International Journal of Community Medicine and Public Health
Aravind A et al. Int J Community Med Public Health. 2023 Oct;10(10):3655-3659
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20233095

Original Research Article

Biomedical waste management: assessment of knowledge, attitude and practice among health care workers

Asokan Aravind[1]*, Sudhiraj T. S.[2], Carol Pinheiro[2], Aqsa M. Haris[1], Ansila Benny[1], Aparna Krishnan[1], Anitta K. R.[1], Anjali Anitha[1], Anjali Susan[1], Anna Sabu[1], Anza Miriam John[1], Asif Nizarudeen[1], Aslah Karimban[1]

[1]Government T.D Medical College, Alappuzha, Kerala, India
[2]Department of Community Medicine, Government T.D Medical College, Alappuzha, Kerala, India

Received: 23 June 2023
Accepted: 22 September 2023

***Correspondence:**
Dr. Aravind A.,
E-mail: aaravind2121@gmail.com

ABSTRACT

Background: The waste produced in healthcare activities carries a high potential for infection and injury than any other type of waste. Inadequate knowledge of biomedical waste (BMW) management can lead to serious health consequences and an adverse impact on environment. The aim of this study is to assess the knowledge, attitude and practice (KAP) of BMW management among healthcare workers of government T. D. medical college, Alappuzha.
Methods: A cross sectional study was conducted among staff and students of government T. D. medical college, Alappuzha. Stratified sampling was done and data was collected using semi structured questionnaire and analyzed using SPSS version 26 software.
Results: The majority of faculty and nurses had good knowledge about segregation of waste into yellow and red coded bags. Nurses, students and residents had good knowledge about waste disposal into white coded containers whereas into blue coded containers was seen in lesser proportion among all categories of health care workers. All the nurses and majority of the faculty had corrected attitude towards BMW management. Assessment of practice revealed that 50% of the nurses practiced proper BMW management and the proportion was much lower among all other categories of health care workers.
Conclusions: Knowledge about infectious plastic waste and sharp waste disposal was low among students and faculty respectively. Knowledge about metallic and glassware disposal was low among all categories of health care workers. Attitude towards BMW management was low among students and residents and its practice was inadequate among all categories of health care workers.

Keywords: BMW management, Infection control, Health care workers

INTRODUCTION

"The term biomedical waste (BMW) is used to define any waste that is generated during the diagnosis, treatment or immunization of human beings or animals or research activities pertaining thereto or in the production or testing of biologicals."[1] About 85% of wastes generated during healthcare activities are general non-hazardous waste and the remaining 15% are hazardous and include infectious, chemical or radioactive materials.[2]

Ineffective BMW management can lead to transmission of infectious diseases, increase in vector borne diseases and also land and water pollution.[3] There has been a rise in BMW production from 500-750 gm per day to 2.5-4.5 kg after the COVID-19 pandemic.[4] The increase in BMW production after the pandemic increases the threat to environment and health of the community.

An estimated 484 TPD (tonnes per day) of BMW is generated in India out of which 447 TPD is treated and 37

TPD is untreated.[5] The challenges in BMW management include lack of awareness about the hazards of BMW, lack of human and financial resources and inadequate waste disposal practices.[6] In developing countries, BMW management has not received sufficient attention.[7]

The core principles for safe and sustainable management of health care waste were developed at the world health organization meeting in Geneva in June 2007. The harmful effects of health-care waste to the people and the environment can be reduced by proper commitment and allocation of the right resources for its management. For ensuring proper BMW management a strong teamwork is required. The healthcare workers and health care facilities should follow good BMW practices. Government should support these activities with strong legislation and regular monitoring and provide necessary financial and human resources.[5]

The first step in BMW management is the segregation of the waste at the site of generation. The waste is segregated on the basis of its type into four colour coded bags.[1]It is the responsibility of the healthcare worker to ensure proper separation of waste at the site of production. Failure to do so puts those who handle BMW at increased risk of needle stick injury and transmission of infectious diseases. BMW management is therefore a vital part of occupational health and safety programme for healthcare workers.[8]

Health-care workers should have an adequate knowledge on the disposal of BMW according to the colour coded system. They must also understand the importance of following the BMW guidelines and the consequences and hazards that can occur due to improper BMW management. Finally, they must practice the correct BMW management methods at their point of generation.

