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From the Director's Desk

Healthcare Associated Infections Prevention & Control is the major pillar for quality patient care in any healthcare setting. This is possible with the help of a robust infection control programme. Such a programme needs to be validated by infection control standards and recommended guidelines. Health care organizations needs to have commitment for adherence to the patient care practices which would yield the desired outcome of reducing infection rates and reduced costs.

It is indeed heartening to know that the essence and spirit of one of the largest tertiary care institution continues to be reflected in this new edition of the manual, as it provides a positive resource to significantly improve the quality, well-being and safety for patients across all healthcare disciplines in AIIMS.

I would further encourage and expect that Antibiotic Stewardship Programme be fully implemented in all areas of the hospital. Continuous surveillance of the Device Associated Infections is of utmost importance in critical care areas and the high dependency units.

To that end, I compliment the team that has worked tirelessly for several months to produce this manual. I strongly recommend this as a ready handbook to surgeons, physicians, residents, microbiologists, hospital administrators, nurses and in fact to all health care providers. We must continue to ensure that the rates of infection at institute, already comparable to the best in the world, would be brought down further.

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Foreword

Healthcare associated infection remains a major hurdle in patient safety. It complicates patient care significantly, which adds to the burden of resource use, and contributes to unexpected deaths. Since HCAIs are preventable, it makes "To err almost seem in human" in developing nations. It is widely accepted that an integrated infection control program can reduce infection rate by as much as 30% which can be further reduced to more than 70% by increasing awareness of the Health care workers. Undue use of antibiotics is a major issue and its control is mandatory in the hospital as well as in the community and might require culture changes. The already robust infection control programme at AIIMS, New Delhi has dramatically driven down our HCAI rates but a continued focus on harmonized and systematic approach is important to tackle the issue across the continuum of patient care.

The Hospital Infection Control manual in its present form deals with the day to day infection control practices. Addition of the chapters like Antibiotic Stewardship Programme highlights the need for judicious use of antibiotics. The infection control is not only about clinical care but also about support services like laundry and pest control which are often overlooked and are a major cause of dissatisfaction for the patient. It is heartening to know that due prominence has been given to these services. Also, CDC has laid emphasis on spill management. The new Bio-Medical Rules, 2016 need to be implemented considering several operational matters including behavioral, logistical, strategic issues.

This manual is aimed at standardizing the clinical procedures with respect to infection prevention, assisting in training new staff, and having information readily available for the hospital staff.

Dr. D. K. Sharma
Medical Superintendent
AIIMS

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ABBREVIATIONS

AIDS	: Acquired Immune Deficiency Syndrome
AMR	: Anti-microbial Resistance
ASP	: Antibiotic Stewardship Policy
CDC	: Centers for Disease Control and Prevention
CDI	: *Clostridium difficile* Infection
CNC	: Cardiothoracic and Neurosciences Centre
CSSD	: Central Sterile Services Department
CTVS	: Cardiothoracic and Vascular Surgery
Dr. BRAIRCH	: Dr. Bhim Rao Ambedkar Institute Rotary Cancer Hospital
Dr. RPCOS	: Dr. Rajendra Prasad Centre for Ophthalmic Sciences
DD	: Device days
DDVP	: 2, 2- dichlorovinyl dimethyl phosphate or dichlorovos
DUR	: Device Utilization Ratio
FUO	: Fever of Unknown Origin
HBV	: Hepatitis B Virus
HCAI	: Healthcare Associated Infection
HCP	: Healthcare Providers
HIC	: Hospital Infection Control
HICC	: Hospital Infection Control Committee
HICPAC	: Healthcare Infection Control Practices Advisory Committee
HIV	: Human Immunodeficiency Virus
HWC	: Hand Washing Compliance
ICP	: Infection Control Program
ICU	: Intensive Care Unit
LBWS	: Laboratory Based Ward Surveillance
MICU	: Medical Intensive Care Unit
MMR	: Measles, Mumps, Rubella Vaccine
MDRO	: Multi Drug Resistance Organism
MRSA	: Methicillin Resistant *Staphylococcus aureus*
NNIS	: National Nosocomial Infections Surveillance

NNRTI	: Non-nucleoside Reverse Transcriptase Inhibitors
NSI	: Needle Stick Injury
OT	: Operation Theater
PPE	: Personal Protective Equipment
PICU	: Pediatric Intensive Care Unit
SOP	: Standard Operating Procedures
SSI	: Surgical Site Infection
UV LED	: Ultra-violet Light Emitting Diode
VAP	: Ventilator Associated Pneumonia
VRE	: Vancomycin Resistant Enterococci
VZIG	: Varicella Zoster Immune Globulin
WHO	: World Health Organization

CHAPTER 1

INTRODUCTION

Healthcare associated infection (HCAI), also referred to as "nosocomial" or "hospital acquired" infection, is an infection occurring in a patient during the process of care in a hospital or other health care facility which was not present or incubating at the time of admission. They usually manifest after 48 hours of admission contact. Some may manifest after discharge from the hospital.

1.1 EFFECT OF HOSPITAL ACQUIRED INFECTIONS ON THE HEALTH CARE

The outcome of disease is adversely affected by healthcare associated infections which increase morbidity and mortality. In addition, the average length of stay of patients and the cost of healthcare increase significantly. These lead to loss of effectiveness and productivity of the hospital services.

With the recent changes in the Consumer Protection Act, all healthcare facilities including the government run hospitals have been included in its ambit and as such, the health facility runs the risk of being the target of litigations by patients. Some patients feel that they have not been provided the best possible care if they have developed HCAI and this belief cannot be taken casually in light of the HIV epidemic. These further result in the hospital acquiring a bad reputation amongst the public.

So, it is advisable to formulate an infection control programme with the following thrust areas:

1. Development of policies and procedures to reduce the risk of healthcare associated infections.
2. Development of an effective surveillance system.
3. Maintenance of a continuing education programme for healthcare personnel.

1.2 EXTENT OF THE PROBLEM

In most healthcare facilities, 0.08-8% of admitted patients requiring acute care develop HCAI. At times these figures may be as high as 10%-30%. The maximum number of HCAI occurs in areas that care for critically ill patients. The highest incidence is observed amongst patients subjected to invasive procedure and those

who are immuno-compromised.

1.3 RISK FACTORS FOR HEALTHCARE ASSOCIATED INFECTIONS

1. Low resistance of patients to infections.
2. Contact with infectious persons.
3. Invasive procedure/ interventions.
4. Inappropriate antimicrobial usage.
5. Drug resistance of endemic microbes.
6. Contaminated environment.

1.4 HOW THE INFECTION PERPETUATES ? (Figure 1.1)

The source of the infective agent may be endogenous or exogenous.The normal microbial body flora changes with hospitalization. In addition to this, these may be selective propagation of resistant organisms due to antibiotic pressure. Loss of normal host barriers leads to introduction of organisms that usually colonise the surface, into the inner sterile sites of the body.

Exogenous infection is usually due to cross infections either from staff or other patients. The mode of transmission is mostly through contact, occasionally by air or droplets.

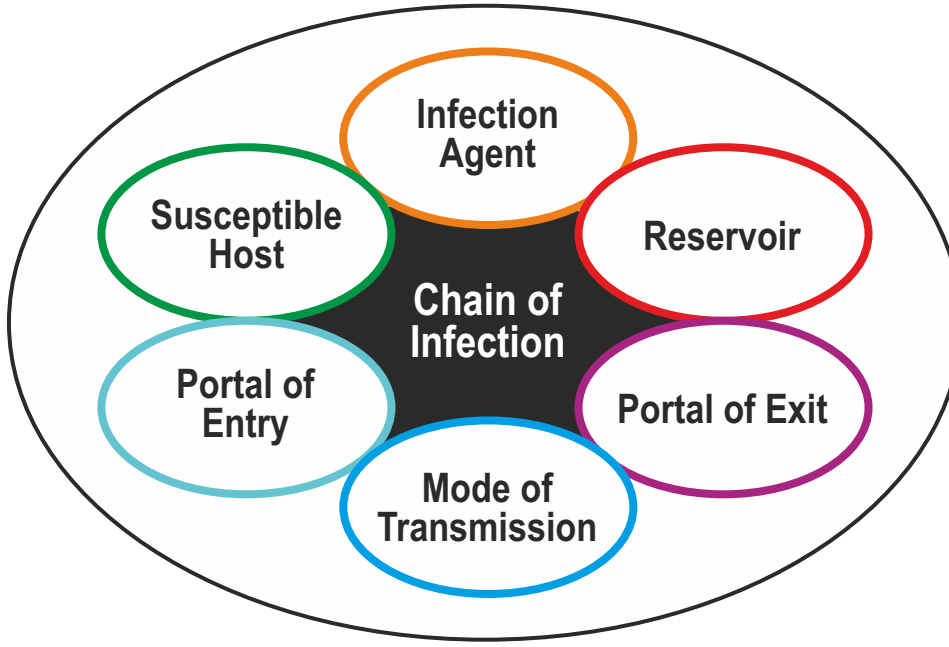


Figure 1.1: Chain of Transmission

1.4.1 Routes of Spread

The most important route of spread is contact with another infected patient, staff or environment. The inanimate environment is of little consequence in the spread of HCAI as it is unlikely to make a direct contact with susceptible host. However, it may at times have a role in outbreaks of HCAI.

1.5 COMMON ORGANISMS

Fig 1.2 shows the common organisms responsible for endogenous infection. The most common organisms implicated in the spread of exogenous HCAI are *Staphylococcus aureus* from direct contact and gram negative bacilli from solutions, fluids and invasive devices (Fig 1.3). Viruses like HIV, HCV, HBV, CMV, etc. are spread by blood and blood products, body fluids and secretions, and contaminated needle stick injuries. Others viruses may cause respiratory and gastro –intestinal tract infections.

Fungal infections have now gained importance with increase in the number of immunocompromised patients. The commonest fungal organism responsible for exogenous HCAI is *Aspergillus* spp. and that for endogenous infection is *Candida* spp.

Endogenous Sources & Reservoirs	**Principal pathogens**
Skin	*Staphylococcus aureus*
Nose	*Staphylococcus epidermidis*
Throat	*Streptococcus pyogenes*(infrequent)
Mouth	
Intestine	Gram-negative bacilli (aerobic)
	Bacteroides spp.
Tissues	*Clostridium spp.*
Infected site	Herpes Virus
	Staphylococcus aureus

Figure 1.2: Endogenous HCAI

Exogenous Sources

Airborne routes		Contact routes		Percutaneous	
Sources Reservoirs Vehicles	**Principal pathogens**	**Sources Reservoirs Vehicles**	**Principal pathogens**	**Sources Reservoirs Vehicles**	**Principal pathogens**
Persons Infection & Carriage Skin scales Wound dressings Bedding Droplet nuclei	*Staphylococcus aureus Streptococci Mycobacterium tuberculosis* Respiratory viruses	Persons (direct) Hands and clothes of staff Large droplets	*Staphylococcus aureus*, Gram negative bacilli, Viruses	I.V. Fluids	Gram negative bacilli
Fluids Nebulizers Humidifiers Cooling towers	Gram negative bacilli (Legionella)	Persons (indirect) Dusts, soil, etc. Instruments	*Staphylococcus aureus*, Clostridium spp.	Needles, syringes, etc.	HIV HBV HCV
Dust from streets, Buildings, etc.	*Clostridium perfringens* Fungi *(e.g. Aspergillus spp.)*	Equipments e.g., bedpans, respiratory endoscopes Fluids including parenteral fluids &some disinfectants Food	*Staphylococcus aureus Mycobacterium* spp. Gram negative bacilli Intestinal pathogens Gram negative bacilli.		

Figure 1.3: Sources of exogenous HCAI

1.6 COMMON HCAI ARE:

1. Surgical Site infections (SSI)
2. Respiratory tract infections
3. Urinary tract infections
4. Bacteremia
5. Meningitis
6. Gastroenteritis
7. Device associated infections

The site of HCAI largely depends on the interventions the patient is subjected to (e.g. bacteremia in patients with indwelling vascular catheters, and urinary tract infections in patients with urinary tract catheterization), the specific area of patient care in the hospital (e.g. wound infections are common in surgical wards while respiratory tract infections will be common in intensive care units), and the host factors (e.g. fulminant bacteremia in neutropenic patients). Appendix-1enlists the definitions of a few common HCAIs as per CDC definitions.

CHAPTER 2

HOSPITAL INFECTION CONTROL PROGRAMME

AIIMS Hospital has a well-defined infection control policy since 1973, which is updated regularly.

2.1 INFECTION CONTROL POLICY AT AIIMS

The important components of this policy are:

1. Monitoring of healthcare associated infection.
    - Microbiological surveillance
    - Investigation and control of outbreaks if any, and
    - Monitoring of anti-microbial resistance
2. Providing facilities to the hospital staff to maintain good infection control practices.
3. Conducting ongoing educational/training programme for all cadres of hospital staff.
4. Making provisions for staff health activities.
5. Having a written document (manual) outlining the various infection control policies and procedures followed at AIIMS and periodically updating it.

2.2 HOSPITAL INFECTION CONTROL COMMITTEE (HICC)

The policies are implemented under the supervision of HICC the constitution of which is as follows:

Chairman: Medical Superintendent

Members:

- Heads of Clinical Departments
- Chief of Centers
- Superintending Engineer
- Infection Control Nurse
- Engineering Services

Member Secretary: Faculty member from Department of Hospital Administration

2.2.1 CORE GROUP

From within the HICC, a core group has been formed on the lines of Infection Control Team to look after the surveillance activities and handling day to day problems. It also implements the educational and training programmes for the hospital staff.

The Department of Microbiology is responsible for monitoring of healthcare associated infections and anti-microbial resistance, disinfection and sterilization as well as surveillance activities in which they are assisted by the Infection Control Nurses.

Infection Control Nurses: Six experienced nurses are appointed full time on this position in main AIIMS Hospital and their functions are described below.

2.3 FUNCTIONS OF INFECTION CONTROL NURSES

1. Regular visits to all wards and high risk units to monitor infection control practices.
2. Recording details of patients with healthcare associated infections
3. Collection of samples from different areas of the hospital for monitoring disinfection, sterilization and air quality and sending them to the lab.
4. Daily visit to microbiology laboratory to ascertain results of samples collected for surveillance and to liaise between microbiology department and clinical departments.
5. Compilation of ward wise, discipline wise and procedure wise statistics for HCAI.
6. Monitoring and supervision of infection among hospital staff.
7. Training of nursing aides and paramedical personnel on correct hygiene practices and techniques.

CHAPTER 3

SURVEILLANCE OF HEALTH CARE ASSOCIATED INFECTIONS (HCAI)

Surveillance involves regular collection of data on infections, its analysis and feedback to the hospital staff

Definition– Surveillance is the on-going, systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those, who need to know, so that action can be taken in order to reduce morbidity and mortality improve health.

Surveillance is a data driven process including collection, analysis, timely dissemination, implementation and evaluation of right data, in the right format, in right hands, at right time, at right place.

3.1 OBJECTIVES OF SURVEILLANCE:

1) Establishing endemic baseline rates
2) Evaluating and monitoring infection control measures
3) Monitoring antimicrobial susceptibility patterns
4) Identifying and containing outbreaks
5) Reducing infection rates in the hospital

3.2 SURVEILLANCE ACTIVITIES

A. Evaluate the population and recognise those at greatest risk for the process or outcome

1. Healthcare-associated infections (HCAI) (outcomes)
2. Patient care practices aimed at preventing HCAI (processes)

B. Select the process for surveillance or outcome

a. Examples of outcomes – e.g. Indicators of outcome such as health care associated infection rates, mortality stratified to severity of illness, device associated infections.
b. Examples of processes in current practices of healthcare delivery – e.g. Hand hygiene, implementation of bundles in device related care, proper isolation

precautions. Basically, it aims at monitoring of the compliance to evidence based or best practices. As these need resources, prioritization is important.

c. Examples of other events: e.g. Hemodialysis related events

C. Define time period for observation

a. The duration for which the data will be collected has to be defined. Infection control is a continuous process, ensure monthly capture of the data.

D. Choose an appropriate surveillance methodology

a. Routine HCAI surveillance in most in-patient healthcare facilities should be conducted by an infection control professional in an active, patient-based, prospective, priority-directed manner that yields risk-adjusted incidence rates, as defined below.
b. This methodology will be most useful for the detection of endemic HCAI.

E. Monitor the process or outcome using standardized definitions

a. Standardized definitions are to be adhered to when categorizing an infection as HCAI. Monitoring is essential to identify any breaches in infection control practices as they affect the patient outcomes.
b. In the event of outbreaks and cross transmission additional data collection, analysis and immediate corrective steps are mandatory.

F. Collect appropriate data, for calculation of rates

(i) Numerator data collection

1. Demographic – name, date of birth, gender, hospital identification number, admission date
2. Infection – onset date, site of infection, patient care location of HCAI onset.
3. Risk factors – devices, procedures, and other factors associated with HCAI.
4. Laboratory – pathogens, antibiogram, serology, pathology.

Sources of numerator data

1. Admission/discharge/transfer records, microbiology laboratory records.
2. Visits to patient wards for observation and discussion with caregivers.
3. Patient charts (paper or computerized) for case confirmation.
   a) Laboratory and radiology/imaging results
   b) Nursing and physician's notes and consults
   c) Admission diagnosis

d) History and physical examination findings
e) Records of diagnostic and surgical interventions
f) Temperature chart
g) Information on administration of antibiotics

(ii) Denominator Data Collection

It may be remembered that the source of numerator data are same as the denominator

For device-associated incidence density rates - Device days and patient days are used for denominators.

For SSI rates - Record information on operative procedures selected for surveillance (e.g., type of procedure, date, any implants placed), detailed logs from the operating room for each operative procedure.

G. Analyse surveillance data

It is important to know the unit in which the indices are expressed - e.g. device days for device related infections, percentages for HCAI and SSI, etc.

