

# Study of Hospital Waste Management in Nayati Multi Super Specialty Hospital, Mathura

*By*

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*Dissertation submitted for the partial fulfillment of the  
MBA Hospital and Health Management*

*Academic year, 2014-2016*



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**Internship Training**

**At**

**Nayati Multi Super specialty hospital, Mathura**

**Study of Hospital Waste Management**

**By**

**Dr. Naveen Kumar**

Under the guidance of

**Neetu Purohit**

**MBA Hospital and Health Management**

**Year 2014-2016**



**The IIHMR University, Jaipur**

**TO WHOMSOEVER MAY CONCERN**

This is to certify that Naveen Kumar student of MBA Hospital and Health Management from The IIHMR University, Jaipur has undergone internship training at Nayati multi super specialty hospital, Mathura from 10 February 2016 to 10 May 2016.

The Candidate has successfully carried out the study designated to him during internship training and his approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish him all success in all his future endeavors.



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The certificate is awarded to

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In recognition of having successfully completed his  
Internship in the

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And

Successfully completed his Project on

**“Study of Hospital Waste Management”**

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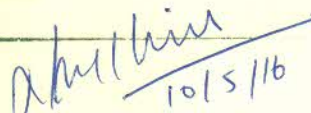
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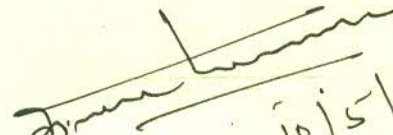
In

**Nayati Multi Super Specialty Hospital, Mathura (U.P.)**

He came across as a committed, sincere & diligent person who has a strong drive  
and zeal for learning.

We wish him all the best for future endeavors

  
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## **ABSTRACT**

### **Study of Hospital Waste Management in Nayati Multi Super specialty Hospital, Mathura(U.P.)**

Submitted by: Dr. Naveen kumar

**Background:** Hospital generated waste is a special category of waste, which needs to be handled appropriately with precautions as it carries a higher potential for infection and injury than any other type of waste.

**Objectives:-** 1)The objectives of the study were to study the present state of health care waste management in the hospital.

2) To assess knowledge, attitude and practice (KAP) regarding health care waste management among various levels of staff in hospital.

3) To provide recommendations for proper health care waste management in the hospital.

**Methodology:** The present study was undertaken in Nayati Multi super specialty hospital, Mathura. Checklist and KAP questionnaire were used to conduct the study. A total of 100 staff members belonging to various hospital departments were surveyed as part of the study.

**Results:** The obtained data was tabulated and the results were interpreted. The management of health care waste was found to be satisfactory in all the groups with need of more training based practice to the housekeeping staff.

The KAP regarding healthcare waste management among the various groups of the hospital did not reveal any statistically significant difference in Knowledge, Attitude and Practice between the various levels of staff members belonging to same skill group.

**Conclusion:**

The present study has revealed that the practice of health care waste management in Nayati Multi super specialty hospital, Mathura is satisfactory but knowledge, attitude, and practice among the house keeping staff were 32%, 56% and 40% respectively which is significantly low compared to other skill groups, it requires more training based practice to the housekeeping staff.

**Key words:** Bio medical waste ,KAP- knowledge, attitude and practice

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**DATE:10/05/2016**

**PLACE:Mathura**

**DR. NAVEEN KUMAR**

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## 1.1 Summary

**Background:** 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. Currently it is being managed casually. The objectives of the study were to study the present state of health care waste management, to assess knowledge, attitude and practice (KAP) regarding health care waste management among various levels of staff in hospital and to provide recommendations for proper health care waste management.

**Methods:** The present study was undertaken in Nayati Multi super specialty hospital, Mathura. Checklist and KAP questionnaire were used to conduct the study.

The obtained data was tabulated and the results were interpreted using comparing obtained marks in percentage.

**Results:** A total of 100 staff members belonging to various departments working in the hospital. The management of health care waste was found to be satisfactory in all the groups with need of more training based practice to the housekeeping staff

The KAP regarding healthcare waste management among the various groups of the hospital did not reveal any statistically significant difference in Knowledge, Attitude and Practice between the various levels of staff members belonging to same skill group.

**Interpretation and conclusion:** The present study has revealed that the practice of health care waste management in Nayati Multi super specialty hospital, Mathura is adequate and satisfactory.

## 1.2 Introduction

Health care 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. Currently it is being managed casually

With a rapid increase in the number of hospitals, clinics and laboratories in the country, the generation of health care waste has been increasing considerably. In western countries it is estimated that hospitals generate 1 to 1.5kg of waste per bed per day. Also it is estimated that in clinics, total amount of waste generated is 200kg/year. It is estimated that patients in India generate between 0.5 to 1kg of waste/person/day. Even the healthcare industry over the last decade has shifted from a mainly reusable product supply system (eg: glass syringes, hospital laundry etc.,) to a primarily disposable product supply system (eg: disposable syringes and needles, disposable hospital linen etc.,) which has caused an increase in the health care waste generation and managing the same has become a problem.

According to WHO (2000), almost 80% of health care waste is comparable to domestic waste, the remaining approximately 20% is considered hazardous, as it may be infectious, toxic and/or radioactive. Improper disposal of waste generated in health care establishments 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 wastes dumped on the land can contaminate surface and ground water supplies and even incomplete combustion of health care waste can lead to toxic emissions, thus exposing the entire population to the risk of diseases.

The so-called disposable plastic syringes if recycled indiscriminately, can become a potential source of infections [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 that the incidence of hospital acquired infections to be about 10% in South East Asia Region.

Even after the implementation of bio-medical wastes rules (management and handling) in July 1998, the condition remains more or less unchanged. It can be attributed to lack of knowledge, resources and enforcement of the regulations.

The indiscriminate and unregulated dumping of health care waste (especially waste sharps) exposes the rag pickers, waste handlers, and children playing in dumpsters to accidental injuries with needles and syringes potentially contaminated with human immunodeficiency virus and Hepatitis B virus.

Majority of the problem can be avoided if the health care waste management is properly managed. The activities that are commonly done in the health care waste management are segregation, storage, collection, transportation and disposal of health care waste. It encompasses, planning, organizational, administrative, financial, legal, engineering aspects and human resource development and their management involves inter-disciplinary relationships.

While health care establishments and other hospitals in developed countries confirm to certain safety standards laid out by regulatory bodies on collecting, transporting and disposing of health care wastes, the same is not often true in developing countries where the level of awareness about the adverse impact of improper disposal of such waste is low, the regulatory tools are inadequate and the skills, resources and necessary motivation are absent. Various studies on health care waste management in urban areas of India have been done whereas in the rural areas very few studies have been undertaken. Hence an attempt is made to study the present state of health care waste management in Nayati multi super specialty hospital, Mathura.

### **1.2.1 Sources Of Health Care Waste:**

#### **Major sources of health care waste:**

- Hospitals
  - University hospital
  - General hospital
  - District hospital
- Other health-care establishments
  - Emergency medical care services
  - Health-care centres and dispensaries
  - Obstetric and maternity clinics
  - Outpatient clinics
  - Dialysis centres
  - First-aid posts and sick bays
  - Long – term health-care establishments and hospices
  - Transfusion centres
  - Military medical services
- Related laboratories and research centres
  - Medical and biomedical laboratories
  - Biotechnology laboratories and institutions
  - Medical research centres
- Mortuary and autopsy centres
- Animal research and testing centres
- Blood bank and blood collection services
- Nursing homes for the elderly

#### **Minor sources of health care waste:**

- Smaller health-care establishments
  - Physicians offices
  - Dental clinics
  - Acupuncturists
  - Chiropractors
- Specialized health-care establishments and institutions with low waste generation
  - Convalescent nursing home
  - Psychiatric hospitals
  - Disabled persons institutions
- Non-health activities involving intravenous or subcutaneous interventions
  - Cosmetic ear – piercing and tattoo parlours
  - Illicit drugs users
- Funeral services
- Ambulance service

### 1.2.2 CLASSIFICATION OF HEALTH CARE WASTE:

World Health Organization (1994) proposes the following classification for developing countries:

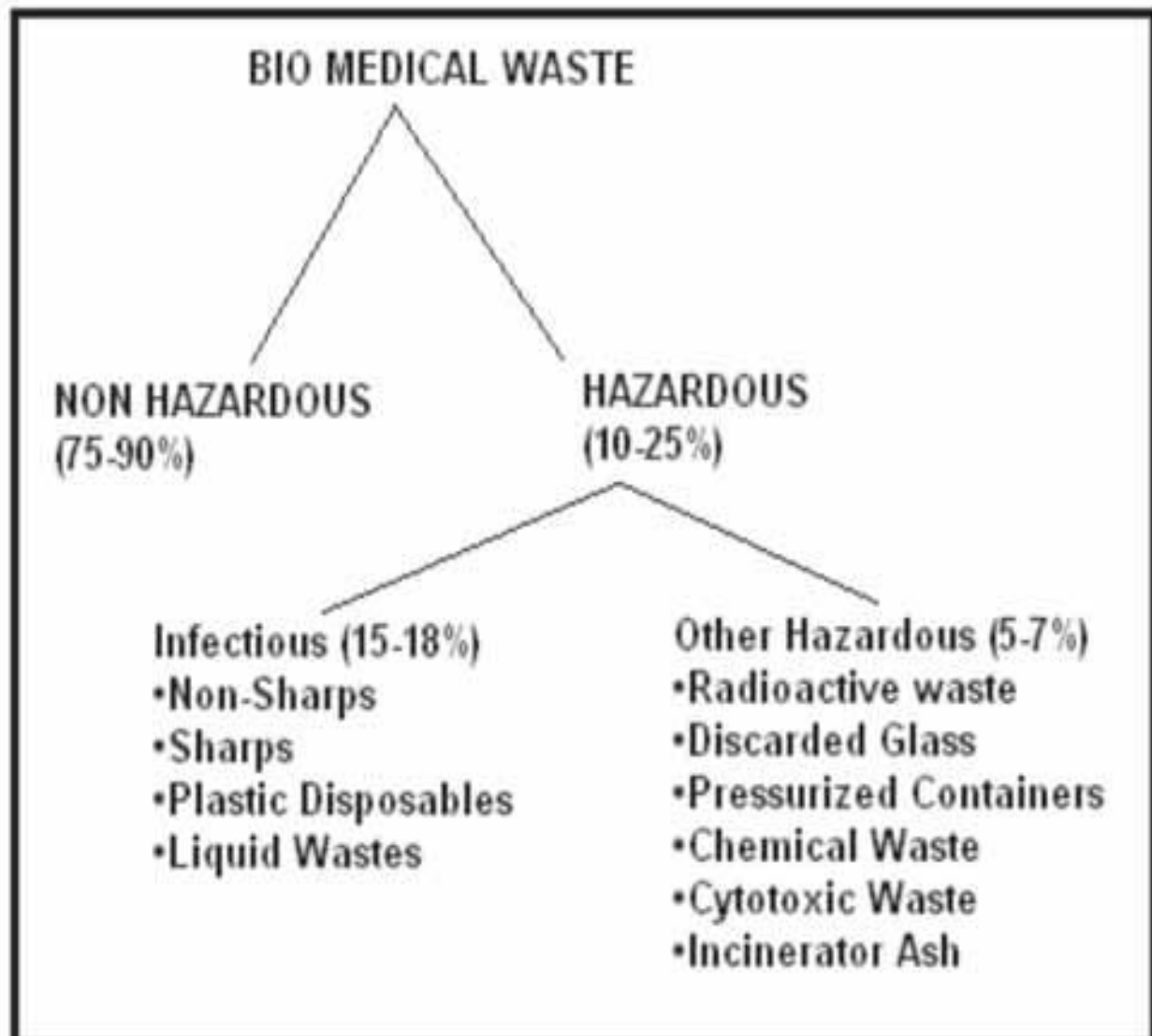
- a. General Non Hazardous waste
- b. Waste sharps
- c. Infectious waste not containing sharps
- d. Chemical and pharmaceutical waste
- e. Other hazardous waste (Radio-active wastes, cytotoxic drugs, high pressure containers)

