International Journal of Community Medicine and Public Health
Shrestha D et al. Int J Community Med Public Health. 2017 Feb;4(2):511-515
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20170282

Original Research Article

A case study to review compliance to biomedical waste management rules in a tertiary care hospital

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Received: 08 December 2016
Accepted: 07 January 2017

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ABSTRACT

Background: Every healthcare establishment is known to produce several tonnes of waste. Over a period of time to cater to the needs and demands of the growing population has resulted in rapid mushrooming of hospitals, both in the government and private sector. Improper management of waste generated in health care facilities causes a direct health impact on the community, the health care workers and the environment. Such waste requires management & specific treatment prior to its final disposal. The objectives were to observe compliance of protocols in handling, transport & storage of Biomedical Waste in a tertiary care hospital and to assess compliance to occupational safety measures used by the health care staff.
Methods: A validated checklist with 41 parameters to check compliance to various functions carried out at source of generation, handling, transport & storage by a Health Care Worker for BMW management was prepared. It was an observational study that made use of complete enumeration method to select all study sites. A total of 67 sites were visited and observed. A total of 4 visits were made to each area to assess the compliance to rules.
Results: Out of 64 wards that were observed for compliance to BMW handling and Management rule 2011, 42.18% disinfected the biomedical waste bins daily. Mixing of contents in the red bag, yellow bag and black bag was found to be 20.31%, 12.5% and 10.93% respectively. None of the wards observed cutting of gloves and saline bottles prior to disposal.
Conclusions: The tertiary care hospital where the study was carried out was compliant with most rules with respect to BMW management. Segregation, mutilation and disinfection practices were not performed strictly at all waste generating sites. Due to patient overload and lack of staffing mutilation and disinfection practices were overlooked at many sites. Day to day collection of waste from all sites was not carried out due to which record books were not properly maintained. False reporting was noted on records at various sites.

Keywords: Biomedical waste, Compliance, Tertiary care hospital

INTRODUCTION

The issue of biomedical waste management has become increasingly important in India in the recent years. This might be due to the fact that there is a steady increase in the number of hospitals. It is not unfamiliar that every human activity deals with the production of waste. The increasing amount of waste generated from hospitals is a cause of concern to environmentalists as well as the general public.[1] Since majority of the persons receiving treatment in the hospital are suffering with infectious diseases the waste generated in hospital has potential to transmit infections and other hazards to hospital staff and nearby community, if not managed adequately. Adequate awareness amongst the hospital staff and practices regarding the biomedical waste management is crucial to prevent these hazards.[2] Every department in the hospital generates waste and the overall product is waste of

different kinds. Majority of waste (75-90%) produced by the healthcare providers is non-risk or general and it is estimated that the remaining (10-25%) of healthcare waste is regarded as hazardous with a potential for creating a variety of health problems.[3,4] Such waste is termed as biomedical waste.

Ministry of environment and forests (MoEF), Government of India (GOI) in its new draft on biomedical waste management and handling rules, 2016 has defined Biomedical waste (BMW) as waste that 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 biologicals or in health camps.[5] The management of hospital waste is not only the responsibility of the hospital administration but also of every department and every healthcare providing personnel in the hospital. It is a process that should begin at the site of generation where medical waste has to be properly collected and segregated from other non-hazardous waste in specific color-coded bags and containers. Transportation of hazardous healthcare waste should be well mapped in the hospital and conveyed by special carts. Storage should be carried out in utility rooms specially prepared for this purpose. Various methods, on-site or off-site are available for the final treatment of hazardous healthcare waste.[6]

