

## EVALUATION OF BIO-MEDICAL WASTE MANAGEMENT PRACTICES IN A TERTIARY CARE HOSPITAL OF ROHILKHAND REGION IN UTTAR PRADESH, INDIA

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### ABSTRACT

**Background:** To protect human beings and their environment from various hazards due to hospital wastes, its management practices should be implemented and evaluated regularly in the hospital.

**Aims & Objectives:** (1) To assess the current hospital waste management practices adopted by the wastes management supervisors and wastes handlers in a tertiary care hospital of Western Uttar Pradesh; (2) To determine the awareness regarding waste management practices among wastes handlers in the hospital; (3) To assess the preventive measures provided and used by wastes handlers in the hospital.

**Materials and Methods:** The study was carried out during April-June, 2013. Data was collected about hospital waste management practices, preventive measures adopted by hospital waste handlers using pretested schedule.

**Results:** The hospital generates average wastes of 1.32 kg/bed/day. Out of 30 places, only 19 (63.33%) places were there in the hospital with all four coloured bins placed properly. Out of total 109 handlers, 69 (63.30%) were aware about hospital waste handling hazards. And out of total aware handlers, majority i.e. 52 (75.36%) were males.

**Conclusion:** The hospital should train, educate and immunize its health care staff and the waste management system should be evaluated intermittently.

**Key Words:** Hospital; Wastes; Practices; Evaluation; Management; Bio-Medical Waste

### Introduction

A hospital, which provides tertiary care level health care, is a complex multidisciplinary system for delivery of health and medical care and is a part of physical environment. Every day, thousands of health care products are consumed during health care processes of the patients in the hospitals, and these processes leave some unusable materials, which are known as hospital waste. The major hazards of hospital waste are infections, as majority of the patients who are coming to the hospital are suffering from infectious diseases.<sup>[1]</sup> When the hospital personnel come in the contact of these patients or waste material produced by their treatment, they may get hospital acquired infection, transfusion transmitted diseases, Hepatitis B, and HIV infections. These wastes are also responsible for land, water and air pollutions which can further lead to increasing possibility of catching many diseases. This problem has now become a serious threat for the public health. Ultimately, the Central Government had intervened by enforcing proper handling and disposal of hospital waste by an act, which was passed in July 1996 and a bio-medical waste (handling and management) rule was introduced in 1998 and notified under the Environment Protection Act by the Ministry of Environment and Forest.<sup>[2]</sup>

Hospital waste management is a part of hospital hygiene and maintenance activities. In fact, it was estimated that 80-85% of total hospital waste is non-infectious general waste and only 15% of hospital waste is hazardous – out of which, 10% is infectious, and 5% is responsible for other hazards.<sup>[3]</sup> These “other hazards” are injuries with sharps, chemicals or drugs, radiations and burns.<sup>[4]</sup> When this 15% hazardous waste is not segregated properly under certain guidelines at the source of generation, and mixed with non-hazardous waste, then 100% waste becomes hazardous.<sup>[5]</sup> Segregation is the essence of waste management, and is done at the source of generation of the waste e.g. all patient care activity areas, diagnostic services areas, operation theatres, labour rooms, treatment rooms etc. The responsible persons for segregation at the place of generation of wastes are doctors, nurses, technicians etc. (medical and paramedical personnel). The biomedical waste is segregated as per categories mentioned in schedule I. Collection of biomedical waste in containers with colour code is done as per schedule II. At ordinary room temperature, the collected waste should not be stored for more than 24 hours. Within hospital, waste routes should be designated to avoid the passage of waste through patient care areas. Separate time should be earmarked for transportation of bio-medical waste to reduce chances of its mixing with general waste.

Desiccated wheeled containers, trolleys or carts are used to transport the waste/ plastic bags to the site of storage/ treatment. Trolleys or carts should be thoroughly cleaned and disinfected in the event of any spillage. The wheeled containers should be so designed that the waste can be easily loaded and remains secured during the transportation. Treatment of waste is required to disinfect the waste (so that it is no longer the source of infection), to reduce the volume of the waste, make waste unrecognizable for aesthetic reasons and make the recycled items unusable. 85% of the waste generated in the hospital belongs to the general category. Safe disposal of this waste is a responsibility of the local authority. The rest 15% waste should be finally disposed after treatment with the help of the procedures – like deep burial, autoclave and microwave treatment, shredding, secured landfill, incineration – according to the categories of the hospital waste.