Also for developed countries the following classification was proposed by WHO:

**Categories of health care waste**

| Sl No | Waste Category                                 | Description and Examples                                                                                                                                                                                                                                    |
|-------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | <b>Infectious waste</b>                        | Waste suspected to contains pathogens.<br>Ex: Laboratory cultures, waste from isolation wards, tissues, materials or equipments that have been in contact with infectious patients, excreta.                                                                |
| 2     | <b>Pathological waste</b>                      | Human tissues or fluids<br>Ex: Body parts, foetuses, blood and other body fluids.                                                                                                                                                                           |
| 3     | <b>Sharps</b>                                  | Sharps waste<br>Eg: Needles, syringes, scalpels, blades, broken glass, nails, knives and any other item that could cause a cut or puncture.                                                                                                                 |
| 4     | <b>Pharmaceutical waste</b>                    | Waste containing pharmaceuticals<br>Eg: Pharmaceuticals that are expired or no longer needed, items contaminated by or containing pharmaceuticals (bottles, boxes)                                                                                          |
| 5     | <b>Genotoxic waste</b>                         | Waste containing substances with genotoxic properties<br>Eg: Waste containing cytostatic drugs (often used in cancer therapy), genotoxic chemicals.                                                                                                         |
| 6     | <b>Chemical waste</b>                          | Waste containing chemical substances<br>Eg: Laboratory reagents, film developer, disinfectants that are expired or no longer needed, solvents.                                                                                                              |
| 7     | <b>Waste with high content of heavy metals</b> | Eg: Batteries, broken thermometers, blood pressure gauges, etc.,                                                                                                                                                                                            |
| 8     | <b>Pressurized containers</b>                  | Eg: Gas cylinders, gas cartridges, aerosol cans                                                                                                                                                                                                             |
| 9     | <b>Radioactive waste</b>                       | Waste containing radioactive substances<br>Eg: Unused liquids from radiotherapy or laboratory research, contaminated glassware, packages or absorbent paper, urine and excreta from patients treated or tested with unsealed radionuclides, sealed sources. |

**Figure 1 showing categories of bio medical waste:**



**The Government of India categorizes Bio – medical waste into ten categories.  
(As listed in Schedule I Bio – medical Waste Rules, 1998)**

| <b>Waste category</b> | <b>Contents</b>                                                                                                                                                                                                                                                                                                                                          |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Category No. 1        | Human anatomical waste (human tissues, organs, body parts)                                                                                                                                                                                                                                                                                               |
| Category No. 2        | Animal waste (animal tissues, organs, body parts carcasses, bleeding parts, fluids, bloods, experimental animals used in research, waste generated by veterinary hospitals, colleges, discharge from hospital, animal house.                                                                                                                             |
| Category No. 3        | Microbiology and biotechnology waste (waste from laboratory cultures, stocks or specimens of micro-organisms, live or attenuated vaccines, human and animal cell culture used in research and infectious agents from research and industrial laboratories, waste from production of biological, toxins, dishes and devices and for transfer of cultures) |
| Category No. 4        | Waste sharps (needles, syringes, scalpels, blades, glass, etc. that may cause puncture and cuts. This includes both used and unused sharps)                                                                                                                                                                                                              |
| Category No. 5        | Discarded medicines and cyto-toxic drugs (wastes comprising of outdated, contaminated and discarded medicines)                                                                                                                                                                                                                                           |
| Category No. 6        | Soiled waste (Items contaminated with blood and fluids including cotton, dressings, soiled plaster casts, linen, beddings, other material contaminated with blood)                                                                                                                                                                                       |
| Category No. 7        | Solid waste (wastes generated from disposable items other than the waste sharps such as tubing, catheters, intravenous sets, etc.,)                                                                                                                                                                                                                      |
| Category No. 8        | Liquid waste (waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities)                                                                                                                                                                                                                                           |

|                 |                                                                                                                       |
|-----------------|-----------------------------------------------------------------------------------------------------------------------|
| Category No. 9  | Incineration ash (ash from incineration of any bio-medical waste)                                                     |
| Category No. 10 | Chemical waste: (Chemicals used in production of biologicals, chemicals used in disinfections, as insecticides etc.,) |

**New BMW Management Rules, 2016 include the following:-**

- (a) The ambit of the rules has been expanded to include vaccination camps, blood donation camps, surgical camps or any other healthcare activity;
- (b) Phase-out the use of chlorinated plastic bags, gloves and blood bags within two years;
- (c) Pre-treatment of the laboratory waste, microbiological waste, blood samples and blood bags through disinfection or sterilization on-site in the manner as prescribed by WHO or NACO
- (d) Provide training to all its health care workers and immunize all health workers regularly
- (e) Establish a Bar-Code System for bags or containers containing bio-medical waste for disposal
- (f) Report major accidents;
- (g) Existing incinerators to achieve the standards for retention time in secondary chamber and Dioxin and Furans within two years;
- (h) Bio-medical waste has been classified in to 4 categories instead 10 to improve the segregation of waste at source;
- (i) Procedure to get authorisation simplified. Automatic authorisation for bedded hospitals. The validity of authorization synchronised with validity of consent orders for Bedded HCFs. One time Authorisation for Non-bedded HCFs;
- (j) The new rules prescribe more stringent standards for incinerator to reduce the emission of pollutants in environment;
- (k) Inclusion of emissions limits for Dioxin and furans;
- (l) State Government to provide land for setting up common bio-medical waste treatment and disposal facility;

- (m) No occupier shall establish on-site treatment and disposal facility, if a service of common bio-medical waste treatment facility is available at a distance of seventy-five kilometer.
- (n) Operator of a common bio-medical waste treatment and disposal facility to ensure the timely collection of bio-medical waste from the HCFs and assist the HCFs in conduct of training

### **Bio-medical waste**

- i. Biomedical waste comprises human & animal anatomical waste, treatment apparatus like needles, syringes and other materials used in health care facilities in the process of treatment and research. This waste is generated during diagnosis, treatment or immunisation in hospitals, nursing homes, pathological laboratories, blood bank, etc. Total bio-medical waste generation in the country is 484 TPD from 1,68,869 healthcare facilities (HCF), out of which 447 TPD is treated.

### **Proper Bio-medical waste management**

- ii. Scientific disposal of Biomedical Waste through segregation, collection and treatment in an environmentally sound manner minimises the adverse impact on health workers and on the environment. The hospitals are required to put in place the mechanisms for effective disposal either directly or through common biomedical waste treatment and disposal facilities. The hospitals servicing 1000 patients or more per month are required to obtain authorisation and segregate biomedical waste in to 10 categories, pack five colour backs for disposal. There are 198 common bio-medical waste treatment facilities (CBMWF) are in operation and 28 are under construction. 21,870 HCFs have their own treatment facilities and 1,31,837 HCFs are using the CBMWFs.

### **Problems of unscientific Bio-medical waste disposal**

- iii. The quantum of waste generated in India is estimated to be 1-2 kg per bed per day in a hospital and 600 gm per day per bed in a clinic. 85% of the hospital

waste is non-hazardous, 15% is infectious/hazardous. Mixing of hazardous results in to contamination and makes the entire waste hazardous. Hence there is necessity to segregate and treat. Improper disposal increases risk of infection; encourages recycling of prohibited disposables and disposed drugs; and develops resistant microorganisms

### **Consultation process for new Bio-medical Waste Management Rules, 2016**

- iv. The draft Bio-medical Waste Rules were published in June, 2015 inviting public objections and suggestions. Stakeholders consultation meets were organized in New Delhi, Mumbai and Kolkata. Consultative meetings with relevant Central Ministries, State Governments, State Pollution Control Boards and major Hospitals were also held. The suggestions / objections (about 50) received were examined by the Working Group in Ministry. Based on the recommendations of the Working Group, the Ministry has published the Bio- medical Waste Management Rules, 2016.

### 1.2.3 Quantum of Health Care Waste Generated:

Several surveys have provided an indication of typical health care waste generation and it shows that this differs not only from country to country but also within the country. The waste generation depends on numerous factors such as:

- Established waste management methods
- Type of health-care establishments
- Hospital specializations
- Proportion of reusable items employed in health care
- Proportion of patients treated on a day-care basis<sup>9</sup>.

In middle and low-income countries, health-care waste generation is usually lower than in high income countries (Table: 1).

**Table: 1**

**Health care waste generation according to national income level<sup>9</sup>**

| National income level            | Annual waste generation<br>(Kg/head of population) |
|----------------------------------|----------------------------------------------------|
| <b>High income countries</b>     |                                                    |
| - All health-care waste          | 1.1 – 12.0                                         |
| - Hazardous health- care waste   | 0.4 – 5.5                                          |
| <b>Middle – income countries</b> |                                                    |
| - All health-care waste          | 0.8 – 6.0                                          |
| - Hazardous health care waste    | 0.3 – 0.4                                          |
| <b>Low income countries</b>      |                                                    |
| - All health – care waste        | 0.5 – 3.0                                          |

Developing countries that have not performed their own surveys of health care waste may find the following estimates for average distribution of health care waste useful for preliminary planning of waste management:

- 80% general health-care waste, which may be dealt with by the

normal domestic and urban waste management system

- 15% pathological and infectious waste
- 1% sharps waste
- 3% chemical or pharmaceutical waste
- Less than 1% special waste, such as radioactive or cytotoxic waste, pressurized containers or broken thermometers and used batteries<sup>9</sup>.

Even a limited survey will probably provide more reliable data on local waste generation than any estimate based on data from other countries or types of establishment.

**Quantification of health care waste helps in:**

- Planning infrastructure
- Procuring equipments
- Allocating resources
- Installation and optimal utilization of treatment and
- disposal facilities/technologies.

**DATA ON QUANTIFICATION OF HEALTHCARE WASTE IN INDIA:**

There are no reliable figures available of the quantum of waste generated per person/day either in out patient or in patient cares in Indian hospitals. Even there is no uniformity in the data on the quantum of the health care waste being generated in our country.

The data below is average composition of health care waste obtained from 10 large hospitals in Mumbai, Kolkata, Delhi, and Nagpur during the period 1993-1996.

**Average composition of hospital waste in India:** <sup>12</sup>

| <b>Material</b>                                                        | <b>Percentage (wet-weight basis)</b> |
|------------------------------------------------------------------------|--------------------------------------|
| Paper                                                                  | 15                                   |
| Plastics                                                               | 10                                   |
| Rags                                                                   | 15                                   |
| Metals(sharps, etc)                                                    | 01                                   |
| Infectious waste                                                       | 1.5                                  |
| Glass                                                                  | 4.0                                  |
| General waste<br>(food waste, sweepings from hospital premises, etc.,) | 53.5                                 |

**QUANTITIES AND TYPES OF HEALTH CARE WASTES EXPECTED IN THE COMING YEARS:**

Projections of increase in waste quantities and changes in composition are difficult to make, even if historical data is available because of possible change in technique and equipment. Improvement in segregation affects quantities classed as hazardous.

Changes in generation rate depend not only on population growth, but also on the access to medical facilities, the development of competing facilities and changes in services offered and techniques used. Because of all these uncertainties, it is advisable to build as much flexibility as possible into the system.

Medical market has become the fourth largest area of medical application of plastics and usage of plastics in medical care is growing at the rate of 6% annually. Plastic demand in medical devices by 2000 AD is expected to reach 10.2 million tones. The most wide use of plastics in health care is in the form of syringes, bloodbags, surgical gloves and catheters.

### **The percentage of global consumption of disposable medical devices by application**

|                      |         |
|----------------------|---------|
| Gloves               | - 8%    |
| Scissors             | - 7.1%  |
| Non-wovens           | - 14.8% |
| Wound processing     | - 26.5% |
| Dialyser             | - 6.2%  |
| Transfusion supplies | - 9.1%  |
| Catheter & cannulae  | - 10%   |
| Syringes & needles   | - 7.1%  |

#### **1.2.4 Hazards Due To Mismanagement Of Hospital Waste:**

Over 75% of health care waste is non-hazardous. There is no established system of segregating 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 health care wastes are dumped along with municipal wastes. Sometimes the health care 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 wastes 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 to 67% 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.