METHODS

An observational study was carried out in an 1800 bedded Tertiary care hospital in a metropolitan city of Mumbai. Sampling method used was complete enumeration method to select the study sites. A total of 64 sites were observed for compliance to BMW handling and management rules with help of a validated checklist. Appropriate approvals were taken to collect data from various patient care areas before the study. Study began after ethical clearance from institutional ethics committee of the medical college to which the hospital was affiliated. The study was conducted over a 3-month period. The checklist used to observe compliance was prepared with help of the draft on BMW rules, 2011 by MoEF, GOI. 5 experts from the Departmental Review Board of Community Medicine and Hospital infection control committee further validated it. A total of 64 sites were observed which included Emergency Areas, Wards, Operation Theatres (OT), Intensive Care Units (ICU), Out Patient Department's (OPD) and biomedical waste room. Each site was visited by the researcher and observed for compliance to biomedical waste management guidelines (2011) with the help of a validated checklist. Areas were visited during morning hours between 8 am to 10 am and evening hours between 2 pm and 4 pm. A total of 2 visits were made to each site in a minimum 15-day interval. The chosen timings were such when maximum waste is generated in a patient care area, as this was the time when blood samples of patients were taken, medication and injections were given. Although medication injections were also given during evening hours and night hours, such time periods were excluded from the study due to operational difficulties in collecting data during these timings. At the source of generation of waste, compliance to 4 broad functions were noted viz**.** Presence and Condition of waste receptacles, Segregation of waste, Mutilation of recyclable waste and Disinfection of certain categories of waste. The checklist also covered a list of items observed while handling, transport & storage of BMW. Personal protective equipment's used by health care staff was observed at all levels. Each desirable observation will be assigned '1' mark and each undesirable observation was assigned '0' mark. As an example, if all of the used hypodermic needles in an area were found mutilated (desirable), it was assigned '1' mark; if none of the needles was mutilated (undesirable), it was assigned '0' mark and if some of the needles were mutilated and some not, such observation was assigned '0.5' mark. Data collected with the help of the checklist for the above parameters was entered using Microsoft-Excel 2011 Software. Data was analyzed by using SPSS Software version 20.0.

RESULTS

With respect to Table 1, in every department, the wards, OT's and ICU's were observed for compliance. Maximum waste generation was observed in the Department of Medicine.

Waste produced per day = Mean waste generated per day / Total number of beds.

Bed occupancy rate is 90%. Each bag on an average weighed around 3kgs as per the information obtained from the common BMW room where the bags were weighed. Waste produced per day is 2.7 kgs. Previous studies suggest that most hospitals in India generate 1-2kgs per day, and the tertiary care hospitals as AIIMS, produces on much higher side.[7]

With respect to Table 2, the yellow bags were absent at 12.5% (i.e. 8 out of 64) of the study sites. Absence of yellow bags was mainly observed at treatment rooms of outpatient departments and vaccination site. Shortage in availability of yellow bags was observed at labor room. BMW bags were fitted on waste bins or cardboard boxes. BMW bags were located at the nursing station at majority of the sites (n=57, 89.06%). 23.4% sites (n=15) did not display posters where BMW bags were kept. Only 27 out of 64 sites disinfected their waste bins daily (42.18%). The rest would disinfect their bins once in 3-4 days.

With respect to Table 3, mixing of contents was seen in all waste bags at all sites at some point. Mixing in plastic cans was mainly with respect to plunger not being separated from the disposable syringe and presence of uncut hypodermic needles.

Table 1: Department wise classification of BMW generation.

Departments	Black bags	Red bags	Yellow bags
	Produced per day		
Medicine (Ward, OT, ICU)	51	23	3
Surgery (Ward, OT, ICU)	41	35	8
Obstetrics & Gynec (Ward, OT, ICU)	30	19	4
Pediatrics (Ward, OT, ICU)	17	10	3
Orthopedics (Ward, OT)	18	12	2
ENT (Ward, OT)	3	2	2
Ophthalmology (Ward, OT)	1	2	2
Super specialty (Ward, ICU)	21	19	2
Out patient department (OPD)	5	5	1
Total	**187**	**127**	**27**

Table 2: Condition of waste receptacles at source of waste generation.

Criteria	Black	Red	Yellow	Plastic cans
Availability	Yes	Yes	No	Yes
Biohazard label	Yes	Yes	Yes	No
Bags securely fitted to container	Yes	Yes	Yes	N. A.
Cover on bins when not in use	No	No	No	No
Foot operated bins	No	No	No	No
Daily disinfection of bins	No	No	No	No
Mixing of waste	Yes	Yes	Yes	Yes
Posters to guide users	Yes	Yes	Yes	Yes

Table 3: Mixing of contents (N=64).

Mixing of contents	Number of sites	Percentage (%)
Red bag	13	20.31%
Yellow bag	8	12.5%
Black bag	7	10.93%
Plastic can	64	100%

Compliance with respect to mutilation and disinfection of recyclable waste

Positive findings observed at all sites

No recapping of needles, no needles found bent and appropriate disinfectant (1% sodium hypochlorite) was present in all plastic cans containing sharps.

Negative findings observed at all sites

Hypodermic needles were not being mutilated by needle cutter or burner prior to disposal in the cans, saline bottles and nozzle of syringes were not being destroyed prior to their disposal, plastic cans containing sharps were not being sent for disposal when 3/4th full with syringes and needles and the sharps were often not completely immersed in hypochlorite solution present in the plastic cans. Weighing machine for monitoring weight of the waste collected in the BMW bags was absent at all sites.