H. Report and use of surveillance information in a timely manner – it should be done at the right time by the right person using the right data.

3.3 TYPES OF SURVEILLANCE

I. Active and passive

- *Active* - Trained personnel, mainly infection control practitioners, rigorously look for HCAI.
- *Passive* - Persons who do not have a primary surveillance role, such as ward nurses or respiratory therapists, infectious disease physicians, identify and report HCAI.

II. Patient-based and laboratory-based

- *Patient-based* - Count HCAI, assess risk factors, and monitor patient care procedures and practices for adherence to infection control principles, requires ward rounds and discussion with caregivers.
- *Laboratory-based* - Detection is based solely on the findings of laboratory studies of clinical specimens.

III. Prospective and retrospective

- *Prospective*- Monitor patients during their hospitalization.
- *Retrospective*- Identify infections via chart review after patient discharge.

IV. Priority-directed and comprehensive

- *Priority-directed*- Focus is on specific events, processes, organisms and/or patient populations.
- *Comprehensive*- Continuous monitoring of all patients for all events and/or processes.

V. Risk-adjusted rates and crude rates

- *Risk-adjusted rates*- Rates are controlled for variations in the distribution of major risk factors associated with an event's occurrence.
- *Crude rates* - Rates assume equal distribution of risk factors for all events.

VI. Incidence and prevalence

- *Incidence* is the number of new cases in a given time period.
- *Prevalence* is the number of cases at a particular point in time divided by the total population being studied.

3.4. HCAI INDICES

1. CLABSI (Central Line Associated Blood Stream Infection) rates
2. CAUTI (Catheter Associated Urinary Tract Infection) rates
3. MDROs (Multidrug Resistant Organisms)
4. SSI (Surgical Site Infection) rates
5. VAP (Ventilator Associated Pneumonia) rates
6. Hand Wash Compliance or Hand Hygiene Compliance
7. DUR (Device Utilization Ratio)

3.5 SURROGATE INDICES OF HCAI

1. IV extravasations/ thrombophlebitis
2. NSI (Needle stick injuries)/Sharp injuries
3. DAPU (Device associated pressure ulcers)
4. HAPU (Hospital acquired pressure ulcers)

In surveillance, it is best to combine the data from the laboratories and wards to have captured a comprehensive and authentic information. This method is known as the Lab Based Ward Surveillance (LBWS). Out breaks and cross transmissions can be detected early by this method.

3.6 OUTBREAK INVESTIGATION

Recognition: An outbreak should be suspected if there is an increase in the number of a particular infection or rise in the prevalence of an organism.

Case definition: The investigation starts with developing a case definition, identifying the site, pathogen and the affected population. In case of notifiable diseases, e.g., Cholera, Tetanus, etc., appropriate authorities are to be informed.

Determination of cause of outbreak: This is carried out by extensive microbiological sampling of cases, carriers, staff screening wherever relevant and environment. Typing of the isolates is also carried out.

Control measures: Theses should be initiated during the process of investigations at the earliest. The general measures include:

- Strict hand washing/hand hygiene
- Adherence to aseptic protocols
- Strengthening of disinfection and sterilization.
- Intensification of environmental cleaning and hygiene

Besides, the specific measures should be implemented as soon as the cause of the outbreak is identified.

CHAPTER 4

STERILIZATION, DISINFECTION & CLEANING PRACTICES

Decontamination encompasses cleaning, disinfecting and sterilizing.

4.1 CLEANING

Cleaning is a process, which physically removes foreign material (e.g. soil, organic material, microorganisms etc.) from an object or body surface.

4.2 DISINFECTION

The process of destroying all pathogenic microorganisms. It can refer to the action of antiseptics as well as disinfectants. It is of 3 types.

1. Concurrent disinfection
2. Terminal disinfection
3. Pre-current (prophylactic) disinfection

Disinfection is required in the following situations:

- Before use of a contaminated equipment/device for any patient.
- Before sending contaminated equipment for further processing in the CSSD.
- Before sending used &contaminated needles and syringes for disposal.
- For the inanimate environment which is likely to be infected and could be a potential source of HCAI.
- Before any item is subjected to disinfection /sterilization, thorough cleaning is mandatory to remove organic material that may interfere with these processes.

4.3 STERILIZATION

It is the process of destroying all micro –organisms including spores.

- Steam is the preferred method of sterilizing critical medical and surgical instruments that are not damaged by heat, steam, pressure and moisture.
- Some items can be sterilized by "dry heat".
- Low temperature sterilizations technologies e.g. Ethylene oxide (ETO) are used for reprocessing critical care patient equipment which are heat sensitive.

The most common factors associated with transmission of infection are related to devices are:

1) Inadequate manual cleaning.
2) Inadequate exposure of surfaces to the disinfectant.
3) Inadequate rinsing and drying.
4) The use of automated endoscope re-processors.

4.4 SPAULDING'S CLASSIFICATION

The choice of the method is determined by the risk of infection to the patients:

- **Critical medical and surgical devices and instruments** (e.g. devices and surgical instruments) that enter normally sterile tissue or the vascular system or through which a sterile body fluid flows, are to be sterilized before being used on any patient.

- **Semi-critical patient care equipment** that comes in contact with mucous membrane (e.g. gastroenterological endoscopes, anaesthesia breathing circuits and respiratory therapy equipment) or non-intact skin, requires a high level disinfection.

- **Non-critical patient care surfaces** (e.g. bedrails, over bed table etc.) and equipment that touch intact skin (e.g. blood pressure cuffs), require intermediate or low level disinfection.

4.5 TYPES OF DISINFECTIONS

I. High level disinfectants: 2% gluteraldehyde, stabilized hydrogen peroxide and 1% sodium hypochlorite solution (10,000 ppm of Cl_2) will destroy all microorganisms including vegetative bacteria, most bacterial spores, fungi, viruses including enteroviruses and *Mycobacterium tuberculosis*, except some bacterial spores.

II. Intermediate level disinfectants: 0.1% sodium hypochlorite solution (1,000 ppm of Cl_2), ethyl or isopropyl alcohol (70%), iodophores and phenolic solution will destroy vegetative bacteria, *Mycobacterium tuberculosis*, most viruses and fungi but not bacterial spores.

III. Low level disinfectants: Quaternary ammonium compounds e.g. Benzylkonium chloride, destroy most vegetative bacteria, fungi and enveloped virus e.g. HIV, but they will not kill bacterial spores, mycobacteria and non-enveloped virus like enteroviruses.

4.6 STERILIZATION PROCESS

4.6.1 Packaging

- Packaging is done to provide a barrier to microorganisms and moisture.
- It should be sufficiently strong to withstand punctures and tears.
- Packaging material should be compatible with the sterilization process.

4.6.2 Monitoring

- Mechanical, chemical and biological monitors can be used to evaluate the effectiveness of the sterilization process.
- Each load is monitored with mechanical (time, temperature, pressure) and chemical (internal and external) indicators.
- Biological indicators (spores) should be used weekly to monitor the effectiveness of sterilization.
- Whenever mechanical and chemical indicators show inadequate processing the loads should be reprocessed.
- Chemical indicators as strips should be used with every pack.

4.6.3 Load Configuration

- The items are loosely placed so as not impede the flow of steam through and in between the packs in the autoclaves.

4.6.4 Storage of Sterile Items

- The sterile storage area should provide protection against dust, moisture insects, temperature, and humidity.
- The sterilized items are labelled clearly with the date and contents of the pack.
- Whenever the integrity of the pack is suspect it should be re-sterilised.
- Unused and/or unopened items should be re-sterilised after every 72 hours.

4.7 CENTRAL STERILE SERVICES DEPARTMENT (CSSD)

The CSSD at AIIMS is located behind the casualty. It functions round the clock in three shifts and is operationally supervised by an ANS (HR). At present there are two big (96 cu ft) and seven small (36 cu ft), autoclaves installed at CSSD which cater to the requirements of the entire institute. These autoclaves operate at temperature of 121°C, at a pressure of 15 psi for a duration of 30 minutes. The entire cycle of

autoclaving from loading of unsterile packs to unloading of sterile packs takes nearly 3 hours.

There are physically demarcated areas in the CSSD for reception, cleaning and washing, packing processing, storage and distribution within the CSSD. The method of supply is exchange of clean for dirty sets. The sterile sets are stocked in the CSSD store for a maximum period of 72 hours after which they are re-autoclaved if they are still unused.

Quality control measures for autoclaves:

- The autoclaving cycle is computerized and changes of pressure and temperature are recorded on a paper disc.
- Monitoring is also done by strips of heat sensitive tape which are applied externally and internally. Once in a week, four to five packs containing *Geobacillus stearothermophilus* spores are autoclaved keeping them in the most unreachable part of the autoclave chamber. These are then cultured to see whether the spores have all been destroyed.

4.8 PERIPHERAL STERILIZATION FACILITIES

Besides the central facility of CSSD, we have peripherally distributed sterilization equipment to ensure the availability of sterile instruments at all times in OTs/ ICUs. The main OT complex on the eighth floor is provided with a flash sterilizer. This is a modified autoclave in which steam sterilization takes place at a much higher temperature (170°C) and pressure (20 psi), consequently the time is reduced to about 5 minutes.

The Main OT, Orthopedics OT, Neurosurgery OT, CTVS OT, Cath lab and RPC OT are provided with Ethylene oxide sterilizers (ETO). These are used for sterilizing, temperature and moisture sensitive medical devices and supplies e.g. fibre optic scopes, ventilator tubings and vascular catheters, etc.

4.9 LAUNDRY SERVICES

The laundry at AIIMS is also a central facility where combined washing of linen from the main hospital, CNC, RPC, and IRCH is done by an outsourced contractor. Disinfection of soiled linen is achieved by chemical and thermal methods. The soiled linen is first sluiced and then treated with 1% bleach. Then the linen is washed in mechanized washing machines through which steam is bubbled heating the water to 70°C for disinfection. Details are provided in chapter 7 of the manual.

4.10 DIETARY SERVICES

In the central kitchen facility, due precautions are taken to ensure proper hygiene and cleanliness in pre-preparation, cooking, transportation and serving of food. The mainstay is preventing spread of diseases with an feco-oral mode of transmission. This is maintained by proper washing of hands as highlighted in the chapter on aseptic practices. The dietetics department uses glass bottles for dispensing different in-house prepared "feeds". These bottles should be boiled and dried before use.

4.11 RECOMMENDATIONS FOR STERILIZATION AND DISINFECTION

For reprocessing of various equipment, manufacturers' recommendations should be followed.

An effort should be made to procure items that are heat and moisture resistant.

Table 4.1 lists the recommended reprocessing of commonly used equipment in hospitals. Details of disinfections and sterilization of some commonly used items are given below:

1. Ampules: The neck should be wiped with 70% alcohol before cutting it.

2. Cheatle forceps: Clean with soap, dry, autoclave and store dry. Keep in a dry sterile bottle or container. It should be replaced every 12 hours or earlier if it is visibly contaminated.

3. Flexible endoscope: All the channels should be flushed and brushed, if accessible, to remove all organic residue. Clean the external surfaces and accessories of devices by using a soft cloth, sponge or a brush. After high level disinfection all channels must be rinsed with sterile water followed by a rinse with 70% alcohol. Then the channel should be forced air dried. The endoscope should be hung in vertical positions (manufacturer's instructions should be followed stringently).

4. Rigid endoscopes (for example, bronchoscopes, arthroscopes, cystoscopes and laparoscope): As these instruments pass through normally sterile tissues they must be subjected to sterilization. If this is not possible then high level flexible endoscopes (manufacturers' instruction should be followed stringently).

5. Incubators (neonates): Surface should be washed with detergent and dried with sterile wipes.

6. Surgical instruments: Contaminated surgical instruments must be washed in a hot water washer disinfector before sterilization. Heat sensitive instruments should

be cleaned with chlorine releasing chemical, 2% glutaraldehyde, or 70% alcohol.

7. Sputum containers: As far as possible use disposable containers. If these are non-disposable, they should be emptied and cleaned with care and heat disinfected.

8. Oral thermometers: Preferably use individual thermometers, wipe with 70% alcohol and store dry. For common use thermometers wipe and dip in 70% alcohol and store dry.

9. Stethoscope: Wipe with 70% alcohol once daily or when visibly soiled. In critical areas dedicated instruments should be used for each patient. If this is not possible, then clean with 70% alcohol after each use.

10. BP Cuffs: BP cuffs with synthetic covers should be cleaned with70% isopropyl alcohol in between patients. In critical areas, dedicated instruments should be used. Cuffs with cloth covers should be washed periodically or when visibly soiled.

11. Laryngoscope

a.) **Blade:** After each use, clean with detergent and water to remove any organic material. Disinfect with 70% isopropyl alcohol swab and store dry.

b.) **Handle:** Clean with a wet cloth and store dry.

12. Suction equipment:

***** Equipment: Clean regularly with a wet mop.

* Bottles: empty regularly. Wash with detergents and hot water, and store dry.

* Tubings: Preferably use autoclavable tubings. Disinfect/sterilize tubings every 24 hours. Wash tubings with detergent and water, rinse and remove extra water. Disinfect using 2% glutaraldehyde. The tubings must be submerged and the lumen should be in contact with disinfectant for 20-30 minutes. Remove from the bucket and rinse with sterile water and dry. Store in dry linen, if extension tubing is cleaned and decontaminated with glutaraldehyde or sterilized with ETO.

13. Anesthesia and ventilator circuits (including humidifiers, T-piece, etc.).

Clean the tubings with detergent and water to remove organic material and rinse with water. Then, submerge the tubings in a container/bucket with 2% glutaraldehyde. The lumen of tubings should be filled with the disinfectant and the duration of contact should be at least 30 minutes; for sterilization immerse for 8-10 hours. Remove from bucket, rinse with sterile water and dry. Store in sterile linen (follow manufacturers' recommendations)/ sterile plastic bags.

14. Nebulizer: Preferably single set should be used for individual patients and the set should be disinfected daily using the same procedure as that for ventilator circuits. Ensure that the chambers and tubings are absolutely dry.

15. Facemask, ambu bags and reservoirs: These should be disinfected after each use using same method as for ventilator circuits.

16. O_2 hood: Wash with soap and water, store dry.

17. Needle and syringes: Use only disposables.

18. Body piercing needles and neurologic test needles: Ideally disposable, single use items should be used. However, in certain exigencies, if they have to be reused, these should be sterilized with either ethylene oxide after proper cleaning to remove organic material or 2% gluteraldehyde with a contact period of 8-10 hours. If they are heat stable, then they can be autoclaved.

19. Probes of pulse oximeter and temperature probes: Should be cleaned if visibly soiled and disinfected with 70% isopropyl alcohol.

20. Wall humidifiers and O_2 tubings: Should be decontaminated and disinfected every 24 hours and stored dry (as for ventilator tubings).

Table 4.1: REPROCESSING OF COMMONLY USED EQUIPMENT IN THE HOSPITAL

Process	Equipment	Examples of items	Products & Methods
Cleaning followed by low level disinfection	All reusable equipment	• Certain environmental surfaces touched by personnel during procedures involving bed -pans, urinals, commodes, stethoscopes, BP cuffs, ear specula, hemodialysis equipment surfaces, in contact with dialysates	• Water, detergent and cidizyme • Clean instruments under running water and then make sure that the instruments are completely immersed.
Cleaning followed by immediate level disinfection	Some semi-critical items	• After large environmental blood spills or spills of microbial cultures in the laboratories. • Thermometers, hydrotherapy tanks used for patients with non- intact skin, involving parenteral and mucus membrane contact	Alcohols, Hypochlorite solutions, Iodophores, Phenolics (not recommended for nurseries)
Cleaning with high level disinfection	Semi critical items	• Flexible endoscopes, respiratory therapy equipment, nebulizer cups, anesthesia equipment, nasal specula, tonometer foot plate, ear syringe nozzle, vaginal specula, vaginal probes used in sonographic scanning, breast pump accessories.	2% gluteraldehyde is the most commonly used high level disinfectant. All immersible internal and external surfaces of equipment should be allowed to be in contact with this for at least 20 minutes. 6% hydrogen peroxide.
Cleaning followed by sterilization	Critical items	• All items coming in contact with sterile body tissues. • Surgical instruments, all implantable devices, hemodialysis, plasmapheresis & Heart lung oxygenator surfaces in contact with blood, bronchoscopes, arthroscopes, laparoscopes, cystoscopes, transfer forceps, acupuncture needles & body piercing objects, neurologic test needles, high speed dental hand pieces.	Steam under pressure, dry heat , ethylene oxide gas (ETO), 2% glutaraldehyde, plasma sterilization with hydrogen peroxide

*After reprocessing of the equipment, clean and rinse preferably with sterile water. Then dry the equipment before use.

4.12 TERMINAL DISINFECTION OF AN AREA: Procedure at AIIMS described on page 80.

A terminal clean is defined as a procedure required to ensure that an area has been cleaned/decontaminated following discharge of a patient with an infection or communicable disease in order to ensure a safe environment for the next patient. Terminal cleaning should be carried out after a patient with an alert organism or communicable disease has been discharged (or transferred), in order to ensure a safe environment for the next patient. Bed screens, curtains and bedding should be removed prior to the room/area being decontaminated.

When the environment is potentially contaminated, disinfectants such as sodium hypochlorite must be used. For disinfectants to work effectively, the surface being decontaminated must be free from organic soil. A neutral detergent solution should be used to clean the environment prior to disinfection or a combined detergent /disinfectant may be used.

There is substantial evidence to support the effectiveness of hypochlorite solutions (1,000 ppm) and sodium dichloroisocynaurate (NaDCC) for the disinfection of surfaces contaminated with Norovirus or *C. difficile*. The effectiveness of disinfectants as part of control measures during outbreaks of other pathogens has also been widely reported.

