

## Study of biomedical waste management system at secondary and primary level Government health institutions in West Bengal, India

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### ABSTRACT

**Background:** Biomedical waste has become a serious health hazard in many countries including India. Careless disposal of waste can contribute to spread of serious disease, environmental pollution among health care providers, patients and common people.

**Aim:** To find out the system of bio medical waste management at primary and secondary level government hospitals of West Bengal.

**Methods:** Descriptive, observational, cross-sectional, institution based study was undertaken among some primary and secondary level government hospitals of West Bengal during May '2010-Aug'2011. Study was done with observational checklists; predesigned, pretested proforma and record analysis of quantity of waste generations. Simple percentages were computed with help of Microsoft Excel 2007 software.

**Results:** Compliance was gradually falling at lower level of health institutions. None of the health care institutions provide prophylactic vaccination neither they used covered bins and dedicated trolleys. Medical waste was mixed with general waste in all hospitals. In all hospitals, final disposal of waste was mainly done by vendor (off- site treatment). Primary level care settings do not had blue puncture proof box and do not use disinfectant for sharp disposal.

**Conclusion:** Biomedical waste management was inadequate in all the hospitals visited. Awareness generation, regular training, vaccination, proper segregation, transportation and disposal should be followed.

**Key words:** bio medical waste, colour coded bags, segregation, transportation, disposal

### INTRODUCTION

Modern hospitals and health care institutions worldwide while providing preventive and curative services to the public generate ample bio-medical waste.<sup>1,2</sup>

Hospital waste refers to all waste that is generated from a hospital and is potent source of infection if concentration and virulence of pathogenic organisms is sufficiently high. Hazardous waste has a potential to cause hazards to health and life of human beings. According to WHO 85% of hospital wastes are non-hazardous, 10% are infectious and around 5% are hazardous wastes.<sup>3</sup> In India proportion of hazardous waste could range from 15% to 35% of the total waste generated whereas in USA, about 15% of hospital waste is hazardous.<sup>4</sup> A study (in 2001) has stated that about 0.33 million tones of

biomedical wastes are generated annually in India.<sup>5,6</sup> Poor bio-medical waste management exposes great risk to all level of health care providers and ancillary staff as well as visitors and general public.

In the year 2000, a review of use of injections in healthcare settings focusing on developing countries, estimated that injections with contaminated syringe caused Hepatitis B infections, contributing to 32% of all new infections; Hepatitis C, 40% of all new infections and HIV, 5% of all new infections could be attributed to this same source (World Health Organization 2004).<sup>7,8</sup> Skin injuries by sharps account for 66-95% of all occupational exposures to blood borne pathogens. Skin injuries from needles account for 62-91% of injuries.<sup>9,10</sup>

The present study was conducted with this background to find out the system of segregation, collection, transportation and disposal of bio-medical waste in few of secondary and primary level Government hospitals in the state of West Bengal.

## MATERIALS AND METHODS

The present study was a descriptive, observational study with cross sectional multisite based design conducted during May 2011-August 2011 to find out the bio medical waste management system in some government hospitals of West Bengal. The present study included six secondary level Government hospitals (three each of district hospitals and sub divisional hospitals) and three primary levels Government health care facilities (one rural hospital and two block primary health center). The hospitals were selected by simple random sampling. The three district hospitals (DH) were at Howrah (Howrah district), Chinsurah (Hooghly district) and Baharampur (Murshidabad district). The three sub divisional hospitals (SDH) were at Uluberia (Howrah district), Srirampur (Hooghly district) and Lalbag (Murshidabad district). The rural hospital (RH/BPHC) was at Tarakeswar (Hooghly district) and the two block primary health centers were at Amta (Howrah district) and Karnasubarna (Murshidabad district).

Healthcare providers involved in biomedical waste management in study areas like superintendants of all secondary level health institutions and block medical officer of health (BMOH) of primary level health institutions along with nursing superintendants of all secondary level health institutions and staff nurse of the primary level health institutions

were the study respondents.

The study tools were the observational checklists (Checklists for wards, labour room, operation theatre, laboratory, outpatient department ); predesigned and pretested proforma for interviewing the respondents (separate for the superintendants and nursing staffs) and the records regarding quantity of waste generation records from hospitals and vendor (April 2009-March 2010).

The parameters investigated were type and category of the hospital, types and quantity of waste generated from hospital, segregation, collection, storage, transportation, treatment and disposal of different categories of waste ,occupational safety issues ,waste management committee, provision of training regarding biomedical waste management, colour coded bags in OT, labour room, wards, OPD, laboratories, knowledge about disease transmitted by needle prick, colour coded bags, collection ,transportation, disposal of biomedical waste etc use of protective gears, reporting after needle stick injury. Simple percentages were calculated using Microsoft Excel 2007 software package.

