# **Original Research Article**

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# Impact of educational intervention on knowledge and attitude of biomedical waste management among health care personnel working in a tertiary care hospital of Bengaluru city, Karnataka, India

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#### **ABSTRACT**

Background: The waste produced in the course of healthcare activities carries a higher potential for infection and injury than any other type of waste. Inadequate and inappropriate knowledge of handling of healthcare waste among health care personnel may have serious health consequences and a significant impact on the environment as well. Hence this study was undertaken to assess the knowledge and attitude regarding the bio-medical waste management among nurses and laboratory technicians working in our hospital and to evaluate the effect of the intervention program given to them.

Methods: A quasi-experimental study was conducted among the nurses and laboratory technicians working at The Oxford Medical College, Hospital and Research Centre, Bengaluru. An identical pre-designed and pre-tested structured questionnaire was given to them before and after the training session.

Results: After the training program, a statistically significant increase in knowledge on all aspects of bio-medical waste management was found among the study participants. The attitude on all aspects related to BMW management improved among the participants after the intervention.

Conclusions: All health care personnel must undergo regular training in BMW management. This should be coupled with effective implementation of rules and regular monitoring by authorities.

Keywords: Knowledge, Attitude, Bio-medical waste management

#### INTRODUCTION

Let the waste of "the sick" not contaminate the lives of "the healthy".

In the persuasion of the aim of reducing health problems, eliminating potential risks, and treating sick people, healthcare services inevitably create waste which itself may be hazardous to health. The waste produced in the course of healthcare activities carries a higher potential for infection and injury than any other type of waste.<sup>1</sup>

Bio-medical waste (BMW) is defined as "any waste which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biologicals".2

BMW management is currently a burning issue more so with the increasing health care facilities and increasing waste generation. It is estimated that annually about 0.33 million tons of hospital waste is generated in India and waste generation rate ranges from 0.5 to 2.0 kg/bed/day.<sup>3</sup>

It is also estimated that, 10-25% of the healthcare waste generated is hazardous and causes serious health problems. The waste generated in the hospital has significant health impact not only on the health care personnel but also on the general public. Improper handling of waste not only poses significant risk of infection due to pathogens like HIV, hepatitis B and C virus but also carries the risk of water, air and soil pollution thereby adversely affecting the environment and community at large.<sup>4</sup>

BMW (management and handling) rules, 1998, prescribed by the Ministry of Environment and Forests, Government of India, came into force on July 28, 1998 (further amended from time to time). These rules apply to all persons who generate, collect, receive, store, transport, treat, dispose, or handle BMW in any manner and also to every institution that generates BMW. BMW should be segregated at source into color-coded bags or containers and its collection and proper disposal should be a significant concern for both medical personnel and general community.<sup>5</sup>

Since the implementation of BMW rules (1998), every concerned health personnel is expected to have proper knowledge, practice and capacity to guide others for waste collection and management, and proper handling techniques.<sup>6</sup> However, due to laxity in implementation of the rules and lack of awareness due to inadequate training of health care personnel has led to the hospitals becoming a hub of spreading diseases rather than working towards eradicating them.

Our hospital is a tertiary care centre functional since four years where the protocols & policies are in a budding stage and yet to be put in place. As recently new rules regarding BMW management were being notified by the Government of India in 2016, hence in view of updating the knowledge of nurses and laboratory technicians working in our hospital, this study was undertaken to assess their existing knowledge and attitude regarding the BMW management and to evaluate the effect of the intervention program given to them.

#### **METHODS**

## Type of study

Quasi-experimental study with "one group pre-test and post-test design"

#### Place of study

The Oxford Medical College, Hospital and Research Centre, Bengaluru

## Period of study

2 months (August 2017 to September 2017)

#### Study population

95 health care personnel working in different departments of our hospital (73 Nurses and 22 Laboratory technicians) who consented to participate in our study

#### Instrument

An identical pre-designed and pre-tested structured questionnaire designed in English language given before and after the training session. The 25-item questionnaire comprised of 2 sections. Section-A consisted of 15 close-ended questions to assess the knowledge regarding various aspects of BMW management (definition, sources, categories, color-coding, storage, health hazards and biohazard symbol). Section-B included 10 questions (as agree / disagree) to assess the attitude towards BMW management.

