

## Original Research Article

# Assessment of biomedical waste management of a multispeciality hospital in the light of new BMW rules 2016: what has changed from the past?

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## ABSTRACT

**Background:** The hierarchies of Bio-Medical Waste (BMW) is largely based on the concept of the “3Rs”, namely reduces, reuse and recycle, and broadly relates to the sustainable practice of resources. The objectives of the study were to assess the Bio-Medical Waste (BMW) Management operating system in a multispecialty hospital and discuss the situation in terms of newly introduced BMW Rules 2016.

**Methods:** A hospital based cross-sectional study was carried out by collecting data by means of independent surveys involving on-ground operating system of BMW management across different wards, outpatient departments, emergency departments, intensive care units and laboratories in the hospital.

**Results:** The hospital was following Bio Medical Waste (Management and Handling) Draft rules, 2011 in the management of BMW. All the wastes were categorized into 8 categories as per 2011 draft rules. Efficient waste segregation, collection, storage, transport and waste treatment were followed as per norms with regular training of all health care workers under the close supervision and monitoring by dedicated BMW management committee. The hospital was registered for BMW management and renewal was being carried out every three years.

**Conclusions:** It can be concluded that the hospital had an efficient and a well-organized BMW management system in place that was even conforming to the latest BMW Management Rules 2016 to some extent. Moreover, the hospital could upgrade the techniques of BMW management as per the newly introduced latest guidelines. As far as the categorization of BMW is concerned, it has to be changed accordingly to the new rules. Needless to say, a regular training and monitoring of BMW Management at all hospitals is the need of the hour and has a long way to go for environmental and human health.

**Keywords:** Bio-medical waste, Hospital, Environment

## INTRODUCTION

Healthcare sector in India has continuously revolutionized with the ever growing urbanization. On

one hand, access to state of the art healthcare services is being provided to the community thereby resulting in the better health for all. While, on the other hand, an improper management of biomedical waste (BMW)

emanating from these healthcare establishments has also been responsible for many environmental and health problems. The latter has probably negated the benefits of the expanding health sector.<sup>1</sup> BMW is a by-product of healthcare practices that includes sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals, medical devices and radioactive materials. In other words, it includes all kinds of waste generated by health care establishments, research facilities, and laboratories including minor or scattered sources such as treatment taken at home e.g. insulin injection.<sup>2</sup>

BMW is a universal problem. Today, with increasing number of health care institutions and careless attitude of health care personnel, the disposal of waste has become even more challenging. Nonetheless, establishment of a waste treatment facility by individual hospitals or nursing homes is a costly issue. Daily operation of medical activities, mass immunization campaigns and even in emergency situations, good health care waste management (HCWM) is crucial to prevent the exposure of health-care workers, patients, waste handlers and the community to infections, toxic effects and injuries.<sup>2</sup> Hospitals are required to ensure proper segregation, treatment and disposal of BMW and adhere to prescribed limit of 48 hours for lifting of waste generated in hospitals which don't have on site treatment facilities as per BMW (management and handling) rules 1998 and draft rules, 2011. Despite availability of trained personnel, implementation of these rules has been found to be inadequate. Therefore, the hospital authorities should take sufficient measures to change the attitude of the healthcare personnel and ensure availability of necessary personal protective equipments. Moreover, making public aware and encouraging participation of citizens in BMW management policy implementation will surely go a long way.<sup>2</sup>

World Health Organization (WHO) reported that serious injuries are frequently caused by contact with flammable, corrosive or reactive chemicals in medical waste.<sup>3-5</sup> A WHO report claimed that in the year 2000, 21million people were infected with Hepatitis B, 2 million people with Hepatitis C and 260,000 people with HIV in the world due to contaminated needle stick injuries.<sup>6</sup> Tamplin et al and Patwary et al found that improper clinical solid waste management practices impact healthcare staffs, patients and hospitals environment both directly and indirectly.<sup>7,8</sup> Therefore, segregation, collection, treatment and disposal of BMW in a suitable way is of great importance as it can considerably reduce damage to flora, fauna and environment.<sup>9,10</sup> An efficient BMW management helps in controlling nosocomial diseases (hospital acquired infections), reduce community exposure dramatically to HIV/AIDS and Hepatitis transmission from dirty needles and other inaccurately cleaned medical items. Also, it cost-effectively addresses health care worker safety issues, including the risk of needle stick injuries, controlling zoonosis (diseases passed to humans through insects, birds, rats and other animals), preventing illegal repackaging and resale of

contaminated needles and complementing the protective outcomes of universal hand washing. Hence, effective BMW management aids in avoiding long-term health effects like cancer and environmental release of toxic substances such as dioxin, mercury and others.<sup>2</sup>