Universal precautions and appropriate safety measures should be adopted and written instructions should be provided regarding the procedures to be adopted in the event of spillage/ accidents. Protective gears should be provided and instructions regarding their use should be given. Workers should be protected by vaccination against tetanus and hepatitis B. For training of staff, each and every hospital must have well planned awareness and training programme for all categories of personnel including administrators (medical, paramedical and administrative).

With the above view, and in context with the bio-medical waste (handling and management) rules notified under the Environment Protection Act 1998, the present study made an attempt to evaluate hospital waste management practices. It also attempted to determine awareness about hazards due handling of hospital waste, with the aim of getting background information about the final disposal of hospital wastes in the hospital.

## Materials and Methods

The study was carried out in a 660 bedded tertiary care hospital in Bareilly, city of western Uttar Pradesh. The hospital is one of the biggest hospitals in the region. It was a hospital based study, conducted during April-June 2013. There were 30 Hospital Waste Management (HWM) stations/ places including Out Patient Departments (OPDs), Wards, Injection Rooms, Operation Theatres (OTs), Laboratories and Intensive Care Units (ICUs) in the hospital.

This cross sectional study was carried out at all the 30 places generating wastes in the hospital, where the segregation was also done. Three investigators visited 30 places to observe the actual management – including segregation, transportation, storage and disposal of hospital waste. We took the weight of waste generated in the hospital at these 30 places during whole day on the day 1 of each month in study duration i.e. for 3 consecutive months. This way, the mean of waste generated in one day was calculated (using formula i.e. total waste in kg, generated during three days, divided by 3, and further divided by total no. of occupied beds in a day in the hospital). Total no. of occupied beds in a day in the hospital was calculated with the help of total no. of beds in the hospital and bed occupancy rate of the hospital.

We interviewed all 109 handlers for the assessment of their awareness about hospital waste handling hazards, and to collect information about their background characteristics including personal details i.e. name, age, sex, education, and use of personal protective gear like use of gloves, apron, long boot, eye shield, facemask during working in the hospital. We also enquired into awareness regarding hazards due to handling hospital wastes and any special training attended during their job in the hospital also about vaccinations like Hepatitis B Vaccines and Tetanus Vaccines received to prevent infections. Out of total 135 handlers of the hospital, 99 were deployed during day shift, and 36 were deployed during the night shift, in all the 30 places of the hospital. Out of 109 interviewed handlers, 87 were found working during day shift while 22 handlers during night shift.

## Results

Total waste generated in the 660-bedded hospital in a day was 707.35 kg/day. After segregation, 187.95 kg, 159.70 kg, 167.50 kg and 192.2 kg was kept in black, blue, yellow and red bins respectively in a day. The bed occupancy rate of the hospital was 81% – thus, average hospital waste generated in the hospital was 1.32 kg/bed/day [Table 1].

Out of 109 handlers handling hospital waste, 69 (63.30%) responded that they were aware about hazards like infections i.e. HBV, HIV, injuries with sharps, burn with chemicals, spillage on them while handling waste during segregation, transportation, storage, disinfection and disposal. Remaining 40 (36.70%) told that they were not aware about hazards [Figure 1]. 65 (59.63%) were males and 44 (40.37%) were females. Gender-wise, 52

male handlers (80%) were aware about hazards of hospital waste handling, and 17 female handlers (38.64%) were aware about hazards [Table 2].

**Table-1: Hospital waste generated per day in kilogram (kg)**

Department	Black	Blue	Yellow	Red
Pathology	13	2.2	0.5	4
Central Lab	6.25	1.25	5.25	42.3
Emergency OPD, Ward, OT	20.25	20.3	20.25	20.3
Surgery OPD, Minor OT, Dressing Room, Wards	17	22	21	16
TB OPD & Wards	16	19	19	17.2
Ortho OPD, Wards	41	22	12	11
Paediatrics OPD, Immunization Room, Ward	13	7	8.5	10.5
O & G OPD, Wards, OT, Labour Room	10.5	10.5	10.5	10.5
Medicine OPD, Injection Room, Wards	22.5	22.5	22.5	22.5
Skin OPD, Ward	0.2	0	0	0
Psychiatry OPD, Ward	0	0	0	0
Eye OPD, Ward	5	5	5	5
ENT OPD, Ward	5	5	5	5
Emergency OT	0.25	0	0	0
NICU	3	0	0	0
ICU, GICU, MICU, SICU	5	5	5	5
OT	8	10	20	10
RICU	2	8	5	3
Burn Ward	0	0	8	10
Total Waste Generated =707.35 kg/day	188	160	167.5	192

