Knowledge, Awareness and Practice of Biomedical Waste Management guidelines 2016 among Healthcare personnel in a Tertiary care hospital, Rajasthan, INDIA

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Abstract
Introduction: Bio-medical waste” (BMW) is a term which means any waste, which 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 biological or in health camps including the categories mentioned in Schedule I appended to these rules¹. BMWM rules were made in 1998, and revised in 2016 which includes 18 rules, 04 schedules and 05 forms, in our hospital, health care personnel too needed to reinforce the revised BMWM 2016 guidelines. Our aim of this study is to determine the existing knowledge, awareness and practice about the BMWM rules 2016 in this tertiary care hospital.

Material and Method: This study was an cross-sectional study conducted with a duration of 3 months from October 2018 to January 2019 in a tertiary care hospital, Rajasthan, India. A total of 150 healthcare personnel which include 75 doctors (36 senior residents and 39 junior residents), 40 nurses and 35 laboratory technicians consented for interview and observations.

Result: We found out that technicians (89.95%) and nurses (88.87%) have more knowledge regarding BMWM than doctors (85.82%). But doctors (82.20%) are more aware for proper management than nurses (73.80%) and technicians (64.0%). Doctors (80.87%) and nurses (82%) are practicing these norms more than technicians (59%).

Conclusion: This study shows that Doctors, nurses and laboratory technicians all had knowledge and awareness regarding revision of biomedical waste management rules in 2016, but laboratory technicians are lagging in practicing them. Strong implementations of rules should be followed in institution and regular training should be held for staff.

Keywords: BMWM (bio medical waste management), knowledge, awareness, practice, healthcare workers.

Introduction
Bio-medical waste” (BMW) is a term which means any waste, which 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 biological or in health camps including the categories mentioned in Schedule I appended to these rules¹. Central population control board, State population control board and Ministry of State(IC) environment, Forest and Climate Change advised to follow and reinforce Bio medical waste.
management rules because of the menace created by improper disposal of health care waste, emissions of furans, dioxins etc and emergence of multi drug resistant organisms. Inadequate and inappropriate knowledge of handling of healthcare waste may have serious health consequences and a significant impact on the environment as well. Whenever waste generated, a safe and reliable method for handling of biomedical waste is essential. Effective management of biomedical waste is not only a legal necessity but a social responsibility. Taking cognizance of inappropriate BMW management, Ministry of Environment and Forests notified the 'BMW (management and handling) Rules, 1998' in July 1998. BMW Management Rules have thereafter undergone timely revisions to meet the prevailing needs. Till date, four amendments have been made in 2000, 2003 and 2011 with these latest guidelines coming into force from 28th March 2016. BMW rules were made in 1998, and revised in 2016 which includes 18 rules, 04 schedules and 05 forms, in our hospital, health care personnel too needed to reinforce the revised BMWM 2016 guidelines.

| 1998 | 2016 |
|------|------|
| Occupiers with more than 1000 beds required to obtain authorisation | It is now mandatory for all the healthcare facilities generating BMW including health camp or AYUSH to obtain authorisation |
| Operator duties are not listed | Duties of the operator have been listed |
| BMW was divided into two categories (reduced to eight categories in 2011 guidelines) | BMW is divided into four categories |
| No format for annual report (format for annual report included in 2011 guidelines) | A format for annual report has been appended with the rules |
| Schedule present were I, II, III, IV, V, VI | Change of Schedule to I, II, III, IV [Table 2] |
| Forms I, II, III, IV, V, VI form was included in 2011 guidelines | Forms I, II, III, IV, V [Table 3] |
| Chemical pre-treatment was with 1% sodium hypochlorite | Chemical pre-treatment with 10% sodium hypochlorite |
| The minimum limit for the release of carcinogenic dioxins and furans have not been specified | The minimum limit of carcinogenic dioxins and furans released from incinerator has been clearly specified |
| Outsourcing of BMW was not mandatory | Outsourcing is strongly recommended (if treatment facility is located within 75 km of radius from hospital) |
| The methods of disposal are incineration/autoclaving/microwaving/ Nasslination/shredding | The newer methods introduced apart from those of 1998 are plasma pyrolysis/hydrolysis/encapsulation/inerisation |
| Cytotoxic drugs to be discarded in black colour bag | Cytotoxic drugs to be discarded in yellow bag |
| Chemical solid waste to be discarded in black bag | Chemical solid waste to be discarded in yellow bag |
| Waste sharp/metal sharp are to be discarded in blue/white bag | Waste sharp/metal sharp are to be discarded in transparent puncture proof box |
| Metallic body implants are to be discarded in blue/white bag | Metallic body implants are to be discarded in transparent puncture proof box |
| Majority of the BMW rules were for discarding the waste | Majority of the waste disposal rules are directed for recycling the waste |

