

Study on Bio-medical Waste Management in a District Hospital

**Internship Training
At
Civil Hospital, Mohali**

**By
Shweta Oberoi**

**Under the guidance of
Dr. Suresh Joshi**

**Post Graduate Diploma in Hospital & Health Management
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Certificate of Dissertation Completion

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This is to certify that the dissertation titled "Study of Bio-medical Waste Management in a District Hospital", submitted by Dr. Shweta Oberoi, enrollment number IIHMR/PGDHM/2012-14/17-1378, under the supervision Prof. Suresh Joshi, for the award of Postgraduate Diploma In Health and Hospital Management of the institute, carried out during the period from 2012-2014 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.

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ABSTRACT

Background- In the course of curing health problems the health care sector produce huge amount of bio-medical waste which may be hazardous to all those who come in contact with this waste.

Indiscriminate disposal of infected and hazardous waste from hospitals, nursing homes and pathological laboratories can lead to significant degradation of the environment, leading to spread of diseases and putting the people to great risk from certain highly contagious and transmission prone disease vectors.

To avoid the hazards caused due to indiscriminate bio-medical waste management, discriminate waste management system should be implemented in hospital infrastructure.

The health care waste management is a process that helps to ensure proper hospital hygiene and safety of health care workers and communities.

The present study was carried out to assess the bio-medical waste management of a District Hospital.

Objectives of the study- Evaluation of the existing process of biomedical waste management in a District Hospital.

Estimation of knowledge, attitude and practices of the healthcare staff, about biomedical waste management.

Methodology- The study was conducted at Civil Hospital, a 120 bedded facility located in a district of Punjab, Mohali. A cross sectional approach was adopted to conduct the study. The study population was divided into strata of doctors, nurses, lab technicians and sanitation staff.

The data collection technique was based on observation of the biomedical waste management in the hospital, using the checklist and distribution of the questionnaire prepared to assess knowledge, attitude and practice, to the healthcare staff i.e. doctors, nurses, lab technicians and sanitation staff.

Results- It was observed with the help of the checklist that the hospital had the necessary requirements for the segregation, disinfection, transportation and storage of bio-medical waste. The management of bio-medical waste in Civil Hospital, Mohali was done in accordance with the Bio-medical Waste (Management and Handling) Rules, 1998. Segregation of bio-medical waste in color coded bins was done in accordance with the rules of Punjab Pollution Control Board.

The KAP survey revealed that majority of the respondent doctors, nurses and lab technicians have knowledge, positive attitude and good practice with respect to management of bio-medical waste.

The sanitation staff has good knowledge of bio-medical waste segregation but poor knowledge regarding disinfection of waste, hazards associated with healthcare waste and personal protective equipment. They have positive attitude and practice of bio-medical waste segregation and disinfection but negative attitude towards training programmes and feel that bio-medical waste management is a burden on hospital.

It was observed that in all categories of the staff, non-reporting of injuries caused due to bio-medical waste was seen and they did not practice wearing personal protective equipment while handling bio-medical waste, which can be linked to non-availability of special forms for injury reporting and personal protective equipment in the hospital.

Conclusion- The study concludes that knowledge and attitude of majority of respondent doctors, nurses and lab technicians regarding bio-medical waste management is more as

compared to sanitation staff. Majority of the respondent staff has good practice of segregating, disinfecting and transporting the bio-medical waste except in case of injury reporting and personal protective equipment while handling bio-medical waste, which can be linked to non-availability of special forms for injury reporting and personal protective gear in the hospital.

Key words- Biomedical waste management, KAP

TO WHOMSOEVER IT MAY CONCERN

This is to certify that, Dr. Shweta Oberoi, student of Post Graduate Diploma in Hospital and Health Management (PGDHM) from Institute of Health Management Research, Jaipur has undergone internship training at, Civil Hospital, Mohali, from 3rd February, 2014 to 30th April, 2014.

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

The internship is in fulfillment of the course requirement.

I wish her all the success in all her future endeavors.

Dean, Academics and Student Affairs

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PART 1
ORGANIZATION REPORT

1.1 INTRODUCTION OF THE ORGANIZATION

The Health and Family Welfare Department, Government of Punjab, is committed to provide preventive, promotive and curative health services to the people of state through a network of medical institutions such as sub-centers, subsidiary health centers, primary health centers, community health centers, Sub-Divisional and District Hospitals, Government Medical & Dental Colleges.

The Punjab Health Systems Corporation was enacted through a special act of legislation to provide for the constitution of a corporation for establishing, expanding, improving and administering medical care in the state of Punjab. There are 176 healthcare institutions under PHSC, out of which there are 21 District Hospitals, 34 Sub-divisional Hospital and 119 Community health centre. A wide spectrum of healthcare facilities, preventive, curative and promotive, is provided in these institutions.

Hospital Services at the secondary level play a vital and complementary role to the Primary Health Care System and together form a comprehensive district based health care system.. Both are essential part of a well-integrated health care system. One of the District Hospitals providing secondary healthcare facility in the district of Punjab is, Civil Hospital, Mohali

1.2 ORGANIZATIONAL PROFILE

Civil Hospital, Mohali is a 120 bedded secondary level institute, located in a district of Punjab, Mohali. This healthcare centre was started in late 90's.

The hospital is two storey building with registration, OPD, Pharmacy, emergency, ICU, imaging services, lab, labour room, NBSU, MRD, female ward, immunization room, purchase department, billing department, drug store, laundry and mortuary at the ground floor and OT, dialysis, blood bank, general male and pediatric wards and private rooms at the first floor and de-addiction centre at the second floor.

It is supported by 3 OT's i.e. eye, orthopedic and general surgery.

Civil hospital, Mohali provides the following services:

- General medicine
- General surgery
- Orthopedics
- Pediatrics
- Gynecology
- ENT
- Ophthalmology
- Dermatology
- Lab medicine
- Radiology
- Blood bank
- Dentistry
- Physiotherapy
- Psychiatry

1.3 DEPARTMENTS VISITED

Registration: Patient will attend the OPD registration desk for new patient registration and will inform the following details to the registration clerk:

- Name of the patient
- Age
- Sex
- OP clinic intending to consult or the disease suffering from so that the registration clerk can guide them to the proper OP.
- Employment status

The following patients are exempted from paying the registration charges:

- Member of both houses of the Parliament.
- Member of the Legislative Assembly.
- State Government Employees.
- Freedom Fighter.
- Below Poverty Card (BPL) holders.

Patient is allotted OPD registration number which is valid for the particular calendar year. The OP clinic number of the particular specialty, to be consulted is indicated in the OP case sheet of the patient.

Patients visiting the OPD of the hospital for follow up consultation within 1month from the date of previous consultation will attend the “follow up patient registration counter”. No fee is charged for such patients. A seal is marked in the case sheet of the patient and the same is handed over to the patients who then visit the particular OP clinic.

If the patient arrives 1 month of the prior date of OP consultation, the old registration number of the patient is deemed to be invalid and a re- registration has to be done following the process mentioned for new patient registration.

Admission: Decision regarding the need to admit the patient in the IP facility of the hospital is taken by the treating consultant, which is marked in the case sheet of the patient. Patients are admitted only if the required medical care is available in the hospital.

The doctor informs the patient and the relatives about the need for IP admission and indicates the same in the OP case sheet of the patient.

The admission of the patient is done at the IP registration window. If the patient is to be admitted in the private ward of the hospital, a separate admission form has to be filled which is available with the admission clerk in the admission window.

If the patient is to be admitted in the general wards of the hospital, the patient's details as indicated in the case sheet along with the specific general ward is recorded and IP number is allotted to the patient. The admission fee is collected by the admission clerk and payment receipt is handed over to the patient's relative. The patient is then taken to the specific ward, by the ward boy.

Discharge: Decision regarding discharging the patients rest with the primary treating consultant of the patient who make such decision during his evening rounds on the previous day prior to the discharge of patient and the same is communicated to the patient, relatives ,the concerned ward nursing staff / on duty Medical Officer. However the final decision regarding discharge is made on the basis of the condition of the patient during the morning round of the treating consultant on the scheduled day of discharge.

After final decision to discharge the patient is taken, the treating consultant, resident doctor or nurse in charge prepares the discharge summary of the patient which contains the following information:

- Reasons for Admission
- Investigations performed and summarized information about the results of the investigations
- Diagnosis made
- Record of any procedures (operation, etc) performed
- Condition of the patient at the time of discharge
- Medication instructions

- Follow up Advice
- Emergency contact number of the hospital

One copy of the Discharge Summary is handed over to the patient/relatives and the other copy is attached to the patient's case file.