### ***The waste-management hierarchy***<sup>11</sup>

Protecting public health through the management of BMW can be achieved by a variety of methods. These can be summarized in an order of preference called the 'waste hierarchy', with the most desirable method at the top to the least desirable at the base. 'Desirability' is defined in terms of the overall assessment of each method from its particular impact on the environment, public health, financial affordability and social acceptability. The waste-management hierarchy is largely based on the concept of the "3Rs", namely *reduces*, *reuse* and *recycle*, and broadly relates to the sustainable practice of resources. The best practice in waste management will aim to avoid or recover as much of the waste as possible in or around a health-care facility, rather than disposing it by burning or burial. This is sometimes described as tackling waste "at source" rather than adopting "end-of-pipe" solutions.

### ***BMW management in India***

BMW (management and handling) rules 1998, formulated by Ministry of Environment and Forests, Government of India (GOI) came into force on 28 July 1998. The rules applied to all those who generated, collected, received, stored, disposed, treated and handled BMW in any manner. These rules had been promulgated as a legislative responsibility of all healthcare establishments. Under the Environment Protection Act 1986, these BMW have been categorized into 10 categories for the purpose of safe disposal. As per BMW rules 2011, these categories were further amended to eight for easier disposal by health care workers. Currently, BMW rules (management) rules 2016 are introduced.<sup>12,13</sup> The rules further clarified the definition of BMW thereby including vaccination camps, blood donation camps, surgical camps or healthcare activities under taken outside the healthcare facility. It envisaged the health care facilities (HCF) to make a provision within their premises for a safe, ventilated and secured location for storage of segregated biomedical waste. It further states pre-treatment of laboratory and microbiological waste, blood samples and bags through disinfection on-site in the manner as prescribed by WHO or National AIDS Control Organisation (NACO) guidelines and then sent to the common bio-medical waste treatment facility for final disposal. Interestingly, it phases out use of chlorinated plastic bags, gloves and blood bags two years from the date of notification of these rules. It further highlights the importance of training and immunization of healthcare workers. It further promulgates establishment of bar code system for disposal of BMW. The earliest reporting of both major and minor accidents has also been given due significance.

Considering the treatment and disposal of BMW, the healthcare facilities are directed to avoid constructing onsite facility if such facility is available within 75 km distance. As per BMW Rules 2016, the wastes would be categorized into four categories based on treatment modality. The standards of emission from incinerators have also undergone a change from 150 mg/nm<sup>3</sup> to 50 mg/nm<sup>3</sup> with an increase in residency time from 1 second to 2 second that will lead improve the operation and reduce emission of pollutants in surroundings. The rules also envisage standards for dioxin and furans which are potential environmental pollutants. The BMW rules 2016, for the first time, highlights the monitoring for implementation of guidelines with Ministry of Environment, forest and climate change being at the apex and District Level Committee with Medical Officer at the base.<sup>12,13</sup>

In view of the importance of an effective BMW management system by the review of literature, regular monitoring of health care facilities in terms of segregation, collection, transfer or treatment of biomedical waste is the need of the hour so that the current environmental situation can improve. Therefore, this study has been carried out with the objective to assess the BMW management operating system in a multispecialty hospital and discuss the situation in terms of newly introduced BMW rules 2016.

## METHODS

We carried out a hospital based cross-sectional observatory study at one of the Multi-speciality hospitals in eastern India. The index multispecialty hospital under study was a 250 bedded setting with laboratory and OT facilities. The study was carried out by collecting data by means of independent surveys of an existing BMW facility involving on-ground operating system of BMW management (including segregation, collection, treatment and disposal of BMW) across different wards, outpatient departments, emergency departments, intensive care units and laboratories so as to cover the entire hospital and all waste generating points were surveyed once. The inspection was done by researcher himself along with hospital administration staff and it was surprise survey without prior intimation to hospital staff except that administrative authorities who were informed half an hour before for taking due permission. The observation was carried out based upon the checklist formulated by experts one in the field of public health, hospital administration and pathology department keeping in view the BMW management guidelines.

## RESULTS

The facilities available in the hospital are as shown in the Table 1 with category wise quantity of waste generated (per month) as shown in Table 2. The details of BMW treatment facilities available in the hospital are shown in Table 3.

