



The Knowledge, Attitude and Practices about Bio-Medical Waste Management System in a Tertiary Care 60 Bedded Hospital in Rajasthan, India

Virender Verma*, Priya Soni, Meenakshi Kalhan, Sanjiv Nanda, Anjani Kumar, Vivek Nandan

Department of Pediatrics, Ruban Hospital, Patna, India

ABSTRACT

Background: From antiquity, the healthcare facilities have treated sick people but there was little awareness about the fact that hospitals generate a lot of hazardous bio-medical waste, which had been disposed without proper guidelines but lately, it has been a proven thing that bio-medical-waste is an important potential hazard for health-personals and environment. Therefore, it must be disposed in a proper manner.

Objectives: This was an observational study carried out at one of the tertiary care hospitals in Rajgarh city about the knowledge attitude and practices of the hospital staff about the bio-medical waste management.

Material and method: An observational (cross-sectional) study using questionnaires was carried out at one of the non-NABH accredited tertiary care hospitals of Rajgarh city in Rajasthan (India).

Results: Eighty-seven percent nurses and lab technicians and 35% housekeeping staff were females. The employee composition is primarily a young and middle age group type. More than 70% staff (except housekeeping) had good ideas about waste categories, segregation and color coding except in radioactive waste. The house keeping staff did well in 3 categories (Linen, sharps and glasses). Most of employees has a clear idea about BMW operation and quality measures except the housekeeping staff which did well on most of parameters except barcoding, pretreatment of anatomical and biotechnology waste, knowledge about STP plant (Sewage treatment Plant), Hazmat and signage. On actual hospital rounds we found that the hazmat practices were in a poor shape. Most of staff was aware occupational hazards except housekeeping staff (16% had some idea about hepatitis B, 35% about needle prick injury). Use of PPE kits was uneven and poor in high risk areas.

Conclusion: A written policy, induction training of healthcare workers, constant and repetitive workshops, motivation and reinforcing supervision are important human factors to implement the biomedical waste practices in a small-scale healthcare organization. Risk-stratification, understanding of health hazards and how to activate hazmat protocols are important things which are to be brought into practice.

Keywords: Bio-medical waste; BMW; Small health care organization; Healthcare workers; Hazmat; KAP practices

INTRODUCTION

Human activities and interventions generate some useful products and some by-products; these generally useful by-products are often termed as waste. Previously when human population was less, the waste generated by human actives was taken care of by natural phenomenon like bacterial degradation,

saprophytes and natural scavengers, but the second half of 20th century witnessed an exponential rise in human activities resulting into enormous waste whose management has resulted into a formulation of many guidelines and practices [1].

“Hospital waste means collective waste, (biological or non-biological) which is not useful and discarded”. “Bio-medical

Correspondence to: Virender Verma, Department of Pediatrics, Ruban Hospital, Patna, India; E-mail: vadrenaline@gmail.com

Received: 24-Jun-2020, Manuscript No. IJWR-24-5102; **Editor assigned:** 29-Jun-2020, PreQC No. IJWR-24-5102 (PQ); **Reviewed:** 13-Jul-2020, QC No. IJWR-24-5102; **Revised:** 01-Aug-2024, Manuscript No. IJWR-24-5102 (R); **Published:** 29-Aug-2024, DOI: 10.35248/2252-5211.24.14.578

Citation: Verma V, Soni P, Kalhan M, Nanda S, Kumar A, Nandan V. The Knowledge, Attitude and Practices about Bio-Medical Waste Management System in a Tertiary Care 60 Bedded Hospital in Rajasthan, India. Int J Waste Resour. 14:578.

Copyright: © 2024 Verma V, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

waste refers to waste generated during the diagnosis, treatment or immunization of human beings or animals or in research activities or in the production or testing of biologicals.”

“Infectious waste the by-products which contain or might contain pathogens in sufficient concentration that could cause diseases for example, culture of infectious agents from laboratories, waste from operation theatres or from infectious patients.”

An act was passed by the ministry of environment and forests in 1986 and notified in July 1998, “the bio medical waste (management and handling) rules”, which states that, “ensuring disposal of waste generated by an institution in a proper way so that it leaves no hazardous effect on human health can environment, is the duty of every occupant of the institution and vicariously reflected by the head [2].