Incase patient/relatives want to get discharged against medical advice; the same is indicated in the patient's case record by the primary treating consultant/medical officer. Records are entered in the LAMA register of the respective patient ward and a written consent is taken from the patient/relatives.

In case of expiry of the patient the primary treating consultant/medical officers/nursing staff informs the patient relatives.

Ward nurse makes necessary preparation for cleaning the body. The on duty medical officer prepares two copies of the Death Certificate and Death Summary which is then stamped. Body is handed over to the patient's relative or kept in the mortuary within an hour of death .Body handed over to the relatives along with one copy of Death Summary and Death Certificate and the other copy is attached to the patient case records.

Billing: In case of discharge of patients admitted in private wards of the hospital, ward nurse forwards the Patient File along with the Discharge summary to the Accounts for clearance.

Accounts departments prepare the final bill of the patient adjusting the advance paid by the patient/relatives at the time of admission. In case any refund has to be made the same is done or the balance if any is collected from the patient / relatives at the accounts section. Final settlement of payment is done, cash receipt prepared and handed over to the patient/relatives and a copy of the same is forwarded to the ward nurse who enters the same in the designated register maintained in the ward.

Emergency: It is located on the ground floor of the department with separate entry and a separate parking for ambulance.

The Emergency Department of Hospital offers comprehensive emergency care 24 hrs a day with one Emergency Medical Officer on duty during the morning and two Emergency Medical Officers in the evening and night shift respectively.

During peak hours, the consultants of all medical services are available in the hospital and can be reached immediately in case of any need and during non peak hours the consultants from each clinical department are available on call basis.

The patient arriving in the emergency department receives initial assessment by the registered nurse and the treatment is initiated according to the level of need. Patients requiring immediate intervention are transferred to the appropriate bed station in the ED to initiate the care process.

The registration process of the patient is also initiated in the ED if the patient condition permits. In case of life threatening situations the registration and consent process are postponed so as to facilitate the initiation of appropriate emergency care.

In case admission of the patient is necessary, the EMO / Consultant on duty make the decision for admission and authorize it.

After the necessary admission procedure is completed, the ED nurse confirms the availability of bed on the floor and shifts the patient along with his documents and reports.

In case of transfer of patient to other hospital due to non-availability of any facility, the decision is taken by the EMO. The availability of drugs and equipments in the ambulance is checked and a nurse is arranged to take care of the patient during the transfer. Transfer out form with patient's details, diagnosis, treatment performed, investigation results is handed over to the patient's attendant and details of transferring hospital are entered in patient's medical record.

In case of brought dead patients, the EMO thoroughly examines the patient and on confirmation of death, gives brought dead certificate to the patient's relatives. The hospital informs the local police for further disposal of the body.

In case of death on arrival EMO goes into the detailed history of the patient to arrive at the probable cause of death. On the basis of this, death certificate is issued and arrangements for release of the body are taken after settlement of hospital dues.

Pharmacy: Located adjacent to the emergency department.

Central medical store directorate is responsible for meeting the bulk of the pharmaceutical requirement of the hospital. The hospital makes periodic indent request to the CMSD.

The indent request is made on the basis of the reorder level for various pharmaceutical item used in the hospital. The supply of pharmaceutical item to the hospital is based on a fixed budget decided annually by the CMSD in collaboration with other government authorities under the Health and Family welfare, Government of Punjab.

CMSD ensure that the EDL is strictly adhered by the medical professionals and the healthcare facilities at various level under the purview of Health and Family Welfare, Government.

Few pharmaceutical products are purchased from the vendors who are already in contract with the hospital and in case of emergency; purchase can be done from nearby medical store under the supervision of SMO/EMO.

All pharmaceutical items are arranged alphabetically in the racks so that easy access is facilitated.

Narcotics are kept under lock and key in a cupboard. It is handled only by pharmacy in-charge or senior pharmacist.

A list of sound alike medicines is mentioned with the pharmacy in-charge and the same are stored separately.

Prior to dispensing the Medicine the pharmacist verifies the following details in the prescription:

- Name of the Patient, registration number
- Name of the drugs, dose and route prescribed.
- Name and Signature of the Prescribing Doctor along with the date and time.

Expiry Date of the item is checked prior to dispensing of the item by the pharmacist.

In case of inpatient, pharmacist issues the drugs to the nurse-in-charge.

Laboratory: It has provision of services in the following areas:

- Hematology
- Clinical pathology
- Biochemistry
- Serology

In case of outpatient, treating Doctor prescribes the required laboratory test in the OP case sheet of the patient. The clerk collects charges for the prescribed test, enters the details in the designated register. Patient visits the sample collection area of the laboratory department along with the payment receipt and OP sheet. Patient's laboratory requisition slip is made and details including the name of the patient, age, sex, sample identification number, tests to be performed, referring doctor are entered in the record register. Patient's name, type (OP/IP), sample identification number and sample type is also mentioned on the container used to collect the sample which is then sent to the laboratory to perform prescribed tests.

In case of inpatient, the ward nurse collects the sample and sends it to the laboratory along with patient's details.

All the test reports generated are signed by authorized laboratory personnel.

Radiology: The department provides following services:

- X-ray
- Computerized radiography
- Ultrasound

In case of outpatient, the radiological procedure is performed as prescribed by the consultant on the OP sheet of the patient. The clerk collects charges for the prescribed test, enters the details in the designated register. The patient visits the department along with the payment receipt and OP sheet. Patient's test requisition slip is made and an identification number is given to the patient. The prescribed tests are performed and the patient is sent to the consultant with the reports duly signed by the radiologist with date and time. The reports are dispatched after taking patient's/receiver's sign.

In case of inpatient, the nurse informs the department of the procedure to be performed. The patient is sent to the department with patient's case sheet. Tests are performed and reports duly signed by the radiologist, are handed over to the nurse/patient/attendant.

Biomedical waste management

According to the Punjab Pollution Control Board, the following color coded bins are used in Civil Hospital, Mohali, to segregate biomedical waste.

Table 1.1: Segregation of biomedical waste

Color coded bins	Biomedical waste
Yellow	Infectious waste like material contaminated with blood e.g. cotton, body parts
Blue	Solid waste like tubing, catheters
White	Sharp waste
Green	General waste

Bins have hand and foot operated lids and biohazard sign on it.

Monthly training is provided to the nursing staff and class IV employees regarding proper segregation of biomedical waste and a record register is maintained for the same.

Biomedical waste is disinfected and mutilated before final disposal.

Syringes are cut with the help of hub cutters before chemically disinfecting it with 1% sodium hypochlorite, at the source of generation.

Plastic waste like IV sets, bottles, latex gloves, catheters are cut by scissors and disinfected with 1% sodium hypochlorite for 1 hour before final disposal.

Blood bags and sharp waste like slides are disinfected with 5% sodium hypochlorite for 1 hour before finally disposing them off.

Liquid waste from laboratory is chemically treated with 4% sodium hypochlorite for 4-5 hours and then drained.

The hospital has provision of wheel barrows to collect the waste, from every department of the hospital in color coded plastic bags. There is a predefined route of carrying the biomedical waste to the collection centre build outside the hospital where the waste is not stored beyond 48 hours.

Record related to amount of biomedical waste generated in terms of weight, is maintained in the hospital.

The hospital does not have provision of treating biomedical waste i.e. incinerators, microwave, which is outsourced.

Issues: The hospital does not have provision of personal protective equipment at every nursing station, for the staff handling biomedical waste.

Blood bank: It is located on the first floor of the hospital and deals only with the transfusion of whole blood.

The department is divided into blood collection room, refreshment room, apheresis room, room for carrying out various tests and room for storage of whole blood.

Following records are maintained in the blood bank:

- a. Blood donor record: It indicates serial number, date of bleeding, name, address and signature of the donor with other particulars of age, weight, hemoglobin, blood grouping, blood pressure, medical examination, bag number, and recipients detail for whom donated in case of replacement donation, category of donation (voluntary/ replacement) and deferral records and signature of Medical Officer in charge.
- b. Master records for blood: It indicates bag serial number, date of collection, date of expiry, quantity in ml., ABO/Rh group, results of testing HIV, malaria, V.D.R.L., hepatitis B and hepatitis C, name and address of the donor with particulars, and signature of medical officer/ in charge.
- c. Issue register: It indicates serial number, date and time of issue, bag serial number, ABO/ Rh group, total quantity in ml. , name and address of the recipient, group of recipient, name of the hospital and unit/ ward, details of cross-matching report, indication of transfusion and issued by.

d. Register for diagnostic kits and reagents used: Name of the reagent/ kit, details of batch number, date of expiry and date of use.

e. Records of purchase, stock in and stock out of disposable needles, syringes and blood bags.

f. Record of report sent to state AIDS control Society.