Total beds in the hospital 660; Bed occupancy rate 81%; Waste produced = 1.32 kg/bed/day

**Table-2: Gender wise awareness about hazards\* of hospital waste handling among hospital waste handlers\*\***

Awareness	Male N (%)	Female N (%)	Total N (%)
Yes	52 (80.00)	17 (38.64)	69 (63.30)
No	13 (20.00)	27 (61.36)	40 (36.70)
Total	65 (100.00)	44 (100.00)	109 (100.00)

\* Infections i.e. HBV, HIV, Injury with sharps, Burn with chemical; \*\* Total No. of Hospital Waste Handlers in the hospital were 109

**Table-3: Training and practices among hospital waste handlers**

Training and Practices (N=109)	Yes	No
	N (%)	N (%)
Handlers attended Special training	41 (37.61)	68 (62.39)
Handlers vaccinated*	5 (4.59)	104 (95.41)
Needle prick injury reported to higher authority	1 (0.92)	108 (99.08)
Using Gloves during work	36 (33.03)	73 (66.97)
Wearing Apron during work	47 (43.12)	62 (56.88)
Wearing Foot wear during work	16 (14.68)	93 (85.32)
Wearing Goggles during work	2 (1.83)	107 (98.17)
Using Mask during work	27 (24.77)	82 (75.23)

\* Vaccinated with Tetanus Toxoid and Hepatitis B Vaccine ever before

**Table 4: Awareness among Supervisors of Hospital waste handlers**

Awareness among Supervisors (N=13)	Yes N (%)	No N (%)
About benefits of use of personal protective measures	13 (100.00)	0 (0.00)
About hazards of hospital waste handling	13 (100.00)	0 (0.00)
Supervisors attended special training	9 (69.23)	4 (30.77)

**Table-5: Educational status of supervisors of hospital waste handlers**

Educational status	N (%)
High school	3 (23.08)
Intermediate	3 (23.08)
Graduation	3 (23.08)
Post-Graduation	4 (30.77)
Total	13 (100.00)

**Table-6: Awareness at the level of source of generation and segregation of hospital waste**

Observation (N=30)	Red Bin	Yellow Bin	Blue Bin	Black Bin
	N (%)	N (%)	N (%)	N (%)
Coloured Bins Availability at right place	19 (63.33)	22 (73.33)	21 (70.00)	21 (70.00)
Coloured Bins Not available at right place	11 (36.67)	8 (26.67)	9 (30.00)	9 (30.00)
Total places	30 (100.00)	30 (100.00)	30 (100.00)	30 (100.00)

**Table-7: Awareness about Placement of coloured plastic bags in plastic bin and availability of needle cutter**

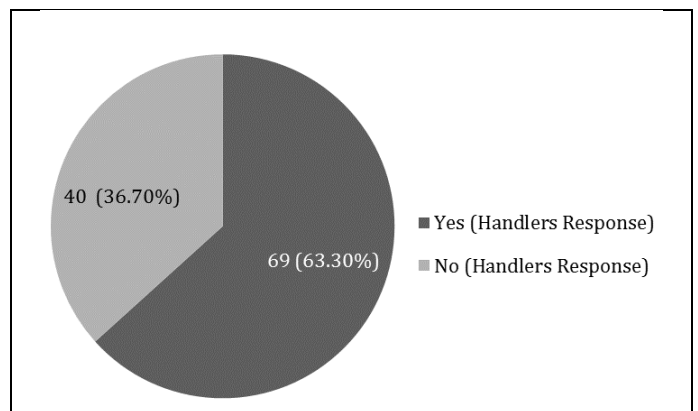
Observation	N (%)
Placed properly	3 (10.00)
Not placed	27 (90.00)
Availability of Needle cutter	30 (100.00)
Total No. of Places, in all	30 (100.00)

**Table-8: Observation at level of transportation of bags**

Action at level of transportation	Observation
Separate route of transportation of waste	No
Separate timings for transportation of hospital waste and general waste to avoid mixing	Yes
Covered wheeled Trolley used for transportation of bags	Yes
Trolley used for transportation of hospital waste labelled with colour	No