Despite many laws and reinforcements by state and central agencies the bio-medical waste is still a difficult practice at ground level, imposing a considerable health risk on health care workers, patients and environment. Bio-medical-waste forms 1%-2% of total solid waste collection by municipality in general. In India, an average hospital bed generates around two kilograms of bio-waste per day. As alluded earlier, BMW might be full of disease causing organisms *viz.*, hepatitis B, hepatitis C, AIDS. Therefore, its proper handling is vital. The BMW management practices are a collective effort of higher administration (policy and funding), biomedical engineering (technology and equipment) and operation/housekeeping department (training and induction), immediate healthcare workers (doctors, nurses and paramedics) and ground force of housekeeping department [3].

The biomedical waste 2004 guidelines of WHO emphasize the important of “human factor” over technology and equipment. Staff motivation and dedication is vital for success of proper disposal of BMW, highly motivated staff can compensate limitation arising because of lack of sophisticated equipment in small health care organizations because of limited budget. According to a government statement there are a total 37725 health-care facilities and approximately 3500 ayush centers were operational in India in 2018. There are a lot of private hospitals which are unregistered and producing BMW. We conducted this study in a small health care organization (60 bedded) at Rajgarh city (Rajasthan) in India.

MATERIALS AND METHODS

Subject

Inclusion criteria: We included all the hospital employees regardless of their hierarchy.

Exclusion criteria: We did not include trainees, security staff and marketing ground force as formers were outsourced and latter were hardly having any function inside the hospital premises and BMW generation and disposal directly or indirectly [4].

Methodology

We conducted this observational (cross section) study at a tertiary care Small Health Care Organization (SHCO), which has recently considered for applying to Nation Accreditation Board of Hospital (NABH), an accreditation agency for hospital quality in India. The hospital is a 60 bedded multispecialty allopathic hospital with all major surgical and medical specialties. It has a routine OPD of almost 250 patients and in-house occupancy rates averaging 80%. The hospital has around 8 higher management officials, 1 quality manager, 4 other managers, 1 bio-medical engineer, 4 pharmacists, 17 doctors, 52 nurses, 4 Lab-technologists and 74 other support staff (housekeeping staff). We carried out a survey about knowledge attitude and practices about BMW using a questionnaire.

A scientifically designed questionnaire, which included details about knowledge of infectivity, disposal (segregation, transport and final disposal), knowledge and attitude about immunization and health hazards and use of protective equipment in the management of (BMW) Bio-Medical-Waste was used. We did not include personal details and duration of the person in healthcare organization in order to get the unbiased and honest answers. However, the questionnaires were printed on colored papers for subgroup analysis, that is, white paper for higher management, managers and pharmacists, pink for nurses and lab-technologists, orange for doctors and blue for housekeeping staff. These were printed in English as well as local language (Hindi) and handed over to respected staff by the human resource manager in opaque envelope. At the time of handing over the employee was thoroughly explained about the need of honesty and it was reinforced that this will be used for training purpose and must not affect their employability. These were distributed between 1st to 5th of January 2020 and the hospital employees were directed to return them without fail on or before 10th of the January in the office of Human resource manager, they day they come to receive their salary cheques. This was step was taken to maximize responses. When the person came for receiving cheque, they needed to drop the envelope containing the response in an opaque letter box and tick on a checklist containing their name. Those employees who did not return the questionnaire by 10th were contacted on their mobiles by human resource manager and were asked to return it at earliest. All questionnaires were received by 13th of the January 2020. The box was shaken and opened in presence of principal investigator and all questionnaires were taken out. These were segregated using the color codes [5].

Out of 165 responses 6 were rejected because of difficult to understand handwriting, ambiguous responses which did not make any sense or blank response etc. 159 questionnaires were analyzed, however, the total number for calculation was assumed to be 165 and same as initial values in individual categories for the purpose of calculations.

On 24th and 25th of January hospital rounds were taken to observe and record the real practices about BMW management and to know the belief of the employees right at the point of care.

RESULTS

Table 1 depicts the actual number (percentage) of employees their gender and age and educational qualification. It is observed that 87% nurses and lab technicians and 35% housekeeping staff were females.

Majority of employees were in the age group of 25 years to 40 years. Most of nurses were diploma holder (76%) or higher (24%), all doctors were graduate and above and only 11% house-keeping staff was educated beyond school. The employee composition is primarily a young and middle age group type [6].