Issues: Adverse transfusion reaction record forms and needle stick injury record forms were not available and there were no such records maintained.

The staff of blood bank was made aware of adverse transfusion reaction (annexure 3) and needle stick injury record forms (annexure 4) and was being told to maintain a separate register for the same.

Medical records department: The Medical Record Department is responsible for proper storage, retrieval and maintenance of confidentiality and security of the record.

MRD is located on the ground floor of the hospital.

It maintains the records in proper accessible manner. All records are placed year and then month wise.

Handing over of records as & when required for administrative purposes is done by getting a slip signed by the person receiving the record e.g. for follow up of in-patients by the Consultants as well as by the Patients, for MLC.

Patient's relatives require a written authorization from the patient for obtaining information from the medical records. Such information is not given in original; a Xerox of the same is handed over to the patient and signature taken in specific format.

The medical record of a patient contains the documents arranged in a sequence of –

- Admission form
- Case sheet comprising of:-
 1. Medical History
 2. Clinical findings
 3. Investigations ordered

4. Treatment instituted
5. Progress reports
6. Consent form for surgery or specialized procedures
7. Anesthesia check record, if applicable
8. Notes on surgical/ special procedures, if applicable
9. Name, date and signature of treating doctor.
10. Laboratory reports in chronological sequence of their ordering
11. Films along with their reports

Narrative Summary with a discharge form is placed in the first position, so that the review can be quickly done.

Following are the records maintained in the department:

- Total number of OPD
- Total number of admissions
- Total number of discharge
- BOR
- ALOS
- Death rate
- Maternal death rate
- Neonatal death rate
- Total number of normal deliveries
- Total number of caesarian section

Laundry: This department is located outside, at the backside of the hospital. The matron is responsible for timely supply of clean and adequate linen to the user departments.

Soiled linen is collected and fetched from various departments by the housekeeping staff. Linen from OT, wards etc soiled with blood and other body fluids are washed at the respective point of generation for removal of the stain and are then send for autoclaving. After autoclaving the linen, the same is the collected for laundry. The matron is responsible for maintaining a register containing details regarding the type of linen, their number, respective ward/unit from where they are collected. The washed linen is then verified by the matron by cross matching with details entered in the register and then the linen is distributed to the user department.

Mortuary: It is located outside, at the backside of the hospital and has 6 refrigerators for storage of dead bodies.

After receiving the dead body the mortuary staff cleans the dead body and wraps it in sterile linen and puts it inside the cold chamber under appropriate temperature/ environmental conditions.

Dead bodies preserved in the mortuary are issued only after written instruction for the same by either the Senior Medical Officer or Emergency Medical Officer on duty.

Details regarding the dead body and the receiver of the same are entered in the Mortuary register. The information documented is as follows:

- Name of the person
- Age of the person
- Sex
- Address
- Name of receiver
- Relationship with the expired person
- Address of the receiver

Signature of the receiver is obtained in the specified column of the register and the dead body is issued to him.

Purchase department: The Department undertakes centralized purchasing of all materials for the hospital. The Material Management department purchases the items on the following two basis: reorder level and request for purchase of items from the User Department or Management.

In case of purchase of general items like stationary, the hospital purchases the required products from the identified vendors at the rate fixed.

The decision to purchase any equipment for the hospital is taken by a multidisciplinary committee known as purchase committee. The committee evaluates the need for any equipment in commensurate with the scope of services provided by the hospital and purchases it through either tender or quotation from three suppliers.

Once the item is received by the hospital, it is verified by the store in-charge, supplier and a representative from the purchase committee, against the order placed. After the clearance of verification of the material, the transaction is made in goods inward register and the invoice of the supplier is forwarded to the accounts for payment.

Transaction regarding the issue of the material to the user department is recorded in goods issue register.

The department prepares a monthly report of the Purchase summary (category wise), items issued during the month and the closing stock at the end of each month and submits the report to the Senior Medical Officer for evaluation.

PART2
DISSERTATION REPORT

CHAPTER 1

INTRODUCTION

According to Bio-medical Waste (Management and Handling) Rules, 1998, biomedical waste is any solid, fluid or liquid waste or any intermediate product, generated during diagnosis, prevention and treatment of diseases in the hospitals.¹

Hospital waste generated is not intended for further use in a hospital and should be discarded by proper method.

In the course of curing health problems the health care sector produce huge amount of bio-medical waste which may be hazardous to all those who come in contact with this waste.

Hazardous waste management is a concern for every health care organization.²

The concern regarding the biomedical waste is mainly due to the presence of pathogenic organisms and organic substances having adverse effect over human health.³

Between 75% and 90% of the waste produced by health-care facilities is non-hazardous or general health-care waste, and only 10% to 25% of health-care waste has a hazard that requires careful management.⁴

Indiscriminate disposal of infected and hazardous waste from hospitals, nursing homes and pathological laboratories can lead to significant degradation of the environment, leading to spread of diseases and putting the people to great risk from certain highly contagious and transmission prone disease vectors.⁵

Risk to healthcare workers- Improperly contained contaminated sharps can pose infectious risk associated with hospital waste, through injuries from syringes and needles contaminated with human blood like AIDS and hepatitis.

Inadequate biomedical waste management can cause environmental pollution, unpleasant smell, growth and multiplication of vectors like insects, rodents and worms and can lead to the transmission of diseases like typhoid, cholera etc.

Risk to the public- There can be increased risk of nosocomial infections in patients due to poor waste management. The general public can also be at risk if the hazardous waste is abandoned or disposed of improperly.

The rag pickers and waste workers are often worst affected, because unknowingly or unwittingly, they rummage through all kinds of poisonous material while trying to salvage items which they can sell for reuse. At the same time, this kind of illegal and unethical reuse can be extremely dangerous and even fatal. Diseases like cholera, plague, tuberculosis, hepatitis (especially HBV), AIDS (HIV), diphtheria etc. in either epidemic or even endemic form, pose grave public health risks.⁶

To avoid the hazards caused due to indiscriminate bio-medical waste management, discriminate waste management system should be implemented in hospital infrastructure.⁷

The health care waste management is a process that helps to ensure proper hospital hygiene and safety of health care workers and communities.²

Ministry of Environment Forest, Government of India, has notified the rules of management and handling of bio-medical waste called Bio-medical waste (Management and Handling) Rules 1998. This rule applies to all those who generate, collect, receive, store, transport, treat, dispose or handle bio-medical waste in any manner and also to every institution that generate bio-medical waste.

The purpose of Bio-medical Waste (Management and Handling) Rule is mainly to ensure its efficient collection, handling, as well as safe disposal in such a way that it controls

infection and improves safety for employees working in the system, community and environment.

Managing waste has two vital parts: firstly management of hazardous waste of different types generated from different sources, which involves careful segregation collection, transportation and final disposal and secondly effective training and supervision of various categories of personnel involved in whole waste management system.⁸

CHAPTER 2

AIMS AND OBJECTIVES OF THE STUDY

2.1.1 Aim of the study

This study is intended to assess the biomedical waste management in a District Hospital.

2.1.2 Objectives of the study

Evaluation of the existing process of biomedical waste management in a District Hospital.

Estimation of knowledge, attitude and practices of the healthcare staff, about biomedical waste management.

CHAPTER 3

LITERATURE REVIEW

Biomedical waste means any solid, fluid, or liquid waste including its containers and any intermediate product which is generated during the diagnosis, treatment, or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biological and includes ten categories for same.⁶

There are eight categories of waste according to the amendments made to Bio-medical Waste (Management and Handling) rules 1998 in 2011.