**Table 1: Facilities available in the hospital.**

Facility available	
Emergency dept	Medical Dept
Operation theatre	Surgical Dept
Laboratory	Eye Dept
Blood transfusion dept	ENT Dept
Vaccination centre	Pediatrics' Dept
Health Section	OBG Dept
Physiotherapy	Radiology Dept
Respiratory medicine dept	

The hospital was following BMW (management and handling) draft rules, 2011 in the management of biomedical wastes. All the wastes were categorized into 8 categories as per 2011 draft rules.

### Waste segregation

The hospital firmly followed waste segregation at the point of generation like in accidental and emergency services department, laboratory, blood transfusion department, OT, medical and surgical wards etc. The entire segregation responsibility was given to the healthcare personnel who generated the respective waste. All the departments and wards were provided with four color coded containers with BMW symbol clearly depicted on them. Moreover, well laminated huge posters were required to be placed over the walls and just above the four colour coded containers. The latter posters depicted the waste categories (in local language as well as in English) and segregation codes for the convenience of the generators. Monthly report of waste generation was checked. Waste generated by this hospital was 0.04 kgs/day/bed.

### BMW collection

The BMW were collected as per specified container, colour and type of plastic bags as per BMW (management and handling) draft rules, 2011. The red coloured bags were used for those wastes which had to be sent for microwave / chemical treatment provided by the manufacture. Every time it was ensured that waste bags were filled only up to 3/4<sup>th</sup> so that they could be easily tied up and there was no overflow. At the end of day, the waste generated were packed and weighed and register of waste generation was maintained. The bags in the respective containers were replaced every day and on a weekly basis (once/ twice) the bins were regularly disinfected.

### Waste storage

All the wastes generated are stored for maximum of 24 hours at the site of generation and standard guidelines of not storing for more than 48hrs is followed very strictly.

### Transport

The time schedule was fixed for the transport of waste generated within the hospital. All the biomedical waste generated was collected in the morning hours between 0800h-1000h by a fixed four member team while the

general wastes was collected in the evening. The team members wore proper personal protective equipments while transporting the segregated wastes to the common area where the treatment was carried out. Two specially designed carts depicting the BMW hazard symbol were dedicated for transportation.

**Table 2: Category wise quantity of wastes generated (per month).**

Cat – 1	Cat – 2	Cat -3	Cat -4	Cat -5	Cat -6	Cat -7	Cat -8
110 kg	-	60 kg	03 kg	02 kg	45 kg	45 kg	15 kg

**Table 3: Details of treatment facilities available.**

S No	Eqpt/facilities	Qty	Capacity
(a)	Incinerator oil fired	01	100 kg/hour
(b)	Shredder	01	25 kg/hour
(c)	Needle/syringe destroyer	15	-
(d)	Microwave	01	2.5 kg/cycle 30-40 min/cycle
(e)	Deep burial	01	-
(f)	Chemical treatment	-	-
(g)	Secured land fill	01	-

**Table 4: Waste segregation pattern followed in the hospital.**

Colour	Container	Category
<b>Blue (Sharp waste)</b>	Blue plastic bag in plastic bin	Broken glasses, needles, syringes, scalpels blades etc.
<b>Red (Infectious Non sharp waste)</b>	Red plastic bag in plastic bin	Soiled cotton, gauzes, catheters, IV tubing etc.
<b>Yellow (Organ and tissue waste)</b>	Yellow plastic bag in plastic bin	Human tissues, organs, body parts, placenta, pathological and surgical waste, microbiology and biotechnology waste.
<b>Black (General waste)</b>	Black bag in plastic bin	General paper waste; and also kitchen waste, that is disposed separately.

### Hospital waste treatment

There was no common BMW management facility in the vicinity of the hospital. However there were multispecialty hospitals which had their own hospital waste treatment plant.

**General waste:** The non-infectious, non-toxic and non-hazardous wastes were being disposed off by means of municipal authority vans. These wastes were collected by evening and transported next morning at the earliest by means of municipal vehicles (trucks/vans).