Table 1: Demographic and educational details of study-subjects.

		Mngt/pharma (n=18)	Doctors (n=17)	Nurses/Lab-tech (n=54)	Housekeeping (n=74)
Gender	Male	11 (61%)	13 (76%)	7 (13%)	42 (57%)
	Female	7 (39%)	4 (24%)	47 (87%)	26 (35%)
Age	0-25	0 (-)	0 (-)	6 (11%)	12 (16%)
	25-40	10 (56%)	9 (53)	31 (57%)	26 (35%)
	40-55	4 (22%)	5 (29%)	13 (24%)	23 (31%)
	>55	4 (22%)	3 (18%)	4 (7%)	7 (9%)
Education	Illiterate	0 (-)	0 (-)	0 (-)	9 (12%)
	Some school	0 (-)	0 (-)	0 (-)	53 (71%)
	Diploma	4 (22%)	0 (-)	41 (76%)	5 (7%)
	Graduate	3 (17%)	5 (29%)	13 (24%)	3 (4%)
	Post-graduate	11 (61%)	6 (35%)	0 (-)	0 (-)
	Doctoral	0 (-)	6 (35%)	0 (0)	0 (0)

Table 2 depicts level of understanding of various categories of waste material and their segregation into various bins/boxes. It is seen that most of management person, doctors and nurses did well in most of categories and more than 70% had good ideas

about it except in radioactive waste where they scored poor around 30%. The house keeping staff did well in 3 categories (Linen, sharps and glasses) and scored about 70% correct responses [7].

Table 2: Knowledge of employees about waste categories and color coding etc.

Waste type	Example	Mngt/pharma (n=18)	Doctors (n=17)	Nurs/Lab-tech (n=54)	Housekeeping (n=74)
Human and animal anatomical waste	Body parts, research animals	11 (61%)	17 (100%)	48 (89%)	39 (53%)
Soiled waste items contaminated body fluids/blood	Bandage, cotton etc.	13 (72%)	17 (100%)	48 (89%)	41 (55%)
Discarded or expired medicine pharmaceutical	Drugs, vaccines etc.	11 (61%)	13 (76%)	39 (72%)	27 (36%)
Chemical waste	Disinfectants	9 (50%)	12 (71%)	45 (83%)	42 (57%)
Chemical liquid waste	Silver-X-ray liquid, formalin	9 (50%)	12 (71%)	47 (87%)	42 (57%)

Hospital linen and laundry	Bedsheets	14 (78%)	17 (100%)	54 (100%)	57 (77%)
Lab waste	Culture bottles, residual culture	13 (72%)	15 (88%)	49 (91%)	34 (46%)
Plastic disposable items	Syringes	15 (83%)	15 (88%)	43 (80%)	51 (69%)
Waste sharps including metals	Needles, blades	18 (100%)	17 (100%)	47 (87%)	55 (74%)
Glass items	Used vials, ampules	12 (67%)	15 (88%)	50 (93%)	50 (68%)
Hazmat	Acid spills	13 (72%)	14 (82%)	47 (87%)	23 (31%)
Radioactive waste	From brachytherapy unit	7 (39%)	5 (29%)	11 (20%)	0 (-)

In Table 3, the operation and quality measures have been depicted and it is clear that most of employees has a clear idea about BMW operation and quality measures except the housekeeping staff which did well on most of parameters except barcoding, pretreatment of anatomical and biotechnology waste,

knowledge about Sewage-Treatment-Plant (STP), Hazmat and signage. On actual hospital rounds we found that the hazmat practices were in a poor shape when even nurses could not brief about them. The barcode system was not followed yet although managers, doctors and nurses had dependable knowledge [8].

Table 3: BMW practices: Operations and quality knowledge and actual observed compliance.