This study aims to assess the KAP among healthcare workers regarding BMW management in a tertiary level teaching institution and determine the factors associated with the level of knowledge. We hoped to identify the gaps in KAP so that necessary changes in practice may be recommended and training programmes can be initiated to ensure proper BMW disposal and management.

METHODS

This hospital based cross sectional study was done in a government medical college in Alappuzha during October-November 2022 among staff and students of the institution. Sample size was calculated using formula

$$N=[Z^2\left(1-\frac{\alpha}{2}\right)(1-p)]d^2$$

Where p is 48.9, 1-α/2 is the desired confidence level (taken as 99%) as 2.576 and d^2 taken as 20% p. The calculated sample size was 174 which was rounded off to 200 and stratified sampling technique was used to choose the study participants.

The study variables included socio-demographic variables like age, sex, category of work, years of experience and variables to assess KAP of participants. A pre tested semi structured questionnaire using Google forms was used to collect information on the socio demographic characteristics and assess the KAP about BMW management. Scores were assigned to all the relevant questions in the questionnaire, the level of knowledge was assessed and gaps in attitude and practice were determined. For the assessment of awareness about infectious plastic waste a total score of 4 was considered as high level of awareness. For the awareness about other categories of wastes a total score 3 was taken as high level of awareness. Those who responded positively to all questions assessing attitude and practice were considered to have high level of attitude and practice. The nature of the study was explained and consent was obtained from the study participants. Privacy and confidentiality of all information collected were maintained throughout study.

Data was entered into Microsoft excel sheets and analyzed using SPSS version 26 software. Assessment of KAP was done according to the category of work. Qualitative variables were summarized using proportions and percentages and quantitative variables in mean with standard deviation.

RESULTS

A total of 200 healthcare workers were studied, of which 114 (57%) were females and majority 115 (57.5%) were students The mean age of the study population was 27.48±10.40 years ranging between 19 and 60 years. The majority (96.6%) of study participants reported that they had seen posters regarding BMW management in the hospital. All the nurses had attended sessions on BMW management and all of them regularly used personal protective equipment in the hospital, 128 (64%) participants opined that they require further training on BMW management (Table 1).

Assessment of knowledge was done on the basis of awareness of the participant on segregation of BMW according to the category of waste: infectious plastic, anatomical, sharps and metallic and glassware. Knowledge about segregation of waste into yellow and red coded bags was good among the majority of faculty and nurses. Knowledge about disposal of waste into white coded containers was good among nurses, students and residents. Knowledge about segregation into blue coded containers was seen in lesser proportion among all categories of health care workers (Table 2).

Attitude was assessed on the basis of whether the participant had tried to correct someone who was incorrectly disposing BMW. All the nurses and the majority of the faculty had the correct attitude towards BMW management. Assessment of practice revealed that only50% (n=7) of the nurses practiced proper BMW management and the proportion was lesser in all the other categories of health care workers (Table 3).

Table 1: Characteristics of study population, (n=200).

Variables	Frequency n (%)			
Gender	Male, 86 (43)		Female, 114 (57)	
Mean age (In years)	27±10.40			
Variables	**Students**	**Residents**	**Faculty**	**Nurses**
Category of work	115 (57.5)	43 (21.5)	28 (14)	14 (7)
Participation in BMW management workshops	106 (92.2)	39 (90.7)	27 (96.4)	14 (100)

Table 2: Knowledge of BMW waste management, (n=200).

