International Surgery Journal
Yadav A et al. Int Surg J. 2020 Jan;7(1):235-239
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20195976

Original Research Article

Feckless practices of bio medical waste management: a conundrum for developing countries

Anand Yadav[1], Rituja Kaushal[2]*

[1]Department of General Surgery, [2]Department of Community Medicine, LNMC and RC, Bhopal, Madhya Pradesh, India

Received: 02 December 2019
Revised: 15 December 2019
Accepted: 17 December 2019

***Correspondence:**
Dr. Rituja Kaushal,
E-mail: dr.rituja@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Biomedical waste poses hazard due to two principal reasons: infectivity and toxicity. 75-90% of waste produced by health care facilities is generally non risky but remaining 10-25% is regarded as hazardous with the potential for creating a variety of health problems. Biomedical waste management is an integral part of infection control practices. Virtuoso biomedical waste handling leads to a better environment for medical as well as surgical care patients.
Methods: It is a descriptive forward moving study conducted to empower first year MBBS students about biomedical waste management and handling skills to enhance their expertise for future as a competent physician or surgeon and to assess their knowledge gain.
Results: Out of 150 students, 131 were present. 68 were males and 63 were females. Mean age was 21.33 with standard deviation of 3.745. Mean marks obtained were 3.09±1.15 (out of 5). ANOVA statistics revealed insignificant p value denoting unambiguous pattern of knowledge gain by all the participants.
Conclusions: Empowering medical undergraduates with basic medical skills at an early stage will make them more efficient for future endeavors.

Keywords: Biomedical waste management, 2016 rules, Medical education, Bhopal

INTRODUCTION

Bio-medical waste (BMW) means "any waste which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities or in production or testing of biological etc." Biomedical waste poses hazard due to two principal reasons: infectivity and toxicity. 75-90% of waste produced by health care facilities is generally non risky but remaining 10-25% is regarded as hazardous with the potential for creating a variety of health problems.

In India, Ministry of Environment, Forest and Climate change amended and enforced the "parent rules" of bio medical waste management (BMWM) in 2016 for various health care facilities (HCFs). Yet again, in February 2019, to improve compliance and strengthen the implementation of the policy for environment viability certain issues were incorporated. As per a joint report by Associated Chambers of Commerce and Industry of India (ASSOCHAM) and Velocity in 2018, the total quantity of medical waste generated in India is 550 tonnes per day (TPD), and these figures are likely to increase close to 775.5 TPD by 2022. Because of this looming concern, 199 common biomedical waste treatment facilities (CBWTFs) are in operation and 23 and many more are under construction. Director General of Health Services of the Delhi Government said that waste management

market in India is expected to reach USD 13.62 billion by 2025, so there is a need for education regarding the hazards associated with improper waste management. In addition to health risks due to inadequate waste management, its impact on environment, especially to the risks of pollution of water, air and soil in developing countries must also be considered. Improper handling and disposal of biomedical waste can cause the spread of deadly infections like HIV, AIDS, hepatitis, besides respiratory and gastrointestinal infections. This waste is actually a ticking bomb that the population has been sitting on it. The safe and sustainable management of BMW is social and legal responsibility of all people supporting and financing health-care activities. Under new rules, coverage has elaborated to include various health care related camps as immunization camps, blood donation camps and surgical camps etc.[1] Effective BMWM is mandatory for healthy humans and cleaner environment.[1] Virtuoso biomedical waste handling leads to better environment for medical as well as surgical care patients. If this all is done in a sophisticated enough manner, the intelligentsia will buy into it, and the people will follow. In this way medical field vanguard, will finally liberate itself from the topsy-turvy octopus of unhygienic practices.

Table 1: Color-coded display of 4 categories of BMW (customized version of BMWM manual of AIIMS, Delhi).[10]