Table3.1: Categories of healthcare waste in India

Category	Description	Treatment
1	Human anatomical waste (Human tissue, organ, body parts, body fluids, fetuses)	Incineration/ deep burial
2	Animal anatomical waste (Animal tissue, organ, body parts, fluid, animals used in research, waste from veterinary hospitals, colleges and animal houses)	Incineration/deep burial
3	Microbiological and biotechnological waste (Lab cultures, microbiological stocks)	Autoclaving/microwaving/incineration
4	Sharp waste (Intravenous or other needles, auto-disable needles, syringes with attached needles, scalpels, pipettes, blades, broken glass)	Chemical disinfection/microwaving/autoclaving/shredding
5	Discarded waste and cytotoxic waste (Outdated, contaminated and discarded medicines)	Incineration/drug disposal in secured landfill
6	Soiled waste (Waste contaminated with blood and other body fluids like cotton dressings, soiled plaster casts, linen)	Autoclaving/microwaving/incineration
7	Solid waste (Waste such as tubings, catheters, intravenous sets)	Chemical disinfection/microwaving/autoclaving/shredding
8	Chemical waste (Chemicals used in the production of biological, used for disinfection)	Chemical treatment and drain for liquids and landfill for solids

According to central pollution control board, the segregation of bio-medical waste in different color coded bags/bins is as follows:

Table 3.2: Segregation of healthcare waste

Color code	Category of waste
Yellow	Category 1, 2, 3 and 6
Blue	Category 7
White	Category 4
Black	Category 5
Green	General waste

Between 75% and 90% of the waste produced by health-care facilities is non-hazardous or general health-care waste, and only 10% to 25% of health-care waste has a hazard that requires careful management. This smaller hazardous or infectious healthcare waste component needs to be properly managed so that health risks from exposure to known hazards can be minimized. Protection of health of staff, patients and the general public is the fundamental reason for implementing a system of health care waste management.⁴

According to WHO, healthcare waste can be classified into different categories, each of which carries risk of transmission of infectious disease or risk to health, due to human exposure.⁴

Sharp waste- unused and used sharps like intravenous needles, auto-disable syringes, and syringes with attached needles, pipettes, blades, broken glass. May cause infection like HIV and hepatitis

Infectious waste- waste suspected to contain pathogens and that poses risk of transmission of disease transmission e.g. waste contaminated with blood and other body fluids, lab cultures, materials that have been in contact with persons infected with disease.

Pathological waste- human tissues, organs or fluids, body parts, fetuses.

Pharmaceutical waste and cytotoxic waste- pharmaceuticals that are expired, contaminated, cytotoxic waste with genotoxic properties. Many cytotoxic drugs are extreme irritants and cause harmful effects on eye and skin after direct contact.

Chemical waste- waste containing chemical substances e.g. lab reagents, film developer, and disinfectants. It may cause intoxication or physical injuries.

Radioactive waste- waste containing radioactive substances like unused liquids from radiotherapy or lab research. Nature of illness caused by radioactive waste may range from headache, dizziness to serious problems like effect on genetic material.

Non-hazardous or general waste- waste that does not pose any particular biological, chemical, radioactive or physical hazard.

Hospital-acquired infections have been estimated at 10% of all fatal/life-threatening diseases in the South-East Asia region and have been identified as one of the indicators for the management of waste.⁹

Management of health care waste is an integral part of hospital hygiene and infection control. Health care waste can be considered as a reservoir of pathogenic microorganisms, which if someone is exposed, could give rise to an avoidable infection.⁵

With a rigorous regime of segregation at source, the problem can be reduced proportionately. Similarly, with better planning and management, not only the waste generation is reduced, but overall expenditure on waste management can be controlled. Organizational set up, training and motivation are given great importance these days. Proper training of health care establishment personnel at all levels coupled with sustained motivation can improve the situation considerably.⁶

A study was conducted in Hamidia Hospital, a 900 bedded hospital. A cross sectional survey was conducted to assess the knowledge of the staff of the hospital i.e. doctors, nurses, ward boys, sweepers. The study shows that all the respondents have good knowledge, although level of knowledge was more among doctors and nurses as compared to ward boys and sweepers. All doctors and nurses were aware that improper management of waste causes health hazards while the same was not in case of the ward boys and sweepers.⁶

A cross sectional study was conducted in a Tertiary Care Rural Medical College to assess knowledge, attitude and practices of healthcare staff i.e. doctors, nurses, lab technicians and sanitation staff. It was found that the knowledge regarding policies of bio-medical waste management was better in doctors but practical aspects were better in nurses and lab technicians. Non-reporting of injuries was present in all 4 categories. Ignorance regarding safe disposal of bio-medical waste and unfavorable attitude was clearly evident amongst the sanitation staff.¹⁰

A cross sectional study was conducted in the department of obstetrics and gynecology of CSM Medical University, Lucknow. Knowledge, practices, attitude of the medical and paramedical staff was assessed. The majority of staff (Doctors and Nurses) was conscious of the measures for safe collection and final disposal of BMW. Almost whole of the staff (Doctors and Nurses) showed a positive attitude towards the need for measures for safe collection and final disposal of BMW.¹¹

A cross sectional study was conducted in Medical College Hospital, Bangalore to assess the awareness and practices of the healthcare staff i.e. doctors, interns, nurses, lab technicians, attenders and housekeeping staff. Doctors, nurses have better knowledge than other staff regarding health care waste management. Knowledge regarding the color coding

and waste segregation at source was found to be better among nurses and laboratory staff. Regarding practices related to health care waste management nurses were better. However, injury reporting was nil across all the groups of health professionals.¹²

A study on knowledge, attitude and practices on the subject was conducted in tertiary care hospital, All India Institute of Medical Science. The data was collected using the questionnaire method. The study showed that people with greater level of education-such as consultants, residents-have good knowledge of the rules but relatively few have the same kind of attitude and practice. In case of nurses, they have good knowledge and practice percentage is also very high. Sanitary staff has poor knowledge about bio-medical waste management rules but good percentage of them has positive attitude and practice habits. Lab staff was found to have lowest percentage in all the categories.¹³

This study was conducted to assess the biomedical waste management practices followed in the District Hospital of Mohali, Punjab.

This means that essential steps are taken into account:

- A) Biomedical waste collection
- B) Segregation
- C) Transportation and storage
- D) Treatment

CHAPTER 4

METHODOLOGY

4.1 Study location- The study was conducted at Civil Hospital, located in a district of Punjab, Mohali. The institute is a 120 bedded secondary care centre.

The hospital has all the basic specialties like general medicine, general surgery, orthopedics, ENT, obstetrics, gynecology, ophthalmology, pediatrics, psychiatry etc.

4.2 Study design- A cross sectional approach was adopted to conduct the study.

Sampling technique- Stratified sampling technique was used to divide the study population into strata i.e. doctors, nurses, lab technicians and sanitation staff.

The total number of staff working in the hospital was 110 (excluding Pharmacists and clerical staff), which included:

Nurses- 49

Doctors- 35

Lab technicians- 6

Class IV- 20

4.3 Study tools- A checklist (annexure 1) was constructed to collect data on the bio-medical waste management for evaluating the existing process of bio-medical waste management, in the hospital.

The checklist was further divided into 5 parts:

Necessary requirements- This part of checklist included requirements necessary for managing bio-medical waste in a hospital setting.

Generation and segregation- Items in this part of the checklist was used to determine whether the bio-medical waste is segregated in specified color-coded bags/bins.

Collection and storage- This section was used to determine the collection and storage of bio-medical waste in the hospital.

Transportation- This section of the checklist was to determine the transportation of bio-medical waste from the hospital to the collection centre.

Management of waste streams- It consisted of items, to determine different methods of treatment for different category of waste.

A structured close-ended questionnaire (annexure 2) was made for estimating the knowledge, attitude and practices of the healthcare staff i.e. doctors, nurses, lab technicians, and sanitation staff, regarding bio-medical waste management.

The questionnaire was divided into three parts:

Waste management policy- It had 15 items for assessing the knowledge regarding bio-medical waste management amongst the hospital staff.

Waste management practices- It had 8 items for assessing the practice regarding biomedical waste amongst the hospital staff.

Attitude assessment- It had 7 items for assessing the attitude regarding bio-medical waste amongst the hospital staff.

4.4 Study technique- The data collection technique was based on observation of the biomedical waste management process in the hospital, using the checklist and distribution of the questionnaire prepared to assess knowledge, attitude and practices, to the healthcare staff i.e. doctors, nurses, lab technicians and sanitation staff.

4.5 Data collection process- A written permission was obtained from the Senior Medical Officer, Civil Hospital, Mohali, for conducting the study in the hospital.

A brief idea about the study was given to the participants and the structured questionnaire was distributed to the doctors, nurses and lab technicians while in case of sanitation staff, the questionnaire was read in hindi and answers were collected.