Segregation into colour coded bags	High level of knowledge regarding BMW management, n (%)			
	Students, (n=115)	**Residents, (n=43)**	**Faculty, (n=28)**	**Nurses, (n=14)**
Infectious plastic waste	42 (36.5)	27 (62.8)	26 (92.9)	11 (78.6)
Anatomical waste	67 (58.30)	27 (62.8)	17 (60.70)	14 (100)
Sharp waste	93 (80.90)	36 (83.70)	12 (42.90)	12 (85.50)
Metallic and glassware waste	44 (38.30)	21 (48.80)	16 (57.20)	9 (64.3)

Table 3: Attitude and practice of BMW management, (n=200).

Assessment of attitude and practice	High level of attitude and practice of BMW management, n (%)			
	Students, (n=115)	**Residents, (n=43)**	**Faculty, (n=28)**	**Nurses, (n=14)**
Attempts to correct wrong method of disposal of BMW	33 (28.7)	21 (48.8)	27 (96.4)	14 (100)
Correct practice of BMW management	6 (5.21)	8 (18.60)	0 (0)	7 (50)

DISCUSSION

The study was conducted to assess the KAP of BMW management among healthcare workers in our institution. Ensuring proper disposal and segregation at source of generation is the most important step in BMW management.[9] Hence all healthcare workers must receive adequate training to make them aware about the colour coded system of disposal of BMW. They must also understand its importance and practice it correctly at their source of generation. Potential implications of improper BMW management includes transmission of hepatitis B, C, E and HIV through contaminated sharps, proliferation and mutation of pathogenic microbial population in municipal waste, physical hazards and antibiotic resistance.[10]

In our study, knowledge among faculty about segregation into red and yellow-coded bags washigh. Similar findings were obtained in another study in which knowledge among doctors about segregation into red and yellow coded bags were found to be 95.2% and 93.70% respectively.[11] However knowledge about sharp waste disposal among faculty was low (42.90%) in our study when compared to 93.7% in the above study. Similar results were obtained in another study in which lowest level of awareness among doctors was about the disposal of sharps.[12] Knowledge about infectious sharp and needle disposal was found to be higher in doctors (70%) when compared to interns (40%) and nurses (50%) in a study conducted among healthcare workers in a tertiary care government hospital in western Maharashtra.[13]

In contrast to our study, more than three-fourth of the residents were aware about colour coding of BMW and its segregation in a study conducted by Basu et al.[14] Similar findings were obtained in a study conducted among post graduate residents in a tertiary care hospital in Lucknow.[15]In our study, knowledge about segregation into yellow coloured bags was good in all categories of participants but only 28% of subjects were aware about it in a study by Kishore et al.[8]

Knowledge about segregation into blue coded containers was seen in lesser proportion among all categories of our study population which is consistent with the findings in a study conducted in a tertiary care hospital in Puduchery.[11]All the nurses and doctors were aware about the colour coding system for BMW segregation in a study by Basavaraj et al among healthcare workers in a dedicated COVID-19 hospital in Bangalore.[16] A study conducted among nursing professionals in Odisha showed that nearly half of the nurses had excellent knowledge about BMW management.[17] In another study, the majority of health care personnel were aware about

availability of different colour coded bags used for BMW collection but awareness about identification of colour coded bags as per BMW act was very poor among all, except doctors (98.4%).[18] In a study by Mathur et al, low level of knowledge among sanitary staff was attributed to poor training facilities and low level of education.[6]

In a study conducted among medical students in a tertiary healthcare centre, none of the students reported to have received any training in BMW management compared to 92.2% in our study.[19]In a study done by Rao et al the study respondents showed satisfactory knowledge regarding BMW management. Knowledge among doctors was distinctively higher followed by that of nurses, technicians, post graduates and interns and similar to the findings in our study, attitude towards BMW management was best among nurses and doctors.[20]

In a study among healthcare workers during COVID-19 pandemic in a health district of West Bengal it was found out that doctors (91%) and nurses (81%) had more favourable attitude than other healthcare workers.[21] Similarly in our study it was seen that nurses (100%) and doctors (96.4%) have a better attitude towards BMW management when compared to residents (48.8%) and students (28.7%). In contrast to our study, a study among interns showed that nearly 97% of interns had a positive attitude towards BMW management.[22] A study by Sachan et al revealed that all the doctors (100%) and 60% of nurses showed a positive attitude towards the need for measures for safe collection and final disposal of BMW.[23] Another study showed that attitude of all healthcare workers was highly positive and it was attributed to the regular training programmes of BMW management conducted in their institution.[24]

