



## A Comparative Study of Hospital Waste Management in Field Hospitals Established By Armed Forces and Health Centers Established By Civil Administration in Forward Localities of North Sikkim

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### Abstract

**Background and objectives:** Bio-medical waste (BMW) generated by hospitals is a special category of waste, which needs to be handled appropriately with due caution as it carries a potential risk for infection and injury. Currently there is a tendency of managing BMW in a casual manner. The objectives of the study was to study the type and quantity of bio-medical waste generated, modality of health care waste management, assess Knowledge, attitude & practice (KAP) regarding hospital waste disposal management among various categories of staff in health care centers and to provide recommendations for proper hospital waste disposal management.

**Methods:** The present study was undertaken in 25 health care centers located in forward localities in North Eastern region. Electronic Weighing machine to weigh the quantum of BMW waste generated, and KAP questionnaire was used during the conduct of the study.

**Results:** A total of 385 staff members belonging to various categories and working in the 25 health care centers were interviewed and their input was obtained. The management of bio medical waste was found to be satisfactory in group 1 (Field hosp of Armed Forces) and some health care centers in group 2 (other forward health care centers) whereas in the majority of health care centers the management of bio-medical waste was not satisfactory. The hospital waste generated was observed in the range from 33 gms/patient/day to 343.7 gms/patient/day. The KAP regarding hospital waste disposal management among the various groups of healthcare centers did not reveal any statistical difference in knowledge, attitude and practice between the various categories of staff. **Conclusion:** The present study has revealed that the practice of hospital waste disposal and its management is still inadequate in forward civil health establishments as compared to Field hospitals of Armed Forces.

**Keywords:** Biomedical waste, Field hospital, health care centre, segregation.

### INTRODUCTION

Hospital waste is a special category of waste, which needs to be handled appropriately with precautions because it carries a higher potential for infection and injury than any other type of waste. With a rapid increase in the number of hospitals, clinics and laboratories in the country, the generation of bio medical waste has been increasing considerably. In western countries it is estimated that hospitals generate 1 to 1.5 kg of waste per bed per day. It is

also estimated that in clinics, the total amount of waste generated is 200 kg/year. It is estimated that patients in India generate between 0.5 to 1 kg of waste/person/day. In Karnataka State (SOER-2003), the generation of hospital waste has been estimated to be 1.0 kg/day in private and government health care establishment, 1.5 kg/day in blood bank, 1.0kg/day in diagnostic laboratory, 0.2kg/day in small clinics and 0.25kg /day in veterinary clinics.

According to WHO (2000), almost 80% of hospital waste is comparable to domestic waste, and the remaining 20% is considered hazardous, as it may be infectious, toxic and/or radioactive. Improper disposal of waste generated in health care establishment can have direct and indirect health impacts on those who work in the health care establishment, the general public and on the environment. Such practices may contribute to the spread of diseases, as well as pollution of water, soil and air. Untreated infectious waste dumped on the land can contaminate surface and ground water supplies and even incomplete combustion of health care waste can lead to toxic emission, thus exposing the entire population to the risk of disease.

The so-called disposable plastic syringes if recycled indiscriminately, can become a potential source of infection (like Hepatitis ‘B’ virus HBV, hepatitis ‘C’ virus HCV) and human immunodeficiency virus (HIV) not only to the patients but also to the workers who are recycling the syringes. As a result of the re-usage of unsterilized syringes, 8-16 million hepatitis B, 2.3 to 4.7 million hepatitis C and 80,000 to 1, 60,000 human immunodeficiency virus infections are estimated to occur yearly. World Health organization has estimated the incidence of hospital acquired infections to be about 10% in South East Asian Region.

Even after the implementation of bio-medical waste rules (management and handling) 1998 as amended in 2016, the condition remains more or less unchanged. It can be attributed to lack of knowledge,

resources and enforcement of the regulation. The indiscriminate and unregulated dumping of bio-medical waste (especially waste sharp) exposes the rag pickers, waste handlers and children playing in dumpsters to accidental injuries with needles.

Various studies on hospital waste management in urban areas/District/Tertiary care hospitals of India have been conducted whereas in the rural areas very few studies have been undertaken. Hence an attempt is made to study the present state of hospital waste management in the forward localities of North Sikkim in NE region of this country.

### Review Of Literature

#### Biomedical Waste (Management and handling) Rules 2016

Safe disposal of biomedical waste is now a legal requirement in India. On 20th July 1998,"Bio-medical waste (Management and Handling) Rules were framed. The 1st Amendment to these rules was made on 06 Mar 2000 and 2<sup>nd</sup> Amendment on 17 Sep 2003. However, On 28th March 2016, Under Environment (Protection) Act, 1986, MoEF & CC notified the new BMW Rules, 2016 and replaced the earlier Rules (1998).In accordance with these rules, it is the duty of every “occupier” i.e. a person who has the control over the institution or its premises, to take all steps to ensure that waste generated is handled without any adverse effect to human health and environment. BMW mgt rules consist of six schedules.