[Neutral detergent followed by a disinfectant containing 1000 parts per million (ppm) available chlorine (av Cl) (or a combined detergent/disinfectant (1000 ppm av Cl)) should be used for decontamination of the isolation room/cohort area]

4.13 FOGGING

Fogging may be done in the following situations:

1. Commissioning of new critical areas such as OTs and ICUs.
2. After annual maintenance in the above mentioned areas.
3. Fogging of OTs may be done on the basis of any microbiology surveillance reports and/or clinical procedures carried out in the operating areas. Routine fogging is **NOT** recommended.
4. Any civil or engineering work should invite fogging of OTs.

4.13.1 Methodology

Ecoshield®/Baccishield® is a non-toxic, environment friendly disinfectant for critical area fogging and surface disinfection. It is a complex formulation of stabilized

Hydrogen Peroxide (11% w/v) and Silver Nitrate solution (0.01% w/v), (Silver nitrate's role is to stabilize the H_2O_2)

4.13.2 Criteria for Fogging

- After new construction and renovation
- Air borne diseases like Tuberculosis, Influenza, Ebola, etc. (After patient's discharge/death in the facility)
- Any known fungal infection in the facility (e.g. Aspergillus)

4.13.3 Instructions to be followed

- Use Personal Protective Equipment.
- Use cap, face mask and gloves for protection.
- Surface cleaning/Terminal disinfection.
- Visibly contaminated areas to be cleaned with damp duster, water or soap and then, Ecoshield soaked duster is used to clean the surface areas.
- For disinfection make 10% solution with Ecoshield/Baccishield.

Example: For making 10% solution (v/v 01:09 ratio) i.e. 10 ml Ecoshield® + 90 ml water.

- Pour reconstituted 10% solution into a container.
- Take a clean duster and dip it into the 10% solution and squeeze.
- Use this wet duster to clean all surfaces and underneath of metallic surfaces of equipments, OT table, ICU beds, side lockers, lights, instrument tables, mattress, walls etc.
- When duster is relatively dry, dip it again in 10% solution, and squeeze to carry on the above mentioned procedure until all the surfaces are mopped clean.

4.13.4 Calculation of the disinfectant to be used for fogging:

- **To undertake Terminal Disinfection before fogging**

  Calculate the area to be fogged in cubic feet i.e. Length X Breadth X Height

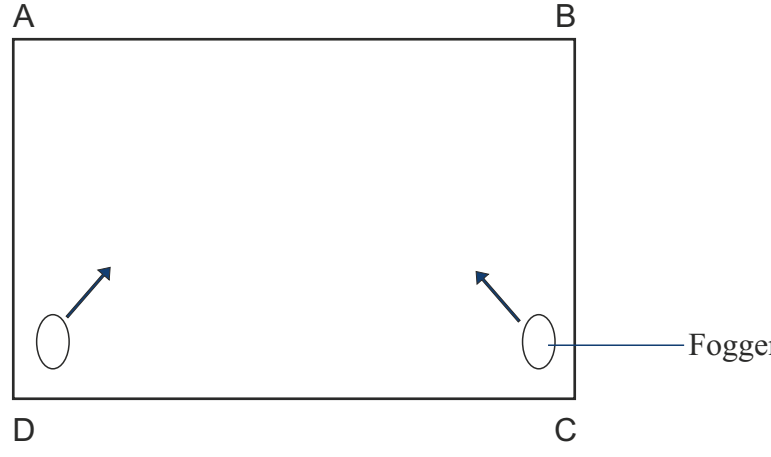
  Example: L= 10 ft, B=10 ft & H=10 ft

  Then cu. Ft area is 10 X 10 X 10=1000 cu. ft.

- **For fogging, make 20% solution with Ecoshield®/Baccishield® in distilled water.**

Space in cubic feet L X B X H	Dilution Ecoshield + Water	Timer of the fogger to be set at
1000 cu ft	200 ml + 800 ml=1 L	1 L
2000 cu ft	400 ml + 1600 ml= 2 L	2 L
2500 cu ft	500 ml + 2000 ml=2.5 L	2.5 L

- As per the room size and example above, make Ecoshield/Baccishield solution and pour into the fogger tank.
- Before starting the fogging, cover electronic equipment's with sterile drapes.
- Take the fogger and place it at least 2 feet above the floor surface, in one corner of the room. It's nozzle head should be kept at an angle of 45 degree facing the corner diagonal to it. If two foggers are used place them in opposite direction as shown below.



In case of window AC/ split AC:

- Switch on air conditioning for 10 minutes once fogging starts in case of window or split AC.
- Set the timer as per the volume of solution in the tank and switch on the fogger.
- Switch off the air conditioning after 10 minutes of fogging in case of window or split AC.
- After completion of fogging i.e. when fogger gets switched off, allow 45 minutes for the mist to settle down.
- In case you find any wet area, wipe it off with clean duster.

In case of central air conditioning:

- Close the AC vent once fogging starts.
- Set the timer as per the volume of solution in the tank and switch on the fogger.
- After completion of fogging i.e. when fogger gets switched off, allow 45 minutes for the mist to settle down.
- In case you find any wet area, wipe it off with clean duster.
- Now fogged area can be opened for use after switching on the air conditioning.

One demonstrated use for this technology is to assist with control of an outbreak caused by microorganism(s) which is continuing unabated, wherein the environment of care is implicated. Other possible applications would be for rooms previously occupied by patients on Contact Precautions (CP) for multidrug-resistant organisms (MDRO) or CDI, or to decontaminate whole areas or patient care equipment that epidemiologic investigation implicates possible involvement in clusters of HCAIs. Scientific studies do show hydrogen peroxide vapor or mist is effective for patient room non-porous surfaces, including hard surface equipment for a wide range of MDROs such as MRSA, VRE, gram negatives such as Acinetobacter and Serratia spp., viruses (e.g., rotavirus; norovirus), fungi, *B. anthracis*, protozoa but most importantly, *C. difficile* spores. Other potential areas include: sensitive equipment that may be difficult to disinfect after cleaning; quarantine rooms in emergency department (for patients with suspected or proven infectious agents); animal lab facilities.

TABLE 4.2: DISINFECTION/STERILIZATION OF INSTRUMENTS AND EQUIPMENT

S.No.	Items to be disinfected	Schedule for disinfection	Procedure for disinfection/sterility maintenance	Alert/Remarks
1.	Resuscitation equipment (Laryngoscope blade, AMBU bag, mask, E.T. stylet)	1. After each use 2. If not used for any patient in 24 hours' time, equipment should be disinfected every day before 10 am	1. Clean with water and soap solution (detergent) to remove bio load. 2. Dry and then disinfect with Bacillol–25 or Spirit. 3. Store Laryngoscope blade and E.T. stylet in sterile pad.	
	Ambu Bag and accessories	1. After each use 2. If not used for any patient in 24 hours' time, equipment should be disinfected every day before 10 am	1. Wash with water and detergent (ambu bag, AR valve and other accessories) to decontaminate and then immerse them in high level disinfectant solution for 30 min 2. After disinfection time ambu bag and other accessories should be thoroughly rinsed with sterile water. 3. Dry and store in a sterile wrapper	
2.	Cheatle forceps	1. Once in 24 hours – every day before 10 a.m. 2. Whenever contaminated. 3. In OT – every nursing shift.	1. Clean with water & detergent 2. Disinfect by autoclaving 3. Store dry in a sterile bottle with sterile cotton.	Label the bottle with date and time.
3.	Thermometers	1. After each use. 2. Set up thermometer tray once in 24 hours before 10 a.m. even if unused.	1. Clean with water and disinfect with spirit. 2. Store dry either in sterile bottle or thermometer containers.	

S.No.	Items to be disinfected	Schedule for disinfection	Procedure for disinfection/sterility maintenance	Alert/Remarks
7.	Ventilator circuits/humidifier (reusable)	1. After each patient use/discharge/ death. 2. If visibly soiled or mechanically malfunctioning 3. Every 72 hours (3 days) whether being used or not.	1. Wash with water and detergent 2. Disinfect by submerging in Korsolex/Cidex solution for 30 minutes. 3. Ensure disinfectant solution enters the tube lumen. 4. Then rinse preferably with sterile water, dry the tubes by hanging in a clean area. 5. If ETO facility is available – it can be sterilized by ETO machine. 6. Circuits which can withstand autoclaving, can be sent for autoclaving. 7. Use sterile water for humidification and fill up to the mark.	- If water level falls below the mark in humidifier bottle, empty then refill with fresh sterile water. - **DO NOT TOP UP.**
8.	Sterile steel drums/sterile sets	1. Shelf life 72 hours. 2. Every 72 hours (3 days) whether being used partially or unused.	1. Clean the instruments with water and detergents. 2. Dry them in a clean area. 3. Then pack the sets and send for autoclaving. 4. Store autoclaved sets in a clean area. 5. Ensure sterile steel drums are stored with their lids and steam inlets closed.	- Whenever the integrity of the pack is suspected, it should be re-sterilized. - Storage area should protect against dust, moisture, insects, temperature and humidity.
9.	Small steel trays used for injections to carry	1. Every 24 hours, if unused. 2. Disinfect after each schedule of injections. 3. If visibly soiled	1. Wash with water and detergent. 2. Disinfect by submerging in Korsolex/Cidex solution for 30 minutes. 3. Then rinse with sterile water and dry. 4. Separate steel tray for individual patients in ICUs	

S.No.	Items to be disinfected	Schedule for disinfection	Procedure for disinfection/sterility maintenance	Alert/Remarks
10.	Needle destroyer Puncture proof containers with boilable hazard	1. Visibly soiled. 2. Every day before 10 a.m. (24 hours)	Puncture proof containers 1. Do not hold the mutilated needle in puncture proof container for more than 24 hours. 2. Change every 24 hours.	- Check daily if the needle destroyer is in working condition. - Make sure the puncture proof container has bio-hazard label.
11.	Cleaning of surface areas : General wards, nursing counter, treatment room, post op cubicle, ICUs/HDUs/OTs walls, all counters, bed rails, lockers, over head table, equipment's, door knobs etc.	1. Every day – before 10 a.m. 2. If found visibly soiled	1. Wet mop with surface disinfectant (Bacillocid, carbolic acid)	- Always use freshly prepared solution and required amount. - Discard the solution after use.

TABLE 4.3: PREPARATION OF DISINFECTANTS/SOLUTIONS

S. No.	Name of the disinfectant solution	Avail. Conc.	Req. Conc.	Method of dilution	Contact time for disinfection	Maximum in-use span**	Remarks
1.	Glutaraldehyde	2% 2.45%	2% 2.45%	Add activator powder/liquid to the 5 ltr. Solution and use undiluted	20-30 minutes	14 days 28 days	
2.	Korsolex Rapid	Pure	5%	5 ml Korsolex Rapid + 95 ml water	5 minutes	7 Days	
3.	Bacillocid : (Benzylkonium chloride, Glutaraldehyde with chemically bound formaldehyde)	Pure	2% 0.5%	20 ml Bacillocid + 980 ml water 5 ml Bacillocid + 995 ml water	Quick disinfection of surface areas		Do not mix with other cleansing agents

S. No.	Name of the disinfectant solution	Avail. Conc.	Req. Conc.	Method of dilution	Contact time for dis-infection	Max. in-use span**	Remarks
4.	Chlorhexidine Gluconate and Cetrimide solution (Savlon)	Pure	3.5%	500 ml solution (17.5 ml pure Savlon + 482.5 ml saline/boiled water)		24 hours	Use only for skin dis-infection
5.	Phenol (carbolic acid)	100% (crystal form)	5%	Warm the phenol bottle in hot water basin to make it into liquid form. 5 ml phenol + 95 ml water	10-15 minutes	24 hours	Use freshly prepared solution
6.	Sodium hypochlorite Solution	10% $\pm$ 1 5% $\pm$ 1	1% 1%	10 ml sodium hypochlorite solution + 90 ml water 20 ml hypochlorite solution + 80 ml water	20-30 minutes	8 hours	Do Not Use re-const-ituted solution beyond 8 hours
7.	Baccishield	Pure	10% for disinfection of items/ equipment surface. 20% for fogging	100ml of Baccishield in 900 ml of water for 10% 200ml of Baccishield in 800 ml of water for 20%	Fogging time 1 hour: (half an Hour for running the machine and half an hour keep the door closed)		Always use freshly prepared solution
8.	Bacillol Spray	-	-	Use as available			Do not use it as surface cleaner

** May need to replace earlier if solution is visibly contaminated or on basis of

Formula for preparing disinfectant solutions:

For preparation of disinfectant solution, the following formula may be used as guide:

$$A = \frac{D \times Q}{H}$$

A = Amount of disinfectant
D = Desired strength
H = Strength in hand
Q = Quantity

For example, in preparation of 1% hypochlorite solution from 10% hypochlorite solution:

- D = 1%
- H = 10%
- Q = 1000 ml

$$A = \frac{1 \times 1000}{10} = 100 \text{ ml}$$

Water required (1000 -100) = 900 ml
900 ml water + 100 ml Sodium Hypochlorite solution makes 1% Sodium Hypochlorite solution

General guidelines:

1. Disinfectant solutions should be re-constituted and changed according to in use life span – As per manufacturer's recommendations.
2. Label the container with name of the solution/date/time of preparation/date of expiry.
3. Always use PPE while handling the chemicals (gloves, mask, apron).
4. Opened Normal saline bottles (for dressing) should not be used beyond 24 hours.
5. Replace fresh bottles every day morning before 10 a.m. Label the bottle with date/time.

4.14 POLICY FOR PURCHASE OF DISINFECTANTS:

Disinfectants and chemicals are purchased at AIIMS through a centralized rate contract which is finalized by the hospital store. However, in case of exigencies, centers can also procure chemicals (which are not in rate contract) by following approved store purchase guidelines. A duly constituted technical committee comprising of all stakeholders is constituted for this purpose. The rate contract is generally valid for 2 years or till the next tender is finalized.

4.15 REUSE OF A SINGLE USE DEVICE (SUD)

These are critical items and should be **sterilized before reuse.** Reuse should be considered only in exceptional circumstances.

- Glutaraldehyde is not recommended for such situation e.g. biopsy needles commonly re-used should undergo autoclaving or plasma sterilization.
- ***The patient must be informed about the re-use of a single use device.***

CHAPTER 5

STANDARD PRECAUTIONS AND ROUTINE ISOLATION PRACTICES

5.1 STANDARD PRECAUTIONS

The risk of acquiring infections from patients and infecting other patients can be decreased by observing certain standard precautions in all health care settings. These precautions have been issued as guidelines by the Government of India and are followed at AIIMS Hospital routinely. These are:

- Washing/ cleaning of hands before and after all patients and specimen contact.
- Handling of blood and body fluids of all patient as potentially infectious.
- Wearing gloves for any contact with blood and body fluids.
- Placing used syringes immediately in nearby imprevious container; re-capping or manipulating of used needles should not be done.
- Wearing protective eyewear and mask, if splashing of blood or body fluids is expected.
- Handling all linen soiled with blood and/ or body fluids as infectious.
- Processing all laboratory specimens as potentially infectious.

5.1.1 STANDARD PRECAUTIONS AND ROUTINE PRACTICES

Standard Precautions comprise of the basic infection prevention practices that should be followed in all patient care settings, regardless of suspected or confirmed infection of the patient. These practices are designed to protect both the health care provider (HCP) and prevent HCP from spreading infections among patients.

The important Standard Precautions include: 1) hand hygiene, 2) use of personal protective equipment (e.g., gloves, gowns, mask), 3) safe injection practices, 4) respiratory hygiene/cough etiquette, and 5) safe handling of potentially contaminated equipment or surfaces in the patient environment. Four of these elements are illustrated in the Figure 5.1 and described in detail in this chapter. Safe handling of potentially contaminated equipment or surfaces in the environment is covered elsewhere in this manual.

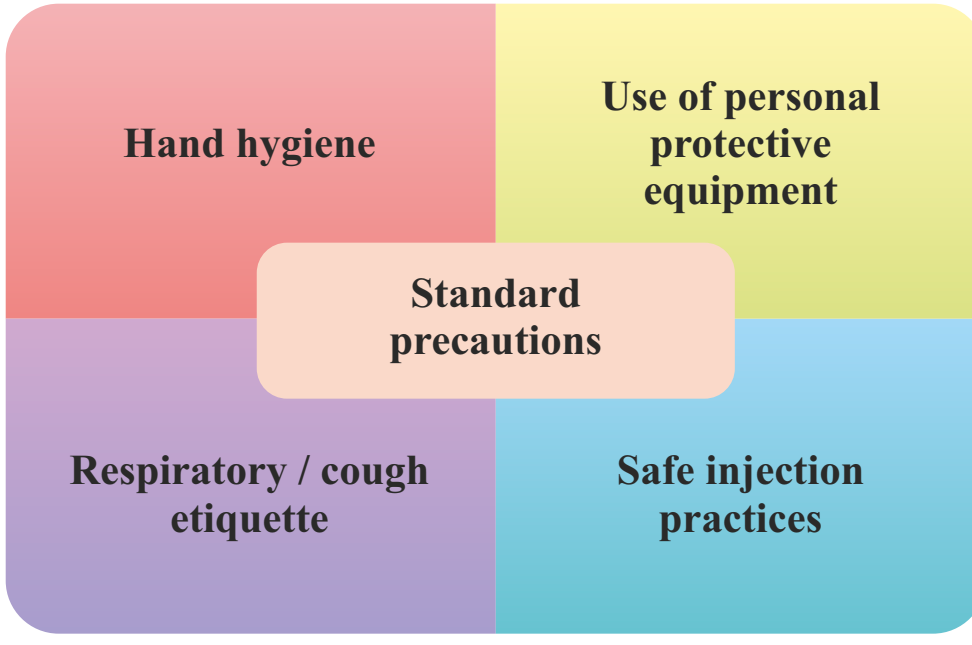


Figure 5.1: Standard precautions and routine practices

5.2 HAND HYGIENE

The human skin is colonized with organisms like *S. epidermidis, Propionibacter,* and, occasionally, gram-negative organisms. Although most skin flora is not virulent, they may cause infection in immunocompromised patients, in patients with abnormal heart valves, and during invasive procedures. Hands of a health personal contain approximately 3.9×10^4 to 4.6×10^6 organisms. There are 2 types of flora namely transient (acquired during patient contact) and resident flora. *Transient flora* are seen in superficial layers of skin and are associated with health care associated infections whereas *resident flora* (coagulase negative staphylococcus and diphtherioids) seen in deeper layers of skin are resistant to removal but are less likely to cause infections. In addition, the health care personnel may come in contact with body fluids/ secretions of infected patients and the hands may be contaminated with the pathogens. The main objective of hand hygiene among health care personal is to protect patients from harmful germs carried by healthcare personal and to protect healthcare personnel and environment from harmful germs.

