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Hospital Waste Management

A Guide for Self Assessment and Review



Shishir Basarkar

2nd Edition

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Chapter 2

Hospital Waste

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1. **What is the multi-layered system of rural health care in India?**
   In India the healthcare system is divided at five levels and these are:
   1. *Subcenter:* This is the most basic unit of healthcare delivery system and most peripheral contact point. It caters for about 3000–5000 populations and these subcenters are staffed with one female multipurpose worker (MPW) and one male multipurpose worker. if female MPW is not available then one auxiliary nurse midwife (ANM) is posted at subcenter. in India there are more than 1,47,069 subcenters.
   2. *Primary health center (PHC)*: It is a referral unit for six subcenters. It caters for 20,000 to 30,000 population. Each PHC has 4–6 indoor bed for patient admission. The staff at PHC consists of one medical officer (MO) and 14 paramedics. There are more than 23,391 PHCs.
   3. *Community health center (CHC)*: It is a referral unit for four PHCs. It is 30 bedded hospital. The staff at CHC consists of doctors, nurses, paramedical and support staff. At present there are more than 5530 CHC in India.
   4. *Sub district hospital:* They are located at the divisional head quarter of each district head quarter level and has bed strength ranging from 100 to 300. These have all the basic specialties.
   5. *District hospital:* These hospitals are located at district level and has bed strength of above 300 beds.

2. **What is waste?**

   Waste is the discarded material much of which can be recycled or reused depending on the type of waste.

3. What do you mean by word 'waste'?

The word 'waste' refers to useless, unused, unwanted or discarded material. It can also be defined as something which is not put in to proper usage at a given time. The waste generation is the result of 'throw away' cultures prevalent everywhere including healthcare sector.

4. What is the WHO definition of hospital?

A hospital is an integral part of a social and medical organization the function of which is to provide for the population complete health care both curative and preventive and whose outpatient services reach out to the family and its home environment.

It is also a center for the training of health workers and biosocial research.

5. Other than hospitals what are other sources of biomedical waste generatiosn?

The other sources are:

- Medical research laboratories
- Tattoo shops and body piercing shops
- Acupuncture clinics and other clinics practicing alternative medical therapies
- Blood banks
- Pathology laboratories
- Physiotherapy and podiatrists clinics
- Veterinary hospital and pet clinics
- Ambulance and special emergency service centers
- General practitioner's clinics
- Pharmaceutical plants and medical shops
- Hospice centers and residential homes for chronically ill patients.

6. How the biomedical waste is quantified on per patient bed per day basis?

The biomedical waste is quantified by using formula:

Total quantum of waste generated per day (W) divided by total number of patient beds occupied at a time (B).

$Q = W/D$

7. How many types of waste are there?

There are various types of waste generated in the health care setting. Types of waste are general waste or non-infectious waste,

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biomedical waste, contaminated waste, pathological waste, animal waste, pressurized cans, infectious waste, chemical waste, liquid waste, hazardous waste, cytotoxic waste, blood and its products waste, radioactive waste, sharps, etc.

8. **What is the difference between sewage and sullage?**
   Sewage it is the waste water containing solid and liquid excreta having very unpleasant smell. Sullage it is the waste water which does not contain human excreta. Example waste water from kitchen, bathroom, etc.

9. **How the waste can be classified in subcategories?**
   Waste can be classified in to various subcategories by multitude of schemes:
   - Based on physical state—solid, liquid, gaseous.
   - Based on material—glass, paper, etc.
   - Based on physical properties—combustible, compostable, recyclable.
   - Based on origin of waste—domestic, commercial, agricultural, industrial, etc.
   - Based on safety level—hazardous, nonhazardous.

   In India, for regulatory purposes, waste is generally classified into municipal solid waste and hazardous waste.

10. **What is an average percentage distribution of waste in hospital?**
    80%—General waste
    15%—Infectious waste
    01%—Sharp waste
    3%—Chemical and pharmacological waste.
    <1%—Special waste, i.e. radioactive, cytotoxic pressurized containers.

11. **When the waste is classified as infectious waste?**
    When the waste contain pathogen of sufficient virulence and quantity as well so that when there is exposure to such waste by a person or animal could eventually result in the infectious disease.

12. **What is the excreted load of enteric disease and infectious agents?**
    As per WHO estimation the excreted load of infectious agents of some of enteric diseases is as under:

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Infectious Agent	Average number per gram of feces
Salmonella typhi	10^8
Hepatitis A virus	10^6
Shigella species	10^7
E coli (pathological)	10^8

These organisms in the environment at the temperature of 20–30°C may remain for 2 weeks to 3 months which aggravate the health hazards especially when associated with biomedical waste generated in healthcare facility.