#### SCHEDULE I & II- Categories of Bio-Medical Waste & Type of containers

Category	Type of waste	Type of Bag or Container to be used	Treatment and Disposal options
1. Yellow	(a) Human Anatomical Waste: Human tissues, organs, body parts and fetus below the viability period .	Yellow coloured non-chlorinated plastic bags	Incineration or Plasma Pyrolysis or deep burial*
	(b)Animal Anatomical Waste : Experimental animal carcasses, body parts, organs, tissues, including the waste generated from animals used in experiments or testing in veterinary hospitals or colleges or animal houses.	Yellow coloured non-chlorinated plastic bags	Incineration or Plasma Pyrolysis or deep burial*

	(c) Soiled Waste: Items contaminated with blood, body fluids like dressings, plaster casts, cotton swabs and bags containing residual or discarded blood and blood components.		
	(d) Expired or Discarded Medicines: Pharmaceutical waste like antibiotics, cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc.		Expired `cytotoxic drugs and items contaminated with cytotoxic drugs to be returned back to the manufacturer or supplier for incineration at temperature >1200 degrees.
	(e) Chemical Waste: Chemicals used in production of biological and used or discarded disinfectants.		Disposed of by incineration or Plasma Pyrolysis
	(f) Chemical Liquid Waste : Liquid waste generated due to use of chemicals in production of biological and used or discarded disinfectants, Silver X-ray film developing liquid, discarded Formalin, infected secretions, aspirated body fluids, liquid from laboratories and floor washings, cleaning, house-keeping and disinfecting activities.	Separate collection system leading to effluent treatment system.	After resource recovery, the chemical liquid waste shall be pre-treated before mixing with other wastewater. The combined discharge shall conform to the discharge norms given in Schedule III.
	(g) Discarded linen, mattresses, beddings contaminated with blood or body fluid.	Yellow coloured non-chlorinated plastic bags	Non- chlorinated chemical disinfection followed by incineration or Plasma Pyrolysis .
	(h) Microbiology, Biotechnology and other clinical laboratory waste: Blood bags, Laboratory cultures, stocks or specimens of microorganisms, live or attenuated vaccines, human and animal cell cultures used in research, industrial laboratories, production of biological, residual toxins, dishes and devices used for cultures.	Autoclave safe plastic bags or containers	
<b>2. Red</b>	Contaminated Waste (Recyclable) (a) Wastes generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (without needles and fixed needle syringes) and vacutainers with their needles cut) and gloves.	Red coloured non-chlorinated plastic bags or containers	Autoclaving or micro-waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent to

			registered or authorized recyclers or for energy recovery or plastics to diesel or fuel oil or for road making, whichever is possible.
<b>3. Blue</b>	(a) Glassware: Broken or discarded and contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes	Cardboard boxes with blue colored marking	Disinfection (by soaking the washed glass waste after cleaning with detergent and Sodium Hypochlorite treatment) or through autoclaving or microwaving or hydroclaving and then sent for recycling.
	(b) Metallic Body Implants		
<b>4. White (Translucent)</b>	Waste sharps including Metals: Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades, or any other contaminated sharp object that may cause puncture and cuts. This includes both used, discarded and contaminated metal sharps	Puncture proof, Leak proof, tamper proof containers	Autoclaving or Dry Heat Sterilization followed by designated concrete waste sharp pit.

**SCHEDULE III: Label for Bio-Medical Waste Containers**



**Fig 1: Bio hazard Label - handle with care**

**SCHEDULE – IV: Label for transport of Bio-Medical Waste Containers**

Day .....	
Month .....	
Year .....	
Date of generation .....	
Waste category No .....	
Waste class	
Waste description	
Sender's Name & Address	Receiver's Name & Address
Phone No .....	Phone No .....
Telex No ....	Telex No .....
Fax No .....	Fax No .....
Contact Person .....	Contact Person .....
In case of emergency please contact	
Name & Address:	
Phone No.	