The questionnaire was administered to 95 study participants after explaining them the plan and purpose of the study and taking their written informed consent. They were assured about their confidentiality and anonymity. After this, an educational training program was conducted by the trained Community Medicine staff in the form of power point presentations on various aspects of BMW management (according to latest guidelines and rules) and demonstration of color-coded bags and containers, and different equipment. This was followed by an interactive session, in which the doubts of participants were clarified. After the session, the participants were again administered the same questionnaire to assess the impact of the educational intervention.

# Statistical analysis

Responses to the questionnaire were coded and entered into Excel Sheet and were analyzed using Epi Info software version 7. Chi-square test was used to test the statistical significance of the difference observed in the knowledge and attitude regarding BMW management during pre-test and post-test. Comparison of mean pre and post-test scores was done with the help of paired t-test. The level of significance was set at p<0.05.

# **RESULTS**

Table 1 shows that out of total 95 study participants, only 30.5% knew the correct definition of BMW during pretest, and the knowledge increased significantly to 97.9% during post-training assessment. Only 26.3% had the correct knowledge regarding the proportion of hazardous waste in the total hospital waste, which improved significantly to 86.3% after the training session. Majority (62.1%) were aware of different sources of BMW, and the percentage increased significantly to 94.7% after giving training. Only 15.8% participants knew that BMW is divided into 4 categories according to BMW management rules, 2016 and the knowledge increased

significantly to 88.4% during post-training assessment. Only 27.4% knew that waste sharps are categorized under category 3 in BMW management, and this score improved significantly to 92.6% after intervention. Only 38.9% participants were aware of segregation as the key step in waste management and only 25.3% were aware that segregation of waste into different categories should be done at the point of generation, and these scores were improved significantly to 97.9% and 87.4% after training program. Only 7.4% participants were aware that human anatomical waste should be disposed off in yellow bag/ container, only 24.2% knew that waste sharps should be disposed in white translucent puncture-proof container, only 34.7% were aware that dressings and cotton swabs soiled with blood should be disposed in yellow bag/ container, only 17.9% knew that intravenous tube sets, catheters, urine bags and gloves should be disposed in red bag / container and only 37.9% were aware that discarded or expired medicines should be disposed in yellow bag / container (according to recent guidelines of BWM management being notified by the Government of India), and these scores improved significantly to 84.2%, 90.5%, 77.9%, 76.8% and 83.2% after creating awareness through training program. 55.8% of them knew that the maximum storage period for BMW is 48 hours, and the knowledge increased significantly to 89.5% after training. Majority (67.4%) knew that HIV, Hepatitis B and C, and injuries are the risks associated with improper disposal of health-care waste, and this score was further improved significantly to 93.7% after the educational intervention. Majority (73.7%) correctly identified the universally accepted biohazard symbol, and the percentage increased significantly to 92.6% after training. There was a highly statistically significant increase in the knowledge (p<0.001) in all aspects of BMW management after training when compared to before training.

Table 1: Analysis of knowledge of participants on various aspects of bio-medical waste management.

Knowledge on BMW management elements	Pre-intervention (n=95) Correct responses n (%)	Post-intervention (n=95) Correct responses n (%)	Chi-square, p-value
Definition of bio-medical waste	29 (30.5)	93 (97.9)	93.81, p<0.0001
Percentage of hazardous bio-medical waste	25 (26.3)	82 (86.3)	69.5, p<0.0001
Sources of bio-medical waste	59 (62.1)	90 (94.7)	29.88, p<0.0001
Categories of bio-medical waste	15 (15.8)	84 (88.4)	100.5, p<0.0001
Category of waste sharps	26 (27.4)	88 (92.6)	84.29, P<0.0001
Segregation - key step in waste management	37 (38.9)	93 (97.9)	76.38, p<0.0001
Segregation done at the point of generation	24 (25.3)	83 (87.4)	74.47, p<0.0001
Understanding of colour coding:			
(i) Disposal of human anatomical waste such as body parts	7 (7.4)	80 (84.2)	112.99, p<0.0001
(ii) Disposal of waste sharps	23 (24.2)	86 (90.5)	85.41, p<0.0001
(iii) Disposal of dressings and cotton swabs soiled with blood	33 (34.7)	74 (77.9)	35.96, p<0.0001
(iv) Disposal of intravenous tube sets, catheters, urine bags and gloves	17 (17.9)	73 (76.8)	66.2, p<0.0001
(v) Disposal of discarded or expired medicines	36 (37.9)	79 (83.2)	40.73, p<0.0001
BMW should not be stored beyond 48 hours	53 (55.8)	85 (89.5)	27.11, p<0.0001
Risks associated with improper disposal of health-care waste	64 (67.4)	89 (93.7)	20.97, p<0.0001
Identification of universally accepted biohazard symbol	70 (73.7)	88 (92.6)	12.18, p<0.001