## RESULTS

Bed strength and average annual bed occupancy rate for the 3 district hospitals were 600 and 77.7% for Howrah DH, 550 and 95.9% for Chinsura DH, 616 and 132% for Berhampore DH. The figures for the sub-divisional hospitals for the same calendar year were 210 and 147.1% for Uluberia SDH, 230 and 76.3% for Serampore Walsh SDH, 205 and 106.5% for Lalbagh SDH. The figures for the block primary health centers/rural hospitals were 60 and 91.2% for 30 and 108.8% for Amta BPHC,

Tarkeswar RH, 15 and 253.2% for Karnasubarna BPHC.

Facilities provided at the secondary level institutions like DH and SDH included emergency, laboratory, radiology, outpatient and inpatient departmental services with the presence of the disciplines like medicine, surgery, gynecology and obstetrics, pediatrics, orthopedics, dermatology, Eye, E.N.T etc. Separate burn wards were present in district hospitals which were not in subdivision hospitals. The rest of the centers visited were at the primary level providing emergency, laboratory, outpatient, immunization services with availability of male and female general wards, diarrhea and obstetrics wards etc.

Out of the 9 health institutions visited only 2 DH had written operational guidelines for BMWM. A committee for the same purpose was present in only 2DH, 1 SDH and a single BPHC. Only a single DH, SDH and BPHC performed staff training regarding BMW handling. Doctors and nursing staff were trained by hospital authorities at DH and SDH level while the doctors were trained by private vender at the BPHC level. Monitoring of the process of BMW management was present in a single DH. Two DH and 2 SDH regularly updated license from Pollution Control Board.

Provision of protective gears were available at all the levels of health care while prophylactic vaccination against Tetanus and Hepatitis B were not available at all the levels. Post exposure prophylaxis was present only at DH and SDH levels. Register for needle stick injury reporting was present only at the DH level. Infectious wastes, sharps and pathological wastes formed the main bulk of waste at the secondary level hospitals (three DH and three

SDH) while anatomical waste, infectious waste and sharps formed the main bulk of waste at primary level of health care. Pattern of segregation, collection, transportation and disposal in different DH, SDH and primary level health settings have been depicted in Table 1.

**Table 1: Pattern of segregation, collection, transportation and disposal in different DH, SDH and primary level health settings (n=9)**

Hospitals	Segregation	Collection	Transportation	Disposal
District Hospitals	Segregated at yellow, red, blue and black bags. Sharp → blue puncture proof box/ discarded plastic box/ cardboard box/ medicine box	Collected from wards by biomedical waste handlers/workers of the vendors.	Biomedical waste handlers carried waste manually or sometime used trolley. Sometimes they carried waste in common lifts.	Blue bags, sharps → autoclave. Autoclave waste, general waste → municipality vat Yellow bag and red bags → vender (blue bag to vendor in one DH)
Sub Divisional Hospitals	Segregated at yellow, blue and black bags. Sharp → medicine box/ phenyl bottle/open bins	Biomedical waste handlers and /or worker of the vendor collected waste from the wards.	Biomedical waste handlers carried waste manually or sometimes uses trolley/wheel chair. Sometimes they carried waste in common lifts.	Yellow, Red, blue bags → vender (including sharps at one SDH) Black → either in municipality vat or if vat inside the hospital not present then stored outside hospital premises (collected by municipality) Sharp → sharp pit Sometimes all waste dumped in municipality vat at one SDH.
Block Primary Health Centers/Rural Hospital	One BPHC Segregated only placenta in labour room. Others segregated outside the wards.	Collected from wards and labour room at one BPHC. For others collected from containers outside wards.	Biomedical waste handlers carried waste manually or workers of the vendor carried waste inside/outside the wards.	Vender → placenta, slides Other waste → burning in hospital premises at one BPHC. General waste → burning /sharp pit while anatomical, non infectious waste, sharps → private vendor company at another BPHC. All waste except general waste carried by private vender company and general waste disposed into sharp pit at RH.

In most of the hospitals, sharps are destroyed in bulk. Both manual method and needle cutter, are used to destroy the needles. In all hospitals, sharps are disposed only when the containers become full. None of the primary health care settings used disinfectant for sharp disposal. Table. 2.