5.2.1 TYPES OF HAND HYGIENE

There are mainly two types of hand hygiene:

1. *Hand washing or hygienic hand scrub:* Treatment of hands with either a hand rub or an aseptic hand wash to reduce transient microflora without necessarily affecting the resident skin flora. This is done during routine patient care.
2. *Surgical hand asepsis*: presurgical hand asepsis done using an aseptic scrub or antiseptic soap to eliminate transient flora and to reduce resident flora.

5.2.2 HAND WASHING AND HAND ASEPSIS

Indications:

The indications of hand washing and hand asepsis are:

1. When hands are visibly dirty or soiled with body fluids or spore forming organism like *Clostridium difficile* spread is suspected, perform hand washing with soap and water (antiseptic or non-antiseptic soap)
2. Alcohol-based hand rub can be used in the following circumstances if hands are not visibly soiled. If not available, use antiseptic soap and water. Do not use soap and alcohol based solutions concomitantly. The indications are :
    - Before and after touching the patient
    - Before handling invasive device for patient care (Irrespective of use of gloves)
    - After contact with body fluids and exposed skin areas
    - After moving from a contaminated site to other body area of same patient.
    - After touching inanimate objects of patients vicinity
    - After removing gloves
    - Before preparing medication or food for patients

WHO advocates 5 moments of hand hygiene:

WHO has identified five important moments at which hand hygiene practices must be followed. These are called 'My five moments of hand hygiene' (Figure 5.2).

- Before patient contact
- Before an aseptic task

- After patient contact
- After body fluid exposure risk (Including hand wash after gloves removal)
- After contact with patient's surroundings

Two moments are before and three moments are after touching the patient. The procedure of hand washing and using alcohol-based hand rub is available in poster form at the WHO website (Figure 5.3 and 5.4).

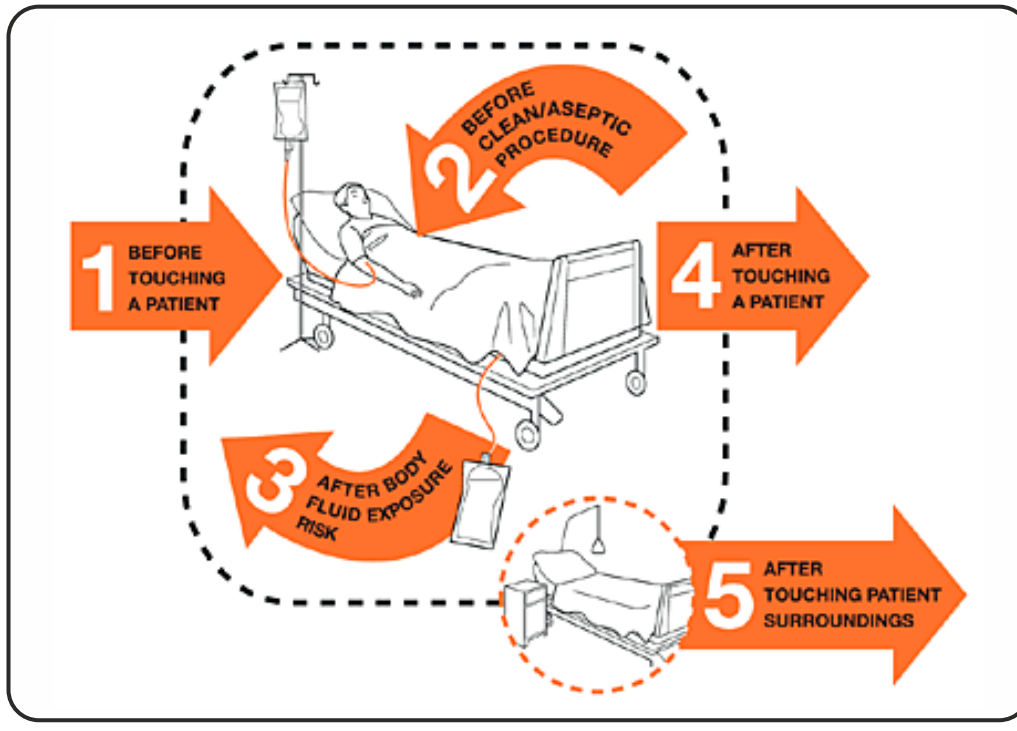


Figure 5.2: Five moments of hand hygiene

I. Types and method of hand washing and duration

1. *Hygienic Hand washing:* wet hands with soap and water and apply necessary amount to cover all surfaces and scrub approximately for 40 to 60 seconds. Rinse hands with running water and dry using single use towel (Figure 5.3).
2. *Hygienic Hand rub:* Apply a palmful (at least 3 ml) of alcohol-based hand rub and cover all surfaces of the hands at least for 20 to 30 seconds with alcohol based solution. Rub hands until dry (Figure 5.4).

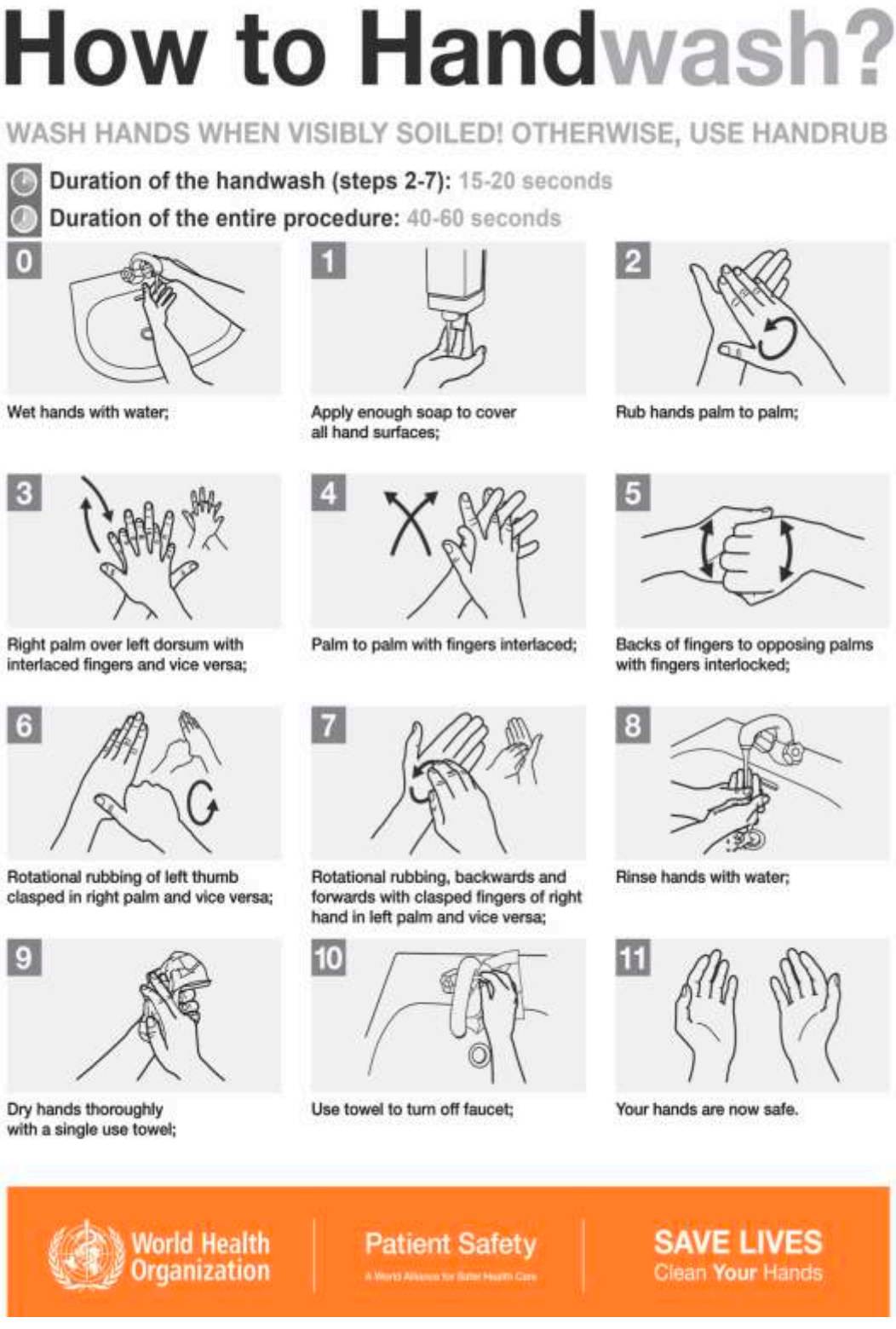


Figure 5.3: Procedure for hand washing

It is recommended that these SOPs should be prominently displayed near wash basins in critical and semi-critical areas of the hospital. It should also be displayed at the nursing stations and in clean utility or treatment rooms.

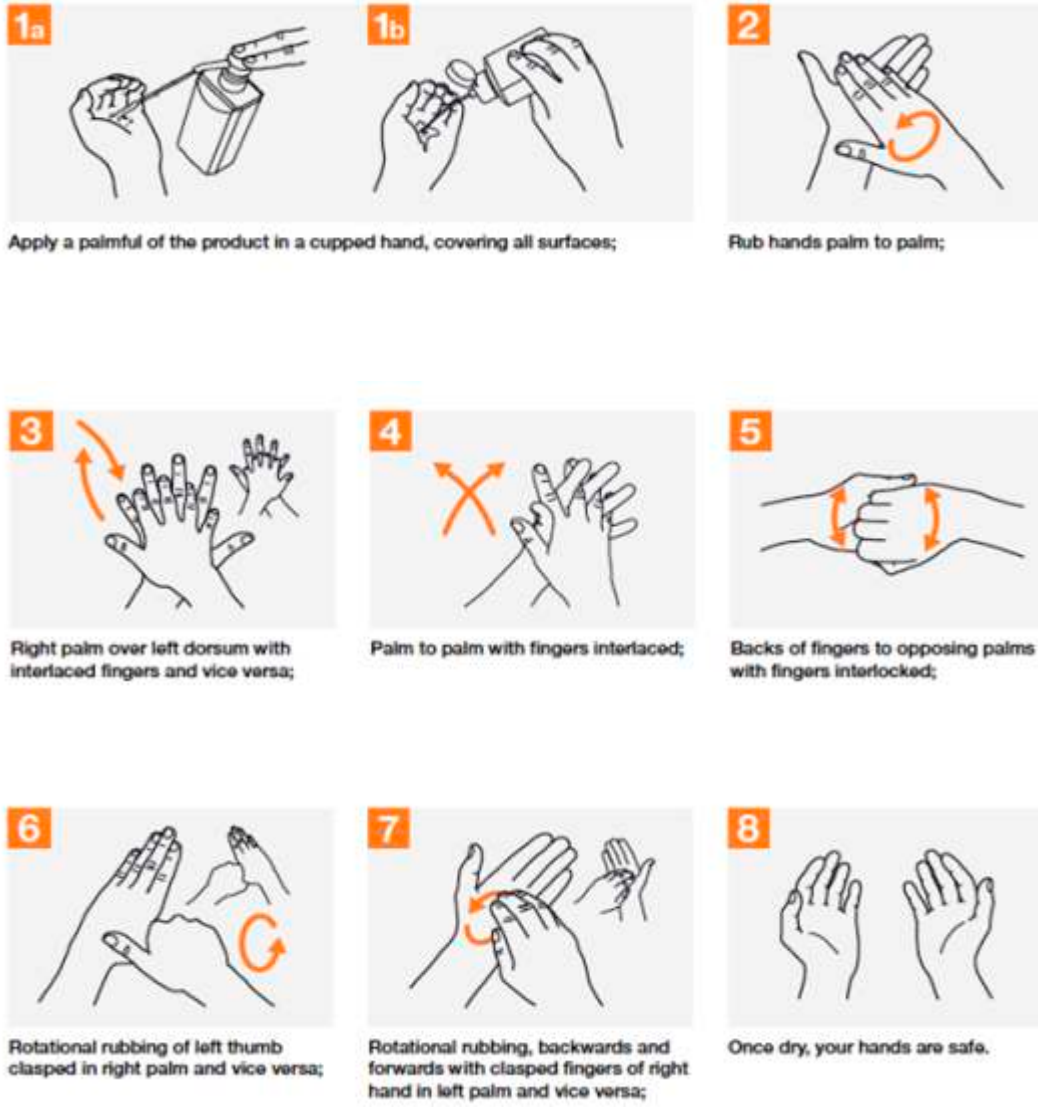


Figure 5.4: Procedure for use of hand rub

5.2.3 SURGICAL HAND WASHING

Recommendation regarding surgical hand washing:

WHO has advised the use of alcohol-based hand rub for pre-surgical hand preparation over surgical scrubbing.

The recommendations are:

- To use sinks with minimal risk for splashes.
- If visibly soiled, hands should be washed with soap and water before surgical washing. Remove debris from underneath finger nails using a nail cleaner under running water.
- Surgical hand wash/scrub can be performed using either an antimicrobial soap solution or an alcohol based hand rub with persistent activity.
- When performing hand scrub using antimicrobial soap solution, scrub hands and forearms till just above the elbow for a period of 2-6 minutes. Dry hands and arms using sterile towel. Then don the gloves.
- If sterile water cannot be ensured for hand washing, then alcohol based solution scrub is preferred.

Steps of surgical hand scrubbing:

- Keep nails short and pay attention to them when washing your hands – most microbes on hands come from beneath the fingernails.
- Do not wear artificial nails or nail polish.
- Remove all jewellery (rings, watches, bracelets) before entering the operating theatre.
- Wash hands and arms with a non-medicated soap before entering the operating theatre area or if hands are visibly soiled. (Dry properly before applying surgical hand rub if used just after hand wash)
- Clean subungual areas with a nail file. Nailbrushes should not be used as they may damage the skin and encourage shedding of cells. If used, nailbrushes must be sterile, once only (single use).
- Start timing. Scrub each side of each finger, between the fingers, and the back and front of the hand for 2 minutes. Active ingredients in order of efficacy in medicated soap is chlorhexidine, iodophores, and triclosan and plain soap.
- Proceed to scrub the arms, keeping the hand higher than the arm at all times. This helps to avoid recontamination of the hands by water from the elbows and prevents bacteria-laden soap and water from contaminating the hands.

- Wash each side of the arm from wrist to the elbow for 1 minute.
- Repeat the process on the other hand and arm, keeping hands above elbows at all times. If the hand touches anything at any time, the scrub must be lengthened by 1 minute for the area that has been contaminated.
- Rinse hands and arms by passing them through the water in one direction only, from fingertips to elbow. Do not move the arm back and forth through the water.
- Proceed to the operating theatre holding hands above elbows.
- At all times during the scrub procedure, care should be taken not to splash water onto surgical attire.
- Once in the operating theatre, hands and arms should be dried using a sterile towel and aseptic technique before donning gown and gloves.

Surgical scrub technique is same as hygienic hand scrub but requires additional forearm rubbing. Approximately 15 ml of alcohol based rub is required and 3 minutes time (according to manufacturer guidelines)

5.3 ANTISEPTIC AGENTS TO BE USED FOR HAND WASHING/ HAND HYGIENE

a. Plain water and soap: Washing for 30 seconds reduces bacterial load by 1.8 to 2.8 log 10.

b. Antiseptic detergents: The following antiseptic detergents can be used:

- 4% chlorhexidine gluconate-detergent (CHG)
- Povidone iodine and iodophors (7.5% to 10%) scrub agent
- 3% Chloroxylenol (does not act rapidly act as CHG and has less persistent activity)
- Hexachlorophene (3%)
- Quaternary ammonium compounds like benzethonium chloride, cetrimide.

c. Alcoholic hand rub products: Alcohol based solution has property of denaturing proteins, thereby destroys microbes; agents with 60-70% alcohol are most efficient and higher concentrations are less effective. Alcohols used are either ethanol or propranolol or isopropanol or combinations of these. Alcohols have excellent activity against gram positive and gram negative bacilli, fungi and some non-enveloped viruses but they have less residual activity against them. Adding chlorhexidine (0.5% to 1%), quaternary ammonium compounds, or triclosan to

alcoholic hand rub increase their persistent activity against microbes. Some examples are:

- 0.5% chlorhexidine or povidone iodine in 70% isopropanol or ethanol,
- 60% isopropanol or 70% ethanol with emollient.

