among healthcare personnel: A cross-sectional study. Indian J. Comm. Med., 36: 143-145.
8. Gupta, N., M. Shukla and S. Tyagi, 2016. Knowledge, attitude and practices of biomedical waste management among health care personnel in selected primary health care centres in lucknow. Int. J. Comm. Med. Pub. Health, 3: 309-313.
9. Malini, A. and B. Eshwar, 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: 172-0.
10. Anand, P., R. Jain and A. Dhyani, 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., 10: 4246-4250.
11. Suwarna, M. and G. Ramesh, 2012. Study about awareness and practices about healthcare wastes management among hospital staff in a medical college hospital, Bangalore. Int. J. Basic Med. Sci., 3: 7-11.
12. Capoor, M.R. and A. Parida, 2021. Biomedical waste and solid waste management in the time of COVID-19: A comprehensive review of the national and international scenario and guidelines. J. Lab. Physic., 13: 175-182.
13. CPCB., 2020. Guidelines for handling, treatment and disposal of waste generated during treatment/diagnosis/quarantine of COVID-19 patients. Central Pollution Control Board, India, http://www.uppcb.com/pdf/Guidelines_190320.pdf.
14. Bansod, H.S. and P. Deshmukh, 2023. Biomedical waste management and its importance: A systematic review. Cureus, Vol. 21 .10.7759/cureus.34589.
15. Bagali, S.S., B.S. Gowrishankar and S.S. Bagali, 2021. Review on biomedical waste management. Waste Tech., 9: 1-5.
16. Arafa, A. and E.S. Eshak, 2020. Medical waste handling and hepatitis B virus infection: A meta-analysis. Am. J. Infec. Control, 48: 316-319.
17. Datta, P., G. Mohi and J. Chander, 2018. Biomedical waste management in India: Critical appraisal. J. Lab. Physicians, 10: 6-14.
18. Patil and Pokhrel, 2020. Sustainable biomedical waste management-case study in India. SpringerLink, New York, USA.
19. Sharma, 2023. Geographical and temporal analysis of bio-medical waste management in India. PMC., Vol. 1.
20. Mathur, P., S. Patan and A.S. Shobhawat, 2012. Need of biomedical waste management system in hospitals-an emerging issue-a review. Curr. World Environ., 7: 117-124.
21. Datar, U., M. Kamat, M. Khairnar, U. Wadgave and K. Desai, 2022. Needlestick and sharp's injury in healthcare students: Prevalence, knowledge, attitude and practice. J. Family Med. Primary Care, 11: 6327-6333.
22. Kim, S.M., T. Kim, J.H. Lee, S.Y. Cho and W.C. Cha, 2022. Effect of the automatic needle destroyer on healthcare providers' work in an emergency department: A mixed-methods study. Healthcare Inf. Res., 28: 123-131.
23. Yun, J., K. Umemoto, W. Wang and D. Vyas, 2023. National survey of sharps injuries incidence amongst healthcare workers in the United States. Int. J. Gen. Med., 16: 1193-1204.
24. Mohamud, R.Y.H., N. Mohamed, A. Dogan, F. Hilowle, S. Isse, M. Hassan and I. Hilowle, 2023. Needlestick and sharps injuries among healthcare workers at a tertiary care hospital: A retrospective single-center study. Risk Manage. Healthcare Policy, 2281-2289.
25. Jalal, S.M., F. Akhter, A.I. Abdelhafez and A.M. Alrajeh, 2021. Assessment of knowledge, practice and attitude about biomedical waste management among healthcare professionals during COVID-19 crises in Al-Ahsa. Healthcare, Vol. 9 .10.3390/healthcare9060747.
26. Tartari, E., F. Bellissimo-Rodrigues, D. Pires, C. Fankhauser and N. Lotfinejad et al. 2024. Updates and future directions regarding hand hygiene in the healthcare setting: insights from the 3rd ICPIC alcohol-based handrub (ABHR) task force. Antimicrob. Resist. Infect Contr., Vol. 13 .10.1186/s13756-024-01374-9.
27. Garzillo, E.M., A. Arnese, N. Coppola, A. Corvino and D. Feola et al., 2019. Hbv vaccination status among healthcare workers: A cross-sectional study. J. Infec. Prev., 21: 23-27