Regarding the attitude towards safe management of BMW (Table 2), out of total 95 study participants, majority (77.9%) of them felt that safe management of BMW is an important issue, which improved significantly to 97.9% after training. 98.9% of them felt that there is a need of such awareness programs about BMW management, which was gone up to 100% after

training but the increase was not significant (p>0.05). Only 27.4% participants were of the view that safe management of health-care waste is not the sole responsibility of the Government, and the favourable attitude increased significantly to 83.2% after the training session. Majority (85.3%) felt that waste management is a team work, and the positive attitude improved

significantly to 96.8% after intervention. Only 32.6% agreed that safe management of health-care waste is not an extra burden on them / institution, and this correct attitude improved significantly to 92.6% in post-test. Only 34.7% were of the view that BMW management does not increase financial burden on hospital management, and there was a significant increase in this positive attitude to 88.4% after training. Majority (83.2%) agreed that segregation of BMW using colour coding is a must, and the percentage improved significantly to 95.8%

after training. Majority (89.5%) agreed that segregation saves the environment from polluting, which increased to 95.8% after training but the increase was not significant. Only 47.4% agreed that it is important to always dispose needles in puncture-proof containers, and the percentage increased significantly to 93.7% after training. Majority (80%) agreed that needle stick injury is a concern, which improved to 89.5% after the training program but the increase was not significant.

Table 2: Analysis of attitude of participants towards safe management of bio-medical waste.

Attitude towards safe management of BMW	Pre-intervention (n=95) Positive responses n (%)	Post-intervention (n=95) Positive responses n (%)	Chi-square, p-value
Safe management of BMW is an important issue	74 (77.9)	93 (97.9)	17.86, p<0.0001
There is a need of such awareness programs about BMW	94 (98.9)	95 (100)	0.8, p>0.05
Safe management of health care waste is the responsibility of Government	26 (27.4)	79 (83.2)	59.8, p<0.0001
Waste management is a team work	81 (85.3)	92 (96.8)	7.82, p<0.01
Safe management of health care waste is an extra burden on you/institution	31 (32.6)	88 (92.6)	73.06, p<0.0001
BMW management increases financial burden on hospital management	33 (34.7)	84 (88.4)	57.86, p<0.0001
Segregation of BMW using colour coding is a must	79 (83.2)	91 (95.8)	8.05, p<0.01
Segregation saves the environment from polluting	85 (89.5)	91 (95.8)	2.78, p>0.05
It is important to always dispose needles in puncture-proof containers	45 (47.4)	89 (93.7)	49.02, p<0.0001
Needle stick injury is a concern	76 (80.0)	85 (89.5)	3.29, p>0.05

Table 3: Paired t-test results of correct answers by the participants regarding BMW management.

Statistical test	Knowledge		Attitude	Attitude	
	Pre-test	Post-test	Pre-test	Post-test	
Mean	34.5	84.5	62.4	88.7	
Standard deviation (SD)	18.8	6.1	25.7	4.8	
t value	11.35		3.74		
p value	p<0.0001		p<0.01		

Table 3 shows that the mean score of the participants regarding knowledge of various aspects of BMW management improved from  $(34.5\pm18.8)$  in pre-test to  $(84.5\pm6.1)$  in post-test and the difference was highly statistically significant (p<0.0001). The mean score of favourable attitude towards safe management of BMW among the participants improved from  $(62.4\pm25.7)$  to  $(88.7\pm4.8)$  after the training session and this improvement in attitude was statistically significant (p<0.01). The significant improvements in knowledge and attitude scores indicate success of the training program.

