



An Insight into the Bio Medical Waste Management Status of Alwar using Indicators and Sub-Indicators

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Abstract

The United Nations in 2015 adopted seventeen sustainable development goals among which good health and wellbeing for all is one of them to be achieved by 2030. Thus, continuous improvements in the health sector have become the primary focus of governments around the globe. The irony is that the medical sector which are our main agencies of health have become a major source of infectious pollutants due to the byproducts released from them after the utilization of these services. The waste generated from health care facilities is called bio medical waste in India; though it has various terminologies which are used widely in different countries across the globe making it all the more complicated to be handled. Already bio medical waste has been regarded as the second most hazardous waste after radioactive waste thus making it essential to be regularized by rules and regulations. Such rules are found to exist all around the world. But the poor management of bio medical waste in developing countries raises some pertinent questions regarding the enforcement of these rules. We through our article are presenting the important parameters that can be a boon for the sustainable management of bio medical waste. These parameters are called indicators or sub indicators and are six in number and indicate how efficiently a health care facility is managing its bio medical waste.

Keywords

health, sustainable development, bio medical waste, bio medical waste management, indicators.

1. Introduction

The waste that is generated during diagnosis/treatment from health care facilities be it hospitals, nursing homes, dispensaries, outpatient service providers, diagnostic centres, research laboratories, immunization camps, blood banks is termed as



Bio Medical Waste (BMW) which can be solid or liquid". 85% of BMW is General waste but the quantity of BMW that needs special attention is 15% of which 10% is infectious and approximately 5% is hazardous waste which may be noninfectious (WHO,2002) 85% of nonhazardous waste is of two types: **Type I** Hospital kitchen waste e.g., food items.

Type II Recyclable waste e.g., glass bottles and cardboard boxes, packings etc.

Out of the 15% hazardous waste, 5% consist of toxic chemicals, cytotoxic drugs, and radioactive waste, 10% consist of infectious waste which is of two types:

Type I Sharp waste which includes needles, scalpels and blades.

Type II Non sharp waste which can be patient contaminated waste and or laboratory waste.

Patient contaminated waste can be plastics and non-plastics; plastics include IV sets, catheters and disposal syringes. Non plastics include dressings, cotton plugs and gauges. Laboratory waste includes specimens, medical lab waste (body fluids, blood, pus and sputum) and animal carcasses and anatomical waste. In developed countries legislation is strict, sound management practices are followed, and the best available techniques are used for the disposal of BMW [8]. On the other hand, in developing countries legislation is framed but is not strictly practiced, management of waste is handled by poorly educated workers and untrained staff with improper guidance [4], [7]. The biggest complication in BMW M arises due to the use of different terminologies across the world for defining waste generated from HCFs [3]. To quote them WHO defines this waste as Health care waste, the secretariat of Basel convention uses the term BMW and HCW and the (ICRC 2011) uses the term medical waste. This waste has some more synonyms in its pocket such as hospital waste, clinical waste, hazardous waste, regulated waste, hazardous health care waste (Nepal), infectious waste (Iran), hazardous medical waste (Croatia) [14]. In India, we call it bio medical waste (BMW). Not only this for different categories of BMW again confusions exist; to quote in developing countries BMW is classified as biohazardous / pathological waste and non-biohazardous / non pathological waste. Biohazardous waste is further classified as infectious, pathological, sharp waste, pharmaceutical waste, genotoxic waste, chemical waste, and radioactive waste. In developed countries it is categorized in 05 groups as

Group A - soiled waste

Group B - sharp waste

Group C - laboratory and culture waste

Group D - pharmaceuticals [10], [11].

2. Composition of BMW as per Indian Scenario

69.5% - General Waste

7.4% - Sharp objects

4.2% - Pathological waste

10.6% - Pharmaceutical and Cytotoxic waste

8.3% - Waste with suspicious biological risks, could be highly infectious.

In India approximately 25-30% of BMW is a special category waste which needs scientific approach in its handling [2],[9]. Considering the hazardous and infectious nature of BMW we in this article are analyzing the BMW M status of our city. For this in Table 1 the available medical facilities of the city are highlighted, in Table 2 the quantity of hazardous waste generated in the last three years have been summarized, Table 3 depicts the BMW M practices of the city, in Table 4 treatment facilities available at CBWTF have been discussed. The data signifies that the city is over burdened with the quantity of BMW generated which is increasing annually, so to minimize the burden on CBWTF indicators and sub indicators have been proposed in this paper and based on the presence and or absence of the above indicators and sub indicators in a particular HCF the performance card of each HCF is prepared, where green card shows a HCF with best BMW M, yellow depicts a HCF with moder-



ate BMW M practices as per BMW M rules 2016 and red shows worst BMW M practices. Thus, this will motivate HCF to adopt the best BMW M practices and thereby reduce the burden on CBWTF.