13. What are the major components of heathcare waste in India?

Components	Percentage (approx)
Bandages	30–35
Plastic	7–10
Glass	3–5
Disposable syringes	0.3–0.5

14. What is an average percentage of plastic and paper in hospital waste?

Plastic 70%
Paper 15%

15. What is hazardous waste?

The waste products which by their characteristics poses threat to environment or human life. For example, radioactive waste, pressurized cans, infectious waste, etc.

16. What is biomedical waste?

The waste generated in diagnosis treatment or immunization of human beings or animals, in research or in the production of testing of biological products including all categories of infected and toxic waste that is potential threat to human beings and environment. Biomedical waste can also be termed as regulated waste/medical waste or health care waste.

17. What is hospital waste?

All discarded biological and nonbiological material which is not intended for further use.

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18. How biomedical waste/medical waste is generated?

It can be generated during:

- Diagnosis
- Treatment
- Immunization
- Biomedical research
- Production and testing of biological products.

19. What is infectious waste/clinical waste?

Waste capable of producing an infectious disease based on four factors namely.

1. Presence of virulent pathogenic organism
2. Portal of entry
3. Sufficient dose of pathogen
4. Resistance of the host.

20. What are the characteristics of general waste?

It is:

- Non-hazardous
- Non-toxic
- Non-infectious
- Disposed through local municipal authorities.

21. Give examples of infectious waste?

- Waste from infectious wards
- Human blood and blood products
- Cultures and stocks of infectious agents
- Waste from surgery and autopsy
- Contaminated sharps
- Dialysis unit waste
- Contaminated animal carcasses
- Contaminated equipments.

22. What are the hazards of pressurized containers?

There may explode if punctured or incinerated and cause damage nearby. They should be returned to manufacturer as far as possible.

23. What are the indirect risks associated with biomedical waste?

The risk associated with biomedical waste per se:

- Contamination of ground soil and water by dumping untreated waste
- In case there is insufficient filtering then smoke can pollute the air.

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24. What is net wastivity?

It is the net quantity of waste generated in proportion inputs. This excludes the recyclable waste.

25. How will you calculate the average quantity of waste generated?

By using the formula:

Average quantity of generated per day divided by the bed occupied on that particular day.

26. How the hospital waste can be classified?

It can be classified as follows:

- As per biomedical waste (management and handling rules 1998), there are 10 categories.
- As per WHO there are 8 categories.
- As per environment protection Act of USA there are 7 categories.

27. Why housekeeping department is "police" of the hospital?

P – Planning	O – Organize	L – Liaison
I – Implementation	C – Control/Monitor	E – Evaluation

28. What are the categories of waste as per WHO?

- General waste
- Pathological waste
- Radioactive waste
- Chemical waste
- Infectious waste
- Sharps
- Pharmaceutical waste
- Pressurized containers.

29. What is the quantum of biomedical waste in different countries?

The quantum of waste generated per bed per day is:

Country	Quantity (Kg/Bed/Day)
USA	4.5
Spain	3.0
UK	2.5
France	2.5
India	1.5

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30. In India what is the composition of biomedical waste?

The composition as per weight is

Waste Type	Percentage (approx.)
Plastic waste	15
Non combustible	22
Wet cellublostic solid *	18
Dry cellublostic solid *	45

*combustible waste

31. What is an average quantity of waste per day?

It ranges between 1 and 3 kg per day per bed of which 2 kg is incinerable waste.

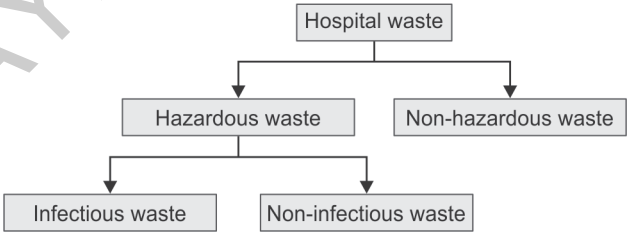
32. Name the sources of biomedical waste.

- Hospital, nursing homes, clinics, dispensaries
- Blood banks
- Industries
- Household (generates less than .5% of total waste).

33. What are the waste generated by microbiology laboratory?

1. Laboratory cultures
2. Stocks and/or specimens of microorganisms
3. Attenuated and/or live vaccines
4. Human or animal cell cultures which are used in research
5. Laboratory material which has come into contact with any of the above.