**Table 2: Collection and disposal of sharps different health institutions (n=09)**

Sharp related issues	Category of the health institutions		
	District hospitals (n=3)	Subdivision hospitals (n=3)	Primary level health Care (n=3)
Method of collection of sharps	Collected into cardboard box/bottle/ puncture proof box	Collected into cardboard box/ open bins	Collected into cardboard box/bottle
Method of disposal of sharps	Manually/needle cutter	Manually/needle cutter	2 BPHC → destroyed manually Rural hospital → destroyed manually/needle cutter
Sharp destroyed individually/bulk	Bulk	Bulk	Bulk
Frequency of disposal	When sharp container full	When sharp container full	When sharp container full
Disinfectant used in the containers	Yes	Yes	No
Frequency of replacement of disinfectant	2 DH → 2-3 days 1 DH → 7 days	2 SDH → 4-5 days 1SDH → 5-7 days	Not applicable
Methods of preparation of 1% of bleaching powder solution	One matchbox amount of bleaching powder is mixed with one liter of water	One matchbox amount of bleaching powder is mixed with one liter of water	Not applicable

In all secondary care as well as primary level health care settings hospital, medical waste is mixed with general waste. Needle cutter used occasionally in all hospitals. None of the hospitals used covered bins. Biomedical waste was not carried by dedicated trolley or through pre defined pathway. Needle cutter occasionally used in only rural hospital. Table 3.

**Table 3. Different issues related to Segregation, collection, transportation and disposal of biomedical waste management in secondary and primary level health institutions (n=9)**

Different issues related to biomedical waste management	Secondary level institutions						Primary level institutions		
	DH-1	DH-2	DH-3	SDH-1	SDH-2	SDH-3	RH	BPHC-1	BPHC-2
Medical waste is mixed with general waste at bedside	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Use of needle cutter for mutilating sharps	Occasional	Occasional	Occasional	Occasional	Occasional	Occasional	Occasional	No	No
Use of freshly prepared bleach solution daily	No	No	No	No	No	No	No	No	No
Covered bins	No	No	No	No	No	No	No	No	No
Bio hazard label is on all bags	No	No	No	No	No	No	No	No	No
The plastic wastes are cut before disposal	No	No	No	No	No	No	No	No	No
Use of dedicated trolley to carry waste to temporary central storage	No	No	No	No	No	No	No	No	No
Transport of waste through predefined path	No	No	No	No	No	No	No	No	No
Labeling of bags before final disposal	Occasional	Occasional	Occasional	Occasional	Occasional	Occasional	No	No	No

In secondary level health institutions, 45.8%, 54.1% and 8.3% of nursing areas had blue bags, black bags and blue puncture proof boxes respectively. 41.6% of nursing area had yellow bags whereas only 5% of female toilets had yellow bags. In secondary level health institutions 4.1%, 29.1% and 50% of nursing area had blue puncture proof box, yellow bags and black bags respectively. Foot of the tables of the operation theatres and labour room had 57.6% of yellow bags whereas instrument cleaning area and near anaesthesia equipment these percentages were 12.5% and 26.6% respectively. Blue puncture proof boxes were

not found in any of the visited laboratories in district and subdivision hospitals. Yellow bags were mainly found in laboratories and dressing area of OPD. Blue bags mainly used in injection rooms and laboratories, Table 4.

**Table 4. Distribution of coloured bags in wards, OT including labour room, different laboratories and OPD, among secondary level care health institutions**

Secondary levels (n=6)	Wards(n=24 wards)											
	Female toilets(n=19)		Nursing areas(n=24)						Dressing area(n=6)			
	Yellow bags		Blue puncture proof box		Blue bags		Yellow bags		Black bags			
	1(5%)		2(8.3%)		11(45.8%)		10(41.6%)		13(54.1%)			
	OT including labour room(n=24)											
	Nursing stations(n=24)				Foot of the table(n=52)				Instrument cleaning area(n=24)		Near instrument cleaning (n=30)	
	Blue puncture proof box		Yellow bags		Black bags		Yellow bags		Yellow bags		Blue bags	
	1(4.1%)		7(29.1%)		12(50%)		30(57.6%)		3(12.5%)		8(26.6%)	
	Laboratories(n=6)					OPD(n=3)						
	Samplecollecting area(n=6)			Sample processing area(n=6)			Dressing room(n=3)			Injecting room(n=3)		
Blue boxes	Yellow bags	Blue bags	Yellow bags	Blue bags	Blue boxes	Black bags	Black bags	Yellow bags	Blue bags	Blue boxes	Yellow bags	Blue bags
-	3 (50%)	3 (50%)	2 (33.3%)	3 (50%)	-	-	-	1 (33.3%)	-	-	-	1 (33.3%)