Operation and quality	Mngt/pharma (n=18)	Doctors (n=17)	Nurses/Lab-tech (n=54)	Housekeeping (n=74)	Observed compliance		
					Ward	Lab	OT
Segregation at site of generation	18 (100%)	17 (100%)	54 (100%)	68 (92%)	100%	100%	100%
Color coding of begs and container	18 (100%)	17 (100%)	54 (100%)	68 (92%)	100%	100%	100%
Labelling of containers	16 (89%)	17 (100%)	54 (100%)	68 (92%)	100%	100%	100%
Bar code and global positioning	14 (78%)	13 (76%)	36 (67%)	10 (14%)	-	-	-
Quality of transport to vehicle	18 (100%)	17 (100%)	43 (80%)	68 (92%)	100%	100%	100%
Transport vehicle to facility	18 (100%)	17 (100%)	40 (74%)	68 (92%)	100%	100%	100%
Pretreatment of anatomical, soiled waste etc. if stored	18 (100%)	15 (88%)	39 (72%)	27 (36%)	NA	NA	NA

Treatment of microbiology waste	18 (100%)	17 (100%)	52 (96%)	10 (14%)	-	100%	
STP plant	18 (100%)	16 (94%)	40 (74%)	10 (14%)	+	+	+
Hazmat practices	13 (72%)	14 (82%)	47 (87%)	23 (31%)	32%	67%	50%
Signage and charts	16 (89%)	15 (88%)	36 (67%)	18 (24%)	+	+	+
Maintenance of record	18 (100%)	17 (100%)	54 (100%)	68 (92%)	+	+	+
Ample disinfectant available	18 (100%)	17 (100%)	54 (100%)	68 (92%)	+	+	+

Table 4 shows that most of staff was aware of tetanus and hepatitis B vaccination except housekeeping staff (16% had some idea about hepatitis B).

Thirty-five percent housekeeping staff were knowing that they need to immediately inform the laboratory in charge in case of needle prick and need to get some tests and take medicines.

Table 4: KAP about occupational safety.

Occupational safety	Mngt/pharma (n=18)	Doctors (n=17)	Nurses/Lab-tech (n=54)	Housekeeping (n=74)	Observed Compliance		
					Ward	Lab	OT
TT immunization	18 (100%)	17 (100%)	54 (100%)	68 (92%)	-	-	-
Hepatitis B immunization	18 (100%)	17 (100%)	54 (100%)	12 (16%)	-	-	-
Needle prick injury protocol	18 (100%)	17 (100%)	48 (89%)	26 (35%)	-	-	-
Exposure to infectious material	18(100%)	17 (100%)	52 (96%)	58 (78%)	-	-	-
Hazmat exposure	13 (72%)	14 (82%)	47 (87%)	23 (31%)	-	-	-
Personal protective devices used							
Gloves	18 (100%)	17 (100%)	54 (100%)	68 (92%)	63%	94%	100%
Shoe cover	18 (100%)	17 (100%)	54 (100%)	68 (92%)	6%	27%	100%
Aprons/Gowns	18 (100%)	17 (100%)	54 (100%)	68 (92%)	86%	100%	100%
Masks	18 (100%)	17 (100%)	54 (100%)	68 (92%)	10%	84%	100%
Caps	18 (100%)	17 (100%)	54 (100%)	68 (92%)	7%	16%	100%
Training received	18 (100%)	17 (100%)	54 (100%)	68 (92%)	-	-	-

PPE kit in hazardous places	18 (100%)	17 (100%)	45 (83%)	12 (16%)	-	30%	-
Health insurance provided	100% corporate tie-up			-	-	-	-

Gloves and aprons were the only protective devices used. Sweepers were not using any of the protective devices except gloves (80%). The use of protective devices was satisfactory as per the area of use. The lab workers used PPE kit in 30% incidences which is considerably low in our opinion especially in microbiology laboratory. All employees were provided health insurance by corporate tie-up with Third Party Administrator (TPA) and the level of coverage was as per their hierarchy and salary structure [9].

DISCUSSION

Biomedical waste management is a collective effort of many agencies and people, any breach in the process can result into failure of the whole process. The waste needs to be tackled carefully from the point of generation to the final destination keeping in mind the safety of patients, staff and environment. We conducted this study in a non-NABH accredited small healthcare organization (60 bedded) in Rajgarh city before they applied for NABH assessment in order to examine the knowledge, attitude and practices of the staff.

In our study we find that in this hospital the nurses and lab-technologists were quite knowledgeable about waste categories and their segregation and their knowledge was superior to that of housekeeping staff, although housekeeping staff did wonderful in most of categories their performance was not up to mark in some categories (*viz.*, the expired medicine), similar findings were also observed in an Indian study. The good understanding is probably because of induction training and constant motivation and repetitive training of nurses and laboratory staff by quality manger and operation manager. More than the theory it is because they were doing these practices strictly in the hospital for about 2 years [10].