4.6 Data analysis technique- The data was analyzed using descriptive statistical method. Descriptive statistics was used to describe the staff with knowledge, practice and attitude in the form of percentages.

CHAPTER 5

BIOMEDICAL WASTE MANAGEMENT PROCESS IN A DISTRICT HOSPITAL

A checklist (annexure) was used to observe the process of bio-medical waste management in the hospital.

The management of bio-medical waste in Civil Hospital, Mohali was done in accordance with the Bio-medical Waste (Management and Handling) Rules, 1998. Segregation of bio-medical waste in color coded bins was done in accordance with the rules of Punjab Pollution Control Board.

Table 5.1: Segregation of waste in Civil Hospital, Mohali

Color coded bins	Category of waste
Yellow	Soiled, infectious waste and anatomical waste
Blue	Solid waste like tubings and catheters
White	Sharp waste
Transparent	Unbroken glass waste
Green	General waste

5.1 Necessary requirements

It was observed with the help of the checklist that all the departments of the hospital i.e. emergency, OT, ward, blood bank, lab, dialysis, labor, NBSU, immunization and OPD had the necessary requirements for management of bio-medical waste i.e. color coded bins and plastic bags with biohazard sign on it, puncture proof containers for sharps, syringe cutters, calibrated weighing machine for bio-medical waste, sodium hypochlorite for treating bio-medical waste before disposal, record register of weight of bio-medical waste produced by the hospital every day, post prophylaxis kit with the pathologist except the personal protective equipment at every nursing station, for the staff handling the waste.

5.2 Generation and segregation

Through second section of the checklist it was observed that the waste was segregated at the site of generation in accordance with the bio-medical waste management rules (as shown in table 4.1).

5.3 Collection and storage

It was also observed that the bins used for collecting bio-medical waste were emptied by sanitation staff twice every day or when $\frac{3}{4}$ filled.

A separate collection centre was situated outside the hospital in which the bio-medical waste was not stored for more than 48 hours. After emptying the bins sanitation staff of the hospital cleaned them with detergent and water in the collection centre.

5.4 Transportation

Wheel barrows were used to transport the waste, in color coded bags, to the collection centre and a predefined route was used to carry it.

5.5 Management of waste streams

The hospital had provision of sodium hypochlorite to treat bio-medical waste before disposal. Infectious waste was chemically treated before disposal.

The syringes were cut and disinfected with 1% sodium hypochlorite at the source of generation, before disposal.

Plastic waste like IV sets, bottles, latex gloves, catheters were cut with scissors and disinfected with 1% sodium hypochlorite for 1 hour before disposing off.

Slides used in laboratory were also disinfected with 1% sodium hypochlorite for 1 hour before disposal and the liquid waste was treated with 4% sodium hypochlorite for 4-5 hours and then drained. Blood bags were disinfected with 5% sodium hypochlorite for at least 5 hours before disposal.

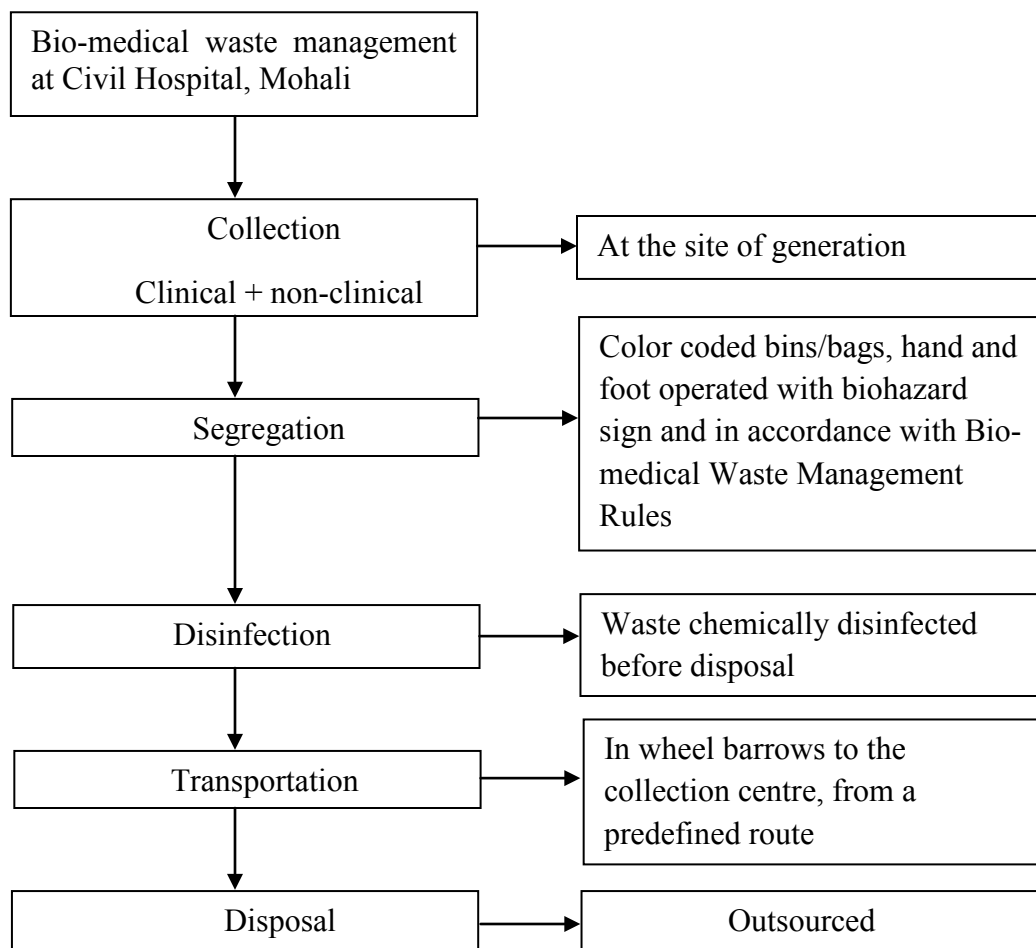


Figure 5.1: Bio-medical waste management process in Civil Hospital, Mohali

The staff of the hospital received monthly training of how to manage bio-medical waste and a record register for the same was also maintained.

The staff handling bio-medical waste specially nurses, lab technicians and sanitation staff were seen wearing latex gloves while managing bio-medical waste since the hospital did not have provision of personal protective equipment.

CHAPTER 6

RESULTS

The percentage of responses was:

Doctors- 91.4%

Nurses- 75.5%

Lab technicians- 100%

Sanitation staff- 100%

6.1: Knowledge of doctors regarding bio-medical waste management

S. no	Knowledge	Doctors		
			Correct	Incorrect
1.	Bio-medical waste	Number	32	0
		Percentage	100	0
2.	Color coded bins	Number	32	0
		Percentage	100	0
3.	Category of waste in yellow plastic bag	Number	32	0
		Percentage	100	0
4.	Category of waste in blue plastic bag	Number	32	0
		Percentage	100	0
5.	Category of waste in white bag	Number	32	0
		Percentage	100	0
6.	Category of waste in green bin	Number	32	0
		Percentage	100	0
7.	Chemical for disinfecting bio-medical waste	Number	32	0
		Percentage	100	0
8.	Personal protective equipment	Number	26	6
		Percentage	81.3	18.7
9.	Hours for which waste can be stored	Number	32	0
		Percentage	100	0
10.	Hazards associated with bio-medical waste	Number	32	0
		Percentage	100	0

Table 6.1 continue

11.	Methods to treat infectious waste	Number	30	2
		Percentage	93.8	6.2
12.	Methods to treat human anatomical waste	Number	32	0
		Percentage	100	0
13.	Methods to treat waste from blue bags	Number	32	0
		Percentage	100	0
14.	Methods to treat liquid waste from lab	Number	32	0
		Percentage	100	0

Table 6.1 shows that all the respondent doctors had knowledge regarding bio-medical waste, color coded bins used for segregating the waste, category of waste collected in yellow plastic bag, blue bag, white and green bag, chemical used for disinfecting the waste, hours for which waste can be stored, hazards associated with bio-medical waste and methods to treat human anatomical waste and solid waste and majority of respondent doctors i.e. 81.3% and 93.8% had knowledge of personal protective equipment and treatment methods for infectious waste, respectively.