**Biomedical wastes:** The hospital had set up a dedicated BMW cum treatment plant around 600 m distance from the main hospital complex but within the campus. It comprised of incinerators (two types - oil fried and open type), autoclave, microwave, shredder, large pits for disposal off sharps after chemical treatment with 2% hypochlorite. Chlorinated plastics were not being incinerated. All plastics including i.v. sets, bottles, catheters, syringes are being chemically treated / microwaved and then shredded. Needle cutters were being placed at each ward and department for earliest

disposal. In the end, all the needles after chemical treatment were disposed of in needle pits that were constructed separately. All the incinerator ash, cytotoxic/discarded medicines were disposed off by means of secured landfill. Oil fired Incinerator has automatic solid waste feeding and ash removal systems and conforms to standards of central pollution control board (CPCB) and suitable for a wide range of wastes while the open one was used rarely. Considering the environmental effects and pollutions norms for incinerators, the hospital authorities are planning to have a common point in consultation with nearby multispecialty hospitals so that disposal becomes more economical although the location of hospital is far away from the city and both the incinerators have their annual maintenance contracts and annual report as per pollution control board format is been filled every year and renewal of registration been carried out every three yearly.

### Training

As per the hospital authorities, training of all health care workers were done regularly as per health worker category and initial training was the responsibility of the

department while monitoring and regular training is by the BMW management committee of the hospital.

### **Management and administration**

A dedicated BMW management committee was established with head of the hospital as chairmen and 06 other members were constituted for proper planning, implementation, monitoring and evaluation of BMW management in the hospital. The latter committee met on a regularly basis. Annual and quarterly BMW management reports were generated and sent to the appropriate authority.

BMW management committee was continuously monitoring the BMW management. Moreover BMW segregation, collection, transport, treatment and disposal were done sincerely.

### **DISCUSSION**

It was noted from reports and on ground visit that the total amount of waste generated was 0.04 kg/day/bed which was much less mainly because the bed occupancy for that particular month was only 60%. At the national level, it is estimated that waste generated is 1-2 kg per bed per day in a hospital and 600 gm per day per bed in a clinic while in developed countries due to increased use of disposables the waste produced has been up to 5.24 Kgs, In hospitals of United Kingdom, France, Norway, Spain, Netherlands, USA and Latin America, waste produce is 3.3 kg, 2.5 kg, 3.9 kg, 4.4 kg, 4.2 kg, 4.5 kg and 3.8 kg per bed per day respectively.<sup>14-16</sup>

Our findings of working of management committee is also reflected by another study carried out at Dr RML hospital in Northern India where a well-established infection control committee was formulated which dealt with the issues related to bio-medical waste management so that the healthcare staff was well aware of good bio-medical waste management practices and hazards caused due to improper handling and spill management.<sup>17</sup> Another study conducted by Kumari et al also revealed that a dedicated bio-medical waste management committee is instrumental in effective waste disposal.<sup>18</sup> Our study also observed on the job HCWs who were available at the hospital during the study period and reflected good ground practices. It also reflects impact of periodical training of HCWs on good BMW management system. Contrastingly, a study carried out in dental hospital revealed an impending need of stringent regulations for the disposal of BMW in order to create a better environmental management system.<sup>19</sup> Moreover, the latter study has shown a lower awareness level in all the categories of healthcare personnel. Similar to our findings, a study carried out in tertiary care hospital in Rajkot, India reflected the significance of training on bio medical waste management.<sup>20</sup>

Recently, BMW management rules 2016 were proposed which had further clarified the applicability and clearly defined the guidelines. BMW rules 2016 envisages provision of a safe, ventilated and secured location within the premises of a health care facility for storage of segregated BMW. This has been observed to be appropriate for our study setting as well. It also envisages pre-treatment of wastes (as per WHO or NACO guidelines) before sending to BMW treatment facility. This has also been found to be true as per our study setting. As far as use of chlorinated plastic bags is concerned, the study hospital was well aware of periodical changing of bags though the timeline was not known to them. As far as training of health care personnel is concerned, the same fact has already been emphasized above. The hospital was reporting accidents caused by fire hazards and during handling of BMW (though there had not been any). The existing incinerators were conforming to the standards as set by State Pollution Control Board. As far as the current rules for treatment and disposal of BMW are concerned, the hospital had BMW treatment facility already in place its complex. Considering the categories, the BMW were classified into 8 categories instead of 4 (as per the BMW rules 2016).<sup>12,13</sup>

### **CONCLUSION**

It can be concluded that the hospital had an efficient and a well-organized BMW management system in place that was even conforming to the latest BMW Management Rules 2016 to some extent. Moreover, the hospital could upgrade the techniques of BMW management as per the latest guidelines. As far as the categorization of BMW is concerned, it has to be changed accordingly. Needless to say, a regular training and monitoring of BMW management at all hospitals is the need of the hour and has a long way to go for environmental and human health.

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