The following is the documented evidence of human immunodeficiency virus as occupational infection recognized by CDC, Atlanta in 1994:

- 32 from hypodermic injuries
- 1 from blade injury
- 1 from glass injury(broken glass from a tube containing infected blood)
- 1 from contact with non-sharp infections items
- 4 from exposure of skin or mucous membrane to infected blood.

The risk of certain infection has been estimated as follows: <sup>2</sup>

| <b>Infection</b> | <b>Risk of transmission</b> |
|------------------|-----------------------------|
| Hepatitis B      | 3%                          |
| Hepatitis C      | 3.5%                        |
| HIV              | 0.3%                        |

On job injuries among hospital staff in the USA is reported to be 180 per 1000 per year. The figures are likely to be higher in India, though no studies have been conducted so far. <sup>4</sup>Rag pickers commonly gather around hospital dumpster sites and frequently injure themselves during rag picking, which largely goes unnoticed. <sup>4</sup>Chitra et. al have reported prevalence of Hepatitis B infection in pourakarmikas of BMP was 5%.An alarming statistics on unsafe injection - more than 50% of the total 16 billion injections administered yearly are unsafe and their dangerous consequences like spread of hepatitis C, hepatitis B and human immunodeficiency viruses.

A study shows that more than half of the disposable syringes (56.3%) marketed in Kolkata are grossly contaminated showing failure of the sterilization process. If such un-sterile articles are recycled and allowed in the market without a proper check, it may lead to increased risk in transmission human immunodeficiency virus and hepatitis 'B' infection.

Injections using glass syringes had risk of transmission of hepatitis "B" in a village in West Bengal. Studies have demonstrated that exposure to reusable needles in a large Govt. Hospital was associated with hepatitis B infection.

Health care wastes can cause other problems. Such problems may not directly result in illness, but the consequences can still be serious. For example waste handlers working at the municipal dumping site refuse to handle waste that has body parts and restart work only after concerned authorities intervene and give an assurance that municipal solid waste will not be mixed with health care waste in the future. Very often, newspapers report the finding of human body parts in the vicinity of the hospitals. Stray dogs carry amputated parts into residential colonies around hospitals. This affects sensibilities and sensitivities of the public. Sometimes body parts are found in trucks carrying the municipal wastes from hospitals that result in investigative dilemmas for local police.

Foul odour is emitted at the collection points if the quick removal of the wastes is not done alongwith spreading of the waste in the area adjacent to local collection point due to activity of rag pickers .

If infectious material is left open in containers or dumped on the ground, the house flies, rodents, birds and other scavenging animals will find access to these waste in search of food and in this process act as reservoir for many organisms.

Open burning of the health care waste and /or 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. These byproducts adversely affect the health of people.

There should be proper method for disposing off of the placenta as it can be another source of HIV infection if the mother is HIV infected.

It has been noticed that 8% of work slips belonging to patients including investigational slips contains stains of blood, urine and stool on them which are due to dispatch of samples along with the investigation slips from the ward to the laboratory and back. They can become a potential source of hospital-acquired infection.

The major identified hazard was that of infection, because communicable disease have been the most common cause of morbidity and mortality in the community. Examples of infections caused by exposure to health care wastes, causative organisms and transmission vehicles are shown below

**Table: 2**

**List of infections, causative organisms and transmission:**

| <b>Types of infection</b> | <b>Examples of causative organisms</b>                                    | <b>Transmission</b>        |
|---------------------------|---------------------------------------------------------------------------|----------------------------|
| Gastro enteric Infections | Enterobacteria (eg: Salmonella, Shigella spp), Vibrio cholerae, Helminths | Faces and/or vomit         |
| Respiratory Infections    | Mycobacterium tuberculosis, measles, virus, streptococcus pneumoniae      | Inhaled secretions, saliva |
| Ocular infection          | Herpes virus                                                              | Eye secretions             |
| Genital infections        | Neisseria gonorrhoeae, herpes virus                                       | Genital secretions         |
| Skin infections           | Streptococcus spp                                                         | Pus                        |
| Anthrax                   | Bacillus anthracis                                                        | Skin secretions            |
| Meningitis                | Neisseria meningitidis                                                    | Cerebrospinal fluid        |

|                       |                                                                                                                                 |                                    |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| AIDS                  | HIV                                                                                                                             | Blood, sexual secretions           |
| Haemorrhagic Fevers   | Junin, Lassa, Ebola and Marburg Viruses                                                                                         | All bloody secretions and products |
| Septicaemia           | Staphylococcus spp                                                                                                              | Blood                              |
| Bacteraemia           | Coagulase – negative staphylococcus Spp. Staphylococcus aureus, Enterobacteria, Enterococcus, Klebsiella and Streptococcus spp. | Blood                              |
| Candidaemia           | Candida albicans                                                                                                                | Blood                              |
| Viral hepatitis A     | Hepatitis A virus                                                                                                               | Faeces                             |
| Viral hepatitis B & C | Hepatitis B and C viruses                                                                                                       | Blood and body fluids.             |

### **1.2.5 components of healthcare waste management:**

- A. Waste Segregation and Containment
- B. Pretreatment/Decontamination
- C. Collection, transportation, storage (within the hospital)
- D. Transportation (outside hospital).

#### **A. Waste Segregation and Containment: Waste**

##### **Segregation**

Waste segregation refers to the process of separating of wastes at the point of generation and should be maintained in storage areas and during transportation.

Segregation of waste is the key to health care waste management process and should always be the responsibility of the waste producer.

By segregation of waste the health care establishments can:

1. Minimise the quantity of infectious and/or hazardous waste that needs to be handled.
2. Reduce the total treatment cost
3. Reduce the impacts of this waste on community
4. Reduce the chances of infecting health care workers

It must be remembered that the number of segregation categories depends on the facilities available for Waste Management. More segregation categories do not always mean better Waste Management practices.

## CONTAINMENT OF WASTE

Containment of waste in appropriate containers needs to be considered as a method of treatment of health care waste. Apart from the obvious advantage of containing the waste in one place, it would also facilitate transportation of the waste. The procedure for containment of health care waste covers the containers as well as the liners for the containers. It is desirable that the two components are given equal weightage.

The container for the health care waste should be of:

- a) Adequate size for the Point of Generation (POG)
- b) Appropriate material for the type of waste
- c) Rounded sides to facilitate cleaning (sharp edges are difficult to clean) and
- d) Ergonomically designed for easy and effective transportation.

A container with a liner

- 1. Facilitates transportation
- 2. Keeps the container clean
- 3. Reduces handling of health care waste by waste handlers.

The most appropriate way of identifying the categories of health care waste is sorting the waste into colour coded plastic bags or containers.

**Few of the recommended methods/guidelines for colour and type of the containers used for the health care waste are listed below:**

| <b>TYPE OF WASTE</b>                                      | <b>COLOUR OF CONTAINER AND MARKINGS</b> | <b>TYPE OF CONTAINER</b>                                   |
|-----------------------------------------------------------|-----------------------------------------|------------------------------------------------------------|
| Highly infectious waste                                   | Yellow, marked “HIGHLY INFECTIOUS”      | Strong, Leak-proof plastic bag or container, autoclavable. |
| Other infectious waste, pathological and anatomical waste | Yellow                                  | Leak-proof plastic bag or Container                        |
| Sharps                                                    | Yellow, marked “SHARPS”                 | Puncture-proof container                                   |
| Chemical and pharmaceutical waste                         | Brown                                   | Plastic bag or container                                   |
| Radioactive waste                                         |                                         | Lead box, labelled with radioactive symbol                 |
| General health care waste                                 | Black                                   | Plastic bag                                                |

Table –8 shows the colour code and type of container for different types of Health care waste as mandated by the Bio-medical Waste (Handling and Management) Rules, 1998.

**Table: 3**

**The Bio-medical waste (handling and management) rules, 1998:**

| <b>Waste Category</b>                      | <b>Treatment and disposal options</b>                                                    | <b>Colour code</b>     | <b>Type of container</b>             |
|--------------------------------------------|------------------------------------------------------------------------------------------|------------------------|--------------------------------------|
| 1. Human Anatomical Waste                  | Incineration/Deep burial                                                                 | Yellow                 | Plastic bag                          |
| 2. Animal waste                            | Incineration/Deep burial                                                                 | Yellow                 | Plastic bag                          |
| 3. Microbiology & Bio Technology Waste     | Local autoclaving/micro-waving/incineration.                                             | Yellow/red             | Plastic bag/disinfected container    |
| 4. Waste sharps                            | Disinfection/Chemical treatment/autoclaving/Micro waving and mutilation and shredding    | Blue/white translucent | Plastic bag/Puncture proof container |
| 5. Discarded Medicines and cytotoxic drugs | Incineration/destruction and disposal in secured landfills                               | Black                  | Plastic bag                          |
| 6. Soiled waste                            | Incineration/ autoclaving/ micro waving                                                  | Yellow/red             | Disinfected container/Plastic bag    |
| 7. Solid waste                             | Disinfection/Chemical treatment/autoclaving/Micro waving and mutilation and shredding    | Red/ Blue/ White       | Disinfected container/Plastic bag    |
| 8. Liquid waste                            | Disinfection by chemical treatment and discharge into drains                             | NA                     | Not applicable                       |
| 9. Incineration Ash                        | Disposal in municipal landfill                                                           | Black                  | Plastic bag                          |
| 10. Chemical Waste                         | Chemical treatment and discharge into drains for liquids and secured landfill for solids | Black                  | Plastic bag                          |

**Note:**

1. There will be no chemical pre-treatment before incineration. Chlorinated plastics shall not be incinerated.
2. Deep burial shall be an option available only in towns with population less than 5 lakhs and in rural areas.
3. Chemical treatment using at least 1% Hypochlorite solution or any other equivalent chemical reagent. It must be ensured that chemical treatment ensures disinfection.
4. Mutilation/shredding must be such so as to prevent unauthorized reuse.

5. Colour-coding of waste categories with multiple treatment options depend on treatment options chosen.
6. Waste collection bags for waste types needing incineration shall not be made of chlorinated plastics.
7. Categories 8 and 10(liquid) do not require containers/bags.
8. Category 3 if disinfected locally need not be in containers/bags.

**Some of the Do's and Don'ts in segregation:**

- All containers used for collection must be resistant to breakage, tears and leaks under normal conditions of usage.
- Containers designated for collection of highly infectious and hazardous chemical wastes in addition to being colour coded must be clearly labeled.
- Staff should never attempt to correct errors of segregation by handling wastes directly.
- If general and hazardous wastes have been accidentally mixed, the entire mixture must be treated as hazardous waste.
- Appropriate instructions must be posted at all locations within the healthcare facility to remind the staff of segregation procedures.
- Extra care must be taken while handling sharps and under no circumstances used needles be handled directly. Recapping of needles, transfer of used needles between containers when full, etc. are all extremely risky practices and must be avoided.
- Waste containing mercury must not be mixed with other waste streams.
- Pressurized containers must not be included in waste streams to be treated by incineration.
- All containers must be removed when they are three-fourths full.
- No untreated Bio-medical wastes are stored beyond 48 hours within a healthcare facility.

## **B.PRETREATMENT/DECONTAMINATION :**

Decontamination prior to disposal is required for some infectious nature of healthcare waste like

- a) Sharps
- b) Disposable infectious plastics/rubber
- c) Infectious glassware
- d) Blood and body fluids
- e) Waste from some laboratories and from isolation wards.
- f) The choice for decontamination depends on
  - 1. The types of waste that requires decontamination
  - 2. The point of generation
  - 3. The facilities available

Waste is required under the biomedical waste (handling and management) rules, 1998 to decontaminate and render any waste free of infection before it is subjected to further handling.

Decontamination at the point of generation is ideal and desirable. However, central decontamination can also be undertaken.

The methods of decontamination that are commonly used are:

- 1. Chemical disinfection
- 2. Sterilization.