Selection of suitable agents:

- Provide efficacious hand hygiene products with less irritation
- To increase Hand hygiene among co-workers, solicit their input regarding skin tolerance, feel and fragrance of any products under consideration
- Solicit information from manufacturer regarding possible contamination, ensure dispensers deliver adequate amounts and are accessible
- Do not add soap or alcohol based products to a partially empty soap dispenser; if its reused, follow recommended procedures for cleaning

Skin care:

- Inform HCW regarding use of healthcare practices to reduce risk of contact dermatitis
- Provide alternative products if HCW is allergic to specific product
- Provide hand lotions and creams to minimize occurrence of contact dermatitis
- Soap and alcohol hand rub should not be used concomitantly

Gloves:

- Gloves are not a substitute for hand washing; hand wash/hygiene should be performed before wearing gloves
- Wear gloves when contact with blood or other potentially infectious materials, mucous membranes, and non-intact skin could occur.
- Remove gloves after caring for a patient. Do not wear the same pair of gloves for the care of more than one patient, and do not wash gloves between uses.
- Change gloves during patient care if moving from a contaminated body site to a clean body site of same patients.
- Never reuse gloves, in-case of reuse implement safest reprocessing methods

Other points to be remembered:

- Covering cuts and wounds: Damaged skin should be protected (especially hands and forearms) with dressing /water proof dressing.
- When a bar of soap is used, it should be kept dry in a soap case that facilitates drainage and should not be allowed to be lying in a pool of soapy water.

- If liquid soaps are used, avoid topping-off of the solution and once the soap finishes the containers should be washed and dried before refilling. The dispenser should be kept clean.
- Do not wear artificial fingernails or extenders when having direct contact with patients at high risk (e.g. those in intensive-care units or operating rooms)
- Keep natural nail tips cut and clean.

5.4 STANDARD PRECAUTIONS: USE OF PERSONAL PROTECTIVE EQUIPMENT

5.4.1 Definition

Personal protective equipment, or PPE, as defined by the Occupational Safety and Health Administration, or OSHA, is "specialized clothing or equipment, worn by an employee for protection against infectious materials." PPE interrupt the chain of transmission of organisms from the patient to the health care worker and from the health care worker to the patient, thus reducing healthcare associated infections.

5.4.2 Types of PPE

PPE listed here prevent contact with the infectious agent, or body fluid that may contain the infectious agent, by creating a barrier between the worker and the infectious material.

Gloves protect the hands, gowns or aprons protect the skin and/or clothing, masks and respirators protect the mouth and nose, goggles protect the eyes, and face shields protect the entire face. The respirator has been designed to also protect the respiratory tract from airborne transmission of infectious agents.

The type of PPE is determined by the following:

- The type of anticipated exposure such as touch, splashes or sprays, or large volumes of blood or body fluids that might penetrate the clothing and whether it is a high risk patient
- The durability and appropriateness of the PPE for the task. This will affect, for example, whether a gown or apron is selected for PPE, or, if a gown is selected, whether it needs to be fluid resistant, fluid proof, or neither.
- Appropriate fit

Key points for PPE use:

- PPE should be properly donned before any contact with the patient, generally

before entering the room. The gown should be donned first. The mask or respirator should be put on next and properly adjusted to fit. The goggles or face shield should be donned next and the gloves are donned last.

- PPE are to be used carefully to limit "touch contamination".
- Proper procedure for removal of the PPE must be followed. The areas of PPE that are considered uncontaminated are the parts that should be touched when removing PPE. These include inside the gloves; inside and back of the gown, including the ties; and the ties, elastic, or ear pieces of the mask, goggles and face shield. The sequence for removing PPE is intended to limit opportunities for self-contamination. The gloves are considered the most contaminated pieces of PPE and are therefore, removed first. The face shield or goggles are next because they are more cumbersome and would interfere with removal of other PPE. The gown is third in the sequence, followed by the mask or respirator.
- Hand hygiene should be performed before going on to the next patient, immediately after discarding the PPE. If hands become visibly contaminated during PPE removal, hands should be washed thoroughly with soap and water; otherwise an alcohol-based hand rub may be used.

a) Gowns:

Gowns should be worn if soiling with blood or body fluids is anticipated. Additional protection to clothes can be obtained by wearing a disposable plastic apron under the gown.

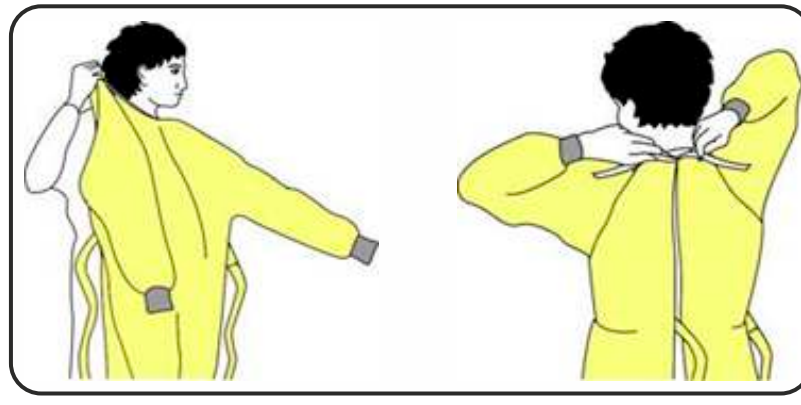
Factors influencing the selection of a gown or apron as PPE:

- Isolation gowns are generally the preferred PPE for clothing but aprons occasionally are used where limited contamination of arms is anticipated.
- Isolation gowns are made either of cotton or a spun synthetic material that dictate whether they can be laundered and reused or must be disposed.
- If fluid penetration is likely, a fluid resistant gown should be used.
- Clean gowns are generally used for isolation. Sterile gowns are only necessary for performing invasive procedures.

Procedure for donning a gown (illustrated below)

- Select appropriate type and size.
- The opening of the gown should be in the back; secure the gown at the neck and waist.

- If gown is too small, two gowns may be used; the first gown is worn with the opening in front and the second gown over the first with the opening in the back.



Procedure for removing a gown (illustrated below)

- The gown ties are unfastened with the ungloved hands.
- The hands should be slipped under the gown which is then peeled away at the shoulder, neck and arms turning the contaminated outside toward the inside and folding into a roll or bundle followed by discarding as appropriate.

b) Facial PPE:

A combination of PPE types is available to protect all or parts of the face from contact with potentially infectious material. The selection of facial PPE is determined by the isolation precautions required for the patient and/or the nature of the patient contact.

Face Mask:

- A mask should be worn if contamination of the oral or nasal mucous membrane is anticipated by splashing of patient's blood.
- It should fully cover nose and mouth and prevent fluid penetration.

Procedure of wearing a mask (see Figure): The mask is placed over the mouth, nose and chin. The flexible nose piece is fitted to the form of the nose bridge; the upper set of ties is then tied at the back of head and the lower set at the base of neck.

c) Respirators

- These are used to protect healthcare workers' from hazardous or infectious aerosols.
- Respirators that filter the air before it is inhaled should be used for respiratory protection.
- The most commonly used respirators in healthcare settings are the N95, N99, or N100 particulate respirators. The device has a sub-micron filter capable of excluding particles that are less than 5 microns in diameter. Like other PPE, the selection of a respirator type must consider the nature of the exposure and risk involved.

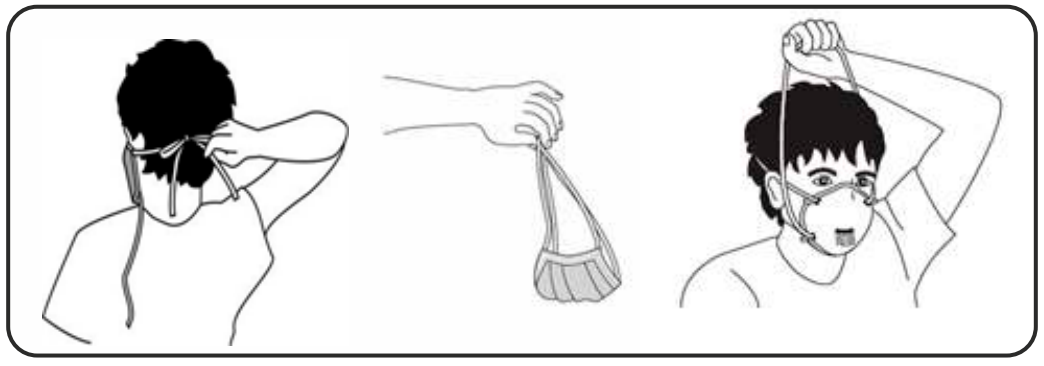
Procedure of wearing a respirator

A fit-tested respirator is selected and placed over nose, mouth and chin; the flexible

nose piece is fitted over nose bridge. The bands are stretched over the head and secured comfortably. A fit check should be performed, that is the respirator should collapse during inhalation and leakage should be checked around the face during exhalation

Procedure for removing a mask or respirator

The front of the mask/respirator is considered contaminated and should not be touched. Only the ties or elastic bands are handled, starting with the bottom then top tie or elastic band. The mask or respirator is lifted away from the face and discarded



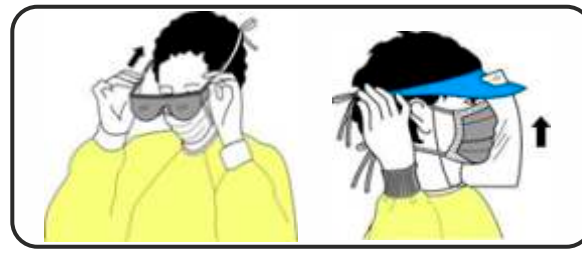
d) Eye wear and goggles:

- Goggles should be used if blood or body fluid splashes are anticipated for e.g. during any surgery, endoscopic procedures, bone drilling or vascular injuries or laser surgeries, etc.
- It should fit snuggly over and around eyes
- Goggles provide barrier protection for the eyes; personal prescription lenses do not provide optimal eye protection and should not be used as a substitute for goggles
- Goggles with antifog feature improves clarity of vision

Face Shields: When skin protection, in addition to mouth, nose, and eye protection, is needed or desired, for example, when irrigating a wound or suctioning copious secretions, a face shield can be used as a substitute to wearing a mask or goggles. The face shield should cover the forehead, extend below the chin, and wrap around the side of the face.

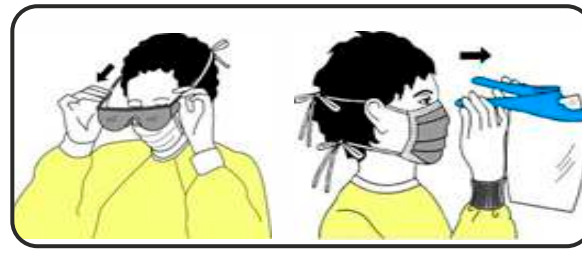
Procedure for wearing eye and face protection

- Goggles should be positioned over eyes (*see illustration*) and secured to the head using the ear pieces or headband and adjusted to fit comfortably
- Face shield should be positioned over face and secured on brow with headband and adjusted to fit comfortably (*see illustration*)



Procedure for removing eye wears and face shield

- The ear or head pieces are grasped with ungloved hands and lifted away from face; these are then placed in designated receptacle for reprocessing or disposal

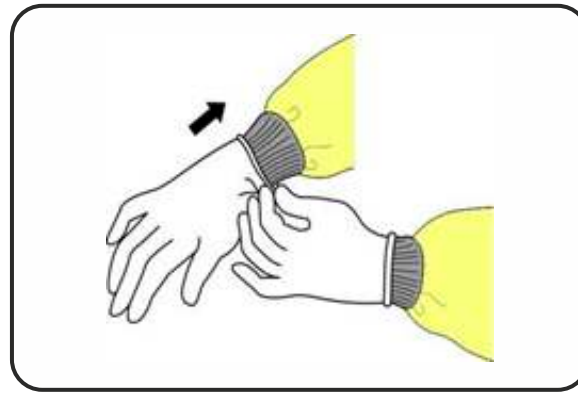


e) Gloves:

- To be used when blood /body fluids, specimens, soiled linen, secretions as well as surfaces, materials or objects exposed to them have to be handled. Gloves are a must whenever the skin is not intact.
- While most patient care activities require the use of a single pair of non-sterile gloves made of either latex, nitrile, or vinyl, sterile gloves are worn by healthcare personnel who perform invasive patient procedures. Double gloves are recommended for high risk patients.
- Contaminated gloves can become a means for transmission of infectious materials. Therefore, the following need consideration:

- Clean body sites or surfaces should be touched before dirty or heavily contaminated areas.
- Avoid "touch contamination" by avoiding unnecessary touching of environmental surfaces/other PPEs with contaminated gloves.
- Gloves must be changed and discarded:
  - If they become torn or heavily soiled; hands should be washed before wearing a new pair.
  - After use on each patient; patient care gloves should never be washed and reused. The same pair of gloves should not be worn for the care of more than one patient.

Procedure for donning gloves: Each hand is inserted into the appropriate glove (*see illustration*) and adjusted as needed for comfort and dexterity. The gown cuffs are tucked securely under each glove.

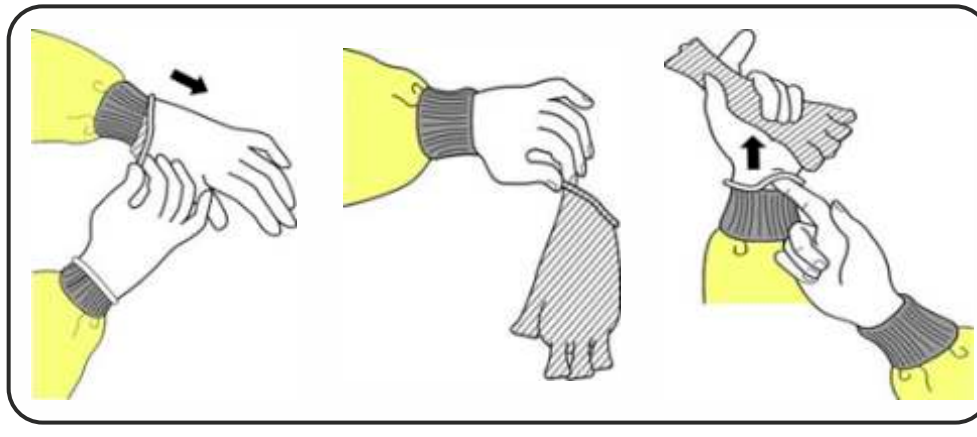


Procedure for donning sterile gloves:

- Pick up the cuff of the right glove with your left hand. Slide your right hand into the glove until you have a snug fit over the thumb joint and knuckles. Your bare left hand should only touch the folded cuff - the rest of the glove remains sterile
- Slide your right fingertips into the folded cuff of the left glove. Pull out the glove and fit your right hand into it
- Unfold the cuffs down over your gown sleeves. Make sure your gloved fingertips do not touch your bare forearms or wrists.

Procedure for removing gloves

- Using one gloved hand, the outside of the opposite glove near the wrist is grasped and peeled away from the hand.
- The glove should now be turned inside-out, with the contaminated side now on the inside. Hold the removed glove in the opposite gloved hand.
- The ungloved finger is sled under the wrist of the remaining glove and peel off from inside, creating a bag for both gloves
- The gloves should be discarded appropriately



f) Protective Foot Wear

Protective footwear should be used when handling biomedical waste as unnoticed cuts and wounds are quite common in the legs. Footwear is also essential to protect legs from 'sharps 'injury.

5.5 STANDARD PRECAUTIONS: RESPIRATORY/ COUGH ETIQUETTE

These are measures to prevent spread of respiratory secretions and include covering ones mouth while coughing, disposing off tissues and following hand hygiene practices after touching respiratory secretions. Instead of covering the mouth with the hand, one may do so with the upper arm (*see figure 5.5)*

5.6 STANDARD PRECAUTIONS: SAFE INJECTION PRACTICES

I. Safe handling of sharps:

All needles, scalpel, broken glass and any other item which may cause injury, have been designated sharps. All sharps should be handled carefully. The following points

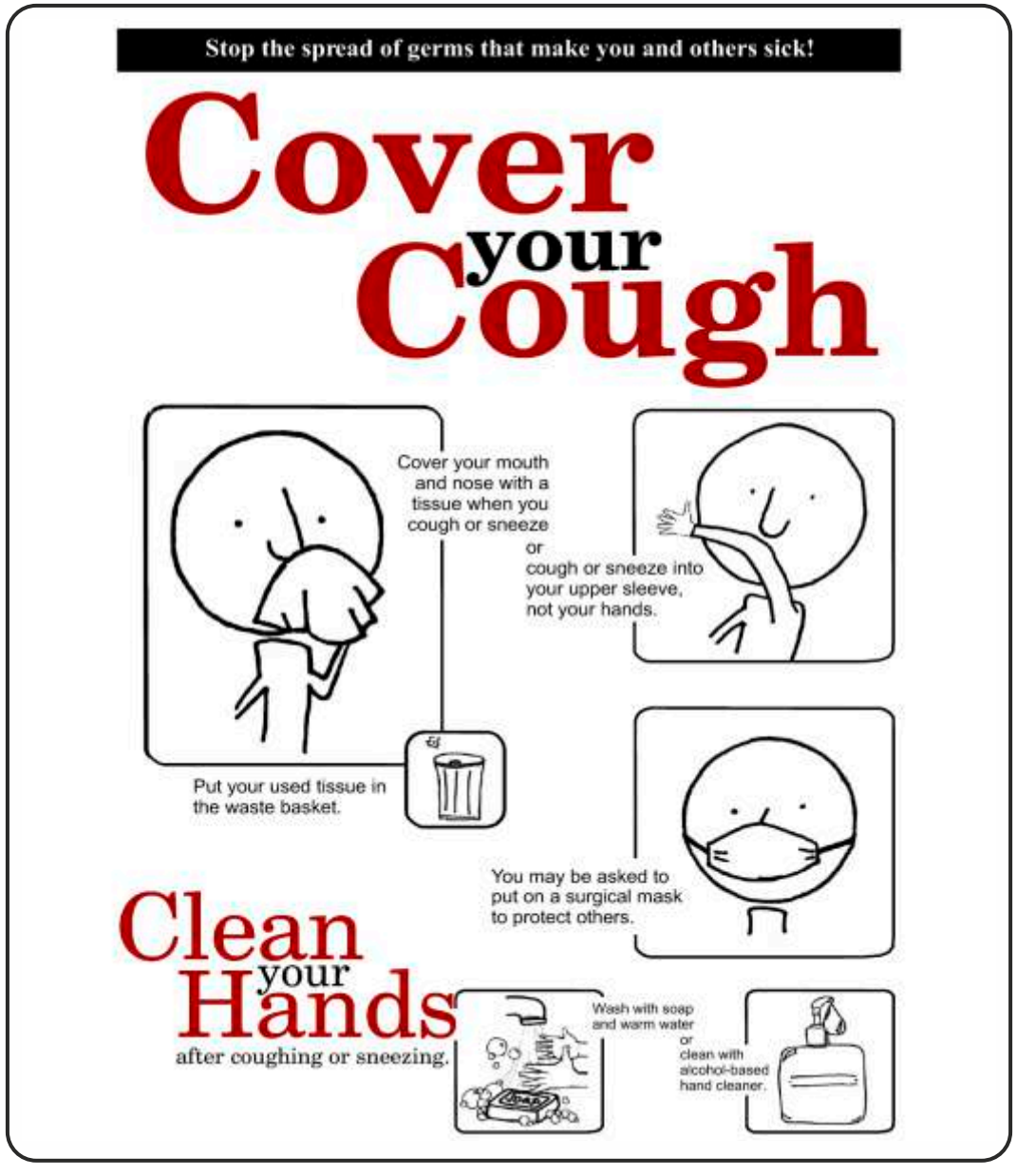


Figure 5.5: Cough etiquette (Source: CDC)

need to be remembered while handling sharps:

- Always dispose your own sharps.
- Never pass sharps directly from one person to another.
- During exposure-prone procedures, the risk of injury should be minimized by ensuring that the operator has the best possible visibility, by positioning the patients, adjusting good light source, and controlling the bleeding.
- Protect fingers from injury by the use of forceps instead of fingers for guiding suturing.
- DO NOT RECAP needles.
- After use, needles and syringes should be locally destroyed /cut by a needle destroyer and these should be collected in a rigid container.
- Locate sharps disposal containers close to the point of use, e.g. in patients room, on the medicine trolley and in the treatment room, etc.
- Dispose used sharps in a puncture resistant container into the blue bag. Never place used and contaminated sharps in any other container.
- Prevent overflow by sending sharps disposal containers for autoclaving and shredding when they are three quarters full.