In primary level health institutions 50% of nursing area had blue bags and 25% of the nursing area had black bags. . None of the nursing area had blue puncture proof box. 25% of nursing area had yellow bags whereas none of the female toilets had yellow bags. None of the nursing stations of primary level health institutions had blue puncture proof box. 33.3% of nursing area had both yellow and black bags. Foot of the tables of the operation theatres including labour room and near anaesthesia equipments had 44.4% and 25% of yellow bags respectively. .None of the instrument cleaning area had yellow bags. Blue puncture proof boxes were not found in any of the visited laboratories in primary level health institutions. None of the visited area had yellow bags, Table 5.

**Table.5. Distribution of coloured bags in wards, OT including labour room, different laboratories and OPD, among primary level care health institutions**

primary level care health institutions (n=3)	Wards(n=13 wards)												
	Nursing areas(n=4)											Dressing area(n=2)	
	Female toilets(n=5)		Blue puncture proof box		Blue bags		Yellow bags		Black bags		Yellow bags		
	-		-		2(50%)		1(25%)		1(25%)		-		
	OT including labour room(n=5)												
	Nursing stations(n=3)				Foot of the table(n=9)			Instrument cleaning area(n=4)		Near instrument cleaning (n=4)			
	Blue puncture proof box		Yellow bags		Black bags		Yellow bags		Yellow bags		Blue bags		
	-		1(33.3%)		1(33.3%)		4(44.4%)		-		1(25%)		
	Laboratories(n=3)						OPD(n=3)						
	Sample collecting area(n=3)			Sample processing area(n=3)			Dressing room(n=1)		Injecting room(n=3)				
Blue bags	Yellow bags	Black bags	Blue bags	Black bags	Black bags	Yellow bags	Blue bags	Black bags	Blue bags	Yellow bags	Blue bags		
-	1(33.3%)	-	1(33.3%)	-	-	-	-	-	-	-	1(33.3%)		

The amount of waste generated in district hospitals, subdivisional hospital and primary care hospital generated 0.25-0.30, 0.04-0.07, 0.01-0.03 kg/bed/day waste in previous year.

## DISCUSSION

During the past few years, there has been an increase in public concern about the management of healthcare waste on a global basis.<sup>11</sup> Areas of concern in medical waste management are similar for all healthcare units and at all stages including segregation, collection, storage, transport, treatment and disposal.<sup>12</sup>

In present study only 30% of the visited health institutions had operational guidelines. The findings corroborates with the study done by Rashid S et al.,<sup>13</sup> while another study conducted in Shandong City, China revealed comparatively higher percentage.<sup>14</sup>

Present study shows that only 40% of visited health institutions organized training regarding biomedical waste management however there were no provisions for training to biomedical waste handlers. In contrast, studies done in Iran, Jordon, Istanbul and China revealed quite a high percentage (60%, 57%, 98% and 93.3% respectively) of providing training courses for

the handlers.<sup>15-18</sup>

It was found that almost all health care institutions supplied protective gears to the waste handlers and post exposure prophylaxis was available in almost all health institutions except two primary level health care settings which are comparable to other studies.<sup>13,14</sup>

We found that segregation practice was not strictly followed in any hospital and medical waste was mixed with general waste. The scenario is not much different in other states.<sup>19-22</sup>

Major hospitals were equipped with incinerators but proper bio-medical waste management systems had not implemented.<sup>23,24</sup>

It is worth mentioning that a significant improvement in waste segregation practices in few hospitals of Delhi, Belgaum and Mumbai.<sup>25-28</sup>

Present study has found out that none of the health care institutions provided prophylactic immunization to the health care provider. Even when injured the staff do not report. Askarian et al<sup>17</sup> found that in 60% of the hospitals, needle stick injuries are not reported and no post exposure prophylaxis is provided. Low reporting of injuries may be due lack of awareness of the health care providers about the formal system of reporting within the health facilities.

## CONCLUSION

The compliance with waste management was poor in regard to following the guidelines, constitution of committee on waste management, training of all concerned staff and renewal of license. However, since the sampling design was purposive and data collection was unblinded so generalization of results may be difficult.

## LIMITATION

Only Govt. health institutions were focussed hence status at private set up cannot be commented. Respondent bias is a possibility as data collection included interview technique. Waste disposal only within hospital premises was the purview of the study and because this was a cross-sectional study, health worker's practice over time could not be assessed.

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