6.2: Attitude of doctors towards bio-medical waste management

S. no	Attitude	Doctors		
			Yes	No
1.	Segregation	Number	32	0
		Percentage	100	0
2.	Bio-medical waste management, a team work	Number	32	0
		Percentage	100	0
3.	Financial burden on the hospital	Number	10	22
		Percentage	31.2	68.8
4.	Extra burden on work	Number	0	32
		Percentage	0	100

Table 6.2 continue

5.	Training programmes	Number	32	0
		Percentage	100	0
6.	Disinfection of bio-medical waste before disposal	Number	32	0
		Percentage	100	0
7.	Significance of wearing personal protective equipment	Number	32	0
		Percentage	100	0

Table 6.2 shows that all the respondent doctors had positive attitude with regards to segregation and disinfection of bio-medical waste, training programmes related to healthcare waste management, significance of wearing personal protective gear and believed that management of bio-medical waste is a team work. The table also shows that some percentage of doctors i.e. 31.2% believed that management of health care waste efforts by the hospital increases financial burden of the hospital.

Table 6.3: Practices of doctors towards bio-medical waste management

S. no	Practices	Doctors		
			Yes	No
1.	Segregation	Number	32	0
		Percentage	100	0
2.	Disinfection	Number	28	4
		Percentage	87.5	12.5
3.	Bio-medical waste record	Number	32	0
		Percentage	100	0
4.	Hub-cutters	Number	28	4
		Percentage	87.5	12.5
5.	Injury reporting	Number	0	32
		Percentage	0	100
6.	Personal protective gear	Number	0	32
		Percentage	0	100

Table 6.3 shows that all the respondent doctors had practice of segregation of bio-medical waste and maintenance of bio-medical waste record. Majority of the respondent doctors i.e. 87.5% had practice of mutilation and disinfection of waste before disposal while none had practice of wearing personal protective equipment while handling bio-medical waste and none reported injury caused due to health care waste management.

Table 6.4: Knowledge of nurses regarding bio-medical waste management

S. no	Knowledge	Nurses		
			Correct	Incorrect
1.	Bio-medical waste	Number	37	0
		Percentage	100	0
2.	Color coded bins	Number	37	0
		Percentage	100	0
3.	Category of waste in yellow plastic bag	Number	37	0
		Percentage	100	0
4.	Category of waste in blue plastic bag	Number	37	0
		Percentage	100	0
5.	Category of waste in white bag	Number	37	0
		Percentage	100	0
6.	Category of waste in green bin	Number	37	0
		Percentage	100	0
7.	Chemical for disinfecting bio-medical waste	Number	37	0
		Percentage	100	0
8.	Personal protective equipment	Number	25	12
		Percentage	67.6	32.4
9.	Hours for which waste can be stored	Number	37	0
		Percentage	100	0
10.	Hazards associated with bio-medical waste	Number	37	0
		Percentage	100	0
11.	Methods to treat infectious waste	Number	22	15
		Percentage	60	40
12.	Methods to treat human anatomical waste	Number	25	12
		Percentage	67.6	32.4
13.	Methods to treat waste from blue bag	Number	25	12
		Percentage	67.6	32.4
14.	Methods to treat liquid waste from lab	Number	23	14
		Percentage	62.2	37.8

Table 6.4 shows that all the respondent nurses had knowledge of bio-medical waste, color coded bins used to segregate waste, category of waste collected in yellow, blue, white and green bins, chemical used to disinfect the waste before disposal, hours for which the waste can be stored and hazards associated with bio-medical waste. In case of personal protective equipment and methods to treat infectious waste, anatomical waste, solid waste and liquid waste from lab, 67.6%, 60%, 67.6%, 67.6% and 62.2% respectively, had knowledge.

Table 6.5: Attitude of nurses towards bio-medical waste management

S. no	Attitude	Nurses		
			Yes	No
1.	Segregation	Number	37	0
		Percentage	100	0
2.	Bio-medical waste management, a team work	Number	37	0
		Percentage	100	0
3.	Financial burden on the hospital	Number	12	25
		Percentage	32.4	67.6
4.	Extra burden on work	Number	9	28
		Percentage	24.3	75.7
5.	Training programmes	Number	37	0
		Percentage	100	0
6.	Disinfection of bio-medical waste before disposal	Number	37	0
		Percentage	100	0
7.	Significance of wearing personal protective equipment	Number	28	9
		Percentage	75.7	24.3

Table 6.5 shows that all the respondent nurses had positive attitude towards segregation and disinfection of bio-medical waste and believed that management of health care waste is a team work and should be made part of training programmes. Majority i.e.75.7% had positive attitude towards personal protective gear. Some percentage of respondent nurses i.e. 32.4% and 24.3%, believed that bio-medical waste management is a financial burden on the hospital as well as extra burden on work, respectively.

Table 6.6: Practices of nurses towards bio-medical waste management

S. no	Practices	Nurses		
			Yes	No
1.	Segregation	Number	37	0
		Percentage	100	0
2.	Disinfection	Number	34	3
		Percentage	91.9	81.1
3.	Bio-medical waste record	Number	37	0
		Percentage	100	0
4.	Hub-cutters	Number	34	3
		Percentage	91.9	81.1
5.	Injury reporting	Number	6	31
		Percentage	16.2	83.8
6.	Personal protective gear	Number	12	25
		Percentage	32.4	67.6

Table 6.6 shows that all the respondent nurses had practice of segregation of bio-medical waste and maintenance of bio-medical waste record. Majority of the respondent nurses i.e. 91.9% had practice of mutilation and disinfection of waste before disposal while only 32.4% had practice of wearing personal protective equipment while handling bio-medical waste and 16.2% reported injury caused due to health care waste management.

Table 6.7: Knowledge of lab technicians regarding bio-medical waste management

S. no	Knowledge	Lab technicians		
			Correct	Incorrect
1.	Bio-medical waste	Number	5	1
		Percentage	83.3	16.7
2.	Color coded bins	Number	5	1
		Percentage	83.3	16.7

Table 6.7: continue

3.	Category of waste in yellow plastic bag	Number	5	1
		Percentage	83.3	16.7
4.	Category of waste in blue plastic bag	Number	5	1
		Percentage	83.3	16.7
5.	Category of waste collected in white bag	Number	5	1
		Percentage	83.3	16.7
6.	Category of waste collected in green bin	Number	6	0
		Percentage	100	0
7.	Chemical used to disinfect bio-medical waste	Number	5	1
		Percentage	83.3	16.7
8.	Personal protective equipment	Number	4	2
		Percentage	66.7	33.3
9.	Hours for which waste can be stored	Number	5	1
		Percentage	83.3	16.7
10.	Hazards associated with bio-medical waste	Number	4	2
		Percentage	66.7	33.3
11.	Methods to treat infectious waste	Number	4	2
		Percentage	66.7	33.
12.	Methods to treat human anatomical waste	Number	4	2
		Percentage	66.7	33.3
13.	Methods to treat waste from blue bags	Number	4	6
		Percentage	66.7	33.3
14.	Methods to treat liquid waste from lab	Number	4	6
		Percentage	66.7	33.3

Table 6.7 shows that majority of the lab technicians had knowledge regarding bio-medical waste (83.3%), color coded bins (83.3%), category of waste collected in different color coded bins (83.3%), chemical used to disinfect the waste (83.3%), personal protective equipment (66.7%), hours for which waste can be stored(83.3%), hazards associated with bio-medical waste (66.7%) and methods used to treat different category of waste (66.7%).

Table 6.8: Attitude of lab technicians towards bio-medical waste management

S. no	Attitude	Lab technicians		
			Yes	No
1.	Segregation	Number	6	0
		Percentage	100	0

Table 6.8 continue

S. no	Attitude	Lab technicians		
			Yes	No
2.	Bio-medical waste management, a team work	Number	6	0
		Percentage	100	0
3.	Financial burden on the hospital	Number	1	5
		Percentage	16.7	83.3
4.	Extra burden on work	Number	0	6
		Percentage	0	100
5.	Training programmes	Number	6	0
		Percentage	100	0
6.	Disinfection of bio-medical waste before disposal	Number	6	0
		Percentage	100	0
7.	Significance of wearing personal protective equipment	Number	6	0
		Percentage	100	0

Table 6.8 shows that all the lab technicians had positive attitude towards segregation and disinfection of bio-medical waste and believed that management of health care waste is a team work and should be made part of training programmes. Only some percentage of lab technicians i.e. 16.7% believed that bio-medical waste management is a financial burden on the hospital.