II. Administration of injections:

The objective is to prevent exogenous infection through needle, syringe, catheters and drugs. The correct techniques are described below:

- Use hygienic hand wash or rub.
- Use sterile drugs.
- Proper cleaning of injection site with alcohol soaked sterile swab should be done and the skin should be allowed to dry before administering the injection.
- Proper handling of drugs:
    - Use single dose vials /ampules where ever possible.
    - Drug vials /ampules should be handled with clean hands.
    - If multi –dose vials are used, then label them properly and cap the vial.
    - Use fresh syringe and needles to pierce the cap each time and fill.
    - Do not leave a needle in place in the stopper of the vial.
    - Whenever opening a glass ampules use a clean gauze piece/pad to protect your fingers. Preferably use a metal file to cut the ampule.

- Ampules should not be used for multiple dose administration.

Hand hygiene

1. Situations where hand hygiene should be performed include:
    a. Before touching a patient
    b. Before exiting the patient care area after touching the patient or the patient's immediate environment
    c. After contact with blood, body fluids or excretions, or wound dressings
    d. Prior to performing an aseptic task (e.g., placing an IV, preparing an injection)
    e. If hands will be moving from a contaminated-body site to a clean-body site during patient care
    f. After glove removal
2. Use soap and water when hands are visibly soiled (e.g., blood, body fluids), or after caring for patients with known or suspected infectious diarrhea (e.g., *Clostridium difficile*, norovirus). Otherwise, the preferred method of hand decontamination is with an alcohol-based hand rub.

PPE

1. Facilities should ensure that sufficient and appropriate PPE is available and readily accessible to HCP
2. Educate all HCP on proper selection and use of PPE
3. Remove and discard PPE before leaving the patient's room or area
4. Wear gloves for potential contact with blood, body fluids, mucous membranes, non-intact skin or contaminated equipment
    a. Do not wear the same pair of gloves for the care of more than one patient
    b. Do not wash gloves for the purpose of reuse
    c. Perform hand hygiene immediately after removing gloves
5. Wear a gown to protect skin and clothing during procedures or activities where contact with blood or body fluids is anticipated
    a. Do not wear the same gown for the care of more than one patient
6. Wear mouth, nose and eye protection during procedures that are likely to generate splashes or sprays of blood or other body fluids
7. Wear a surgical mask when placing a catheter or injecting material into the spinal canal or subdural space.

Safe injection practices

1. Use aseptic technique when preparing and administering medications
2. Cleanse the access diaphragms of medication vials with 70% alcohol before inserting a needle into the vial
3. Never administer medications from the same syringe to multiple patients, even if the needle is changed or the injection is administered through an intervening length of intravenous tubing
4. Do not reuse a syringe to enter a medication vial or solution
5. Do not administer medications from single-dose or single-use vials, ampules, or bags or bottles of intravenous solution to more than one patient
6. Do not use fluid infusion or administration sets (e.g., intravenous tubing) for more than one patient
7. Dedicate multidose vials to a single patient whenever possible. If multidose vials will be used for more than one patient, they should be restricted to a centralized medication area and should not enter the immediate patient treatment area (e.g., operating room, patient room/cubicle)
8. Dispose off used syringes and needles at the point of use in a sharps container that is closable, puncture-resistant, and leak-proof.

Table 5.1 describes the various PPE as per transmission of infection.

5.7 ISOLATION PRECAUTIONS [Table 5.2, 5.3]

Besides standard precautions specific isolation precautions are observed according to the mode transmission of the various conditions to protect health care workers and other patients from cross infections.

Table 5.1: Type of PPE according to the mode of transmission of infection

Type of PPE	Isolation precautions	Mode of transmission is contact (I)	Mode of transmission is droplet (II)	Mode of transmission is airborne (III)
Mask		No	Yes	Yes
Gown		Yes	No	No
Gloves		Yes	No	No

Table 5.2: Isolation precautions during different patient care processes

Process		Precautions
Patient transport		· Receiving department to be informed of precautions · Mask the patient
Environmental cleaning		· Dedicate or change solutions and equipment's after use · Change privacy curtain when isolation is discontinued or patient is discharged
Patient care equipment handling	Special handling	· Dedicated equipment should be used. · Wherever possible, disposables should be used
Visitors		· Gown, gloves for patient care · Wash hands when entering/leaving room · Mask to be worn as directed

Table 5.3: Isolation precautions for various diseases and conditions

- Standard precautions: As described above
- Contact precautions: As in table 5.1 (Category I)
- Droplet precautions: As in table 5.1 (Category II)
- Airborne precautions: As in table 5.1 (Category III)

Disease/Condition	Precaution category	Infective material	Duration for precautions	Comments
Abscess draining, major	Contact	Drainage	Unit drainage	Major: drainage not contained by dressing
Acid fast bacillus positive	Contact	Drainage, air borne		
Acquired immunodeficiency syndrome (AIDS)	Standard	Blood and body fluids		AIDS is a specified communicable disease. For staff safety, refer to chapter on Staff health programme
Actinomycosis	Standard			
Amoebiasis (Dysentery)				
Adult	Standard	Faeces	Duration of symptoms	Consider contact precautions for adults with poor hygiene and /or who contaminate the
Pediatric	Contact	Faeces	Duration of symptoms	
Arthropod borne viral encephalitis (Japanese B Encephalitis)	Standard	Blood and body fluids		
Arthropod borne viral fevers (Dengue)	Standard	Blood and body fluids		Arthropod borne viral fever is a specified communicable disease
Aspergillosis	Standard			
Bronchiolitis				
Adult	Standard			
Pediatric	Contact	Respiratory secretions	Duration of symptoms	Various etiologic agents such as respiratory syncytial virus, parainfluenza viruses, adenoviruses, have been associated with this condition
Candidiasis-All forms including mucocutaneous,	Standard			

Disease/Condition	Precaution category	Infective material	Duration for precautions	Comments
Cellulitis (uncontrolled drainage)	Contact	Drainage	Until drainage contained	
Chancriod (Soft chancre)	Standard			
Chicken pox (Varicella) caused by Varicella zoster virus	Airborne and contact	Respiratory secretions and lesions	Until all lesions are crusted	Negative pressure room is required. Neonates born to mothers with active Varicella should be placed on Airborne and contact isolation at birth Exposed susceptible patients should be placed on airborne and contact isolation beginning 10 days after first exposure and continuing until 21 days after last exposure (up to 28 days if VZIG is given). First exposure is defined as Day one. Consult attending physician to assess need for VZIG. Period of communicability begins 2 days before onset of rash until all lesions are crusted.
Cholera	Contact	Faeces		
Clostridium difficile diarrhea	Contact	Faeces	Until formed stools or no stools X 48 hours	
Clostridium perfringens (Gas gangrene)	Standard			
Congenital rubella	Contact and droplet	Respiratory secretions and urine	During any admission of the 1st year after birth unless nasopharyngeal and urine cultures after 3 months of age are negative for rubella virus	Susceptible persons should stay out of the room

Disease/Condition	Precaution category	Infective material	Duration for precautions	Comments
Conjunctivitis (pink eye) (Acute bacterial, Chlamydial, Gonococcal, Acute Viral)	Standard Contact	Eye discharge	Duration of symptoms	
Croup Pediatric	Contact	Respiratory discharge	Duration of symptoms	Viral Agents such as parainfluenza viruses and influenza A virus have been associated with this condition
Cryptosporidiosis Adult	Standard			Consider Contact precautions for adults with poor hygiene and/ or who contaminate the environment
Cryptosporidiosis Pediatric	Contact			
Cytomegalovirus infection	Standard			
Decubitus ulcer-major	Contact	Drainage	Until drainage contained	Major: drainage not contained by dressing
Dengue	Standard			
Diarrhea, acute	Contact	Faeces	Until formed or normal stools X 24 hours	
Diphtheria (*Corynebacterium diphtheriae*)				
Diphtheria Cutaneous	Contact	Lesion secretions	Until 2 cultures from skin lesions taken at least 24 hours apart after cessation of antimicrobial therapy are negative	
Diphtheria Pharyngeal	Droplet	Respiratory secretions	Until 2 cultures from both nose and throat taken at least 24 hours apart after cessation of antimicrobial therapy are negative for *Cornybacterium diphtheriae*	

Disease/Condition	Precaution category	Infective material	Duration for precautions	Comments
Epiglottitis *Haemophillus influenzae* Type B	Droplet	Respirator secretions	For 24 hours after start of effective therapy	
Epstein barr virus infection (including infectious mononucleoisis)	Standard			
Food poisoning (Botulism, *Clostridium perfringens* or *Staphylococcus*)	Contact	Faeces	Until formed or normal stools X 24 hours	
Furunculosis, staphylococcal (Pediatric)	Contact	Drainage	Until drainage stops	
Gonorrhea	Standard			
Guillain Barre syndrome	Standard			
Helicobacter pylori	Standard			
Viral Hepatitis, Hepatitis A, Hepatitis E				
Adult	Standard			
Pediatric	Contact	Faeces	For 7 days after onset of symptoms	For Hepatitis A & E consider Contact precautions for adults with poor hygiene and/ or who contaminate the environment
Hepatitis B (Hb s Ag +) Hepatitis C and other specified non A and non B	Standard	Blood and body fluids		Hepatitis B & C are specified communicable diseases. For staff issues, refer to chapter on Staff Health
Herpes simplex (Herpes virus hominis)	Standard			
Herpes simplex Neonatal	Contact	Lesion, secretions, possibly all body secretions and excretions	Duration of symptoms	Precautions are indicated for infants delivered either vaginally or by caesarean section (if membranes have been ruptured more than 4-5 hrs) to women with active genital herpes simplex infections, until neonatal HSV infection has been

Disease/Condition	Precaution category	Infective material	Duration for precautions	Comments
Herpes simplex Mucocutaneous, disseminated or primary severe	Contact			
Herpes simplex Mucocutaneous, recurrent skin, oral or genital	Standard			
Herpes Zoster caused by Varicella zoster virus (shingles)				
Herpes Zoster Localized in normal patient	Standard			For localized lesions, try to contain with dressings. Roommates should not be susceptible to chickenpox
Herpes Zoster Localized in immunocompromised patient , and/ or disseminated in any patient	Airborne and contact	Lesion, secretions, possibly respiratory secretions	For 72 hours after start of effective antiviral therapy or if untreated until all lesions are crusted	Negative pressure isolation room required Exposed susceptible patients should be placed on Airborne and contact isolation beginning 10 days after first exposure and continuing until 21 days after last exposure (up to 28 days if VZIG given), First exposure is defined as day one. For staff issues, refer to chapter on Staff Health Programme
Human immunodeficiency virus (HIV)	Standard	Blood and bloody body fluids		HIV is a specified communicable disease, For staff issues, refer to chapter on Staff Health Programme
Influenza	Droplet	Naso-pharyngeal secretions	For 7 days after onset of symptoms Viral shedding may occur longer in younger children	If private room is unavailable, consider cohorting patients with influenza
Leprosy (Hansen's disease)	Standard			
Leptospirosis	Standard			
Malaria	Standard			

Disease/Condition	Precaution category	Infective material	Duration for precautions	Comments
Measles (Rubeola)	Airborne	Respiratory secretions	For 4 days after start of rash, except in immunocompromised patients for whom precautions should be maintained for duration of illness	Negative pressure room is required. Exposed susceptible patients should be placed on Airborne isolation beginning 5 days after first exposure through 21 days after last exposure. For staff issues, refer to chapter on Staff Health Programme
Meningitis Unknown etiology	Droplet	Possibly respiratory secretions	Until etiology known	
Neisseria meningitidis (meningococcal) known or suspected	Droplet	Respiratory secretions	For 24 hours after start of effective therapy	For staff issues, refer to chapter on Staff Health Programme
Haemophilus influenzae Type B known or suspected	Droplet	Respiratory secretions	For 24 hours after start of effective therapy	For staff issues, refer to chapter on Staff Health Programme
Other Bacterial, Fungal meningitis	Standard			Bacterial Meningitis is a specified communicable disease
Aseptic (Viral or nonbacterial) meningitis	Standard			
Ritter's disease (Staphylococcal scalded skin syndrome)				
Adult	Standard			Consider contact precautions for adults with poor hygiene and/ or who contaminate the environment
Pediatric	Contact	Faeces	Until formed or normal stools X 24 hours	
Rubella (German measles)	Droplet	Respiratory secretions	Until 7 days after onset of rash	Exposed susceptible patients should be placed on droplet isolation beginning 12 days after first contact through 26 days after last exposure. For staff issues, refer to staff health programme

Disease/Condition	Precaution category	Infective material	Duration for precautions	Comments
Salmonellosis, Including Typhoid fever or *Salmonella typhi* (case/ carrier)				
Adult	Standard			Consider Contact precautions with poor hygiene and/ or who contaminate the environment.
Pediatric	Contact	Faeces	Until formed normal stools X 24 hours	Typhoid fever is a specified communicable disease
Shigellosis	Standard			Consider Contact precautions for adults with poor hygiene and/ or who contaminate the environment
Pediatric	Contact	Faeces	Until formed or normal stools X 24 hours	
Streptococcal infection (Group A Streptococcus Endometritis (Puerperal sepsis)	Standard			
Skin, wound or burn- major	Contact	Drainage	For 24 hours after start of effective therapy	Major: drainage not contained by dressing
Necrotizing fasciitis, myositis, or other soft tissue necrosis	Contact	Drainage	For 24 hours after start of effective therapy	For staff issues, refer to chapter on Staff Health Programme
Pneumonia				
Adult	Droplet	Respiratory secretions	For 24 hours after start of effective therapy	
Pediatric	Droplet	Respiratory secretions	For 24 hours after start of effective therapy	
Scarlet fever Pediatric	Droplet	Respiratory secretions	For 24 hours after start of effective therapy	
Toxic shock syndrome (TSS)	Standard			
Syphilis	Standard			

Disease/Condition	Precaution category	Infective material	Duration for precautions	Comments
Tetanus	Standard			
Toxoplasmosis	Standard			
Trachoma	Standard			
Tuberculosis (*Mycobacterium tuberculosis, M. africanum, M.bovis*)	Airborne	Respiratory secretions	Prior to discontinuing isolation	Negative pressure isolation room required. For staff issues, refer to staff health programme
Skin test (Mantoux), positive with no evidence of current pulmonary disease	Standard			
Extra pulmonary meningitis, and drainage lesion (including scrofula)	Standard			Assess for pulmonary disease
Urinary Tract infection including pyelonephritis with or without urinary catheter	Standard			

CHAPTER 6

ASEPTIC PRECAUTIONS FOR VARIOUS PROCEDURES

Introduction

The objective of aseptic practices is to reduce endogenous and exogenous sources of infection to patients and health care workers. Some of the indications for aseptic practices are as follows:

1. During care and nursing of patients : Barrier nursing
2. During various therapeutic procedures: Intramuscular injections, CVP line access, etc.
3. During various endoscopic procedures: Bronchoscopy, GI endoscopy
4. During various diagnostic procedures: Bone marrow biopsy

6.1 BARRIER NURSING:

Objectives:

To keep a barrier between infected and non- infected, or sterile and unsterile area to prevent cross infections. Barrier precautions to be taken for various procedures have been enlisted in table 6.1 below:

TABLE 6.1: APPROPRIATE BARRIER PRECAUTIONS FOR DIFFERENT PROCEDURES

S. No.	PROCEDURE	GLOVES	GOWNS	MASKS	EYE PROTECTION
1.	Venipuncture	Yes	–	–	–
2.	Venous cannulation	Yes	–	–	–
3.	Arterial cannulation	Yes	Yes	Yes	±
4.	Urinary catheterization	Yes	–	–	–
5.	Broken skin of HCW*	Double gloves	–	–	–
6.	Nursing of immunocompromised patients	Yes	Yes	Yes	–
7.	General nursing	Yes	Plastic apron	Yes	–
8.	Suctioning (tracheal)	Yes	Yes	Yes	±

S. No.	PROCEDURE	GLOVES	GOWNS	MASKS	EYE PROTECTION
9.	Blood sampling	Yes	–	–	–
10.	ICU/OT (cleaning)	Thick rubber gloves	–	–	–
11.	Protection against aerosol infection	–	–	Yes	Yes
12.	Vaginal delivery	Yes	Yes + Gum boots	Yes	Yes
13.	Specimen and sample handling	Yes	–	–	–
14.	Blood bank	Yes	–	–	–
15.	Laundry	Yes	Plastic apron + footwear	Yes	Yes
16.	Dental procedures	Yes	–	Yes	Yes
17.	Autopsy & embalming	Yes (thick)	Yes (Plastic apron)	Yes	Yes

*If the skin is not intact then the healthcare worker should wear double gloves or stay away from contact with patient's blood or body fluid.