## **1. Chemical disinfection:**

Chemical disinfection is most commonly employed technique to disinfect the medical waste. This is used routinely in health care establishments to inactivate microbes by their acidic action. Usually chemical disinfection is suitable for treatment of liquid waste. Solid infectious waste can also be treated chemically before or during shredding as only surface disinfection occurs with intact solid waste. The disinfectant must be allowed to mix properly. The contact time, concentration of disinfectants, pH and temperature must be controlled as necessary.

Effective chemical disinfection of infectious wastes depends on the nature of material (organic), number of microorganisms and the sensitivity of microorganisms occurring in the waste. Certain precautions are to be adopted in disinfection.

The various chemical disinfectants available to use are:

- Sodium hypochlorite\* (liquid bleach) (5% available chlorine)
- Calcium hypochlorite (bleaching powder) (70% available chlorine)
- Chloramines (25% available chlorine)
- Ethanol (70%)
- Povidone Iodine (2.5%)
- Glutaraldehyde (2%)
- Formaldehyde (4%)
- Phenol (3%)
- Savlon (1%)
- Hydrogen peroxide (3 to 6%)

Note: \*Chlorine compounds are very unstable. Prepare solutions daily or store in covered brown bottles upto 30 days. Keep away from direct sunlight.

## **2. Sterilization:**

Sterilization is a process of freeing an article from all living organisms including bacterial and fungal spores and viruses.

Sterilization is carried out with steam under pressure, dry heat and gas or liquid chemicals. Sterilization is done for all objects that are introduced directly into the blood stream or into other normally sterilized areas of the body and for certain objects entering non-sterile body cavities, such as feeding bottles and nipples, or dressings. All forms of sterilization inactivate human immunodeficiency virus and hepatitis B virus.

The methods of sterilization include:

1. Steam under pressure:
  - Autoclave or pressure cooker at 15 psi pressure for 20 minutes at 121<sup>0</sup> C
2. Dry heat:
  - Application of heat at 170<sup>0</sup> C or 340<sup>0</sup> F for 2 hours
3. Chemical:
  - Use 2% glutaraldehyde for 10 hours or 3% hydrogen peroxide for 2.5 hours.

### **C. Collection, Storage And Transportation Of Waste (within the hospital):**

#### **1) Collection:**

Health care waste contains hazardous and highly infectious waste, which needs careful handling. Waste should be collected and stored in thick non-corrosive disposable plastic bags of adequate size, which may be kept in a hard plastic container of suitable size covered with a lid. Polythene bags or containers of specific coded colours, that are labeled appropriately with non-washable material are used for collection of specific type of health care waste. Nursing and other staff should be ensured that waste bags are tightly closed when they are about three quarters full. The bags can be closed by tying the neck, but bigger bags probably require a plastic sealing tag of the self locking type.

Workers in charge of waste collection should follow certain recommendation:

- Waste should be collected daily and transported to designated central storage room.
- No bags should be removed unless they are labeled with their point of production and contents.
- The bags or containers should be replaced immediately with new ones of the same type<sup>9</sup>.

## 2) STORAGE:

Storage area should be designated inside the healthcare establishment. The waste in bags or containers should be stored in a separate area, room, or building of a size appropriate to the quantities of waste produced and the frequency of collection.

Recommendation for storage facility for hospital waste:

- The storage area should have an impermeable, hard-standing floor with good drainage; it should be easy to clean and disinfect, should have a good water supply.
- The storage area should have easy access for staff in charge of handling the waste and also for waste collection vehicle.
- It should be possible to lock the store to prevent access by unauthorized persons.
- It should be protected from the sun and inaccessible for animals, insects and birds and should have good lighting and at least passive ventilation.
- The storage area should not be situated in the proximity of fresh food stores or food preparation areas.
- A supply of cleaning equipment, protective clothing, and waste bags or containers should be located conveniently close to the storage area.

Unless a refrigerated storage room is available, storage time for health care waste (i.e. the delay between production and treatment) should not exceed the following:

Temperate climate: 72 hours in winter 48 hours in summer.

Warm climate: 48 hours during the cool season 24 hours during the hot season.

### **c) Transportation( within the hospital):**

Health care waste should be transported within the hospital or other facility by means of hand cart wheeled trolley or containers, that are not used for any other purpose and meet the following specifications:

- Easy to load and unload.
- No sharp edges that could damage waste bags or containers during loading and unloading.
- Easy to clean.

The vehicle should be cleaned and disinfected daily with appropriate disinfectant.

All waste bag seals should be in place and intact at the end of transportation.<sup>9</sup>

### **IV. Transportation (outside hospitals):**

For safe transportation of waste, the following guidelines have to be practiced.

- Maintain the segregation
- No spillage/dispersing
- Closed containment of waste from hygiene and aesthetic point.

Waste bags may be placed directly into the transportation vehicle, but it is safer to place them in further containers (eg., Cardboard boxes or wheeled, rigid, lidded plastic or galvanized bins.). This has the advantage of reducing the handling of filled waste bags, but results in higher disposal costs.

Vehicle so meant should be of adequate size and there should be provisions for loading and unloading of waste with minimal handling<sup>13</sup>.

There are three basic methods for loading waste to the collection vehicle:

- i. Manual lifting of the waste into the truck or container.
- ii. Split level loading by gravity if the truck or container is below the level of the waste
- iii. Mechanical loading using a device on the truck or in the storage area.
  - Manual loading present high risks because of the contact of the loaders with waste.
  - Mechanical loading can be unreliable, unless good maintenance is available and there are spare vehicles.
  - Hazardous healthcare waste should be loaded in containers.

### **1.2.6 Treatment Options/Technologies For Safe Management Of Health Care Waste:**

Treatment of waste by various technologies provides the mechanism to reduce or eliminate the number of pathogens, thereby minimizing or eliminating the potential for disease transmission or microbial destruction required for any medical waste treatment process.

The final choice of treatment system should be made carefully on the basis of various factors, many of which depend on local conditions:

- Disinfection efficiency
- Health and environmental considerations
- Volume and mass reduction
- Occupational health and safety considerations
- Quantity of wastes for treatment and disposal
- Type of waste for treatment and disposal
- Infrastructure requirements
- Locally available treatment options and technologies
- Options available for final disposal
- Available space
- Location and surroundings of the treatment site and disposal facility
- Investment and operating costs
- Public acceptability
- Regulatory requirements<sup>9</sup>.

**According to Bio Medical Waste (Management and Handling) Rules , 1998, the treatment and disposal options for each waste category are shown:**

| <b>Waste category</b>                      | <b>Treatment and disposal options</b>                                                    |
|--------------------------------------------|------------------------------------------------------------------------------------------|
| 1. Human Anatomical waste                  | Incineration/Deep burial                                                                 |
| 2. Animal waste                            | Incineration/Deep burial                                                                 |
| 3. Microbiology & Biotechnology waste      | Local autoclaving/microwaving/incineration.                                              |
| 4. Waste sharps                            | Disinfection(chemical treatment/autoclaving/microwaving and mutilation/shredding)        |
| 5. Discarded medicines and Cytotoxic drugs | Incineration/destruction and disposal in secured Landfills                               |
| 6. Soiled waste                            | Incineration/ autoclaving/ microwaving                                                   |
| 7. Solid waste                             | Disinfection by chemical treatment/autoclaving/microwaving and mutilation /shredding     |
| 8. Liquid waste                            | Disinfection by chemical treatment and discharge into Drains                             |
| 9. Incineration Ash                        | Disposal in municipal landfill                                                           |
| 10. Chemical waste                         | Chemical treatment and discharge into drains for liquids and secured landfill for solids |

**The various treatment options are summarized below:**

| <b>Treatment</b>            | <b>Advantages</b>                                                                                                                                                                             | <b>Disadvantages</b>                                                                                                                                                                                                     |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rotary kiln                 | Adequate for all infectious waste, most chemical waste and pharmaceutical waste                                                                                                               | High investment and operating costs                                                                                                                                                                                      |
| Pyrolytic incineration      | Very high disinfection efficiency. Adequate for all infectious waste and most pharmaceutical and chemical waste                                                                               | Incomplete destruction of cytotoxics. Relatively high investment and operating costs.                                                                                                                                    |
| Single chamber incineration | Good disinfection efficiency. Drastic reduction of weight and volume of waste. The residues may be disposed of in landfills. No need for highly trained operators. Relatively low investment. | Significant emissions of atmospheric pollutants. Need for periodic removal of slag and soot. Inefficiency in destroying thermally resistant chemicals and drugs such as cytotoxics.                                      |
| Drum or brick incinerator   | Drastic reduction of weight and volume of the waste. Very low investment and operating costs.                                                                                                 | Destroys only 99% of microorganisms. No destruction of many chemicals and pharmaceuticals. Massive emission of black smoke, fly ash, toxic flue gas and odours.                                                          |
| Chemical disinfection       | Highly efficient disinfection under good operating conditions. Some chemical disinfectants are relatively inexpensive.                                                                        | Required highly qualified technicians for operation of the process. Uses hazardous substances that require comprehensive safety measures. Inadequate for pharmaceutical chemical and some types of infectious waste.     |
| Wet thermal treatment       | Environmentally sound. Relatively low investment and operating cost.                                                                                                                          | Shredders are subject to frequent breakdowns and poor functioning. Operation required qualified technicians. Inadequate for anatomical, pharmaceutical and chemical waste and waste that is not readily steam-permeable. |
| Microwave irradiation       | Good disinfection efficiency under appropriate operating conditions. Drastic                                                                                                                  | Relatively high investment and operating costs. Potential operation and maintenance problems.                                                                                                                            |

|               |                                                                                                       |                                                                           |
|---------------|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
|               | reduction in waste volume.<br>Environmentally sound.                                                  |                                                                           |
| Encapsulation | Simple, low cost and safe. May also be applied to pharmaceuticals.                                    | Not recommended for non- sharp infectious waste.                          |
| Safe burying  | Low costs. Relatively safe if access to site is restricted and where natural infiltration is limited. | Safe only if access to site is limited and certain precautions are taken. |
| Inertisation  | Relatively inexpensive.                                                                               | Not applicable to infectious waste.                                       |

### **Needle Cutters Of Destroyers:**

There are two types –mechanical or electrically operated. These equipments can be fixed on the table, are light and portable and can be used at blood collection centres, nursing stations, clinics etc., The main purpose of using these instruments is to avoid the reuse of disposable syringes.

The mechanical equipment operated by a lever shears the needle from the syringe and the electrical equipment may either shear the needle or burn the needle and completely destroy it leaving a residue of steel. The sheared needle collected in a box should be disinfected before disposal. The time taken for cutting or destroying the needle is only one minute in both the cases. Care should be taken while handling the equipment as needle stick injuries are common.

### **Syringe Crushers:**

These are used to safely destroy the syringes after the needle has been removed. This instrument is usually used to prevent reuse of syringes, especially those used to draw the blood samples and also in immunisation and health camps. The syringes crushers consist of two plates- one fixed and the other movable. A lever operates the movable plate. The syringes are kept between the two plates and crushed.