**Fig 2: Label for Transport**

**SCHEDULE- V:** Standards for treatment and disposal of bio-medical wastes

**SCHEDULE VI:** Schedule for waste treatment facilities like incinerator/ autoclave/ microwave system

Over 75% of hospital waste is non-hazardous. There is no established system of segregation of hazardous from non-hazardous waste in majority of the health care establishments. This mixing of the various components results in increased quantity of hazardous wastes. Very often, the hospital wastes are dumped along with municipal wastes. Sometimes the healthcare establishments are provided with incinerators, but very often these are inappropriate in design, improperly operated or remain out of order. In a study that was done in the city of Lucknow it was observed that health care waste were dumped outside the health care establishment premises, on roadside, in residential areas, on public waste dumping sites and drains carelessly, which resulted in the increase in risk of spreading of many diseases. 60-70% of hospital employees, knowingly or unknowingly, sustain injuries from sharps. The groups most vulnerable include medical care

workers, specially ayahs, ward boys and waste handlers inside and outside health care facilities.

Very often, newspapers report the finding of human body parts in the vicinity of the hospitals. Stray dogs carry amputated parts and placenta into residential colonies around hospitals. Open burning of the hospital waste and incineration of plastics and hazardous materials will generate at least 75 hazardous chemicals as byproducts like oxides of sulphur, oxides of nitrogen, carbon dioxide, suspended particulate matter, dioxins and furans. Dioxins and furans are carcinogenic in nature and other substances when inhaled by persons can cause respiratory diseases.

**Aim**

To undertake a comparative study of hospital waste management in field hospitals established by Armed

Forces and health centres established by civil administration in forward localities of North Sikkim.

### Objectives

1. To study the type and quantity of Bio-Medical waste generated by the hospital.
2. To study the present modality of hospital waste management.
3. To assess knowledge, attitude and practices (KAP) regarding hospital waste disposal among various categories of staff in health care centers/units.
4. To recommend measures to improve Biomedical waste management in forward health care centres.

### Scope of study

Being a single worker study, it was confined to study of BMW disposal in Field hospitals established by Armed Forces and health care centers established by

the Civil administration in forward localities in North Sikkim.

### Material & Method

**Comprehensive check list for appropriateness:** A comprehensive check list was prepared to conduct the study and was tested for appropriateness in some of the health care centers/units during the pilot study.

**Questionnaire for KAP Study:** Questionnaire for KAP study was prepared and tested for understanding knowledge, attitude and practices among the various levels of staff in the health care centers.

**Methodology:** Firstly, the various health care centers (listed in Table No 1) were visited and a rapport was developed with the heads & staff of the healthcare centers/units. The purpose of the study was explained and their co-operation was requested to conduct the study in their health care centers/units.

**Table No: 1**  
**Distribution of Health Care Centers under various groups**

Groups	Health care centers/units	Number	Studied
Group-1	Field hospital	4	4
Group-2	Advanced dressing station	10	10
Group-3	Primary health centers	6	4
Group-4	General practitioners clinics	4	2
Group-5	Dental clinics	5	4
Group-6	Private laboratory	1	1
Total		<b>30</b>	<b>25</b>

Secondly, the staffing pattern of these health care centers was studied. The details are given in Table No 2 below:

**Table No: 2**  
**Staffing pattern in the various groups of health care centers/ units**

Groups	No of doctors	No of nursing staff	No of Lab technicians	No of pharmacists	No of other staff	Total
1	40	60	12	8	128	268
2	10	20	4	0	10	44
3	12	16	4	4	16	52
4	2	2	0	0	2	6
5	4	4	0	0	4	12
6	1	0	1	0	1	03
<b>Total</b>						<b>385</b>

Thirdly, the type and quantity of waste generated in each health care center was assessed by the following method:

1. Prior to the start of the study, the concerned staff members were explained and requested to store the biomedical waste generated in last 24 hours and not to dispose of the same till the interviewer met them on the next day for weighing, after which they could dispose off the waste. They were requested to follow the same for 7 days.
2. Then the waste that was stored, if not segregated earlier, was physically segregated using appropriate personal protective measures. After segregating, the waste was weighed using a weighing machine (that weighs maximum of 2 kgs and minimum 10 gms). Before each weighing, it was set to zero, with the help of correction knobs. Then the weight of waste was documented by rounding off to the nearest zero value.
3. Some of the waste materials could not be weighed on the weighing machine as they were too light to be weighed by the machine. For such waste materials, an electronic weighing machine was used to prerecord the weight of individual waste material and the same was multiplied with the quantity/ number of that waste. The weight of a few waste materials, determined by an electronic weighing machine is as shown in the Table No : 3.

**Table No: 3**  
**Weights of waste materials determined by an electronic weighing Machine**

Waste materials	Weight in Grams	
	2ml syringe	5ml syringe
Disposable plastic needle cover	0.6022 gms	0.6087 gms
Disposable injection needle	0.2093 gms	0.2129 gms
Disposable plastic syringe	3.3371 gms	5.6653 gms

The state of hospital waste disposal management in each health care center was observed and studied by using the pre-tested checklist.