6.2 INJECTIONS (INTRAMUSCULAR AND SUBCUTANEOUS)

Objective:

To prevent exogenous infection through needle, syringe, i.v. cannula, catheters and drugs.

Correct Techniques:

a) Hygienic hand washes or rubs.
b) Use of sterile drugs.
c) Proper cleaning of injection site with alcohol soaked sterile swab should be done and the skin should be allowed to dry before administering the injection.

Proper Handling of Drugs:

a) Use single dose vials /ampules where ever possible.

b) Drug vials /ampules should be handled with clean hands.
c) If multi –dose vials are used then label them properly and cap the vial.
d) Use fresh syringe and needles to pierce the cap each time and fill.
e) Do not leave a needle in place in the stopper of the vial.
f) Whenever opening a glass ampoule, use a clean gauze piece/pad to protect your fingers. Preferably use a metal file to cut the ampule.
g) Ampules should not be used for multiple dose administration.

6.3 PERIPHERAL I.V. CANNULATION /BLOOD SAMPLING

Objective:

To reduce intra -vascular catheter related infections and protect the HCW.

Precautions before the Procedure:

a) Use all sterile items: needles, syringes, cannula and flushing solutions.
b) Before procedure, wash hands as per instructions of hygienic hand wash/ hand rub.
c) Use clean gloves (not necessarily sterile).
d) Disinfect skin at the site of insertion with alcohol soaked swab and wait till dry.
e) Apply povidone iodine for at least 2 minutes or till it is dry (it is not necessary to wipe off the povidone iodine before insertion except in neonates).

Precautions during the Procedure:

a) Proper technique of insertion.
b) Secure the cannula with adhesive tape.
c) If insertion fails then control the bleeding /oozing by applying firm pressure.
d) Do not touch the clean area unless wearing sterile gloves.
e) It soiling of hands occurs, wash immediately.

Precautions *in situ*:

a) Do not rub the vein in the hope of facilitating flow.
b) Replace I.V. sets no more frequently than every 72 hours.
c) Replace the tubings used to administer blood/blood products, fat emulsion within 24 hours of use.
d) Clean injection ports and stop cocks with alcohol swabs/povidone iodine.
e) Promptly remove the I.V. cannula in case of cannula site inflammation.
f) Replace the I.V. cannula every 72-96 hours or earlier if there is any evidence of phlebitis or cannula site inflammation.

g) Change the cannula site dressing promptly if it becomes damp, loosened or visibly soiled.
h) Do not give fluids and drugs through the TPN lines.
i) Do not use stock solutions for flushing. Use single dose ampoules for this purpose.

Precautions after Removal:

a) Remove the plaster /dressing.
b) Clean the area around the insertion of the needle with spirit and povidone iodine.
c) Remove the cannula.
d) Keep firm pressure over the puncture site with a sterile swab till the oozing stops.

6.4 CENTRAL VENOUS CANNULATIONS / ARTERIAL CANNULATION

Objectives:

To decrease the incidence of catheter related infections (Blood stream infection).

Precautions before the Procedure

As discussed for I.V. Cannulation; however, surgical hand washing should be done.

a) Sterile gloves should be donned.
b) In addition, the person performing the procedure should wear a face mask and goggles.
c) Sterile gown should also be worn especially for central venous cannulation.
d) The site for insertion should be draped with sterile sheets after cleaning and disinfecting the area.

Precautions during the procedure

a) As for peripheral I.V. cannulation.
b) Trained personnel only should perform the procedure.
c) Use a catheter with minimum number of ports required for management. Preferably subclavian vein should be used for Central Venous Cannulation to minimize infection.
d) Use a sterile gauze to secure the cannula/catheterization. Cover the site with permeable sterile semitransparent dressing or sterile gauze.
e) If the patient is sweating excessively or the site is bleeding or oozing then a gauze dressing is preferable.

Precautions *in situ*

a) Asepsis should be maintained during administration of medications/blood sampling and during infusion and flushing.
b) Do not keep the cap over unsterile area and care should be taken not to touch the middle part of the cap.
c) Tip of medication syringe should not touch unsterile area.
d) Flush after administration of medication.
e) Injection ports should be closed and covered with sterile gauze.
f) Replace the gauze dressing after every 48 hours.
g) Transparent dressing should be changed every 7 days or earlier if it gets visibly soiled or loosened.
h) The cannula/catheter should be removed when evidence of thrombophlebitis occurs in the surrounding area or positive evidence of catheter related bacteremia is discovered.
i) If sampling is done, port should be flushed with sterile heparinized saline. If port of a 3-way is smeared with blood, replace the same with a sterile one.
j) Fluids and drugs should not be given through the TPN line.
k) Use pressure bags during rapid transfusion. Avoid pushing through the three ways.
l) If transducer is used for pressure monitoring, avoid blood soiling or entering into the transducer.
m) Try to keep I.V. set and the cannula /catheter as a closed system. Repeated connections and disconnections should be avoided.

Precautions during and after Removal

a) Use sterile gloves.
b) Keep sterile blade/scissor, specimen bottle ready for sending the tip of the cannula /catheter for culture.
c) Remove the plaster and dressing carefully.
d) Clean the area surrounding the cannula.
e) Remove the catheter and the tip should be sent for culture /sensitivity to microbiology laboratory along with a peripheral blood sample for culture.
f) Puncture site should be covered with sterile dressing and tape.
g) Dressing should be removed after 24 hours.

6.5 URINARY CATHETERISATION

Objectives

To reduce the risk of hospital acquired urinary tract infection.

Precautions before the Procedure

Catheterization should be done only when necessary. If possible, other means of urinary drainage should be resorted to.

a) Catheters should be inserted by trained personal taking due sterile precautions. Appropriate size of catheter should be selected for proper drainage.
b) All items should be sterile and strict asepsis should be maintained.
c) Sterile gloves should be worn after hand washing.
d) Site should be prepared using povidone iodine and should be draped with sterile sheet before catheterization.

Precautions during the procedure

a) Open the pack carefully and take out the catheter. Do not touch the tip of the catheter.
b) Apply sterile lubricating jelly which should ideally be available in single use packs.
c) Insert the catheter, taking care that the tip of the catheter should not touch any area outside the urethra.
d) After insertion secure the catheter properly to prevent movement and urethral traction.
e) Use a sterile, continuous, closed drainage system.

Precautions *in situ*

a) Avoid raising the level of the urine collection bag or tubing to such a height that causes a backflow particularly during transportation of the patient.
b) Hang the urine bag to the hook attached to the bed.
c) Do not let the bag touch the floor.
d) Hands should be washed (hygienic hand wash) before and after handling the catheter.
e) Empty the bag as required with sterile precautions.
f) Unnecessary disconnection of the urinary bag should not be done.
g) The collecting bag and tubing should not be changed frequently unless it is overtly contaminated.

h) If a urine sample for culture has to be taken, clean the area over the catheter with an alcohol swab and then aspirate with a sterile syringe and needle. On removal of the needle there is no need to seal the site.
i) Do not change catheters routinely unless there is definite evidence of infections.
j) Do not flush or irrigate obstructed catheters. It should be removed and replaced if required.
k) Routine hygienic care of the perineal area to prevent soiling of the catheter should be done daily.

Precautions after Removal

a) The catheter should be removed as soon as possible.

6.6 OPERATIVE PREPARTIONS

Objective

To reduce the surgical site infection. This can be achieved by keeping the surgical site clean and reducing the number of microorganism on the skin/mucosa.

Pre –operative preparations

a) Proper bathing a day prior to surgery preferably with medicated soap or solution such as 4% chlorhexidine solution. Preferably 2-3 baths at an interval of 8-10 hours should be taken.
b) Infection at any site should be preferably treated before an elective surgery.
c) Do not shave the surgical site in the ward. However if hair has to be removed it should done before the surgery in O.T with electric clippers (depilatory creams may be used).
d) Patient should wear clean hospital clothes for surgical procedures; for cardiac, neuro –surgical or transplant patients, autoclaved, sterile hospital clothes should be used.

Surgical Site Preparation in the O.T.

a) Appropriate antimicrobial prophylaxis should be administered according to the unit/department policy.
b) The part to be operated should be thoroughly cleaned using a medicated solution or soap to remove any dirt.
c) Use appropriate antiseptic agent for skin preparation e.g. 4% chlorhexidine or povidone iodine using circular strokes moving from centre to periphery.
d) A final application of chlorhexidine in an alcohol base should be painted on to the

prepared part and should be allowed to dry.

e) The prepared area must be large enough to extend the incision or create new incisions or drain sites if needed.

f) All other sterile precautions in the O.T. should be followed stringently.

Post-Operative Incision Care

a) Cover the incision that has been sutured primarily, with a sterile dressing for 48 hours.

b) Wash hands before and after changing the dressing and before any contact with the surgical site.

c) Use sterile techniques to change the dressing.

6.7 ENDOTRACHEAL INTUBATION

Objective

To reduce the incidence of ventilator associated pneumonia.

Precautions before Endotracheal Intubation

a) Hand hygiene should be performed.

b) Take barrier precautions (using of gloves, mask).

c) Use sterile single use endotracheal tube, and clean, disinfected laryngoscope.

Precautions during Endotracheal Intubation

a) During laryngoscopy and endotracheal intubation care should be taken to ensure that the sterile tube does not touch external surfaces.

b) In case a stylet is required, all care should be taken not to contaminate the sterile tube while inserting the stylet and the tip of the stylet should not project beyond the endotracheal tube tip.

c) The tube should be secured properly.

d) The endotracheal tube should be connected with sterile accessories and breathing circuit.

Precautions *in situ* (same as ventilator and circuit care)

a) Aseptic technique should be adhered to during suctioning.

b) Use single use sterile suction catheters separately for oral and endotracheal suction.

c) While disconnecting the endotracheal tube from circuit, keep the open end of angle connection on a sterile pad. Do not keep it over the patient's chest or bed.

d) Change angle connection and corrugated tubing every 24 hours or when visibly soiled.
e) Preferably use disposable ventilator circuit; there is no need to change the circuit unless it is visibly soiled. Change the reusable breathing circuit after 72 hours or whenever it is visibly soiled.
f) Sterile water should be used for humidifier chamber.
g) Wash your hands each time before and after suction and physiotherapy.

Precautions during and after extubation

a) Extubate, when all criteria are fulfilled.
b) Protective attire and standard precautions should be strictly followed.
c) Separate suction catheter for oral and endotracheal suction should be used.
d) After a thorough suction (both oral and tracheal) and oxygenation, the cuff is deflated if present and the tube is removed.
e) Ask the patient to clear the throat and bring out the secretion at the lips and suck out if feasible.
f) Clean the mouth and apply oxygen mask.

6.8 MECHANICAL VENTILATION

Precautions during mechanical ventilation

a) Do not routinely change the ventilator circuit (tubing, exhalation valve and humidifiers) more frequently than 72 hours unless visibly soiled or mechanically malfunctioning.
b) Periodically drain and discard any condensate that collects in the ventilator tubings. The condensate should not be allowed to drain towards the patients.
c) Sterilize reusable breathing circuits /ventilator tubings or subject them to high level disinfection between uses on different patients.
d) Use sterile water to fill humidifiers. Always empty the contents when the water level falls below the desired level and refill afresh.

6.9 ENDOTRACHEAL SUCTION

a) All standard precautions to be taken.
b) New sterile, suction catheter to be used with each suction.
c) If possible, single use saline containers should be used for each suction.

CHAPTER 7

INFECTION CONTROL IN LAUNDRY AND LINEN SERVICES

INTRODUCTION

Linen in the hospital setting is an important marker of quality of services in the hospital. Most of the quality assessment of services of a health facility from a patient's perspective comes from his experience with food, linen, and washrooms of the hospital. Careful and safe laundering of the hospital linen, therefore, becomes an important responsibility of the hospital manager. Evidences of recent times have suggested hospital linen could be an important source of infection when not maintained properly.

Reports have suggested the presence of a number of micro-organisms in hospital linen at various places including moulds, Staphylococcal species, Corynebacterium spp, MRSA, *C. difficile*, gram negative bacilli, Micrococcus and Enterococcus species, Rotaviral RNA, Parainfluenza virus and many others. Risk may be both to the patients as well as the employees of the hospital.

7.1 INFECTION CONTROL IN LAUNDRY AND LINEN SERVICES

Hospital linen may be of various categories such as bed linen, garments, OT linen or staff uniform which undergo processing at various levels. Most infection control measures need to be targeted in the following steps of laundering:

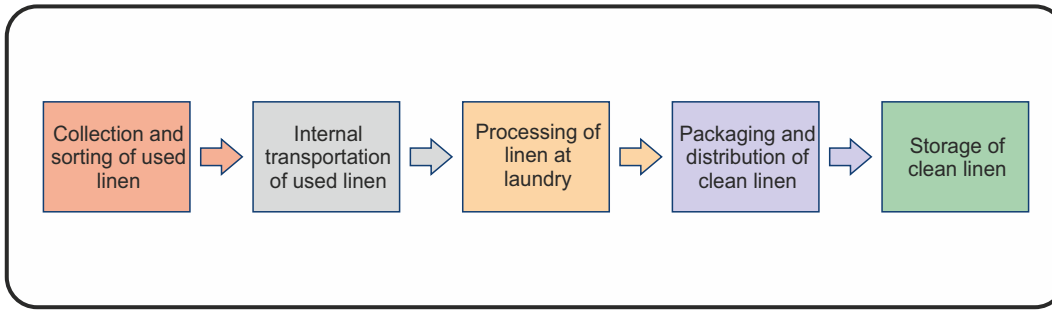


Figure 7.1: Steps of linen movement in the hospital

Measures of infection prevention therefore need to be targeted towards the following steps of processing linen:

PROCESS	INFECTION CONTROL MEASURES
Collection and sorting of used linen	o The place for sorting of used linen should be away from any patient care area. o The space should be well lit and ventilated. o Soiled linen should be handled as little as possible o Appropriate personal protective measures should be adopted by the person handling used linen. Soiled and dry linen should be kept separately. o Sorting should be performed carefully to prevent any needle stick injury as often soiled drapes, etc. may contain sharps. o Count of the different types of linen should be maintained during sorting so that there is no need for handling the same for counting again. o Provision should be made to store the heavily soiled linen separately from those that are not heavily soiled. o Use of color coded laundry bins for the same may be used of fixed structures as already exists in some of the wards. o Collection of used linen should be done at such times so as to avoid public rush hours.
Internal transportation of used linen	o Appropriate personal protective equipment may be used by the hospital worker involved in transportation of the used linen. o An adequate sized laundry trolley should be available for the same. o There should be no over loading of carts/ trolleys with used dry or soiled linen. While transportation of the trolleys/ carts, they may be adequately covered using clean/used linen or with proper trolley covers. However, it should not be soiled one. o The person carrying these used linen in the trolleys should used an earmarked passage for the same preferably low traffic areas of the hospital. o In case they need to use the corridors or routes with higher traffic, they should announce aloud so that people may move aside to give way for these trolleys o Speed of pulling the trolleys should be controlled so that they do not bang or touch the side walls or any other structure of the hospital.

PROCESS	INFECTION CONTROL MEASURES
Processing of the linen at laundry	o When used linen is brought to the area of laundering, they should be received from a route that is not used for carrying clean linen. o All linen items should be thoroughly washed before reuse. o Decontamination of linen prior to washing is not necessary except for soiled linen of HIV and HBV patients, otherwise the fabric deteriorates early. o Appropriate personal protective measures should be adopted by workers during washing and drying also (such as plastic/ rubber apron). o Soiled linen should be washed separately from non-soiled linen. o Those heavily soiled may be pre-soaked in soap, water and bleach. o Washing linen at 70-80 degree C for over 20 minutes with a detergent is an effective method to clean and reduce bacterial count. o Washing may be repeated if linen appears unclean. o Clean linen should be completely dried after washing. o After total drying they should be checked for holes, thread bare areas and repaired accordingly. o Clean and dry linen should be calendared as required and packed for distribution. o Linen likely to go for sterilization need not be calendared as steam penetrability is reduced after ironing linen.
Packaging and distribution of clean linen	**Storing Clean Linen** o Keep clean linen in clean, closed storage areas. o Wash hands before handling clean linen. o Use physical barriers to separate folding and storage rooms from soiled areas. o Keep shelves clean. o Handle stored linen as little as possible. o Area of storage should be free from moisture and dust. **Transporting and Distribution of Clean Linen** o Clean and soiled linen should be transported in separate carts/trolleys. o They should be labeled to avoid confusion. o Carts or trolleys should be washed according to schedule. o Clean linen must be wrapped or covered when transporting to avoid contamination.

PROCESS	INFECTION CONTROL MEASURES
Storage of clean linen	o Protect clean linen until it is distributed for use. o Do not leave extra linen in patients' rooms. o Handle clean linen as little as possible. o Avoid shaking clean linen. It releases dust and lint into the room. o Clean soiled mattresses before putting clean linen on them.