3. BMW M in Alwar city

Alwar city is progressing steadily in the field of health care with hospitals catering to the needs of people both in the public and private sector.

Table 1. Highlights the available medical facilities

S No	Type of HCF	Number
1	Public hospitals (bedded)	03(01-multispeciality, 368 beds, 01- zanana,262 beds and 01 satellite hospital-50 beds)
2	Private hospitals (bedded)	96(02 with 100 beds, 03- 90 bedded,05-50 bedded, rest less than 50 beds)
3	Pathological labs and diagnostic centres	34
4	Blood banks	03
5	Clinics and dispensaries (non-bedded)	17
Total	Public hospitals Private hospitals	03-bedded,04-nonbedded 96-bedded, 13-non bedded
Total	Beds in public and private hospitals	680 in public and 2534 in private.

Table 2. highlights the quantity of BMW generated

Year	BMW kg/day
2020	654
2021	716
2022	764

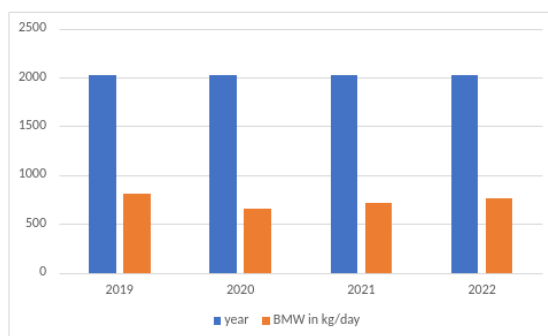


Figure 1. Thus, BMW increased by 9.5% in 2020 and 6.7% in 2021

As per the BMW M rules ,2016 every 30 bedded or more HCF is mandatorily to be registered to the common bio medical waste treatment facility (CBWTF) located within 75 km radius of the HCF.

Table 3. highlights the details of the BMW M in Alwar city

Total no of HCFs covered in the city	153
Total no of beds	3214
Total no of authorized HCFs	83
No of captive treatment and disposal facilities	12
No of HCFs practicing pretreatment of waste	87
No of HCFs with installed liquid waste treatment facility	09
No of HCF violating BMW M rules	08

Table 4. highlights the treatment facilities at CBWTF

Name of the CBWTF	Hoswin Incinerator Pvt Ltd.
Area covered	150 km
Cities included	Alwar, Bharatpur, Karauli, Sawai Madhopur, Tonk, Bhiwadi.
Total number of HCF covered	694
Total number of beds covered	14,662
Total quantity of BMW collected	1309 tons/day
Installed treatment equipments and their treatment capacities	i) Incinerator- 01, Continuous operable for 12 hrs with a capacity to incinerate 01,100 kg/hr.
	ii) Autoclave- 01, can treat 110 kg/hr of waste.
	iii) Shredder- 01, can mutilate 120 kg/hr of used needles.
	iv) Deep burial pit- 01, for sharp encapsulation.
Actual BMW treated as per official records	a) Incineration- 903 kg/hr
	b) Autoclave 342 kg/hr
	c) Shredder 173 kg/hr
Quantity of treated waste left for final disposal	i) Incinerated ash- 1500 kg

	ii) Sharps- 100 kg
	ii) Sharps- 100 kg
	iii) Plastics- 102 kg

(Data sourced from Rajasthan pollution control board annual report 2021)

In Alwar thus for final disposal of BMW there is a common incineration facility in the MIA area where infectious and hazardous waste is sent. Such waste is packed into yellow, red and blue bags. These bags contain different categories of waste as per the BMW rules, 2016 to mention the incinerable waste (yellow bag waste), recyclable plastic waste (red bag waste), sharp and glass waste (white and blue bag waste) are the major categories of BMW sent to the CBWTF. BMW is a complex waste since not only its quantity, but its quality also varies within a country from health care facility to facility. The variations in waste generation in a particular health care facility depend on the location of HCF, the level or type of services it provides, availability of resources, number of beds and appointed medical staff. In lieu of this BMW M needs to be monitored within each HCF and for this indicators and sub indicators were chosen which will help HCF to manage its BMW in an eco-friendly manner [1].

4. Indicators/Sub Indicators

Indicators represent how a particular BMW M system will perform based on a required change in any chosen parameter. Hence for the effective management of BMW in any HCF; three indicators namely management, technical and sustainable dimensions were analyzed by integrating their functional aspects. The utility of each dimension is unique in that the technical dimension helps in the control and disposal of waste at the point of generation i.e., HCF which on neglecting can otherwise be a key source of spreading infectious diseases. The managerial dimension deals with legalization of rules & regulations, framing policies & regulating the effective implementations so that BMW can be managed effectively. Lastly, the sustainable dimension helps the policy makers & the health care personnel to process the BMW in an environmentally friendly & cost-effective manner. Thus, in every HCF there should be a professional committee for waste management which can handle all the three indicators effectively.