Emphasis of cleanliness and systemic disposal of wastes including hospital waste is aimed by Government of India with a goal to make India “cleaner and greener” and make environment better, this mission is launched as “Swachh Bharat Abhiyan”.

This study was conducted in tertiary care hospital with the aim to assess the knowledge, awareness and practice of doctors, nursing staff and technicians regarding BMWM rules of 2016 and its management (segregation, color coding etc.) that may help the authorities of hospital and society to develop strategies for improving situation in future.

Methods and Material
This study was a cross-sectional study conducted with a duration of 3 months from October 2018 to January 2019 in a tertiary care hospital, Rajasthan, India. Study participants were working in different departments of hospital and were at different level of healthcare providers such as doctors, nursing staff and laboratory technicians. A total of 150 healthcare personnel which include 75 doctors (36 senior residents and 39 junior residents), 40 nurses and 35 laboratory technicians consented for interview and observations. These interviews and observations were conducted on a predesigned questionnaire containing a set of questions pertaining to biomedical waste management rules.
2016 knowledge, awareness and practice was used. All Doctors, nurses and laboratory technicians who consented for the study were included in this study. Housekeeping staff and sanitary staff were excluded because of there reluctance to participate in the study.

Data was collected and entered into Microsoft excel sheets, and double checked for any manual typing error and percentage was used to analyze the result.

Result
Knowledge
Analysis of data revealed that Doctors, nurses and laboratory technicians have adequate knowledge regarding biomedical waste management, but nurses and laboratory technicians have better knowledge regarding color coding and waste segregation to doctors.

All participants were aware about the fact that infectious diseases can spread through BMWs. All of them heard about BMWM but only 72% had formal training in it and 58% of them knew about change in rules of BMW 2016.

All of the participants knew about use of personal protective measures while handling BMW. 82.4% of the participants knew about use of gloves and mask together but only 72.4% of them knew of use of gloves, mask and cap simultaneously.

[Table 1] knowledge regarding biomedical waste management among healthcare participants (n=150)

| Knowledge                        | Doctors (n=75) | Nurses (n=40) | Laboratory technicians (n=35) |
|----------------------------------|---------------|--------------|------------------------------|
| Biomedical waste management rules | 72 (96%)      | 35 (83%)     | 31 (88.5%)                   |
| Color coding for waste containers | 66 (88%)      | 39 (97.5%)   | 33 (94.2%)                   |
| Segregation of waste at source   | 50(66%)       | 38(95%)      | 32(91.4%)                    |
| Disinfection of hospital waste before disposal | 70(93.3%) | 32(80%)     | 30(85.7%)                    |

Awareness
Among all 62% were aware about modifications done in BMWM guidelines in 2016. Biohazard and cytotoxic symbols were identified by 83% and 76% respectively. Approx 71% and 45% had clarity of sharp waste disposal and changed specification of BMW bags respectively. 15.1% of them preferred black and blue containers for disposal of sharps.