Compliance with respect to storage at all sites

At source of generation of biomedical waste (Wards, ICU's and OT's), it was seen that there was no separate storage room for collected BMW bags before transport to the Common BMW room. BMW bags were kept in the toilets or patient waiting areas attached to these sites of waste generation, which had free access to patients and their relatives. Also within the toilets no separate area was demarcated for storage of biomedical waste. The toilet floors and walls were however impermeable and washed daily with 2% sodium hypochlorite solution.

Compliance with respect to transport

All sites producing BMW had designated trolleys to carry their waste to the common BMW room that met the requirements as per the BMW rule and management guidelines. The bags and plastic cans were accompanied by a signed document by the sister in charge of the respective ward/ICU/OT/OPD where waste was being

generated. The document mentioned the site, date, shift, number of bags of each color and number of plastic cans. Waste was not collected daily in 42.18% (n=27) of the sites. The BMW bags and cans were collected only once in a day (morning hours). Black bags were collected twice in a day. There was no separate trolley for general waste collected in black bag and those collected in the BMW bags. The record book at 20.31% (n=13) of the sites was not properly maintained.

The common BMW room

It is located at a distance of 20 meters from the hospital building. BMW from all sites was transported to this room in the morning hours on a daily basis except Sunday. General waste was not stored here. The room had flooring and walls that were impermeable to water. Waste was not stored here for over 24 hours except on Sundays. The room was kept closed when not in use. An authorized vehicle was appointed to collect BMW daily to a common BMW treatment facility. A separate caretaker was appointed for the BMW room. He maintained records of all the BMW bags and cans brought from all sites in the hospital and daily cleaned and disinfected the whole room with 2% hypochlorite solution once the waste was sent for final disposal to a common BMW treatment plant.

Personal protective equipment's (PPE's)

Compliance with respect to use of PPE's such as gloves, masks and aprons was observed only at only 93%, 24% and 6% of the total sites respectively.

DISCUSSION

Mean waste generated per day (2.7kgs) was higher than the waste production in similar study carried out by Srivastav S in a 650 bedded government medical college, Jhansi (0.5 kg/bed/day).[7] In a similar study by Singh A in a 660 bedded tertiary hospital at Rohilkhand, Uttar Pradesh the mean waste generated was 1.32 kgs/bed/day.[8]

There was shortage in availability of yellow bags at 12.5% of the study sites (n= 8) and at 89.06% (n=57) of the study sites the all 4 color coded BMW bags were available at the right place (nursing station). In a similar study by Singh A et al, only 10% of the study sites had all 4 color-coded bags at the right place. Also, their study results revealed that there was shortage of both red (36.67%) and yellow bags (26.67%).[8]

23.4% of the sites did not display posters or signage where BMW bags were kept. In a similar study by Verma L et al, 12.50-33.40% of HCFs were not using posters. Disinfection of plastic waste, especially syringe waste was being practiced at all sites, however mutilation of plastic waste especially subjecting the needle to cutting or burner prior to disposal in plastic cans and separation of the plunger from the needle was not being practiced. Similar findings were observed in the study carried out by Verma L et al.[9]

At 93% of the sites glove usage was observed while handling BMW, which is better than studies carried out at similar settings. The safety measures adopted by the waste handlers was very poor with respect to masks (24%) and aprons (6%) while handling the Biomedical waste. None wore eye shields and long boots. Similar findings were seen in a study carried out by Srivastav S et al.[7] Results in a study by Sharma S et al, out of total 54 waste handlers who were interviewed at Sarojini Naidu Medical College, Agra, 68.52% stated that they did not use any type of personal protective clothing.[10] Results of a study carried out at a tertiary hospital by A. Singh et al revealed only 33.03% usage of gloves by waste handlers.[8]

There was no separate storage area for BMW at the site of waste generation. It was stored in the toilets and waiting areas for patients. Similar findings were observed in a study titled "Biomedical waste management in nursing homes and smaller hospitals in Delhi" by Verma L.[9]

CONCLUSION

The tertiary care hospital where the study was carried out was compliant with most rules with respect to BMW management. Segregation, mutilation and disinfection practices were not performed strictly at all waste generating sites. Due to patient overload and lack of staffing mutilation and disinfection practices were overlooked at many sites. Day to day collection of waste from all sites was not carried out due to which record books were not properly maintained. False reporting was noted on records at various sites.

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

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Cite this article as: Shrestha D, Gokhe SB, Dhoundiyal A, Bothe P. A case study to review compliance to biomedical waste management rules in a tertiary care hospital. Int J Community Med Public Health 2017;4:511-5.