34. Classify the hospital waste.



35. Give examples of biodegradable and non-biodegradable waste.

Biodegradable waste: Peel of fruits, paper, vegetable skin, leftover food, etc.

Non-biodegradable waste: Foils, wrapping plastics, etc.

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36. Classify the hospital waste in percentage.

- Hazardous waste 10–25%
- Non-hazardous waste 75–90%
- Infectious waste 15–18%
- Non-infectious waste 5–7%

37. What are the types of hazardous waste?

a. Injurious
b. Cytotoxic
c. Infectious
d. Chemical.

38. What are routes through which waste may cause transmission of disease?

- Inhalation
- Absorption
- Ingestion
- Injury.

39. What is the hospital waste which needs special disposal?

- Pharmaceuticals waste
- Radioactive waste (solid, liquid and gaseous)
- Laboratory waste.

40. How the radioactive waste is disposed?

It is disposed as per the regulations laid down by Atomic Energy Commission (AEC).

41. How the radiological waste is disposed?

- **Solid:** By storage during which its radioactivity is reduced to acceptable level over a period of time or by size reduction in which under controlled condition waste is incinerated and ashes are disposed safely.
- **Liquid:** By diluting the waste and released into existing sewage system into very small amount over extended period of time.

42. When the chemical waste is considered hazardous?

If the chemical waste is:

- Corrosive
- Toxic
- Genotoxic/cytotoxic
- Toxic in general
- Reactive.

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43. Which are the potential toxic waste from hospitals?

- Radioactive waste—radiotherapy isotopes
- Pharmaceutical waste (antibiotics, cytotoxic analgesics, etc.)
- Chemical waste (disinfectants, reagents, X-ray dark room chemicals).

44. What effect cytotoxic waste may produce?

a. Immune suppression
b. Cancer
c. Fetal abnormalities
d. Pancytopenia
e. Genetic abnormalities.

45. What are the diseases biomedical waste can cause?

- Tuberculosis
- Hepatitis B/C
- HIV/AIDS
- Gastroenteritis
- Tetanus
- Skin injection
- Typhoid fever (enteric fever)
- Fetal abnormalities.

46. Who are the persons at risk of getting infected with biomedical waste (BMW)?

- Healthcare workers (doctors, nurses, lab tech, attendants, sweeper, waste handlers, etc.)
- Patients and their attendants
- Workers of hospital support services (workers of laundry, waste store room, transportation, etc.)
- Rag pickers.

47. What are different steps in health care waste management?

These steps can be represented in the form of flowchart (*see on the next page*).

48. What are the goals of biomedical waste management (BMWM)?

- Cost containment by reducing waste
- Reduction in environmental pollution
- Protecting community health
- Reduction in hazards
- Enhancement of hospital image.

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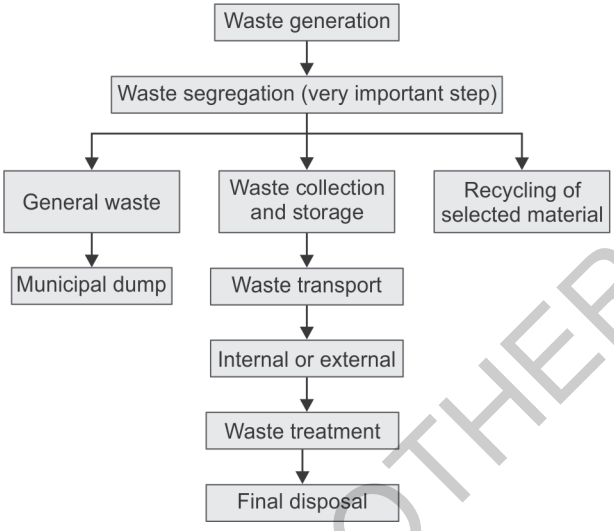

49. What should be the measures to ensure proper waste management rules?

- Regular inspection of the site of BMW generation regarding other steps being followed or not
- Sufficient supply of the material needed for BMWM
- Daily record maintenance of incinerator temperature
- Feedback from staff and people involved in BMWM
- Periodic communication with central and state pollution control board
- Training and update to the staff and waste handlers.

50. Mention the characteristics of the bags used for BMW.

- Bags used for incineration should be of non-chlorinated material
- Bags used for autoclaving should be heat resistant.

51. What are the main characteristics of the waste?

- Compaction characteristics
- Bulk density
- Acidity
- Viscosity
- Moisture
- Volatile matter
- Calorific value

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- Ash
- Fixed carbon.