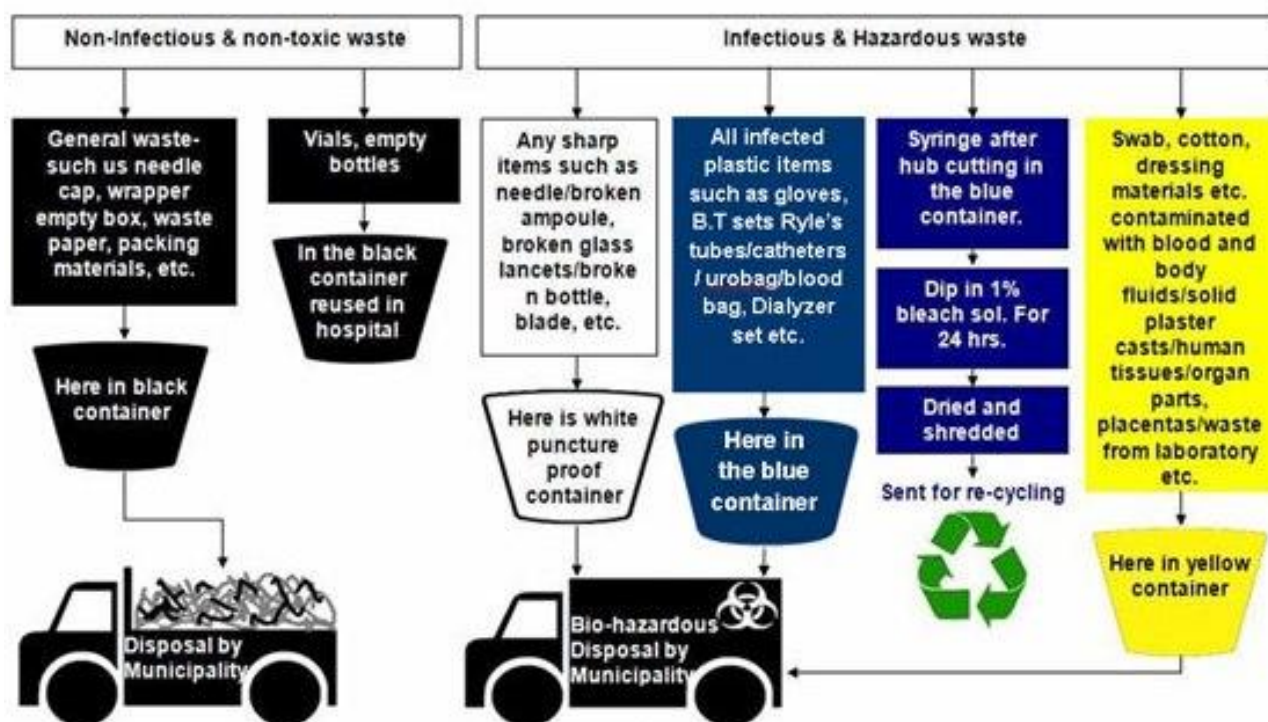
In recent years, a number of alternative technologies are being developed. Some examples are Hydroclave, Electron Beaming, Plasma technology, etc. In most of these innovations disadvantages outweigh advantages. They are technically more elaborate but less economical which are difficult to adapt to the needs of the state hospitals.

There is no ideal waste disposal strategy. Therefore a method, which satisfies most conditions and is cost effective, is the one likely to be sustainable. Waste reduction and recycling helps to reduce the cost of waste management considerably.

**Setting Up Of Common Biomedical Waste Treatment Facility:** A Common Bio-medical Waste Treatment Facility (CBWTF) is a set up where bio-medical waste, generated from a number of healthcare units, is imparted necessary treatment to reduce adverse effects that this waste may pose. The treated waste may finally be sent for disposal in a landfill or for recycling purposes. Installation of individual treatment facilities by small healthcare units requires comparatively high capital investment. In addition, it requires separate manpower and infrastructure development for proper operation and maintenance of treatment systems. The concept of CBWTF not only addresses such problems but also prevents proliferation of treatment equipment in a city. In turn, it reduces the monitoring pressure on regulatory agencies. By running the treatment equipment at CBWTF to its full capacity, the cost of treatment of per kilogram gets significantly reduced. Its considerable advantages have made CBWTF popular and proven concept in many developed countries.

CBWTF as an option has also been legally introduced in India. The Bio-medical Waste (Management & Handling) Rules, 1998, gives an option to the bio-medical waste generator that such waste can also be treated at the common bio-medical waste treatment facility. The Second Amendment of the Rules in June 2000, further eased the bottleneck in upbringing the CBWTF by making Local Authority responsible for providing suitable site within its jurisdiction. The concept of CBWTF is also being widely accepted in India among the healthcare units.

**Figure 2 classification of healthcare waste:-**



## 2.6 Occupational Health And Safety Measures:-

These include

- Meticulous practice of Universal precautions as a work culture
- Proper use of Personal Protective Equipment (PPE)
- Periodic medical and health examinations
- Maintenance of records of morbidity, accidents or injury
- Reporting of morbidity, accidents or injury
- Immunization of Health Care Personnel, especially waste handlers, against tetanus, typhoid and hepatitis B
- Training, retraining and continued training
- Good house keeping / safe and hygienic laundry practices.<sup>2</sup>

## **Essentials of the Universal precautions to be used in the care of all patients:**

### **a) Hand washing**

- Wash hands after touching blood, secretions, excretions and contaminated items, whether or not gloves are worn, wash hands immediately after gloves are removed and between patient contacts.
- Use a plain soap for routine hand washing.
- Use an antimicrobial agent for specific circumstances.

### **b) Gloves**

- Wear gloves when touching blood, body fluids secretions, excretions, and contaminated items. Put on clean gloves just before touching mucous membranes and non-intact skin.

### **c) Mask, eye protection, face shield**

- Wear a mask and eye protection or a face shield during procedures and patient care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, and excretions.

### **d) Gown**

- Wear a gown during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids secretions, or excretions.

### **e) Patient- care equipment**

- Ensure that the reusable equipment is not used for the care of another patient until it has been cleaned and reprocessed appropriately.

### **f) Environmental control**

- Ensure that the hospital has adequate procedures for the routine care, cleaning and disinfections of environmental surfaces.

**g) Linen**

- Handle used linen, soiled with blood, body fluids, secretions and excretions in a manner that prevents skin and mucous membrane exposures to avoid transfer of microorganisms to other patients.

**h) Occupational health and blood borne pathogens**

- Take care to prevent injuries when using needles, scalpels, and other sharp instruments or devices.
- Use ventilation devices as an alternative to mouth-to-mouth resuscitation methods.

**i) Place of care of the patient**

- Isolation room should be provided to the patient who is suffering from communicable disease.

### 1.3 Review Of Literature

- ISHWMC on 2001. Safe management of health care waste, Safe management of health care waste-Selected resources, The Indian society of Hospital Waste Management, 2001: 15 :-The study has revealed that the management of health care waste in the health care centres/units of Nagamangala taluk is not satisfactory and does not meet the guidelines of the act. It is imperative that the concerned authorities act in concert with the concerned stakeholders to improve the situation and impress upon them about the need for appropriate health care waste management as per the act. To achieve quality in disposal of health care waste of the health care centres/units should have a transparent holistic approach in medical services. This should include management of their waste in an environmentally friendly manner.
- Health Care Waste Management Cell. Information and learning units for safe management of Health care waste, Health care waste management cell, Dept. of Community Medicine, MSRMC, Bangalore, 2003:-The major constraints were lack of emphasis on training on importance of the safety of the workers and the resource availability. Safe disposal of sputum as per guidelines was glaringly lacking. Plastic waste incineration followed in certain places. The main issue and challenge is the need for attitudinal change which could definitely overcome the existing constraints and difficulties.
- Environmental Management and Policy Research Institute (EMPRI). Bio medical Waste Management, EMPRI Publishers, 2004:-Environmental Management and Policy Research Institute (EMPRI):- Waste generation rate in government hospital varies from 65-75kg/day and in case of private hospital the waste generation varies from 11-13 kg/day 2. An incinerator has been designed to treat the biomedical waste which is being generated in chikmagalur city with a capacity of 100kg/hr. 3. From material balance analysis by assuming complete combustion total mass input (1607.6kg/hr) is found to be

equal to total mass output (1607.4kg/ hr). 4. From the heat balance analysis, total heat input.

- Acharya D.B., and Singh Meeta. The Book of Hospital Waste Management, Minerva Press, New Delhi, 2000:-Acharya D.B., and Singh Meeta:- After analyzing the results of study it was felt that there is an urgent need to standardize the infrastructural requirement so that hospitals following BMW rules strictly do not suffer additional costs.
- Akter Nasima, Hussain Zakir, Trankler Josef, and Parkpian Preeda. Hospital Waste Management and It's Probable Health Effect: A Lesson Learned from Bangladesh, Indian Journal of Environmental Health, 2002; 44 (2): 124 – 137:-Hospital Waste Management and It's Probable Health Effect:- The study indicates that there is a need to improve the handling and disposal methods of hospital waste in almost all the available medical facilities. There are a few NGOs that have started awareness building and training on waste management for selected hospital staff and NGO officials. Based on the analysis of the situation, several suggestions and recommendations have been made to aid in the development of a waste management system.

## 1.4 Objectives

- ✓ To study the present state of health care waste management.
- ✓ To assess Knowledge, Attitude and Practices regarding health care waste management among various levels of staff in the hospital.
- ✓ To provide recommendations for proper health care waste management.

## **1.6 Methodology**

### **Study area:**

Nayati Multi super specialty hospital, located in the Mathura is a 351 bedded multi super specialty hospital with Superspeciality in cardiac services, pulmonology and gastric science. It is located on the main NH-2 highway with well connected roads and railway line that cater to the adjoining suburbs as well as the rural population.

Hospital has the facilities of Cath Lab, Cardiac OT, MS OT, ICU, Labour rooms, Emergency, Diagnostic Labs, OPD Services, Dental Clinic, Male/Female General Wards, Deluxe and Suit Private Rooms. The hospital has 130 operational beds with average bed occupancy of 50%, with around 180 patients per day in OPD. Number of patient visit in Emergency is about 25-35 patients. Number of RTA and cardiac emergencies are more.

The hospital possesses world class infrastructure with all modern amenities.

Biomedical waste Management facilities and infrastructure is updated with the laws and specific requirements with disposal being done by Municipal Common Bio-medical Waste Treatment Facility in the city.

**Study Period:**

The study was conducted from February 2016 – May 2016

**Source Of Data:**

100 health care personnel of various departments of the hospital were selected based on convenience and voluntary participation in the present study. The different health care personnel of various departments of the hospital are shown in table:

**Table: 4**

**Health care personnel of various departments of the hospital:**

| Sl. No       | Department                           | Number of staff |
|--------------|--------------------------------------|-----------------|
| 1            | ICCU Ward                            | 22              |
| 2            | Sample Collection Room<br>Laboratory | 6               |
| 3            | Cath Lab/ Operation Theatre          | 12              |
| 4            | OPD                                  | 4               |
| 5            | Surgical Ward                        | 23              |
| 6            | Dental clinic                        | 3               |
| 7            | Male/Female Ward                     | 30              |
| <b>Total</b> |                                      | <b>100</b>      |

**Method Of Collection Of Data:**

A checklist was prepared to conduct the study and was tested for appropriateness in some of the departments of the hospital during the pilot study. Also the questionnaire for KAP study was prepared and tested for appropriateness among the various levels of staff members of the hospital.

First the various departments of the hospital (listed in Table: 9) were visited and a rapport was developed with the heads & staff of the departments. The purpose of the study was explained and co-operation was requested to conduct the study. Next, the state of health care waste management in each unit was observed and studied by using the pre-tested checklist. (**Annexure –I**)

For the KAP study regarding health care waste management, the pre-tested questionnaires (**Annexure – II**) were given to all the staff members of various departments and were requested to fill the same. Some staff members like workers, sweepers, ayahs, attendees etc., were verbally asked the contents of pre-tested questionnaire and the responses were recorded. Marks were provided and were tabulated in percentage for comparing.

The obtained data was tabulated and the results were interpreted to determine the present state of health care waste management in various departments of

**Nayati Multi super specialty hospital, Mathura**

## 1.7 Results And Discussion

**Table: 5**

**Staff pattern in the various groups of departments/units included in the study:**

| Departments of hospital | Total Staff | No. of Doctors | No. of Nursing staff | No. of Technicians | No. of Pharmacists | No. of Other Staffs | Total staff |
|-------------------------|-------------|----------------|----------------------|--------------------|--------------------|---------------------|-------------|
| 1<br>Dental             |             | 1              | 1                    | 1                  | 0                  | 0                   | 3           |
| 2<br>OT/CATH LAB        |             | 2              | 3                    | 3                  | 0                  | 4                   | 12          |
| 3<br>Gen.Wards          |             | 4              | 20                   | 0                  | 0                  | 6                   | 30          |
| 4<br>Lab/sample room    |             | 1              | 0                    | 3                  | 0                  | 2                   | 6           |
| 5<br>ICU                |             | 2              | 14                   | 0                  | 0                  | 6                   | 22          |
| 6<br>Surgical Ward      |             | 3              | 15                   | 0                  | 0                  | 5                   | 23          |
| 7<br>OPD                |             | 1              | 1                    | 0                  | 0                  | 2                   | 4           |
| Total                   |             | 14             | 54                   | 7                  | 0                  | 25                  | 100         |
| Percentage              |             | 14%            | 54%                  | 7%                 | 0%                 | 25%                 | 100%        |

Table 13 shows a total of 100 staff members working in 7 different units of the hospital. Out of 100 staff members, 14 (14%) were doctors, 54 (54%) were nursing staff, 7 (7%) were laboratory technicians and 25 (25%) were other staffs.