S. no	Category	Type of waste	Type of bag/container to be used
1.	Yellow	a) Human anatomical wastes: human tissues, organs & body parts. b) Animal anatomical waste: animal waste used in experiments/testing etc. c) Soiled waste: items contaminated with blood/other body fluids like dressings, plaster casts, cotton swabs & bags (containing residual/discarded blood & blood components). d) Expired or discarded medicines including all items contaminated with cytotoxic drugs.(to be assembled in separate labelled yellow bags/bins) e) Chemical wastes: chemicals used in production of biological & used/discarded disinfectants. f) Discarded linens, beddings contaminated with blood or body fluids. g) Microbiology, biotechnology and other clinical laboratory waste: cultures, specimens/stocks of microorganisms, vaccines, human/animal cell cultures, residual toxins, dishes & devices used for cultures, blood bank bags etc. (pretreated/autoclaved as per NACO guidelines) OR to be disposed in autoclave safe plastic bags or containers. h) Chemical liquid wastes: X-ray film developing liquid, discarded formalin, infected & aspirated body fluids, liquids from labs & housekeeping & disinfecting activities etc. (Separate collection system leading to effluent treatment plant)	Yellow colored non chlorinated plastic bags.
2.	Red	Contaminated waste (recyclable): waste generated from disposable items (plastics, rubber, latex) such as tubings, bottles, IV tubes & sets, catheters, urobags, syringes (without needles) & fixed needle syringes, gloves, vacutainers etc.	Red colored non chlorinated plastic bags or containers.
3.	White	Waste sharps including metals: needles, syringes with fixed needles, scalpels, blades or any other contaminated sharp object that may cause puncture & cuts. This includes used, discarded and contaminated sharps.	Puncture proof, leak proof & tamper proof containers.
4.	Blue	Glass: broken or discarded or contaminated glass except those contaminated by cytotoxic drugs. Metallic body implants	Cardboard boxes with blue colored marking.

Segregation, collection, storage, transportation and disposal should be followed in stepwise recommended manner as per schedule 1. Points mentioned in schedule 3 should also be taken care. Pretreatment of biomedical waste is to be customized as per requirement to avoid accidents, needle stick injuries etc.[2]

Alternate technologies, use of non poly vinyl chloride medical devices and development of newer novel, ecofriendly systems for disposal should be encouraged.[2]

There is a pecking order of waste pyramid. The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of waste. It can help prevent emissions of greenhouse gases, reduces pollutants, save energy, conserves resources, create jobs and stimulate the development of green technologies. Every health personnel is expected to have proper knowledge about collection, handling and disposal of BMW. For this to happen, a proper effort has to be made from physicians to ward boys including medical students.

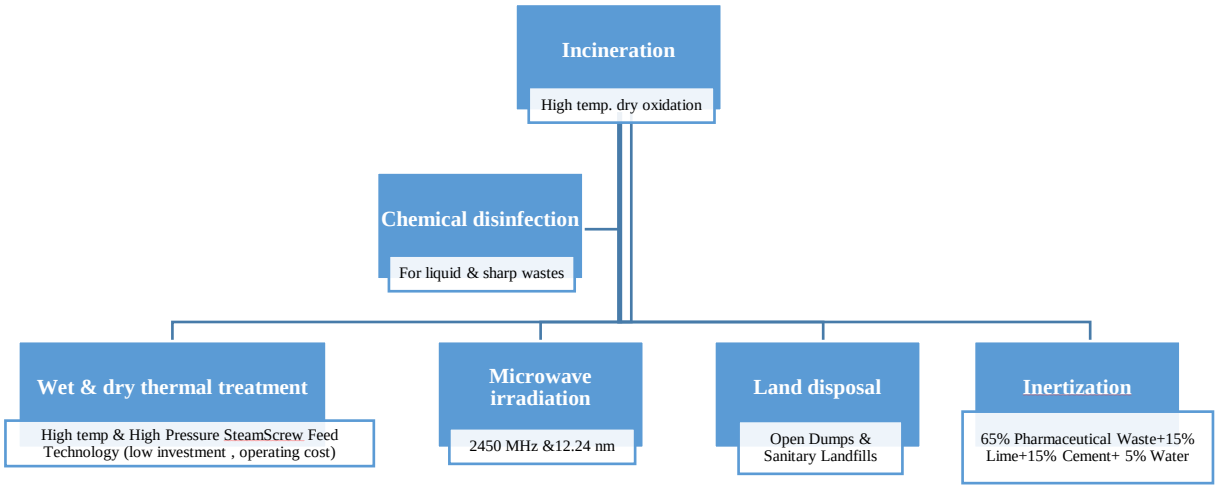

Figure 1: Treatment and disposal technologies for health care waste.

So to solve this perplexing enigma up to some extent, biomedical waste management topic has been introduced in foundation course of first year MBBS under competency based medical education (CBME) to make students aware about it at an early stage.

Aims and objectives

The aims and objectives of the study was to empower first year MBBS students about biomedical waste management and handling skills; to assess knowledge gain, in terms of their level of perception about biomedical waste management and handling practices by viva-voce (assessment tool); to analyze any difference in scoring pattern amongst 3 groups of students in view of cheating, exchange of information and flaws in framing viva questions of different weightage.