[Table 2] awareness regarding biomedical waste management among healthcare participants (n=150)

| Awareness                                    | Doctors (n=75) | Nurses (n=40) | Laboratory technicians (n=35) |
|----------------------------------------------|---------------|--------------|------------------------------|
| Modification in waste category              | 66 (88%)      | 16 (40%)     | 20 (57%)                     |
| Identifying biohazard symbol                 | 54 (72%)      | 37 (92%)     | 30 (85%)                     |
| Identifying cytotoxic symbols                | 57 (76%)      | 33 (83%)     | 25 (70%)                     |
| Specification and definition of sharps      | 69 (92%)      | 33 (82%)     | 16 (40%)                     |
| Specification of biomedical waste bags       | 62 (83%)      | 29 (72%)     | 24 (68%)                     |

Practice
Posters of segregation of BMW according to color codes were provided by the authority.

[Table 3] Practice about BMW among Health care personnel (n=150)

| Practice                                      | Doctors (n=75) | Nurses (n=40) | Laboratory technicians (n=35) |
|----------------------------------------------|---------------|--------------|------------------------------|
| Safe injection practice                       | 60 (80%)      | 25 (62%)     | 15 (44%)                     |
| Discarding sharps/vials/ampoules             | 71 (95%)      | 37 (92%)     | 31 (88%)                     |
| Discarding gloves                            | 73 (97%)      | 39 (98%)     | 12 (34%)                     |
| Discarding solid linen                        | 54 (72%)      | 33 (82%)     | 22 (62%)                     |
| Discarding Foley’s catheter with urobag      | 66 (88%)      | 36 (90%)     | 25 (72%)                     |
| Onsite disinfection of waste                 | 50 (66%)      | 28(71%)      | 18 (51%)                     |
| Emptying bag/container                       | 59 (78%)      | 32 (79%)     | 23 (66%)                     |
| Reporting of injuries due to sharps          | 53 (71%)      | 33 (82%)     | 19 (55%)                     |
We found out that technicians (89.95%) and nurses (88.87%) have more knowledge regarding BMWM than doctors (85.82%). But doctors (82.20%) are more aware for proper management than nurses (73.80%) and technicians (64.0%). Doctors (80.87%) and nurses (82%) are practicing these norms more than technicians (59%).

**Discussion**

The present study revealed that health care workers including doctors, nurses and technicians had sufficient knowledge, awareness and practices of biomedical waste management which is same as of Sehgal et al³ in Delhi which also said that awareness of biomedical waste is satisfactory in doctors and nurses. Awareness of categories of biomedical waste as per changed guidelines of 2016 was found in doctors 82.2% followed by nurses 73.8% and technicians 64.4%. This is similar to Bhagwati et al⁴ study which stated awareness among doctors 50% is highest and very poor in nurses and technicians. Mathew et al⁵ also stated awareness of 65% and 100% among technician and paramedical staff respectively. Madhukumar et al⁶ reported that 62.5 %
technicians were aware about biomedical waste management. Awareness regarding health hazards due to improper BMWM was found to be 80%. In our study 88% doctors were aware of the same which is contrast to study done by Narang et al where 100% were aware. All participants heard about BMW management which is similar to Chudasama et al, Madhuri et al who also found 95.4% and 94.8% of the population knew about Management respectively. About 44% of them knew about bleaching solution use for disinfection whereas 58.2% knew that 1% hypochlorite solution use for disinfection. 75.44% knew about presence of poster in wards, laboratories etc. which is similar to study of Chudasama et al which showed 81.2% of study population knew about posters. Only 10.5% participants knew about the time limit of 48hrs set by national authorities for infectious BMWs to be kept in hospital premises. Posters of segregation of BMW according to color codes were provided by the authority. All bins were found to be covered with lids and none were left open in wards. In all the wards proper sharps disposal and disinfection with 1% hypo chloride or bleaching powder was done. Safe PPM practice was conducted by all the participants. Biohazard and cytotoxic symbols were identified by 83% and 76% respectively in our study which is higher than studies conducted by Sanjeev et al and Madhuri et al who showed 64% and 65.2% respectively. Approximately 71% and 45% had clarity of sharps waste disposal and changed specification of BMW bags respectively. 15.1% of them preferred black and blue containers for disposal of sharps.