For the KAP study regarding hospital waste disposal management, the pre-tested questionnaires were given to all the staff members of various health care centers/units and were requested to fill the same. Some staff members like group D workers, sweepers, ayahs and attendants etc, were verbally asked the contents of pre-tested questionnaire and the response were recorded.

### Observation & Discussion

During quantification study, the following observations relating to infection control and waste management were recorded:

1. The general cleanliness in the healthcare centers in the civil set up was not up to the desired standards.
2. It was observed that biomedical waste management has not been given due priority and there was no regular administrative monitoring in civil health care establishments.
3. Number of available Housekeepers (safaiwalas) was found inadequate in civil health care establishments.

4. In all the civil health care centres, bio waste bins were available but the size of the bins did not match the quantity of waste generated by the healthcare facilities.
5. The placement of bio waste bins did not match the waste generation trends. Single bin system was being followed at the sampled facilities.
6. Analysis of questionnaire revealed that the staff of the health care centers was partially aware on the significance and practice of proper segregation and disposal of bio-medical waste (see Table No 4 & 5).

**Table No -4**  
**Staff members giving correct response on KAP questionnaire on BMW**

Questionnaire	Various levels of staff members				
	Doctors-69	Nursing staff-102	Lab tech-21	Pharmacist-12	Others-161
Knowledge	52 (75%)	75 (73.5%)	18 (85.7 %)	5 (41.6%)	45 (27.9%)
Attitude	60 (86.9%)	75 (73.5%)	19 (90.4%)	7 (58.3%)	105 (65.2%)
Practice	20 (28.9%)	35 (34.3%)	15 (71.4%)	2 (16.6%)	85 (52.7%)

**Table-5**  
**Category wise response on KAP questionnaire regarding BMWM**

Cat of staff	Apron	Boots	Masks	Goggle	Glove	Immunization	Segregation	Disposal
Doctors	Yes	No	Yes	No	Yes	Partial	Yes	NA
Nursing staff	Partial	No	Mask	No	Yes	Partial	Partial	Na
Lab technician	Partial	No	Partial	No	Yes	Partial	Yes	NA
Pharmacists	No	no	No	No	No	No	No	No
House keepers	No	Partia l	Partial	Partial	Partia l	Partial	Partial	partial

Mixing of general waste with infectious waste is a common feature.

Pen burning was taking place at all the healthcare facilities. Awareness regarding hazards of open burning is lacking.

IV bottles were included during quantification. Invariably these bottles are not disposed of in the waste stream.. Storing of IV bottles and selling them to kabadiwalas is a common practice found in the healthcare facilities situated in the plains or more populated towns/ cities. It is a matter of serious concern because many of these used IV bottles approximately (sixty per cent) were attached with IV sets and needles which pose direct threat of prick injury and infection to the waste handlers.

The used IV bottles and disposable syringes received at the quantification point were not cut or mutilated. Protective gears have been supplied to the housekeeping staff by the Health care facility but use of protective gear at the time of handling waste was completely absent.



The comparative details between Armed Forces medical facility and Civil medical facility with reference to biomedical waste is as given in Table 6 below:

**Table No -6**  
**Comparative study between Armed Forces Medical facility and civil Medical facility**

Areas	Armed Forces medical facility	Civil medical facility
Generation of hospital waste	Yes	Yes
Segregation of waste	Adequate	Partially adequate
Collection of waste	Timely	Random
Movement of waste	Safe and closed containers	Open containers
Education of waste handlers	Adequate	Inadequate
Use of PPE	Regular	Casual
Availability of eqpt	Available	Partially available
Use of transport	Regular	Partial
Disposal of hospital waste	At designated places	At one place
Use of colour coding	Adopted	Not in small centers

## CONCLUSION

Proper segregation and disposal of biomedical wastes is the need of the hour not only in terms of Biomedical waste Management rules but also for the safety of health care workers and the society at large, Hence the following recommendations are made:

1. Proper segregation of Biomedical wastes at the source or point of generation needs to be emphasized and practiced by all health care workers.
2. It should be made mandatory for all healthcare facilities to get their healthcare personnel trained in handling and management of Biomedical wastes from accredited training centers. These training sessions should not become merely an one-time activity but should be a continuous process to reinforce memory and practice.
3. Morale & motivation of sanitary staff should be enhanced by periodic interactions and they

should be constantly encouraged to use personal protective equipment (PPE).

4. It should be ensured that the needle stick injuries happening to the healthcare personnel are reported to the person in-charge of biomedical waste management or to the biomedical waste management committee, so that pre-emptive action can be initiated in time.

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