**Table: 6**

**Descriptions of containers/ bin used by the various units of the hospital:**

| <b>Groups<br/><br/>/units</b> | <b>Colour coded bin</b> |               | <b>No. of containers /bins</b> | <b>Nature of container / bins</b> |                      |                  | <b>Lid of container / Bin</b> |               |
|-------------------------------|-------------------------|---------------|--------------------------------|-----------------------------------|----------------------|------------------|-------------------------------|---------------|
|                               | <b>Present</b>          | <b>Absent</b> |                                | <b>Plastic bin</b>                | <b>Cardboard box</b> | <b>Metal Bin</b> | <b>Present</b>                | <b>Absent</b> |
| dental                        | Y                       | N             | 4                              | (100%)                            | 0                    | 0                | Y                             | N             |
| O.T/Cath                      | Y                       | N             | 58                             | (100%)                            | 0                    | 0                | Y                             | N             |
| Gen ward                      | Y                       | N             | 20                             | (100%)                            | 0                    | 0                | Y                             | N             |
| Lab                           | Y                       | N             | 10                             | (100%)                            | 0                    | 0                | Y                             | N             |
| ICU                           | Y                       | N             | 15                             | 100%                              | 0                    | 0                | Y                             | N             |
| Surgical Ward                 | Y                       | N             | 15                             | (100%)                            | 0                    | 0                | Y                             | N             |
| OPD                           | Y                       | N             | 30                             | 20 (66%)                          | 0                    | 10 (34%)         | Y                             | N             |

Table 21 shows that in group 1(Dental) there were total of 4 colour coded containers/bins, all made of plastic as recommended by Biomedical waste management rules. Out of the 4 containers/bins, all containers had lids.

In group 2(O.T. and CATH) there were total of 58 colour coded containers/bins, all made of plastic as recommended by Biomedical waste management rules. Out of the 58 containers/bins, all containers had lids.

In group 3(Gen Ward) there were total of 20 colour coded containers/bins, all made of plastic as recommended by Biomedical waste management rules. Out of the 20 containers/bins, all containers had lids.

The number of colour coded containers were observed to be 10,15,15 & 30 respectively., all made of plastic as recommended by Biomedical waste management rules, all containers had lids.

Containers with lid help in appropriate containment of waste, they would not only help from the aesthetic point of view, but would act as barrier for various vectors from accessing the contents and spreading the pathogens of infectious potential.<sup>33</sup>

**Table: 7**

**Method of transportation of health care waste to the site of final disposal:**

| <b>Groups of health care hospital</b> | <b>Manual</b> | <b>Container and Trolley</b> |
|---------------------------------------|---------------|------------------------------|
| 1                                     | Y             | N                            |
| 2                                     | N             | Y                            |
| 3                                     | N             | Y                            |
| 4                                     | N             | Y                            |
| 5                                     | N             | Y                            |
| 6                                     | N             | Y                            |
| 7                                     | N             | Y                            |
|                                       |               |                              |

Table 22 shows that out of 7 UNITS only dental department was manually transporting the waste to the site of final disposal. Rest all units of the hospital used containers and trolley for transportation of waste to the site of final disposal.

**Table: 8**

**Personal protective measures used by the various departments of the hospital:**

| Groups of health care hospital | Personal protective measures |             |              |            |              |              |                                 |
|--------------------------------|------------------------------|-------------|--------------|------------|--------------|--------------|---------------------------------|
|                                | Apron                        | Boots       | Masks        | Goggles    | Gloves       | Soap & water | Immunization (TT & Hepatitis B) |
| 1<br>(n = 1)                   | 1                            | 0           | 1            | 0          | 1            | 1            | 1                               |
| 2<br>(n = 12)                  | 12                           | 12          | 12           | 4          | 12           | 12           | 12                              |
| 3<br>(n = 16)                  | 16                           | 0           | 16           | 0          | 16           | 16           | 8                               |
| 4<br>(n = 4)                   | 3                            | 0           | 4            | 1          | 4            | 4            | 3                               |
| 5<br>(n = 8)                   | 8                            | 8           | 8            | 0          | 8            | 8            | 8                               |
| 6<br>(n = 7)                   | 7                            | 7           | 7            | 0          | 7            | 7            | 5                               |
| 7<br>(n = 2)                   | 2                            | 0           | 2            | 0          | 2            | 2            | 0                               |
| Total<br>(n = 50)              | 49<br>(98%)                  | 27<br>(54%) | 50<br>(100%) | 5<br>(10%) | 50<br>(100%) | 50<br>(100%) | 37<br>(74%)                     |

\* Sample was selected from the staff present at the time of conducting questionnaire in each department. Out of Total 100 staff a sample of 50 staffs were taken ***n = 50***.

From the above table, it is observed that out of 50 health care personnel, Most of them had access to the protective gears, hospital just lacked proper nos. of eye protection gear and not all the health care workers were vaccinated for hepatitis-B.

These measures essentially protect health care workers from blood borne infections caused by human immunodeficiency virus ,hepatitis B virus and hepatitis C virus.<sup>9</sup>

Although heavily relied upon, personal protective measures are often used without adequate training or a full understanding of its limitations. Since personal protective measures can give its wearer a feeling of confidence in the face of hazardous

situations, the inappropriate selection or misuse of these measures can cause overexposure, illness or death.

Employees are not protected and are not trained to wear boots, hand gloves, eye cover and they work barefoot amidst hospital wastes, thereby exposing themselves to injuries with sharps and needles. A senior professor of Pediatrics of SMS medical college, succumbed to meningitis while treating a patient with the same disease because of ignorance of personal protective measures.

Viral hepatitis B infections have been reported among health care personnel and waste handlers and immunization against the disease is therefore recommended. Tetanus immunization is also recommended for all personnel handling waste.

**Table: 9**

**Distribution of various levels of staff members of Group 1(Dental Clinic)  
giving correct responses for KAP questionnaire:**

| Questionnaire | Various levels of staff members of Group 1 (Dental Clinic) |                             |                               |                         |
|---------------|------------------------------------------------------------|-----------------------------|-------------------------------|-------------------------|
|               | Doctors<br>(n = 1)                                         | Nursing<br>Staff<br>(n = 1) | Lab<br>technicians<br>(n = 1) | Other staffs<br>(n = 0) |
| Knowledge     | (80%)                                                      | (66.2%)                     | (58.3%)                       | 0                       |
| Attitude      | (77%)                                                      | (74.3%)                     | (66.6%)                       | 0                       |
| Practice      | (61.1%)                                                    | (64.8%)                     | (58.3%)                       | 0                       |

The above table shows the correct responses to KAP questionnaire given by various level of staff members of group 1 (Dental Clinic) of the hospital. Correct knowledge about health care waste management among the doctors, nursing staff, lab technician, and other staffs were (80%), (66.2%), (58.3%), respectively. With regard to attitude, the correct responses among the doctors, nursing staff, lab technicians and other staffs were (77%), (74.3%), (66.6%) respectively. With regard to the practices, the correct responses among the doctors, nursing staff, lab technicians were (61.1%), (64.8%), (58.3%) respectively.

However the difference in KAP of various levels of staff members among group 1 regarding health care waste management were statistically not significant.

**Table: 10**

**Distribution of various levels of staff members of Group 2(OT CATH LAB) giving correct responses for KAP questionnaire:**

| Questionnaire | Various levels of staff members of Group 2 |                             |                               |                        |                            |
|---------------|--------------------------------------------|-----------------------------|-------------------------------|------------------------|----------------------------|
|               | Doctors<br>(n = 2)                         | Nursing<br>Staff<br>(n = 3) | Lab<br>technicians<br>(n = 3) | Pharmacists<br>(n = 0) | Other<br>staffs<br>(n = 4) |
| Knowledge     | (73.6%)                                    | (80%)                       | (70%)                         | 0                      | (52.5%)                    |
| Attitude      | (68.4%)                                    | (60%)                       | (60%)                         | 0                      | (40.2%)                    |
| Practice      | (42.1%)                                    | (90%)                       | (70%)                         | 0                      | (59.4%)                    |

The above table that shows the correct responses to KAP questionnaire given by various level of staff members of group 2 (OT CATH LAB) of the hospital Correct knowledge about health care waste management among the doctors, nursing staff, lab technicians, and other staffs were (73.6%), (80%), (70%), and (52.5%) respectively. With regard to attitude, the correct responses among doctors, nursing staff, lab technicians, and other staffs were (68.4%), (60%), (60%), and (40.2%) respectively. With regard to the practices, the correct responses among the doctors, nursing staff, lab technicians, and other staffs were (42.1%), (90%), (70%), and (59.4%) respectively. The knowledge attitude and practice of other staff is comparatively low as compared to all other groups.

**Table: 11**

**Distribution of various levels of staff members of Group 3 (Male/Female Gen.Wards) giving correct responses for KAP questionnaire:**

| Questionnaire | Various levels of staff members of Group 3<br>(Male/Female Gen.Wards) |                            |                        |
|---------------|-----------------------------------------------------------------------|----------------------------|------------------------|
|               | Doctors<br>(n = 4)                                                    | Nursing Staffs<br>(n = 20) | Other staff<br>(n = 6) |
| Knowledge     | 73.7%                                                                 | (92.2%)                    | 42%                    |
| Attitude      | 80%                                                                   | (50%)                      | 63%                    |
| Practice      | 90%                                                                   | 71.1%                      | 54%                    |

Knowledge is checked based on the responses given in the questionnaire and checklist. Attitude is assessed by making certain statements and scoring of responses.

The above table that shows the correct responses to KAP questionnaire given by various level of staff members of group 3 (Male/Female Gen.Wards) of the hospital. Correct knowledge about health care waste management among the doctors nursing staff and other staffs were 73.7%, 92.2% and 42% respectively. With regard to attitude, the correct responses among the doctors, nursing staff and other staffs were 80%, 50% and 63% respectively. With regard to the practices, the correct responses among the doctors, nursing staff and other staffs were 90%, 71.1% and 54% respectively.

However the difference in KAP of various levels of staff members among group 3 regarding health care waste management were statistically not significant.

**Table: 12**

**Distribution of various levels of staff members of Group 4(Lab and Sample collection Room) giving correct responses for KAP questionnaire:**

| Questionnaire | Various levels of staff members of Group 4(Lab) |                           |                         |
|---------------|-------------------------------------------------|---------------------------|-------------------------|
|               | Doctors<br>(n = 1)                              | Lab Technicians<br>(n =3) | Other Staffs<br>(n = 2) |
| Knowledge     | 50%                                             | 56%                       | 33.3%                   |
| Attitude      | 50%                                             | 62%                       | 33.3%                   |
| Practice      | 20%                                             | 68%                       | 23%                     |

From the above table it is observed that, the correct responses to KAP questionnaire given by various level of staff members of group 4 (Lab and Sample collection Room) . Correct knowledge about health care waste management among the doctors, lab technician and other staffs were 50%, 56% and 33.3% respectively. With regard to attitude, the correct responses among the doctors, lab technician and other staffs were 50%, 62% and 33.3% respectively. With regard to the practices, the correct responses among the doctors, lab technician and other staffs were 20%, 68% and 23% respectively.