In a study among healthcare personnel in Jaipur, India, 65% of dentists and 64% of nurses were found to properly practice BMW management.[25] This is in contrast with our study in which none of the faculty and only 50% of nurses practiced proper BMW management. Nearly three-fourth of the observations followed appropriate BMW disposal practices in a study conducted among healthcare workers during COVID-19 pandemic in secondary and tertiary care facilities of Tamil Nadu.[26] Another study revealed that only 23% of the study population was found to be performing good BMW management practices with the average practice score highest among nurses and least in doctors.[27]

Our study showed that knowledge about disposal of infectious plastic waste into red coded bags was low among students. Knowledge about sharp waste disposal was low among faculty. All categories of health care workers had lesser proportion of knowledge about metallic and glassware disposal. Attitude towards BMW management was found to be low among students and residents. Practice of proper BMW management was found to be inadequate in all categories of health care workers. This shows the necessity of conducting training programmes to educate them about the colour coded system of BMW disposal. Particular emphasis must be given to the disposal method of the particular type of waste that each category of healthcare worker had low level of knowledge about. Students and residents must be educated about the importance of proper BMW management and the consequences of improper disposal of BMW. Regular monitoring of BMW management must be done at the sources of generation to ensure that the health care workers are practicing proper disposal of BMW according to the guidelines.

ACKNOWLEDGEMENTS

Author would like to thank Dr. Nisha R. S., professor and head of department of community medicine, government T. D. medical college, Alappuzha for her valuable guidance. Also, to study participants whose cooperation transformed this study into reality.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Bio-medical Waste Management Rules 2016. Available at: https://dhr.gov.in/sites/default/files/Bio-medical_Waste_Management_Rules_2016.pdf. Accessed on 12 June, 2023.
2. Health-care waste. Available at: https://www.who.int/news-room/fact-sheets/detail/health-care-waste. Accessed on 12 June, 2023.
3. Manekar SS, Bakal RL, Jawarkar RD, Charde MS. Challenges and measures during management of mounting biomedical waste in COVID-19 pandemic: an Indian approach. Bull Natl Res Cent. 2022;46(1):159.
4. Capoor MR, Parida A. Current perspectives of biomedical waste management in context of COVID-19". Indian J Med Microbiol. 2021;39(2):171-8.
5. Datta P, Mohi GK, Chander J. Biomedical waste management in India: Critical appraisal. J Lab Physicians. 2018;10(1):6-14.
6. Mathur V, Dwivedi S, Hassan M, Misra R. Knowledge, Attitude, and Practices about Biomedical Waste Management among Healthcare Personnel: A Cross-sectional Study. Indian J Community Med Off Publ Indian Assoc Prev Soc Med. 2011;36(2):143-5.
7. Da Silva CE, Hoppe AE, Ravanello MM, Mello N. Medical wastes management in the south of Brazil. Waste Manag. 2005;25(6):600-5.
8. Kishore J, Goel P, Sagar B, Joshi T. Awareness about biomedical waste management and infection control among dentists of a teaching hospital in New Delhi, India. Indian J Dent Res Off Publ Indian Soc Dent Res. 1999;11:157-61.