Table 6.9: Practices of lab technicians towards bio-medical waste management

S. no	Practices	Lab technicians		
			Yes	No
1.	Segregation	Number	5	1
		Percentage	83.3	16.7
2.	Disinfection	Number	5	1
		Percentage	83.3	16.7
3.	Bio-medical waste record	Number	6	0
		Percentage	100	0
4.	Hub-cutters	Number	5	1
		Percentage	83.3	81.1
5.	Injury reporting	Number	0	6
		Percentage	0	100
6.	Personal protective equipment	Number	2	4
		Percentage	33.3	66.7

Table 6.9 shows that majority of lab technicians i.e. 83.3% had practice of segregation, mutilation and disinfection of bio-medical waste and all of them had practice of maintenance of bio-medical waste record. Only 33.3% practiced wearing personal protective gear while handling bio-medical waste and none reported injury caused due to bio-medical waste.

Table 6.10: Knowledge of sanitation staff regarding bio-medical waste management

	Knowledge	Sanitation staff		
			Correct	Incorrect
1.	Bio-medical waste	Number	16	4
		Percentage	80	20
2.	Color coded bins	Number	15	5
		Percentage	75	25
3.	Category of waste in yellow plastic bag	Number	14	6
		Percentage	70	30
4.	Category of waste in blue plastic bag	Number	14	6
		Percentage	70	30
5.	Category of waste in white bag	Number	16	4
		Percentage	80	20
6.	Category of waste in green bin	Number	20	0
		Percentage	100	0
7.	Chemical for disinfecting bio-medical waste	Number	14	6
		Percentage	70	30
8.	Personal protective equipment	Number	2	18
		Percentage	10	90
9.	Hours for which waste can be stored	Number	13	7
		Percentage	65	35
10.	Hazards associated with bio-medical waste	Number	9	11
		Percentage	45	55
11.	Methods to treat infectious waste	Number	7	13
		Percentage	35	65
12.	Methods to treat human anatomical waste	Number	11	9
		Percentage	55	45
13.	Methods to treat waste from blue bag	Number	0	20
		Percentage	0	100
14.	Methods to treat liquid waste from lab	Number	12	8
		Percentage	60	40

Table 6.10 shows that majority of the sanitation staff had knowledge regarding bio-medical waste (80%), color coded bins (75%), category of waste collected in different color coded bins, chemical used to disinfect the waste (70%) and hours for which waste can be stored (65%) while in case of personal protective equipment and hazards associated with bio-medical waste only 10% and 45% respectively, had knowledge. Only 35% and 55% had knowledge of methods used to treat infectious waste and human anatomical waste before disposal, respectively and none knew about methods used to treat solid waste from blue bag.

Table 6.11: Attitude of sanitation staff towards bio-medical waste management

S. no	Attitude	Sanitation staff		
			Yes	No
1.	Segregation	Number	20	0
		Percentage	100	0
2.	Bio-medical waste management, a team work	Number	20	0
		Percentage	100	0
3.	Financial burden on the hospital	Number	17	3
		Percentage	85	15
4.	Extra burden on work	Number	17	3
		Percentage	85	15
5.	Training programmes	Number	5	15
		Percentage	25	75
6.	Disinfection of bio-medical waste before disposal	Number	14	6
		Percentage	70	30
7.	Significance of wearing personal protective equipment	Number	9	11
		percentage	45	55

Table 6.11 shows that the sanitation staff had positive attitude regarding segregation of bio-medical waste and believed that management of health care waste is a team work. Majority of them i.e. 85% believed that bio-medical waste management is a financial burden on the hospital as well as extra burden on work. Only 25% felt the need of including bio-medical waste management as a part of training programmes and 45% believed that wearing personal protective equipment while handling bio-medical waste is important.

Table 6.12: Practices of sanitation staff towards bio-medical waste management

S. no	Practices	Sanitation staff		
			Yes	No
1.	Segregation	Number	14	6
		Percentage	70	30
2.	Disinfection	Number	13	7
		Percentage	65	35
3.	Bio-medical waste record	Number	20	0
		Percentage	100	0
4.	Hub-cutters	Number	15	5
		Percentage	75	25
5.	Injury reporting	Number	0	20
		Percentage	0	100
6.	Personal protective gear	Number	2	18
		Percentage	10	90
7.	Wheel barrows to carry bi-medical waste	Number	18	2
		Percentage	90	10
8.	Spill kits	Number	15	5
		Percentage	75	25

Table 6.12 shows that majority of the sanitation staff i.e. 70%, 65% and 75%, practiced segregation, mutilation and disinfection of bio-medical waste, respectively. All had practice of maintaining bio-medical waste record. Majority of them i.e. 80% and 75% used wheel barrows to transport bio-medical waste to the collection centre and spill kits to clean spills like blood spills, respectively. None of the sanitation staff reported injury caused due to bio-medical waste and only 10% had practice of wearing personal protective equipment while handling bio-medical waste.

CHAPTER 7

DISCUSSION

The present study was carried out to assess the bio-medical waste management process of Civil Hospital, Mohali and to estimate the knowledge, attitude and practices of the staff of Civil Hospital, Mohali.

Civil Hospital, Mohali had the necessary requirements for segregation, disinfection, transportation and storage of bio-medical waste, except the personal protective gear for the staff handling the waste.

The bio-medical waste management was done in accordance with the Bio-medical Waste (Management and Handling) Rules, 1998.

The study revealed that that majority of the respondent doctors, nurses and lab technicians have knowledge, positive attitude and practice with respect to management of bio-medical waste.

The sanitation staff has good knowledge of bio-medical waste segregation but poor knowledge regarding disinfection of waste, hazards associated with healthcare waste and personal protective equipment. They have positive attitude and practice of bio-medical waste segregation and disinfection but negative attitude towards training programmes and feel that bio-medical waste management is a financial burden on hospital as well as extra burden on work.

It was observed that in all categories of the staff, non-reporting of injuries caused due to bio-medical waste was seen and they did not practice wearing personal protective equipment while handling bio-medical waste, which can be linked to non-availability of special forms for injury reporting and personal protective equipment in the hospital.

The findings of this study are similar to the study conducted by Y Saraf et al.

It shows that knowledge regarding bio-medical waste management is more among doctors and nurses as compared to sanitation staff. All the respondent doctors and majority of respondent nurses are aware that improper management of waste causes health hazards while only 45% of the sanitation staff is aware of this fact.

Similar finding to the study conducted in CSM Medical University, Lucknow is that the majority of doctors and nurses are conscious of the measures for safe collection and final disposal of BMW and showed a positive attitude towards the need for measures for safe collection and final disposal of BMW.

A similar finding to study conducted in Medical College Hospital, Bangalore by S. Madhukumar and in Tertiary Care Rural Hospital by R. Radha, is that there is no injury reporting by the staff of the hospital.

Findings contrary to the findings of study conducted in All India Institute of Medical Sciences are that majority of lab technicians have good knowledge, positive attitude and practices regarding bio-medical waste management. The sanitation staff has good knowledge regarding segregation of bio-medical waste but only few have knowledge regarding treatment of waste before disposal, hazards associated with bio-medical waste and personal protective equipment. The Majority of respondent doctors have good knowledge, attitude and practice with respect to management of bio-medical waste.

CHAPTER 8

CONCLUSION

The study concludes that knowledge and attitude of majority of respondent doctors, nurses and lab technicians regarding bio-medical waste management is more as compared to sanitation staff. Majority of the respondent staff has good practice of segregating, disinfecting and transporting the bio-medical waste except in case of injury reporting and personal protective equipment while handling bio-medical waste, which can be linked to non-availability of special forms for injury reporting and personal protective gear in the hospital.

CHAPTER 9

SUGGESTIONS

1. Personal protective equipment should be made available at every nursing station or in every department of the hospital, for the staff handling bio-medical waste management.
2. It should be ensured that the injuries caused due to bio-medical waste should be reported timely on a prescribed format to the person in-charge of bio-medical waste.
3. Education of the sanitation staff should be stressed upon specially regarding the disinfection of bio-medical waste, hazards associated with it and the significance of wearing personal protective equipment.
4. Bio-medical waste committee should meet regularly to discuss monthly progress reports on bio-medical waste management.
5. Strict supervision should be followed in day-to-day hospital waste management activities especially regarding the protective gear.
6. Information about the risks linked to BMW can be displayed with the help of posters in hospitals.
7. Training sessions can be followed by tests and the best scores can be awarded.
8. Audio-visuals can be used to reflect proper management of bio-medical waste.