The operation and quality manager in collaboration with deputy medical superintendent and nursing superintendent were organizing the training and ward in charge nurses and nursing superintendents were responsible for observing the compliance and nursing superintendent is responsible for holding such trainings for the new employees with the help of relevant faculty from nursing college and medical college. The senior nursing staff and sisters in charge of the ward are given the responsibility for implementation of the BMW management rules by the authorities. The housekeeping staff on the contrary did not receive repetitive training but only orientation and induction training. The housekeeping supervisor (who was a post-graduate in business administration) did receive constant training and he was responsible for training the housekeeping staff but he was already overburdened with hospital duties that he got little time for training, nevertheless the housekeeping staff performed well because they were practicing it for long and were constantly

under supervision of ward-nurses. Lack of training in staff result in less knowledge in BMW management practices [11]. The hospital did not have a radiotherapy department hence the respondents were mostly blank on this aspect those who responded rightly were either had worked in some other hospital or knew it because they had studied about it out of their interest.

Table 3 depicts the knowledge and practices about segregation of the bio-medical waste right at the site of its generation. Biomedical waste must be segregated at the site of its generation to avoid appropriate disposal and to minimize health risk to the staff handling it and to the environment. The availability of color-coded bins and charts about the waste categories are important parameters which could influence the success of the BMW segregation. Because of government regulation it is a mandatory requirement for registration of a healthcare facility to comply with the BMW segregation and disposal practices. In an Indian study from Gujarat it was found that most hospitals and labs are strictly following these regulations. In our observation this hospital had complied nicely with most of regulatory processes except the bar coding of bins, which was informed to be in process. The handling of sharp waste was quite impressive and ample disinfectant was available; these finding were in accordance with another Indian study from Himachal Pradesh [12].

CONCLUSION

Constant motivation, induction and training coupled with reinforcement in terms of feedback is vital for implementation of BMW practices. The person responsible for handling and disposal of BMW should be well informed about the potential dangers to self, others and environment. Their training should include mock drills and real-life scenarios to make thing possible in a better way.

FUNDING

Dr. Ram Avtar Soni, is the chairman and managing director of the hospital where this study was conducted and was responsible for all the funding associated with the study.

CONFLICT OF INTEREST

No conflict of interest.

REFERENCES

1. Horváth A. Management of waste disposal in medical institutions. *Orv Hetil.* 1991;132(17):919-924.

2. Ali M, Wang W, Chaudhry N, Geng Y. Hospital waste management in developing countries: A mini review. *Waste Manag Res.* 2017;35(6):581-592.
3. Tsakona M, Anagnostopoulou E, Gidakos E. Hospital waste management and toxicity evaluation: A case study. *Waste Manag.* 2007;27(7):912-920.
4. Duran A, Gulati K, Gunasekar A, Gupta SK, Kumar P, Lahariya C. Public hospital governance in India. *Public Hosp Govr Asia Pacific.* 2015;1(1):222-255.
5. Hendricks R, Pool EJ. The effectiveness of sewage treatment processes to remove faecal pathogens and antibiotic residues. *J Environ Sci Health.* 2012;47(2):289-297.
6. Soliman SM, Ahmed AI. Overview of biomedical waste management in selected governorates in Egypt: A pilot study. *Waste Manag.* 2007;27(12):1920-1923.
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):245-247.
8. Kumar S, Mazta SR, Gupta AK. Comparing the biomedical waste management practices in major public and private sector hospitals of Shimla City *Int J Sci Study.* 2015;2(11):112-118.
9. Verma V, Soni P, Kalhan M, Nanda S, Kumar A, Nandan V. The Knowledge, attitude and practices about bio-medical waste management system in a tertiary care 60 bedded hospital in Rajasthan, India. *medRxiv.* 2020:2020-2006.
10. Singh Z, Bhalwar R, Jayaram J, Tilak VW. An introduction to essentials of bio-medical waste management. *Med J Armed Forces India.* 2001;57(2):144-147.
11. Pandey A, Ahuja S, Madan M, Asthana AK. Bio-medical waste management in a tertiary care hospital: An overview. *J Clin Diagn Res.* 2016;10(11):DC01-DC03.
12. Shalini S, Harsh M, Mathur BP. Evaluation of bio-medical waste management practices in a government medical college and hospital. *Nat J Community Med.* 2012;3(01):80-84.