**Table: 13**

**Distribution of various levels of staff members of Group 5 (ICCU) giving correct responses for KAP questionnaire:**

| Questionnaire | Various levels of staff members of Group 5 |                         |                         |
|---------------|--------------------------------------------|-------------------------|-------------------------|
|               | Doctors<br>(n =2)                          | Nursing Staff<br>(n=14) | Other Staffs<br>(n = 6) |
| Knowledge     | 78%                                        | 73.5%                   | 59%                     |
| Attitude      | 80%                                        | 69%                     | 52%                     |
| Practice      | 82%                                        | 82%                     | 63%                     |

It is observed from the above table that, the correct responses to KAP questionnaire given by various level of staff members of group 5 (ICU) of the hospital. Correct knowledge about health care waste management among the doctors, nursing staff and other staffs were 78%, 73.5% and 59% respectively. With regard to attitude, the correct responses among the doctors, nursing staff and other staffs were 80%, 69% and 52% respectively. With regard to the practices, the correct responses among the doctors, nursing staff and other staffs were 82%,82% and 63% respectively.

However the difference in KAP of various levels of staff members among group 5 regarding health care waste management were statistically not significant.

**Table: 14**

**Distribution of various levels of staff members of Group 6(surgical ward)  
giving correct responses for KAP questionnaire:**

| Questionnaire | Various levels of staff members of Group 6 |                           |                         |
|---------------|--------------------------------------------|---------------------------|-------------------------|
|               | Doctors<br>( n= 3)                         | Nursing Staff<br>(n = 15) | Other Staffs<br>(n = 5) |
| Knowledge     | 76%                                        | 85%                       | 33.3%                   |
| Attitude      | 73%                                        | 80%                       | 33.3%                   |
| Practice      | 85%                                        | 82.5%                     | 40%                     |

From the above table it is observed that, the correct responses to KAP questionnaire given by various level of staff members of group 6 (Surgical Ward) of the hospital. Correct knowledge about health care waste management among the doctors, nursing staff and other staffs were 76%, 85% and 33.3% respectively. With regard to attitude, the correct responses among the doctors, nursing staff and other staffs were 73%, 80% and 33.3% respectively. With regard to the practices, the correct responses among the doctors, nursing staff and other staffs were 85%, 82.5% and 40% respectively.

**Table: 15**

**Distribution of various levels of staff members of Group7 (OPD) giving correct responses for KAP questionnaire:**

| Questionnaire | Various levels of staff members of Group 7 |                         |
|---------------|--------------------------------------------|-------------------------|
|               | Doctors<br>(n = 2)                         | Other Staffs<br>(n = 2) |
| Knowledge     | 50%                                        | 32%                     |
| Attitude      | 50%                                        | 56%                     |
| Practice      | 60%                                        | 40%                     |

It is observed from the above table that, the correct responses to KAP questionnaire given by various level of staff members of group 7, among the doctors was 50% 50% and 60% With regard to knowledge, attitude, and practice and the correct response among the other staffs were 32%, 56% and 40% respectively.

Though the KAP regarding health care waste management among the various groups of health care hospital was not statistically significant, but the knowledge, attitude and practice regarding health care waste management among the doctors were high when compared to the other staffs.

## 1.8 Results & Conclusion

**Results:-** The present study was undertaken to assess the status of health care waste management among the different level of staff of various department in Nayati multi super specialty hospital, Mathura.

Out of the 7 department of the hospital and their 100 staff members the study was conducted through questionnaire and the marks obtained were summarized in percentages and were tabled. Out of 100 staff members working in 7 department of the hospital, 14% were doctors, 54% were nursing staff, 7% were lab. Technicians, and 25% were other staffs.

**Knowledge and Attitude:-**Though the KAP regarding health care waste management among the various groups of health care hospital was not statistically significant, but the knowledge, attitude and practice regarding health care waste management among the doctors were high when compared to the other staffs.

**Practice:-**The colour coded container/bins as recommended by Biomedical waste management rules were observed with lids in all departments. The containers and trolleys were being used for transportation of waste to the site of final disposal from all departments. Chemical disinfection is used for sharp objects at source. It is observed that almost all the staff used aprons, masks gloves as personal protective measures. The soap and water were provided in all locations liberally by hospital. Immunization (against TT and Hepatitis B) was observed in 74% health care workers of the hospital.

**Conclusion:-**To conclude, the present study has revealed that the practice of healthcare waste management of Nayati multi super specialty hospital, Mathura is adequate and satisfactory. There is need to improve the awareness levels as well as practice of health care waste management among the housekeeping and 4<sup>th</sup> grade employees appropriately for which necessary training and follow Up are required.

## 1.8 RECOMMENDATIONS

1.All the head of the departments, health care personnel and other staff must undergo periodic training and awareness programme to keep abreast with the current knowledge of scientific waste management system and its importance and benefits to the patients, staff and the community as a whole.

2. Establishment of waste management and infection control committees would be helpful in overseeing the day to day activities concerning waste management and infection control respectively.

3.For the successful initiatives in health care waste management awareness about a sound legal/ regulatory framework has to be used in conjunction with scientific judgment so as to make the initiative sustainable in the long run.

4. Periodic monitoring and auditing of the practices concerning safe management of health care waste should be done in different hospital departments.

5. Occupational health and safety of the health care personnel should assume importance since it is the health care personnel who are at immediate risk if waste were mismanaged.

6.Public education: Every member of the community has the right to be informed about health hazards of health care waste. Hence the public has to be educated in a comprehensive manner using mass media.

To achieve quality in disposal of health care waste of the health care hospital should have a transparent holistic approach in medical services. This should include management of their waste in an environmentally friendly manner.

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**ANNEXURE-I**  
**CHECK LIST FOR THE STUDY OF THE PRESENT STATE OF**  
**HOSPITAL WASTE MANAGEMENT OF**  
**NAYATI MULTI SUPER SPECIALTY HOSPITAL,MATHURA**

1. Name of the Department:
2. Name of the respondent with designation:
6. Staff Pattern (numbers):
  - a. Consultants :
  - b. Duty doctors (Staff/PG/Internees) :
  - c. X – ray technicians :
  - d. Lab technicians :
  - f. Nursing staff :
  - e. Ward boys :
  - g. Ayahs :
  - h. Others :
  - i. Total number of staff :
7. Average Out-Patients/day:
8. Out-Patients strength in the last six months:
9. Total Number of beds:
10. Average bed occupancy:
11. Average In-patients admission/day:
12. In-patients strength in the last six months:
13. Average surgeries/month:
14. Average deliveries/month:
15. Number of dental chairs:
17. Tick if the following is present:
  - a. Infection control committee
  - b. Waste sharp management policy.
  - c. Waste management committee.
  - d. Occupational safety policy.
  - e. Disinfection policy.

18. System of reporting & recording illness/injuries/accidents to the considered committee : Yes/No
19. Immunization of cleaning staff against:
  - a. Tetanus : Yes/No
  - Hepatitis B : Yes/No
21. Collection:
  - a. How is the waste collected: Together/Segregated
  - b. Container:
    - i. Nature
    - ii. Total number
    - iii. Frequency of emptying
    - iv. Lid - present/absent
  - c. Who collects the solid waste at the source?
    - i. Ward boys.
    - ii. Ayahs
    - iii. Nurses
    - iv. Others
  - d. At the time of the collection of the waste, what do they wear?
    - i. Apron - Yes/No
    - ii. Gloves - Yes/No
    - iii. Boots - Yes/No
    - iv. Mask - Yes/No
    - v. Goggles - Yes/No
  - e. Method of transportation of waste from your hospital to site of final disposal:
    - i. Manually
    - ii. Container
    - iii. Opened Vehicle
    - iv. Closed vehicle
22. How long do you store bio-medical waste?
  - a. 24 hours b. 48 hours c. 72 hours d. One week
25. Details of disposal:
  - a. /Solid waste:
    - i. Burial
    - ii. Burning on open ground
    - iii. Incinerator
    - iv. Dumping to municipality bin
    - v. Dumping indiscriminately

b. Liquid waste:

- i. Whether liquid waste is disinfected before disposal - Yes/No
- ii. Disposal into underground drainage system - Yes/No
- iii. Disposal into open drains - Yes/No

26. According to BMW (M & H) rules, 1998, which of the following types of health care settings need to apply to pollution control board for grant of authorization for Bio– medical waste: Please tick

- a. Government Hospitals
- b. Private Hospitals
- c. Nursing homes
- d. Blood bank & Pathological laboratory
- e. Any health care settings that treats more than 1000 patients per month
- f. All of the above

**ANNEXURE-II**  
**A STUDY OF HOSPITAL WASTE MANAGEMENT OF**  
**NAYATI MULTI SUPER SPECIALTY HOSPITAL,**  
**MATHURA**

**KNOWLEDGE, ATTITUDE AND PRACTICE (K.A.P)**  
**QUESTIONNAIRES**

**A. GENERAL INFORMATION:**

1. Name: \_\_\_\_\_ Age: \_\_\_\_\_ Years Sex: M/F
2. Educational qualification: \_\_\_\_\_
3. Designation: \_\_\_\_\_
4. Work experience: \_\_\_\_\_
5. Date: \_\_\_\_\_
6. Signature: \_\_\_\_\_

**B. PLEASE ENCIRCLE YOUR ANSWERS:**

1. Who generates the hospital /health care waste?
  1. Private medical & dental clinic
  2. CHC/PHC/PHU
  3. Medical college & hospital
  4. Veterinary hospital
  5. Government hospital
  6. All of the above
  7. Don't know
2. The disease that has the potential for transmission through infected hospital waste.
  1. TB
  2. Hepatitis B
  3. Malaria
  4. Diabetes Mellitus
  5. HIV
3. Predominant source of infection to Health Care Personnel is through
  1. Infected Linen
  2. Waste sharps
  3. Contaminated dressings
  4. Specimens
4. Predominant source of injuries to Health Care Personnel is through
  1. Sharp needles
  2. Broken glass ampoules
  3. Scalpels
  4. All of the above
5. The best way of personal protection to prevent transmission of diseases from health care waste is
  1. Immunization
  2. Isolation of the patient
  3. Appropriate medical treatment of patient
  4. Following Universal Precautions
6. The basic component of Universal Precaution is
  1. Hand washing
  2. Sterilization
  3. Isolation of the patient
  4. Disinfection

7. UNIVERSAL PRECAUTIONS needs to be followed to isolate
1. Pathogen
  2. Patient
  3. Physician
  4. Patient attendants
  5. All of the above

8. HAND WASHING helps in PREVENTION of
1. Infection of health care personnel
  2. Cross infections to patients
  3. Nosocomial infections
  4. All of the above

9. Hands should be washed for at least
1. 0 – 1min
  2. 3 – 4min
  3. 1 – 2 min
  4. 2 – 3 min

10. Segregation is best achieved at the time of
1. Final disposal
  2. Point of generation
  3. Intermediate storage
  4. Final storage

11. COLOUR – CODING of Health Care waste helps in
1. Segregation of waste
  2. Safe transportation of waste
  3. Reduces the risk of injury to waste handlers
  4. None of the above
  5. All of the above

12. Please match the color code to the type of waste. As recommended by BMW rules.

|   | Colour code                             | Choice |     | Type of waste                                            |
|---|-----------------------------------------|--------|-----|----------------------------------------------------------|
| a | Yellow plastic bag                      |        | i   | Microbiological and Biotechnological wastes/Solid wastes |
| b | Red plastic bag                         |        | ii  | Human anatomical and animal wastes                       |
| c | Black plastic bag                       |        | iii | Sharps                                                   |
| d | Blue / White puncture – proof container |        | iv  | Incinerated ash/ Chemical waste/Drugs.                   |

13. “Sterilization” is a process of
1. Destroying all living organisms.
  2. Cleaning
  3. Disinfecting
  4. All the above

14. Disinfection of waste should be ideally done at
1. Final storage
  2. At point of generation
  3. Before transportation to final disposal
  4. Don't know