The sub indicators act as the building blocks and have state /national level relevance and are quantifiable. When selecting sub indicators of BMW M the reports by local state, central government pollution boards were considered and extensive study of literature based on BMW issues was done and the following sub indicators were henceforth selected.

Coverage rate (CR), Efficiency of waste collection (CE), Noncompliance degree, Recycling rate (RR), Awareness & training, Emission of greenhouse gases (GHG).

All the sub indicators have positive(+ive) effects on BMW M except for the degree of violation and emission of greenhouse gases (-ive).

5. Observations

a. Coverage rate (CR) - defines the nod of HCF utilizing the CBWTFs available in that area. $CR = \text{HCF covered} / \text{Total HCF}$
HCF covered = the number of HCF that come under the 75 km radius of CBWTFs, Total HCF = the number of healthcare facilities present in that area. By determining this ratio, the stake owners can easily assess the number of HCFs violating the BMW rules [15].

b. Collection efficiency (CE) - The better the collection facility, the lower will be the spreading of infections and diseases. This

sub indicator is important as it can stop open dumping/burning of BMW. $CE = \text{Waste Collected} / \text{Total waste generated}$

c. Violation - These can be from the HCF or from the CBWTF side.

i) Violations by HCF - include non-segregation of waste into color coded bins, no pretreatment of waste, non-implementation of barcode system and open burning of BMW all these aspects of BMW M come under the category of violations [12].

ii) Violations from CBWTF's - can be no air pollution control device installed, emission standard not maintained, combustion in incinerators at low temp's [6].

d. Recycling rate (RR) - Only authorized recyclers are permitted to recycle plastics, glass & metals from BMW. This is not only the source of revenue for the HCF but also prevents the environment from being polluted, but this target can only be achieved after segregation of waste at the point of generation which has been emphasized all through our study.

e. Greenhouse gas emission (GHG) - BMW is a contributor to 3% of GHGs [5].

f. Awareness and training - Number of workshops organized/attended by healthcare personnel regarding BMW in a particular year. This is an essential compliance for effective BMW [9].

After selecting indicators and sub indicators analytical methods are used to give weightage to each sub indicator.

In all the selected sub indicators the weightage is as per the table [13].

Awareness & training	43.1%
Violations	31.7%
GHGS	19.9%
Coverage	2.21%
Recycling	2.05%
Collection	.963 %

6. Discussions and Results

Although different categories of BMW for its effective management have been framed and color-coded bins with biohazard symbols are seen in maximum HCF across the country but a lack of insensitivity or knowledge towards the delirious nature of BMW leads to mixing of general BMW with infectious BMW. Also lack of authorization of HCF to CBWTF results in open dumping and open burning of BMW which is not at all acceptable.

- i)** Table 3 highlights the number of authorized HCF which is 83, i.e., out of 153 registered HCF, only 83 send their waste to CBWTF for disposal as per BMW M rules.
- ii)** Violations by HCFs show that 08 HCFs have been given show cause notices.

This clearly asserts the fact that BMW M practices are not being aptly followed.

Bio Medical Waste generation cannot be stopped as every health care activity that is done has its financial and environmental implications. But strategic planning and strict monitoring can minimize the losses incurred due to the generation of waste. Planning should be from HCF side and for this every health care facility should appoint a team for BMW M and allocate budget for BMW handling, the team should focus on organizing training schedules for the persons involved in waste management so that knowledge and awareness about different categories of BMW is generated which will help in segregation of waste thus minimizing the harmful effects of BMW. Monitoring should be from the state pollution control board persons (SPCB) so that violations pertaining to BMW M can be minimized. Based on the weightage assigned to each sub indicator the annual performance card for individual HCFs should be prepared by the local stakeholders giving them green, yellow and red cards. This practice will motivate them for sustainable management of BMW.



7. Conclusions

Bio Medical Waste management is the need of the hour. With the increasing number of medical facilities, the quantity of waste generation is also increasing. Since the disposal of this waste is a costly affair, its recycling and reuse will not only earn revenue for the hospital authorities but also minimize environmental and human health hazards. Also, compliance of the BMW M rules, 1998 by the hospital staff will help in upgrading the standards of health care facilities as waste management in today's scenario is globally linked with the health index of a country and forms a crucial parameter for categorizing a nation as developing / developed.

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