# **DISCUSSION**

In the present study, only 30.5% study participants knew the correct definition of bio-medical waste during pretest, and the knowledge increased significantly to 97.9% during post-training assessment. This is in contrast to the finding of a study conducted by Kulkarni et al in a tertiary care centre of Ambajogai city according to which 90% of the participants were aware of 'what biomedical waste is' before training session and the score improved significantly to 100% after training.<sup>7</sup> In our study, only

26.3% had the correct knowledge regarding the proportion of hazardous waste in the total hospital waste, which improved significantly after the training session. A study conducted by Ismail et al reported that only 18.3% participants were aware that infectious waste constitutes 10-25% of the total hospital waste.<sup>8</sup>

In the present study, majority (62.1%) of the study participants were aware of different sources of BMW and only 15.8% knew the number of categories of BMW, and the knowledge was improved significantly after training. According to a study conducted by Nema et al in a tertiary care hospital of Bhopal city, 85.6% participants knew the different sources of BMW and only 15.2% were aware of the number of categories of BMW.

In our study, only 38.9% participants were aware that segregation is the key step in BMW management and the knowledge improved significantly after training. This is in contrast to the finding of a study conducted by Basu et al in a tertiary care hospital of West Bengal in which 78.8% participants were aware of segregation as the golden rule in BMW management.<sup>5</sup> In the present study, only 25.3% of the participants were aware about segregation of waste at the point of generation and majority were not aware of the colour coding for disposal of different types of wastes, and the knowledge improved significantly after the training program. Similar findings were reported by a study conducted by Mannapur et al in a tertiary care hospital of Bagalkot city.<sup>10</sup>

In our study, 55.8% participants knew that the maximum storage period for BMW is 48 hours and majority (67.4%) were aware of the health hazards associated with improper disposal of health-care waste and these scores improved significantly after training. A study conducted by Mannapur et al reported that 71.31% participants knew the maximum storage period of BMW and 62.3% were already having prior knowledge about health hazards due to improper management of BMW, and the knowledge improved after training. <sup>10</sup> In the present study, majority (73.7%) correctly identified the universally accepted biohazard symbol, and the percentage increased significantly after training. According to a study of Sanjeev et al, 64% of the respondents correctly recognized the biohazard symbol. <sup>11</sup>

Present study showed a highly statistically significant increase in the knowledge (p<0.001) in all aspects of BMW management after training when compared to before training. A study conducted by Mannapur et al showed a highly statistical significance increase in the knowledge in all aspects of BMW management after training when compared to before training except health hazards.  $^{\rm 10}$ 

Regarding attitude towards safe management of BMW, majority (77.9%) of the participants felt that safe management of BMW is an important issue which improved significantly after training, and 98.9% of them

felt that there is a need of such awareness programs about BMW management, which was gone up to 100% after training, though not significantly. In a study conducted by Nema et al, 97.6% respondents agreed that safe management of BMW is an important issue, and 96% participants felt need of separate training programme for BMW management. In our study, majority (85.3%) felt that waste management is a team work, and the positive attitude improved significantly after intervention. Malini and Eshwar in their study reported that majority of the participants felt that waste management is a team work.

In our study, only 27.4% participants were of the view that safe management of health-care waste is not the sole responsibility of the Government, only 32.6% agreed that safe management of health-care waste is not an extra burden on them / institution, only 34.7% were of the view that BMW management does not increase financial burden on hospital management, and the favourable attitude increased significantly in post-test. These findings are in contrast to the findings of a study conducted by Sehgal et al in which 95% participants were of the view that safe management of health-care waste is not the sole responsibility of the Government, 92.5% agreed that safe management of health-care waste is not an extra burden on them / institution and 81.7% were of the view that BMW management does not increase financial burden on hospital management. 12

In our study, majority (83.2%) of the participants agreed that segregation of BMW using colour coding is a must, and the percentage improved significantly after training. According to a study of Manchanda et al, 90% participants agreed that use of colour code for segregation is a must.<sup>13</sup> In the present study, 89.5% participants agreed that segregation saves the environment from polluting and only 47.4% agreed that it is important to always dispose needles in puncture-proof containers, and the scores increased after training. Jadhav et al in their study reported that 94.2% participants agreed that segregation saves the environment from polluting and 85.8% agreed that it is important to always dispose needles in puncture-proof containers, and the scores improved after training. 14 In our study, 80% participants agreed that needle stick injury is a concern, and this positive attitude improved after training. According to a study of Nema et al, 95.2% of participants showed concern about needle stick injury.9