METHODS

It is a descriptive forward moving study conducted in LN Medical College of Bhopal city, to analyze any difference in mean scores of obtained marks for 3 groups of students of same batch with assessment done on three different consecutive dates. Study was conducted in the month of September-October 2019. Target population was first year MBBS students attending Foundation Course of CBME. Teaching material was primarily taken from textbook of Park's BMW chapter and authentic websites of internet. Total number of enrolled participants was all 150 students (non probability/purposive sampling). This study was designed to meet all the pre decided objectives. Study was done in a tertiary care medical center after imparting a didactic lecture (large group teaching-learning method) and demonstration (small group teaching-learning method over a group of 50 each) on BMWM rules 2016 along with amendments. To reduce biases, inclusion and exclusion criteria were framed and matched in advance. Same faculty took the theory as well as practical classes on different dates. All students who have attended both the teaching sessions and were present for the assessment were included in the study. Preferred assessment tool was viva voce. Questions of similar weightage and of same difficulty level were framed to be asked by students of 3 batches on three different dates. In view of quantitative data, excel spreadsheets were chosen for data entry and statistical calculations. Mean, standard deviation and ANOVA (analysis of variance) were the analytical statistical tools which were used to interpret methodically the differences among group means in a sample. Study was conducted after taking due permission from institutional ethical committee. Verbal consent was also taken and confidentiality of data was maintained.

RESULTS

Out of 150 students, 131 were present. 68 were males and 63 were females. Mean age was 21.33 with standard deviation of 3.745. Presence of students as per set protocol was not followed and on consecutive test days 46, 25 and 60 students made the attendance respectively. Mean marks obtained were 3.09±1.15 (out of 5). Findings of ANOVA test statistics were as below.

Table 2: Distribution of outcome parameters of sample population as per ANOVA statistics.

Groups	Students present for the test (day wise)	Cumulative marks obtained by students present	Average of marks obtained out of 5	Variance
1st day marks	46	148.5	3.228261	1.018961
2nd day marks	25	83.5	3.34	1.848333
3rd day marks	60	173.5	2.891667	1.331285

Input variable was a set of questions of equal weightage (from the topic) and was used as assessment tool.

Table 3: ANOVA statistics results.

Source of variation	Sum of squares within groups	Degree of freedom	Mean square within groups	F value	P value	F critical value
Between groups	4.79816	2	2.39908	1.81965	0.16625	3.06695
Within groups	168.759	128	1.31843			
Total	173.557	130				

DISCUSSION

Government of India notified first BMW rules in July 1998, by the erstwhile Ministry of Environment and forest.[3] Presence of scavengers who sort out open, unprotected health-care waste with no gloves, masks, or shoes for recycling, and second, reuse of syringe without appropriate sterilization etc further commixture the BMW dicey situation, in India.[4]

During 2002-2004, International Clinical Epidemiology Network probed the status in quo of BMW practices, setup, and framework in primary, secondary, and tertiary HCF in India across 20 states.[5] They found that around 82% of primary, 60% of secondary, and 54% of tertiary HCFs in India had no convincing and trustworthy BMWM system. In 2009, around 240 people in Gujarat, India contracted hepatitis B following reuse of unsterilized syringes.[6] This and many more studies shows that despite India being among the first country to initiate measures for safe disposal of BMW, there is an urgent need to take action for strengthening the existing system capacity, increase the funding and commitment toward safe disposal of BMW. These findings of various surveys and research studies indicates that there is a dire urgency to teach various professionals engaged in health care sector about it and to check the devoir properly carried out.

A study of Gujarat revealed that there is lack of knowledge about waste management among the doctors, which affects the safe practices for management. Authors recommended policy makers to endorse vigorous training programs for the doctors and the supportive staff, to hardware the problem. It was recommended in the study that this subject is to be included in the curricula of medical education.[7-9]

Based on above iterations of various studies and the way they have endorsed, we tried to empower our MBBS undergraduates at the very blossoming stage to safe guard against this peril.

Inferences obtained from our study are matching with the set objectives. Questions of our study are related to new BMW rules, bio hazard symbol, category of BMW, segregation at source, color-coding of bags, pre-treatment, various methods of final disposal and health problems related to BMW were asked. Majority of questions were framed from schedule 1 and 3 of BMW management rules 2016. Knowledge gained by the students was found to be moderately satisfactory. As our F value is less than F critical value, we couldn't reject the null hypothesis. It means that in all three groups, there was almost normal distribution of knowledge gain amongst students. Also as p value is non-significant, cheating or passage of information about viva questions asked from preceding batches to later batches could be ruled out. It also denotes that questions included in viva voce were of almost equal weightage.