15. The most easy way of disinfecting at point of Generation is
1. Autoclaving
  2. Chemical disinfection
  3. Thermal disinfection
  4. Incineration
16. Incineration is the method of
1. Disinfection
  2. Final Disposal
  3. Treatment
  4. None of the above.
17. Incineration is
1. Controlled burning
  2. Burning with Petrol/Diesel
  3. Burning with any fossil fuel
  4. None of the above
18. The Advantage with the use of Incineration in waste management is
1. Volume reduction of waste
  2. Sterilization/Disinfection
  3. Ash of incinerator is Non toxic
  4. All of the above
19. Which of the following should not be incinerated
1. Contaminated cotton and gauze
  2. Anatomical waste
  3. Chlorinated plastic
  4. Paper waste
20. Dioxin is produced by burning of
1. Paper waste
  2. Chlorinated plastic
  3. Sharp waste
  4. Anatomical waste
21. Dioxin have potential to cause
1. UTI
  2. Cancers
  3. Renal diseases
  4. Diarrhoeal diseases
22. The following material is to be handled with extreme caution
1. Aluminum
  2. Steel
  3. Mercury
  4. Plastic
23. Composting is most suited for which type of waste:
1. Sharp waste
  2. Anatomical waste
  3. Food waste
  4. Contaminated dressing
24. Please match the color code to waste treatment. As recommended by BMW rules.

|   | Colour code                             | Choice |     | Waste treatment              |
|---|-----------------------------------------|--------|-----|------------------------------|
| A | Yellow plastic bag                      |        | i   | Chemical treatment/Shredding |
| B | Red plastic bag                         |        | ii  | Incineration/Deep Burial     |
| C | Black plastic bag                       |        | iii | Autoclaving/Microwaving      |
| D | Blue / White puncture – proof container |        | iv  | Disposal in secured landfill |

25. The CRITICAL component for Safe Management of Health Care Waste

- |                                          |                                        |
|------------------------------------------|----------------------------------------|
| 1. Disinfection                          | 2. Incineration of HealthCare Waste    |
| 3. Disposal of Anatomical Waste/Placenta | 4. Segregation at Point of generation. |

26. Safe Management of Health Care Waste is required to tackle

- |                                      |                                                |
|--------------------------------------|------------------------------------------------|
| 1. Hospital acquired infections      | 2. Emergence of ANTIBIOTIC RESISTANT pathogens |
| 3. Increase cost of care to patients | 4. All of the above                            |

27. Safe management of Health Care Waste benefits

- |                               |                          |
|-------------------------------|--------------------------|
| 1. Management of the hospital | 2. General community     |
| 3. Health Care Personnel      | 4. Patients & attendants |
| 5. All of the above           |                          |

28. Who is responsible for management of Health Care Waste:

- |                         |                         |
|-------------------------|-------------------------|
| 1. Medical Personnel    | 2. Nursing personnel    |
| 3. Ayah's and ward boys | 4. Municipality workers |
| 5. All of the above     | 6. None of the above    |

29. The following need to be trained for Safe Management of Health Care Waste

- |                        |                     |
|------------------------|---------------------|
| 1. Nurses              | 2. Doctors          |
| 3. Ayahs and Ward boys | 4. Managerial staff |
| 5. All of the above.   |                     |

30. Bio-medical Waste Management Rules were notified in

- |         |         |
|---------|---------|
| 1. 1986 | 2. 1989 |
| 3. 1998 | 4. 1999 |

**C - 1. Indicate the items that need to be segregated / disinfected / deformed:  
Encircle your answers. Also indicate the colour coding and their final disposal.  
Recalling from the work of yesterday indicate the quantum of waste generated per day.**

|   | Waste Materials                                 | Segregation (Sg) | Disinfection (Df) | Disfigurement (Dg) | Colour coding (Cc) | Final Disposal (Fd) |
|---|-------------------------------------------------|------------------|-------------------|--------------------|--------------------|---------------------|
| a | Remains after surgery                           | Yes / No         | Yes / No          | NA                 |                    |                     |
| b | Placenta                                        | Yes / No         | Yes / No          | NA                 |                    |                     |
| c | Disposable needles and syringes                 | Yes / No         | Yes / No          | Yes / No           |                    |                     |
| d | Scalpel blades                                  | Yes / No         | Yes / No          | Yes / No           |                    |                     |
| e | Discarded glass ware (vials, Ampoules, bottles) | Yes / No         | Yes / No          | Yes / No           |                    |                     |
| f | Bandage cloth                                   | Yes / No         | Yes / No          | NA                 |                    |                     |
| g | Cotton                                          | Yes / No         | Yes / No          | NA                 |                    |                     |
| h | Excised tissues                                 | Yes / No         | Yes / No          | NA                 |                    |                     |
| i | Paper                                           | Yes / No         | Yes / No          | Yes / No           |                    |                     |
| j | Plastic material                                | Yes / No         | Yes / No          | Yes / No           |                    |                     |
| k | Banana leaves / Fruit peels / Etc.,.            | Yes / No         | Yes / No          | NA                 |                    |                     |
| l | Left over food                                  | Yes / No         | Yes / No          | Yes / No           |                    |                     |
| m | Cloth / thread                                  | Yes / No         | Yes / No          | Yes / No           |                    |                     |
| n | Urine Remains                                   | Yes / No         | Yes / No          | NA                 |                    |                     |
| o | Stools samples                                  | Yes / No         | Yes / No          | NA                 |                    |                     |
| p | Blood / Serum samples                           | Yes / No         | Yes / No          | NA                 |                    |                     |
| q | CSF / Pleural / Ascitic fluid                   | Yes / No         | Yes / No          | NA                 |                    |                     |
| r | Sputum                                          | Yes / No         | Yes / No          | NA                 |                    |                     |
| s | Vomitus                                         | Yes / No         | Yes / No          | NA                 |                    |                     |
| t | Others (specify) Lab waste                      | Yes / No         | Yes / No          | Yes / No           |                    |                     |
| u | Others (specify) Liquid waste                   | Yes / No         | Yes / No          | Yes / No           |                    |                     |
| v | Others (specify)                                |                  |                   |                    |                    |                     |

**C-2, I - (Please tick)**

|   |                                                      | <b>Uniform</b> | <b>Apron</b> | <b>Boots</b> | <b>Mask</b> | <b>Goggles</b> | <b>Gloves</b> | <b>Soap &amp; water</b> | <b>Other clothing</b> |
|---|------------------------------------------------------|----------------|--------------|--------------|-------------|----------------|---------------|-------------------------|-----------------------|
|   |                                                      | <b>(Uf)</b>    | <b>(Ap)</b>  | <b>(Bt)</b>  | <b>(Mk)</b> | <b>(Gg)</b>    | <b>(Gv)</b>   | <b>(Sw)</b>             | <b>(Oc)</b>           |
| a | Protective clothing provided by the institution      |                |              |              |             |                |               |                         |                       |
| b | Protective clothing not used by you & <b>Reason:</b> |                |              |              |             |                |               |                         |                       |

**C-2, II - Please tick the clothing you use under following circumstances:**

|   |                                   |  |  |  |  |  |  |  |  |
|---|-----------------------------------|--|--|--|--|--|--|--|--|
| a | Handling soiled laundry           |  |  |  |  |  |  |  |  |
| b | Cleaning contaminated instruments |  |  |  |  |  |  |  |  |
| c | Starting IV & taking blood        |  |  |  |  |  |  |  |  |
| d | Controlling minor bleeding        |  |  |  |  |  |  |  |  |
| e | Controlling massive bleeding      |  |  |  |  |  |  |  |  |
| f | Suctioning                        |  |  |  |  |  |  |  |  |
| g | Handling Health care Waste(HCW)   |  |  |  |  |  |  |  |  |
| h | Transporting HCW                  |  |  |  |  |  |  |  |  |
| i | Disinfecting infectious waste     |  |  |  |  |  |  |  |  |

**D The following section contains statements, which are designed to understand the Attitude. The statements are not TRUE all the time. Encircle the response which you think is most appropriate. The answers are absolutely right or absolutely wrong. It reflects a point of view only.**

**A=Agree; D=Disagree.**

|    |                                                                                                         |   |   |
|----|---------------------------------------------------------------------------------------------------------|---|---|
| 1  | All the waste generated in hospital is infectious.                                                      | A | D |
| 2  | Safe management of Health Care Waste is an extra burden on work                                         | A | D |
| 3  | Only Management is responsible for the Management of Health Care Waste.                                 | A | D |
| 4  | Only Ayahs/Ward boys are responsible for Health Care Waste                                              | A | D |
| 5  | Only Doctors are responsible for Safe Management Health Care Waste                                      | A | D |
| 6  | Only Nurses are responsible for Safe Management Health Care Waste                                       | A | D |
| 7  | Only Patients / Attenders are responsible for Safe Management Health Care Waste                         | A | D |
| 8  | Patients / Attendees NEED NOT known about Safe Management Health Care Waste                             | A | D |
| 9  | Safe Management Health Care Waste is not an important issue at all.                                     | A | D |
| 10 | Health Care Waste have be potential to be hazardous / Dangerous                                         | A | D |
| 11 | Health is at risk because of mismanagement of Health Care Waste                                         | A | D |
| 12 | Presence of legal provision help in safe management of health care waste                                | A | D |
| 13 | There should be a hospital policy for safe management of health care waste                              | A | D |
| 14 | Safe Management of health care waste does not help in controlling hospital acquired infection.          | A | D |
| 15 | The most important step in safe management of health care waste is segregations at point of generation. | A | D |
| 16 | Segregation increases the quantum of infectious waste                                                   | A | D |
| 17 | Segregation of waste at point of generation increases the risk of injury to waste handlers.             | A | D |
| 18 | Colour - coding helps in segregation/ transportation of Waste                                           | A | D |
| 19 | Decontamination of infected waste at point of generation is a must.                                     | A | D |
| 20 | Health Care waste must be disinfected before discarding/reusing.                                        | A | D |
| 21 | Needles waste sharps are the most hazardous waste in a Hospital                                         | A | D |

|    |                                                                                                                    |   |   |
|----|--------------------------------------------------------------------------------------------------------------------|---|---|
| 22 | It is necessary to disfigure/ mutilate syringes, IV bottles before discarding                                      | A | D |
| 23 | There is a need to attempt and develop recycling of Plastics used in health care settings as a mode of management. | A | D |
| 24 | Safe management of health care waste is the responsibility of the government.                                      | A | D |
| 25 | Presence of a waste management committee helps in safe management of health care waste                             | A | D |
| 26 | Incineration is the method of treatment and not final Disposal                                                     | A | D |
| 27 | All types of waste can safely be incinerated                                                                       | A | D |
| 28 | Presence of incinerator is a must for safe management of health care waste                                         | A | D |
| 29 | Training orientation towards safe management of health care waste is not necessary.                                | A | D |
| 30 | There should be a separate routing system for waste transportation from wards to final disposal facility           | A | D |
| 31 | Accident reporting by health care personnel while handling waste helps in safe management of health care Waste     | A | D |
| 32 | Quantification of various categories of waste generated helps in planning infrastructure/                          | A | D |
| 33 | There should be periodically medical examination for all health care personnel.                                    | A | D |
| 34 | Contaminated waste should not be stored for more than a working day.                                               | A | D |
| 35 | Lack of awareness is the only reason for mismanagement of health care waste.                                       | A | D |
| 36 | Microbiological waste should be autoclaved before putting in the sorter cum collector                              | A | D |
| 37 | There is no harm in incineration plastics                                                                          | A | D |
| 38 | Plastics should be incinerated to avoid reuse.                                                                     | A | D |
| 39 | Plastics should be recycled                                                                                        | A | D |
| 40 | The best method of disposing kitchen waste is composting                                                           | A | D |
| 41 | Mismanagement of health care waste has the potential to spread diseases like Hepatitis and HIV                     | A | D |
| 42 | The best way of disinfecting infectious waste is by chemical disinfection                                          | A | D |
| 43 | There is no need of legal provisions to ensure safe management of health care waste                                | A | D |
| 44 | Safe management endeavors increased financial burden on hospital.                                                  | A | D |
| 45 | Safe management endeavors by the hospitals increased financial burden on patients.                                 | A | D |