**Table-9: Observation at level of storage facilities of waste**

Features of Storage Room	Observations
Separate room for storing waste after collection	Yes, one separate room was available for storing waste
Storage area impermeable for water	Yes, storage area was impermeable
Storage area can be locked to prevent unauthorized entry	Yes, storage area can be locked
Weighing machine is present in storage room	Weighing machine was not available
Waste stored for more than 48 hours	Waste was not stored for more than 48 hours



**Figure-1: Awareness about Hazards\* of hospital waste handling among hospital waste handlers (\*Infections i.e. HBV, HIV, Injury with sharps, Burn with chemical)**

41 (37.61%) handlers responded that they had attended special training covering biomedical waste management schedule I and II, 5 (4.59%) handlers received vaccines e.g. Hepatitis B and Tetanus vaccine, 1 (0.92%) handler reported needle prick injury to higher authority, 36 (33.03%) used gloves during work, 47 (43.12%) wore apron, 16 (14.68%) wore foot wear during work, 2

(1.83%) wore goggles during work, 27 (24.77%) used mask during work [Table 3].

Supervisors were also employed to supervise the works of the waste handlers in the hospital. All the 13 supervisors were aware about benefits of the use of personal protective measures and about the hazards of hospital waste handling. Out of 13, 9 (69.23%) attended special training of waste management, and all were well educated [Table 4 & 5].

It was observed that out of total 30 places of waste generation, 19 (63.33%) were having all four colour coded bins. But 11 (36.67%), 8 (26.67%), 9 (30.00%) and 9 (30.00%) places did not have coloured bins of red, yellow, blue and black respectively. Plastic bags in these bin were placed properly of respective colours only at 3 (10.00%) places [Table 6 & 7].

To avoid mixing of the hazardous waste generated during health care procedures, with the non-hazardous general waste generated in the hospital – separate timings and covered wheeled trolleys were used at the time of transportation from places of the wastes generation to the storage area. The trolleys used to transport the wastes were not colour coded, and no separate routes were adopted for the transportation of the hospital wastes [Table 8].

At the level of storage, there was separate room for storing waste after collection. Storage area was impermeable for water, and could be locked to prevent unauthorized entry, but no weighing machine was there. No waste was stored for more than 48 hours [Table 9].

## Discussion

The tertiary care hospital of the present study generated 1.32 kg wastes per bed per day and had 13 sanitary supervisors and 135 waste handlers for waste management. The average wastes (1.32 kg/bed/day) generation was more in this hospital, as compared with results (0.52 kg/bed/day) of the study carried out by Srivastava Shalini et al.<sup>[7]</sup>

We also analyzed and compared the result of other studies carried out in different parts of the country, and world, for better conclusion regarding hospital waste management practices of the hospital of the present study. In a study carried out by Shahida Rasheed et al (2005), out of total eight teaching hospitals of Karachi

City, only 2 (25%) hospitals were segregating sharps, pathological waste, chemical, infectious, pharmaceutical and pressurized containers at source according to the bio-medical wastes management and handling rules of the country. For handling potentially dangerous waste, two (25%) hospitals provided essential protective gears to its waste handlers. Only one (12.5%) hospital arranged training sessions for its waste handling staff regularly. Five (62.5%) hospitals had storage areas but mostly it was not protected from access of scavengers.<sup>[8]</sup> In the present study, 19 (63.33%) places were segregating and there were no uniformity regarding use of protective gear – 36 (33.03%) were using gloves during work, 47 (43.12%) were wearing apron during work, 16 (14.68%) were wearing foot wear during work, 2 (1.83%) were wearing goggles during work, 27 (24.77%) were using mask during work and so on. In our Study, needle cutters were found in all 30 (100%) places.

## Conclusion

In the hospital, on the majority of the places, coloured bins were placed properly, and majority of the hospital wastes handlers were aware about hazards due to hospital wastes handling. At some places in the hospital, only one, two or sometimes three coloured bins were there. The female handlers were less aware about hazards as compared with the male handlers of the hospital. Being sensitive issue for human society and threat to the environment and other living creatures, hospital wastes should be managed till all parameters become perfect like 100% awareness and immunization in both female and male handlers. After taking a serious note in this regard, it was decided to train the staff with the help of the department Community Medicine. After completion of one year from the training, the waste management system would be re-evaluated.

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