There is a difference between hospital waste and biomedical waste. Hospital waste refers to all waste, biological or non-biological that is discarded and not intended for further use.

As per new definition, bio-medical waste means 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 biological, and including categories mentioned in Schedule I, of the BMW rules, 2016.

The major salient features of BMW management rules, 2016 include the following:

- The ambit of the rules has been expanded to include vaccination camps, blood donation camps, surgical camps or any other healthcare activity;
- Phase-out the use of chlorinated plastic bags, gloves and blood bags within two years;
- Pre-treatment of the laboratory waste, microbiological waste, blood samples and blood bags through disinfection or sterilization on-site in the manner as prescribed by WHO or NACO;
- Provide training to all its health care workers and immunize all health workers regularly;
- Establish a Bar-Code System for bags or containers containing bio-medical waste for disposal;
- Report major accidents;
- The new rules prescribe more stringent standards for incinerator to reduce the emission of pollutants in environment;
- Existing incinerators to achieve the standards for retention time in secondary chamber and Dioxin and Furans within two years;
- Bio-medical waste has been classified in to 4 categories instead of 10 to improve the segregation of waste at source;
- Procedure to get authorization simplified. Automatic authorization for bedded hospitals. The validity of authorization synchronized with validity of consent

orders for Bedded HCFs. One time Authorization for Non-bedded HCFs;

- No occupier shall establish on-site treatment and disposal facility, if a service of `common bio-medical waste treatment facility is available at distance of seventy-five kilometers.
- Operator of a common bio-medical waste treatment and disposal facility to ensure the timely collection of bio-medical waste from the HCFs and assist the HCFs in conduct of training.[10]

As per energy security and sustainable development, analysis of the synergies between waste to energy, and 3R (reduce, reuse, and recycle of waste) is to be explored like that of municipal waste. This all is linked to goal 7, 11 and 12 of the sustainable development goals. Treatment and disposal options should be adequate for all infectious waste, have very high disinfection efficiency, have low investment and operating costs, inexpensive and environmentally sound with no need for highly trained operators.

CONCLUSION

It has been found that sensitization about biomedical waste related risks and its appropriate management at an early stage of MBBS course, will make medical students more alert about its hazards and will help them to inculcate the skills of competency based learning for future corrective and preventive measures regarding HCFs waste management. They will develop a better leadership as head of any health care unit to guide their subordinate staffs for tackling health care facility waste problems in a skillful way.

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

REFERENCES

1. Datta P, Mohi GK, Chander J. Biomedical waste management in India: Critical appraisal. J Lab Physicians. 2018;10(1):6-14.
2. Park K. Park's Textbook of Preventive and Social Medicine. India: M/s Banarsidas Bhanot Publishers; 2017.
3. Bio-Medical Waste (Management and Handling, 1998) Rules. New Delhi: Government of India Publications; 1998. Ministry of Environment and Forests Notification; 1998: 276-284.
4. WHO. Review of Health Impacts from Microbiological Hazards in Health-Care Wastes. Geneva: World Health Organization; 2004.
5. INCLEN Program Evaluation Network (IPEN) Study Group, New Delhi, India. Bio-medical waste management: Situational analysis & predictors of performances in 25 districts across 20 Indian states. Indian J Med Res. 2014;139:141-53.
6. Seetharam S. Hepatitis B outbreak in Gujarat: A wake-up call. Indian J Med Ethics. 2009;6:120-1.
7. Pandit NB, Mehta HK, Kartha GP, Choudhary SK. Management of Bio-medical Waste: Awareness and Practices in a District of Gujarat. Indian J Public Health. 2005;49(4):245-7.
8. 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.
9. Chouhan AS, Chauhan SR, Pati S, Pati SM. Teaching of biomedical waste in India: A mapping exercise. Ntl J Community Med. 2016;7(5):386-90.
10. Available at: https://aiims.edu/en/departments-and-centers/central-facilities/265-biomedical/7346-bio-medical-waste-management.html. Accessed on 25 November 2019.

Cite this article as: Yadav A, Kaushal R. Feckless practices of bio medical waste management: a conundrum for developing countries. Int Surg J 2020;7:235-9.