9. BMW-Book final. Available at: https://www.aiims.edu/images/pdf/BMW-Book%20final.pdf. Accessed on 19 June, 2023.
10. Saritha NS, Veeregowda BM, Leena G, Chakraborty S, Tiwari R, Dhama K et al. Biomedical Waste Management. Adv Anim Vet Sci. 2014;2(2):1-6.
11. Malini A, Eshwar B. Knowledge, Attitude and Practice of Biomedical waste management among health care personnel in a tertiary care hospital in Puducherry. Int J Biomed Res. 2015;6(3):172.
12. Sharma N. Study to Assess the Knowledge, Attitude and Practices of Biomedical Waste Management among Healthcare Personnel at a Tertiary Care Hospital in Haryana. J Adv Res Med Sci Technol. 2017;1(2):34-9.
13. Gawande A, Gokhale R, Soni A, Ram N. Study of knowledge, attitude, and practices of biomedical waste management among healthcare workers in tertiary care government hospital in western Maharashtra. Int J Community Med Public Health. 2022;9:4535.
14. Basu M, Das P, Pal R. Assessment of future physicians on biomedical waste management in a tertiary care hospital of West Bengal. J Nat Sci Biol Med. 2012;3(1):38-42.
15. Sharma S, Deori TJ. Study on knowledge, attitude and practices regarding biomedical waste management among post graduate residents in a tertiary care hospital of Lucknow. Int J Community Med Public Health. 2020;7(7):2730-3.
16. Basavaraj TJ, Shashibhushan BL, Sreedevi A. To assess the knowledge, attitude and practices in biomedical waste management among health care workers in dedicated COVID hospital in Bangalore. Egypt J Intern Med. 2021;33(1):37.
17. Dash K, Das M, Satapathy NK. Assessment of Knowledge, Attitude, and Practices about Biomedical Waste Management among Nursing Professionals in a Tertiary Care Hospital, Bhubaneswar, Odisha. Clin Med. 2021;08(03).
18. Chudasama R, Sheth A. Awareness and Practice of Biomedical Waste Management Among Different Health Care Personnel at Tertiary Care Centre, Rajkot, India. Online J Health Allied Sci. 2014;13:2014.
19. Kumar M, Kushwaha R, Kumari M, Maurya, Singh G, Kumari R. Knowledge, Awareness and Attitude regarding Biomedical Waste Management among Medical Students in a tertiary health Care centre: A Cross Sectional Study. 2017;6(4):611-4.
20. Rao D, Dhakshaini MR, Kurthukoti A, Doddawad VG. Biomedical Waste Management: A Study on Assessment of Knowledge, Attitude and Practices Among Health Care Professionals in a Tertiary Care Teaching Hospital. Biomed Pharmacol J. 2018;11(3):1737-43.
21. Dalui A, Banerjee S, Roy R. Assessment of knowledge, attitude, and practice about biomedical waste management among healthcare workers during COVID-19 pandemic in a health district of West Bengal. Indian J Public Health. 2021;65:345.
22. Priya P, Dixit UR. Knowledge, attitude and practices of biomedical waste management among interns of SDMCMSH, Dharwad. Int J Community Med Public Health. 2019;6(11):4736-8.
23. Sachan R, Patel M, Nischal A. Assessment of the knowledge, attitude and Practices regarding Biomedical Waste Management amongst the Medical and Paramedical Staff in Tertiary Health Care Centre. 2012;2(7).
24. Soyam GC, Hiwarkar PA, Kawalkar UG, Soyam VC, Gupta VK. KAP study of bio-medical waste management among health care workers in Delhi. Int J Community Med Public Health. 2017;4(9):3332-7.
25. Sharma A, Sharma V, Sharma S, Singh P. Awareness of Biomedical Waste Management Among Health Care Personnel in Jaipur, India. 2013;12(1).
26. Krishnamoorthy Y, Rajaa S, Samuel G, Sinha I. Biomedical waste disposal practices among healthcare workers during COVID-19 pandemic in secondary and tertiary care facilities of Tamil Nadu. Indian J Med Microbiol. 2022;40(4):496-500.
27. Hina TN, Das S, Das M. Knowledge, attitude and practice regarding biomedical waste management amongst healthcare workers in a teaching hospital from a north eastern state of India. Int J Community Med Public Health. 2021;8(2):701-6.

Cite this article as: Aravind A, Sudhiraj TS, Pinheiro C, Haris AM, Benny A, Krishnan A, et al. Biomedical waste management: assessment of knowledge, attitude and practice among health care workers. Int J Community Med Public Health 2023;10:3655-9.