#### **CONCLUSION**

From this educational interventional study, it was concluded that knowledge and attitude regarding various aspects of bio-medical waste management among paramedical staff were quite unsatisfactory. Knowledge and attitude improved substantially in post-training assessment. This indicates the need for intensive training programs at regular time interval to repeatedly train and retrain all the health care personnel to make them aware about the proper management of BMW. Sensitization of

employees coupled with effective implementation of rules and regular monitoring by authorities can go a long way towards the safe disposal of hazardous hospital waste and protect the community from its various adverse effects. Safe and effective management of bio-medical waste is not only a legal necessity but also a social responsibility.

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Institutional Ethics Committee

#### **REFERENCES**

- Mathur V, Dwivedi S, Hassan MA, Misra RP. Knowledge, Attitude, and Practices about Biomedical Waste Management among Healthcare Personnel: A Cross-sectional Study. Indian J Community Med. 2011;36(2):143–5.
- Park K. Park's Textbook of Preventive and Social Medicine. 24th ed. Jabalpur: Bhanot Publishers; 2017.
- Goyal S, Dileep CL, Mathur A, Chaudahry S, Makkar DK, Batra M, Sood P. Knowledge, attitude and practices regarding biomedical wastes among health care professionals in Sri Ganganagar city: A cross- sectional study. DHR-IJMS. 2015;6(2):162-171.
- 4. 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):172-6.
- 5. Basu M, Das P, Pal R. Assessment of future physicians on biomedical waste management in a tertiary care hospital of West Bengal. J Nat Sc Biol Med. 2012;3(1):38-42.
- Yadavannavar MC, Berad AS, Jagirdar PB. Biomedical Waste Management: A Study of Knowledge, Attitude, and Practices in a Tertiary Health Care Institution in Bijapur. Indian J Community Med. 2010;35(1):170–1.
- Kulkarni VL, Rajhans VV, More SR, Nilekar SL, Kulkarni DM, Ovhal RS, et al. A Comparative Study of Knowledge, Attitude and Practice Regarding Biomedical Waste Management Before and After Training among Doctors. IOSR J Dent Med Sci. 2016;15(4):50-4.
- 8. Ismail IM, Kulkarni AG, Kamble SV, Borker SA, Rekha R, Amruth M. Knowledge, attitude and

- practice about bio-medical waste management among personnel of a tertiary health care institute in Dakshina Kannada, Karnataka. Al Ameen J Med Sci. 2013;6(4):376-80.
- 9. Nema S, Singh A, Tripathi K, Shidhaye P, Kumar A, Dhanvijay AK. Biomedical Waste Management: A Study of Knowledge, Practices and Attitude among Health Care Personnel at a Tertiary Care Hospital in Bhopal, Central India. JMSCR. 2015;3(5):5844-55.
- Mannapur BS, Dorle AS, Ghattargi CH, Kulkarni KR, Ramdurg UY, Hiremath LD, et al. Impact of Educational Intervention on the Knowledge of Bio-Medical Waste Management among Health Care Workers in a Tertiary Care Hospital at Bagalkot City. J Evol Med Dent Sci. 2014;3(19):5076-82.
- 11. Sanjeev R, Kuruvilla S, Subramaniam R, Prashant PS, Gopalakrishnan M. Knowledge, attitude, and practices about biomedical waste management among dental healthcare personnel in dental colleges in Kothamangalam: a cross-sectional study. Health Sci. 2014;1(3):1-12.
- Sehgal RK, Garg R, Dhot PS, Singhal P. A study of knowledge, attitude, and practices regarding biomedical waste management among the healthcare workers in a multispeciality teaching hospital at Delhi. Int J Med Sci Public Health. 2015;4(11):1540-4.
- 13. Manchanda K, Fotedar S, Dahiya P, Vats A, Sarkar AD, Vats AS. Knowledge, attitude, and practices about biomedical waste management among dental healthcare personnel in dental colleges in Himachal Pradesh: A cross-sectional study. SRM J Res Dent Sci. 2015;6:166-9.
- 14. Jadhav J, Thangaraj S, Dsouza L, Rao A. Assessment of educational intervention on biomedical waste management among Government Nursing College students, Bengaluru. Int J Med Sci Public Health. 2015;4(5):726-9.

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