CHAPTER 10

LIMITATIONS OF THE STUDY

1. The results of the study cannot be generalized since the study population is less in number.
2. The socio-demographic data was not collected which could have link to knowledge, attitude and practice regarding bio-medical management like experience and qualification of the staff.
3. The results of different category of staff with respect to knowledge, attitude and practice of bio-medical waste management, can be biased due to difference in the methods of data collection.
4. Since the questionnaire was self administered there can be difference in the results of the study and actual practice of each category of staff.

ANNEXURE 1

Checklist for bio-medical waste management

S.no	Necessary Requirements	Yes (Y)/No (N)
1.	Color coded bins for biomedical waste, in every department of the hospital	
2.	Biohazard sign on every bin and colored plastic bags	
3.	Puncture proof containers for sharps	
4.	Syringe cutters	
5.	Calibrated weighing machine for BMW	
6.	Personal protective equipment for staff handling bio-medical waste	
7.	Availability of sodium hypochlorite for disinfecting the waste	
8.	BMW record register	
9.	Post exposure prophylaxis kit with ICN/pathologist	
	Generation and segregation	
10.	Waste segregated at the site of generation	
11.	Sharp infectious waste collected in white puncture proof container	
12.	Anatomical and infectious waste collected in yellow colored bins	
13.	Infected plastic collected in blue colored bins	
14.	Non-infectious general waste thrown in green bin	
15.	Unbroken glass in transparent container	
	Collection and storage	
16.	Bins are emptied when $\frac{3}{4}$ filled	
17.	Separate room for biomedical waste storage (collection centre)	
18.	Waste stored in collection centre beyond 48 hours	

19.	Bins cleaned and disinfected, regularly after disposing off the waste	
	Transportation	
20.	Wheel barrows used for transporting the waste to the collection centre	
21.	Waste transported in closed containers/bags, to the collection centre	
22.	A predefined route is used to carry biomedical waste to the collection centre	
	Management of waste streams	
23.	PPE worn by the hospital staff while handling BMW	
24.	Barrel and plunger detached and syringes chemically disinfected with 1% sodium hypochlorite at the source of generation	
25.	Plastic waste i.e. IV sets, bottles, syringes, latex gloves and catheters cut by scissors and disinfected with 1% sodium hypochlorite solution for 1 hr, before disposing it off	
26.	Infectious waste chemically disinfected before disposal	
27.	Slides disinfected with 1% sodium hypochlorite for 1 hour before disposal	
28.	Blood bags disinfected with 5% sodium hypochlorite for at least 1 hour	
29.	Spill kits used to treat liquid spillage like blood	
30.	Liquid waste from lab treated with 4% sodium hypochlorite for 4-5 hrs and drained	

ANNEXURE 2

Questionnaire on bio-medical waste management

(I, Dr. Shweta Oberoi working as Hospital Administrator in Civil Hospital, Mohali, am conducting a study on biomedical waste management. This questionnaire will be used to generate data on biomedical waste management, which will be strictly used for study purpose. Confidentiality of the respondent will be maintained.)

Please tick the correct answers:

1. I am working as in Civil Hospital, Mohali.
 - Doctor
 - Nurse
 - Lab technician
 - Sanitation staff
2. What is biomedical waste?
 - Waste generated from medical activities such as diagnosis, prevention and treatment of diseases.
 - It is hazardous waste such as chemical, radioactive waste
 - It is normal trash or general waste.
3. What color coded bins are used for segregating biomedical waste?
 - Yellow, white, red, blue and black
 - Yellow, white, blue, and green
 - Yellow, white, red, black and green
4. Which category of waste is collected in yellow plastic bag?
 - Sharps
 - Infectious waste
 - Chemical waste
5. Which category of waste is collected in blue plastic bag?
 - Sharps
 - Solid waste like tubing, catheters
 - Chemical waste
6. Which category of waste is collected in white plastic bag?
 - Sharps and glassware
 - Chemical waste
 - General waste

7. Which category of waste is collected in green bin?
 - General waste
 - Chemical waste
 - Sharps
8. Which chemical is used to treat biomedical waste before disposing it off?
 - Sodium hypochlorite
 - Phenol
 - Detergent
9. What does personal protective equipment (PPE) include?
 - Gloves and masks
 - Gloves, Masks, and gum boots
 - Heavy duty gloves, masks, gum boots and safety glasses
10. For how many hours can waste be kept?
 - More than 48 hours
 - Less than 48 hours
 - Upto 72 hours
11. What hazards are associated with biomedical waste?
 - Injury, nosocomial infections.
 - No hazard is associated with BMW
 - BMW does not cause infections.
12. What methods can be used to treat infectious waste?
 - Incineration
 - Autoclave
 - Chemical treatment
 - All of the above
13. What methods are used to treat human anatomical waste?
 - Chemical treatment
 - Incineration
 - Autoclave
 - All of the above
14. How is waste from blue bags treated?
 - Chemical treatment
 - Autoclave

- Microwave
- All of the above

15. How is liquid waste from lab treated?

- Chemical treatment
- Drainage
- Both of the above

16. Should biomedical waste be segregated into different categories?

- Yes
- No

17. Is biomedical waste a team work/no single class of people is responsible for safe management of healthcare waste?

- Yes
- No

18. Does safe management of healthcare waste efforts by the hospital increases the financial burden on the hospital?

- Yes
- No

19. Is safe management of healthcare waste an extra burden on work?

- Yes
- No

20. Should biomedical waste management be made part of the training programmes?

- Yes
- No

21. Is it important to disinfect the biomedical waste before finally disposing it?

- Yes
- No

22. Is wearing personal protective clothing while handling biomedical waste of any significance?

- Yes
- No

23. Is proper segregation of waste done, in the color coded bags?

- Yes
- No

24. Is disinfection of biomedical waste done before final disposal?

- Yes
- No

25. Is biomedical waste record maintained in the hospital?

- Yes
- No

26. Are hub cutters used to cut syringes before disposing them off?

- Yes
- No

27. Are there any registers maintained for injury reporting, occurred due to biomedical waste?

- Yes
- No

28. Is personal protective equipment worn while handling biomedical waste?

- Yes
- No

29. Are wheel barrows used for transporting biomedical waste to the collection centre?

- Yes
- No

30. Are spill kits used to clean spills like blood spills?

- Yes
- No

ANNEXURE 3

CIVIL HOSPITAL, MOHALI

ADVERSE TRANSFUSION REACTION FORM

Name of patient :		Patient ID number:	
Date of Birth:		Ward:	
Sex:		Transfusion History:	☐ Yes ☐ No

Transfusion Date:	_____ DD _____ MM _____ YY
Time of the transfusion started:	
Time when adverse reaction detected:	
The blood donation No of the blood/components:	
Type of the transfused blood product:	☐ RBC ☐ FFP ☐ Platelets ☐ Cryoprecipitates
Volume Transfused:	

General Transfusion Reaction	Suggested Major Transfusion Reaction
☐ Fever _____ oC (>1 oC of baseline)	☐ Backache ☐ Pain at infusion site
☐ Chill ☐ Itching	☐ Chill ☐ Itching
☐ Rash ☐ Nausea	☐ Hypotension ☐ Jaundice ☐ Bleeding tendency ☐ Haematuria
☐ Flushing ☐ Other _____	☐ Dyspnea ☐ Chest pain ☐ Tachycardia ☐ Oliguria ☐ Seizure ☐ Other

Pre-transfusion	Post-transfusion
Temperature: _____ oC	_____ oC
Blood Pressure: _____ mmHg	_____ mmHg
Pulse: _____ /Min	_____ /Min
Management:	
Outcome ☐ Complete recovery	☐ Recovered with complication
☐ Death	

Reaction reported by:	Time:
Reporting Physician:	TIME:
Contacted Tel No:	Date:

ANNEXXURE 4

CIVIL HOSPITAL, MOHALI

INCIDENT REPORTING FORMAT

1	Date of accident/ incident Time Location
2	Affected person: Patient ☐ Staff ☐ Student ☐ Volunteer ☐ Contractor ☐ Other ☐ Male ☐ Female ☐ Years Age Name & Address Tel (R) Tel (M) E-mail:
3	Type of accident/ incident severity Clinical ☐ Non-clinical ☐ Major ☐ Moderate ☐ Minor ☐ Near miss ☐
4	Details of accident/ incident:
5	Immediate action taken at time of incident:
6	Section completed by- Date & time: Designation: Signature
7	Subsequent action: To be completed by Line Manager on duty at time of incident

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