52. Describe briefly each of characteristic.

- *Compaction characteristics:* To what extent the waste can be made compact so as to reduce transport contained dispersal space as volume of waste is reduced considerably. Moisture affects the compaction characteristics adversely.
- *Bulk density:* It is the weight of a unit volume of a material (gm/cm^3). It is more for all solid waste before treatment and compaction. It is inversely related to the cost of collection and transportation.
- *Acidity:* pH of waste needs special attention because strong acidic waste are corrosive and reactive and require special treatment to reduce the acidity.
- *Viscosity:* It is fluidity of the waste and inversely related with temperature, i.e. if temperature increases viscosity decreases this waste become more fluid in nature.
- *Volatile matter:* The presence of volatile matter in waste which turns into gaseous form on high temperature. This is estimated by heating the waste material in furnace at 200°C for 10 minutes.
- *Calorific value:* This is the amount of heat released from combustion of unit weight of substance.
- *Ash contents:* This is amount of ash produced when material is completely burnt. Ash of a material may be toxic or non-toxic and knowledge about composition of ash guides about suitable disposal.
- *Moisture contents of waste:* This can be estimated by drying the waste at 104–110°C for 24 hours and then weighting and finding the difference in weight before drying and after drying. More moisture content leads to incomplete and low quality boring.
- *Fixed carbon:* It is the portion of the waste which is left after eliminating moisture and volatile matter excluding ash. It is calculated using the following formula:
  Fixed carbon% = 100 – (Moisture% + Volatile matter%)
  Total carbon = Volatile matter + Fixed carbon.

53. What is the linkage between biomedical waste management with municipal waste management?

Since health care establishments are located within the municipal area therefore formers waste management has a close linkage

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with the municipal system of waste management. Also the civic authority is responsible for public health. For this reason the health care establishments must have a clear and close understanding with the municipality regarding sharing of responsibilities associated with this issue.

Three-fourth of the total hospital waste is not hazardous/infected (provided strict segregation is practised) and can even be taken care of by the municipal waste management system. For example waste generated at the hospital kitchen, garden, office, store, etc.

The practices of strict and careful segregation of waste at the generation site would reduce the load and the cost of management of the actually hazardous and infected biomedical waste at every step of collection, transportation, treatment and final disposal.

For every health care establishment it is not possible to have its own full-fledged waste treatment and disposal system hence the need for common treatment and disposal facilities arises which can be under the ownership/supervision/guidance of the civic authority.

54. When for the first time the issue of biomedical waste was discussed?

The issue of biomedical waste was first time discussed in 1983 in Norway at meeting convened by the WHO. The issue was fuelled by the reports of beach washing of medical waste on the coasts of Gulf and Florida state. Another issue was recycling of disposable articles in third world countries because of their sparse resources and weak economy.

55. What are the role of district level monitoring committee in BMWM rules amendments 2011?

The district level monitoring committee is established by the government of every state and union territory and will work at district level to monitor compliance by occupier to BMWM rules in healthcare facility as well as in common treatment facility. The chairman of committee is District Medical Officer (DMO).

56. Why there is need of biomedical waste management in healthcare facility?

The need of proper management of hospital waste management is felt because of following reasons:

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- Injuries from sharps leading to infection to all categories of hospital personnel and waste handler.
- Hospital acquired infections in patients from poor infection control practices among hospital staff and poor waste management by stakeholders.
- Risk of infection outside hospital for waste handlers and scavengers and at time general public living in the vicinity of hospitals.
- Risk associated with hazardous chemicals, drugs to persons handling wastes at all levels.
- "Disposable" discarded in waste without any mutilation being repacked and sold by unscrupulous elements without even being washed.
- Drugs which have been disposed off, being repacked and sold off to unsuspecting buyers.
- Risk of air, water and soil pollution directly due to waste, or due to defective incineration emission and ash.

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Salient Features

- A guide of self-assessment for hospital waste management
- Useful for all medical and paramedical professionals
- Presented each topic in short answers form so that each question is well-understood
- Given line diagrams of complex processes and machines to make them easy-to-understand
- Made every chapter complete in itself.

Shishir Basarkar MBBS PGDHHM MBA Dip T&D is a Medical Graduate with dual MBA (Business and Customer Relationship Management) along with PG Diploma in Hospital and Health Management. Besides this he has many other qualifications in his credit. He has been trained in various fields of hospital management and human resource management. Being a certified trainer from one for the premier institute of India he has been involved in training of staff members of various healthcare organizations through training workshops. He has attended many national and international conferences and has presented papers. He is a accredited management teacher from AIMA and has worked as resource faculty.

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