In our study doctors had very casual approach towards segregation of waste (66%) which is in contrast to study of Selvarej et al (98%). It may be due to overloading of emergency and OPD overloading with patients which gives doctors no choice but to give priority to patients first than waste segregation.

Conclusion

This study shows that Doctors, nurses and laboratory technicians all had knowledge and awareness regarding revision of biomedical waste management rules in 2016, but laboratory technicians are lagging in practicing them. Importance of training cannot be overemphasized so, there should be strict implementation of rules by healthcare facilities and continuous training of healthcare personnel should be done. Injuries to staff due to sharps should be reported to in-charge of BMWM and they report it to pollution control board. Most medical waste is being incinerated this practice is short lived because of environmental considerations. The burning of solid and regulated medical waste generated by healthcare system creates many problems such as emitting toxic air pollutants and toxic ash residues, which are the major source of dioxins in the environment. Public concerns about incinerator emissions and its toxic emissions, as well as the creation of strict regulations for medical waste incinerators, are causing many healthcare facilities to reconsider their choices in medical waste treatment. The newer non-incineration treatment technologies can be adapted to create a toxin-free environment. Adequate equipments and supplies should be provided to all departments for proper care of wastes. Public and private sectors should be incorporated into this matter for better management of waste.

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References

1. Ministry of Environment and Forests, Notification N. S.O.630 (E). Biomedical Waste (Management and Handling) Rules, 1998. The Gazette of India, Extraordinary,
Part II, Section 3(ii), Dated 27th July, 1998. p. 10-20, 460.
2. Ministry of Environment, Forest and Climate Change (2016). The gaete of India. Extraordinary Part 2, Section 3(1). New delhi:controller of publications pp.1-63.
3. Sehgal RK, Garg R, Dhot PS, Singhal p. A study of knowledge, attitude and practices regarding biomedical waste management among the health care workers in a multispeciality teaching hospital at Delhi. Int J Med Sci Public Health 2015;4(11):1540-4.
4. Bhagwati G, Nandwani S, Singhal S. Awareness and practices regarding biomedical waste management among health care workers in a tertiary care hospital in Delhi. Indian J Med Microbiol 2015;33(4):580-2.
5. Mathew SS, Benjamin AI, Sengupta P. Assessment of biomedical waste management practices in a tertiary care teaching hospital in Ludhiana Healthline.2011;2(2):28-30.
6. Madhukumar S, Ramesh G. Study about awareness and practices about health care waste management among hospital staff in a medical college hospital, Bangalore. Int J Basic Med Sci.2012;3(1):7-11.
7. Chudasama RK, Rangoonwala M, Sheth A, Misra SK, Kadri AM, Patel UV. Biomedical waste management: A study of knowledge, attitude and practice among health care personnel at tertiary care hospital in Rajkot. J Res Med Dent Sci 2013;1:17-22.
8. Madhavi KV, Reddy BC, Ravikumar BP. Awareness Regarding Biomedical Waste Management among Interns in a Tertiary Health Care Hospital, Khammam. J Evol Med Dental Sci. 2:5360-5365.
9. 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;13:1-12.
10. Narang Rs, Manchanda , Singh S, Verma N, Padda S. awareness of biomedical waste management among dental professions and auxiliary staff in Amritsar, India. Oral Health Dent Manag 2012;11:162-8.
11. Gautam V, Thapar R, Sharma M. Biomedical waste management: Incineration vs. environmental safety. Indian J Med Microbiol 2010;28:191-2. [PUBMED] [Full text]
12. Selvaraj K,Sivaprakasam P, Nelson SB, Kumar GH, Norman P, Pandiyan KR, Knowledge and practice of biomedical waste(BMW) Management among the medical practitioners of Kanchipuram Town, India. Int J Curr Microbiol Appl Sci 2013;2:262-7.