7.2 RECOMMENDED PPE FOR PERSONNEL PROCESSING LINEN

1. Gloves (preferably household utility gloves) and closed shoes that protect feet from dropped items (sharps) and spilled blood and body fluids, should be used when:

   Handling disinfectant solutions
   Collecting and handling soiled linen
   Transporting soiled linen
   Sorting soiled linen
   Hand washing soiled linen
   Loading automatic washers

2. Plastic or rubber apron and protective eyewear should be worn when

   Sorting soiled linen
   Hand washing soiled linen
   Loading automatic washers

7.3 INFECTION PREVENTION MEASURES FOR LAUNDRY WORKERS:

1. Use of personal protective equipment such as gloves, plastic/rubber aprons, gowns, and facemask, and gum boots should be practiced as a protocol.
2. Workers should be immunized against tetanus and Hepatitis B.
3. Protocol should be established for workup and treatment of workers sustaining needle stick injury while processing linen.
4. Regular training and instructions to the workers regarding safe handling of linen.

7.4 QUALITY CHECK ON LAUNDERING PROCESS AT AIIMS:

The HIC lab in the Department of Microbiology has standardized the following SOPs for bacteriological quality of laundered linen or dry cleaned blankets at AIIMS hospital which will be used for random checks of quality of laundry processes.

1. Under sterile conditions, cutout 10 cm X 10 cm area of a laundered /dry-cleaned fabric.
2. With the sterile forceps place it on sterile culture plate for 15-20 minutes.
3. Remove the cloth sterile forceps and transport plate to the Microbiology lab.
4. The plate is to the incubated at 37^0C for 24 hrs, and observed for bacterial growth.
5. If the numbers at colonies are $\geq$ 20 it will be considered unsatisfactory process.

7.5 OTHER IMPORTANT MEASURES:

1. Laundry floors and work areas should have a regular cleaning schedule using an EPA registered disinfectant.
2. Areas should be vacuumed to remove lint.
3. Wet-vacuumed pick-ups should be used for terminal cleaning.
4. Casual visitors should not be allowed inside the laundry.

CHAPTER 8

HOUSEKEEPING ACTIVITIES

All healthcare environments should pose minimal risk to patients, staff and visitors. However, different functional areas represent different degrees of risk and, therefore, require different cleaning frequencies, and levels of monitoring and evaluation. Dry conditions favour the presence of gram – positive cocci in dust and on surfaces, whereas moist, soiled environments favour the growth and persistence of gram-negative bacilli. Fungi are also present in dust and proliferate in moist, fibrous material.

For the sake of ease, a functional area refers to any area in a healthcare facility that requires cleaning. As per the National Guidelines for Clean Hospitals by the Ministry of Health and Family Welfare, the areas have been divided into the following:

- **High risk areas**
- **Moderate risk areas**
- **Low risk areas**

High Risk Areas require consistently high cleaning standards to be maintained. Required outcomes will only be achieved through intensive and frequent cleaning. For **moderate risk areas**, outcomes should be maintained by regular and frequent cleaning with 'spot cleaning' in-between. For **low-risk areas**, high standards are required for aesthetic and to a lesser extent, hygiene reasons where outcomes should be maintained by regular and frequent cleaning with 'spot cleaning' in-between. The division of the patient care areas in a hospital is enumerated in Table 8.1.

Table 8.1: Classification of Hospital areas into risk categories

High Risk areas	Moderate risk areas	Low risk areas
✓ Operation theatre units including recovery area – Major & minor ✓ Intensive care units/ Cardiac care units/Neonatal ICU etc. ✓ High dependency units ✓ Emergency department/casualty ✓ Labour room ✓ Post operative units ✓ Surgical wards ✓ Central sterile supply department/Theatre sterile supply unit ✓ Radiation Treatment Areas ✓ Chemotherapy ward/room ✓ Renal Dialysis facility ✓ Isolation wards/ rooms & attached internal areas like bathrooms / toilets	✓ Medical and allied wards ✓ Laboratory areas ✓ Blood bank ✓ Pharmacies ✓ Dietary services ✓ Laundry services ✓ Mortuary ✓ Nurses/ Doctors rest rooms ✓ Rehabilitation Areas ✓ Psychiatry wards	✓ Departmental areas/office areas ✓ Outpatient department ✓ Non sterile supply areas ✓ Libraries ✓ Meeting Rooms ✓ Medical records section ✓ Stores section ✓ Manifold services/room ✓ Telephone rooms, electrical, mechanical, External surroundings ✓ Staff areas

Cleaning is a form of decontamination that renders the environmental surface safe to handle by removing organic matter, salts and visible soils. The physical action of scrubbing with detergents and surfactants and rinsing with water removes large number of microorganisms from surfaces. Most, if not all, housekeeping surfaces need to be cleaned only with soap and water or a detergent/disinfectant depending on the nature of the surface and the type and degree of contamination. Cleaning and disinfection schedules and methods may vary according to the area of the hospital, type of surface to be cleaned and the amount and type of soil present. Housekeeping surfaces can be divided into two groups:

a. Those with minimal hand contact (e.g. floors, walls, ceilings, etc.)
b. Those with frequent hand contacts (e.g. door knobs, bed rails, light switches etc.)

Extraordinary cleaning and decontamination of floors in health care setting is unwarranted. Use of disinfectants for floors has no significant advantage over cleaning with detergent and water. Newly cleaned floors become rapidly re-contaminated with airborne microorganisms and those transferred from shoes, equipment wheels and body substances.

Methods that produce minimal mists/aerosol and dispersion of dust in patient care areas is preferred. Dry dusting and brooms should not be used. Floors should be mopped daily including the evening and night shifts and whenever soiled, with a hospital grade disinfectant/ detergent solution mixed according to the manufacturer's recommendations. A clean, dry mop head should be used each time the floors are mopped. Always use freshly prepared reconstituted cleaning solutions.

General cleaning procedures

1. **Walls:** Method of cleaning may vary according to the area of the hospital

   a) **Operation Theatres:** Daily thorough cleaning is necessary.
   b) **Intensive Care Units:** Clean walls when dirty or soiled and also according to the ICU protocol.
   c) **General wards**: Routine disinfection is not necessary, unless visibly soiled or dirty.

2. **Floors:** Use wet cleaning or dust attracting mop or a vacuum cleaner with a filtered exhaust. Disinfection may be required in areas of high risk (OT, ICU, HDU, Dialysis unit and procedure rooms, etc.) and also where the number of potential pathogens is thought to be high.

3. **Windows, window frames and window grills:** Should be cleaned on a regular schedule (as per ward/ICU/HDU schedule) but do not require daily cleaning.
4. **Air:** Ensure good ventilation with filtered air in OTs, ICUs and isolation rooms. Ensure air filters are changed as per recommendations and maintain the record of the same.
5. **Baths:** Thorough cleaning with detergents is recommended. For surgical units, disinfection with chlorine releasing solutions may be done.
6. **Wash bowls and bed pans:** Thorough cleaning with detergent and hot water. Keep them dry.
7. **Furniture and fixture:** should be cleaned daily with a wet duster.
8. **Cubicle curtains: S**hould be laundered every week or during terminal cleaning following treatment of an infectious patient.
9. **Clean and disinfect high touch surfaces** (e.g. door knobs, bedrails, light switches, surfaces in and around toilets in patients rooms) on each shift and whenever visibly soiled, compared to that for minimal touch housekeeping surfaces.
10. **Bedding:** sorting of soiled and dry linen is advisable and store in sluice room in separate drums. Dry and wet linen should be collected by laundry personnel separately. Never mix dry and wet linen. The linen which is soiled with blood and body fluids of patients with HIV and HBV infection should be treated with 1% sodium hypochlorite solution and should be sent along with wet linen. Both wet and dry linen should be sent to the laundry in covered impermeable trolleys.
11. **Bed frames:** Clean with detergent and dry. If contaminated with blood or body fluids clean with phenolics (5% Carbolic acid) or 1% sodium hypochlorite solution.
12. **Bed pans:** preferably individual bed pans should be used. In patients with enteric infections, chemical disinfectants (1% sodium hypochlorite solution) can be used if multiple use bedpans are used.
13. **Blankets:** Dry cleaning for woolen blankets is advocated.
14. **Bowls:** Surgical bowls can be autoclaved.
15. **Crockery and cutlery** (including food trays)**:** Clean with detergent and hot water, store dry.
16. **Furniture and fittings** (including locker tops)**:** Wet mopping with detergent. In known contaminated and special areas, disinfect using phenolics (5%

Carbolic acid) or 1% sodium hypochlorite solution.

17. **Mattresses and pillows:** Use water impermeable covers. Wash with detergent solution and dry. If contaminated, disinfect with phenolics (5% Carbolic acid) or 1% sodium hypochlorite solution.
18. **Mops:** Should be rinsed after each use, wrung and stored dry. If disinfection required then use 1% sodium hypochlorite solution for 30 minutes, then rinse and dry.
19. **Sputum container:** Preferably use disposables.
20. **Toilet seats:** Wash with detergent and dry. After use by an infected patients or when grossly contaminated mop with phenolics (5% Carbolic acid) or 1% sodium hypochlorite solution.
21. **Trolley tops:** Clean with detergent and dry. If disinfection is needed then use 70% isopropyl alcohol or phenolics (5% Carbolic acid) or 1% sodium hypochlorite solution.
22. **Urinals:** Use preferably individual urinals; clean with hot water and detergent.
23. **Mackintosh (Rubber Sheet):** Use preferably individual Mackintosh. Clean with water and detergent and dry it.

8.2 PROCEDURES FOR CLEANING ISOLATION AREAS /ICUs

The strategies for areas housing immuno-suppressed, critically ill patients include:

- Wet dusting horizontal surfaces daily with clean cloth pre-moistened with a hospital disinfectant.
- Exercises caution when wet dusting equipment and surfaces above the patient to avoid patient contact with detergent/disinfectant.
- Regular cleaning and maintenance of equipment to ensure efficient particle removal.

The guidelines for cleaning the isolation areas/ICUs are:

- An approved disinfectant – detergent solution should be prepared fresh for each cleaning.
- After cleaning the isolation room, mops and cleaning cloths should be laundered before being reused.
- Dirty water and used disinfectant solutions should be discarded and the buckets and basins disinfected before being refilled. Items used in a contaminated isolation area must not be taken into another area.

- Linen should be carefully removed from the bed and transported in a bag.
- All waste material should be disposed off properly according to established BMW guidelines.

8.3 PROCEDURES FOR TERMINAL CLEANING

- Every item in the room must be cleaned with an appropriate hospital germicidal solution.
- Linen should be stripped from the bed, with care taken not to shake linen. Linen should be folded away from the person and folded inward into a bundle, then removed with minimal agitation.
- When applicable, all reusable receptacles such as drainage bottles, urinals, bedpans, etc. should be emptied and rinsed with phenolics (5% Carbolic acids) or 1% sodium hypochlorite solution.
- All equipment that is not to be discarded, such as IV poles, ventilators and suction machines, should be cleaned thoroughly with phenolics (5% Carbolic acids) or 1% sodium hypochlorite solution.
- When applicable, mattresses and pillows covered with durable plastic covers should be washed /cleaned with phenolics (5% Carbolic acids) or 1% sodium hypochlorite solution.
- Beds and furniture should be carbolized with phenolics (5% Carbolic acids) or 1% sodium hypochlorite solution.
- Wastebaskets should be thoroughly washed with phenolics (5% Carbolic acids) or 1% sodium hypochlorite solution after trash has been removed.
- Walls and ceilings need not be washed entirely, but areas that are obviously soiled should be washed with phenolics (5% Carbolic acids) or 1% sodium hypochlorite solution.

8.4 PROCEDURE FOR CLEANING OPERATION THEATRES

The operation theatre air may contain microbial-laden dust, skin squames, or respiratory droplets. The microbial level in the OT air is directly proportional to the number of people moving about in the room. Therefore, efforts should be made to minimize personal traffic during operations. OTs should be maintained at positive pressure with respect to corridors and adjacent areas; this prevents airflow from less clean areas into more clean areas. All ventilation or AC systems in hospital should have two filter beds in series, with the efficiency of the first filter bed being $\geq 30\%$ and that of the second$\geq 90\%$. Conventional OT ventilation systems should produce the minimum of 15-20 air changes of filtered air per hour, three of which must be fresh

air. Air should be introduced at the ceiling and exhausted near the floor. The OT doors should be kept closed except as needed for passage of equipment, personnel and the patient.

Environmental surfaces in Operation Theatres are only very rarely the source of pathogens important in the development of surgical site infections. Nevertheless, it is important to perform routine cleaning of these surfaces to re-establish a clean environment after each operation.

TABLE 8.2: HOUSING KEEPING AND DISINFECTION ROUTINES

S. No.	Name	Disinfectant/Germicidal Solution	Frequency	Other Considerations
1	Floors • Corridors/ Cubicles • Pantry • Sluice Room • Toilets/ Bathrooms	Washing Detergent with water	Every day and in each shift	Do not sweep or do dry dusting. All holes and crevices in the floors, walls and ceilings should be sealed. Do not use glutaraldehyde
2	Walls	Water and detergent (Soap Solution)	Once a week	If soiled or stained
3	Fans	Wet Mop with water	Once in two weeks	
4	Air conditioners	Vacuum Cleaning	Once a week around window A/C; Once in two weeks for split A/C	Before restarting A/C after a long period of nonuse, call plant technician for cleaning.
5	Glass (windows/Doors)	Glass cleaning solution	Once in a week	Whenever needed
6	Refrigerators	Defrost and clean with soap solution	Once in a week	
7	Sinks/ washbasins	Cleaning solution (e.g. Soap/Detergent)	Daily in each shift	Whenever necessary
8	Buckets	Soap and water	Daily in the morning shift, after picking up bio medical waste bags; tharough cleaning once in a week	Dry after cleaning and put respective color coded polythene bags

**The frequency of cleaning / disinfection may vary according to the risk categories as defined in the National guidelines.*

CHAPTER 9

SPILL MANAGEMENT

9.1 INTRODUCTION

Spills of blood and body fluids should be cleaned up and the surfaces decontaminated in such a manner as to minimize the possibility of workers becoming exposed to infection agents, including HIV, HBV. The protocols have been clearly defined by WHO and CDC.

There are 2 types of spills:

Small spills: For decontamination of small spills i.e. <10 ml, 1:100 dilution of sodium hypochlorite solution should be used.

Large spills: For decontamination of large spills i.e. ³ 10 ml, or culture spills in laboratory, a 1:10 dilution of sodium hypochlorite solution should be used for first application (before cleaning) to reduce the risk of infection before cleaning. After first application, any visible organic matter should be removed with absorbent material (paper towels etc.) and then, a terminal disinfection with 1:100 dilution sodium hypochlorite solution should be done.

By using the absorbent material, first remove the spill bio-load and dispose it in yellow polythene bag.

Place absorbent material over the spilled area and then pour 1% sodium hypochlorite solution

*A 1:100 dilution of 5.25- 6.15% sodium hypochlorite solution provides 525 to 615 ppm of available chlorine.

9.2 SPILLAGE KIT

Spillage Kit should be made available in all patient care areas of the hospital. The kit contains PPE (Mask, Cap, Shoe cover, Heavy duty gloves, gown, plastic apron, goggles, gum boots), yellow polythene bag, absorbable materials (paper/waste cloth/ duster), sodium hypochlorite solution, cleaning up scoop and scrapper, spillage slides (Figure 9.1).

Figure 9.1: Spillage kit

General recommendations for cleaning blood spills

1. Small spills should be managed with one step procedure. (using 1% sodium hypochlorite solution)
2. Appropriate personal protective clothing should be worn for cleaning up a blood spill. Household heavy duty gloves should be worn during cleaning and disinfecting procedures. If the possibility of splashing exists, the worker should wear a face mask and gown. For large blood spills overalls gowns or aprons, boots and protective shoe covers should be worn. Personal protective clothing should be changed if torn or soiled, and always removed before leaving the location of spill after washing hands.
3. The blood spill area must be cleaned of obvious organic material. The organic material should be first removed with disposable towels or paper and be discarded it in a yellow plastic waste receptacle
4. After removing organic material, the area should be covered with absorbable material such as paper or cloth and 1% sodium hypochlorite solution is poured over the spread and left for 10-15 minutes, then wipe and discard the material in a yellow plastic waste receptacle.
5. After disinfection, thorough cleaning of the floor with soap and water is necessary.
6. The treated area should be cleaned and allow it to dry.
7. Care must be taken to avoid splashing or generating aerosol during the clean-up.

CHAPTER 10

BIOMEDICAL WASTE MANAGEMENT AT AIIMS

Appropriate management and disposal of hospital waste is one of the important ways of reducing hospital acquired infection. The biomedical waste management policy followed at AIIMS is as per the Biomedical Waste Management Rules 2016, notified by the Ministry of Environment, Forest and Climate Change, Government of India as per the gazette notification dated 28th March 2016. Till this notification, AIIMS had been following the Bio-medical Waste (Management & Handling) Rules 1998 notified by the same ministry. At present, the biomedical waste management at AIIMS has been outsourced to a common biomedical waste management facility.

10.1 CATEGORIZATION OF BIO-MEDICAL WASTE

As per the 1998 Rules, biomedical waste had been classified into10 categories and to be disposed off in four different colour coded bins/bags. However, in the Biomedical Waste Management Rules 2016, four colour coded categories have been defined, including their methods of disposal. Details of segregation, treatment and disposal have been provided in Appendix III. The following table enlists the various categories of biomedical waste along with their segregation and method of collection.

TABLE 10.1: CATEGORIES OF BIO-MEDICAL WASTE (2016)

CATEGORY	TYPE OF WASTE	TO BE COLLECTED IN
YELLOW	**(a) Human Anatomical Waste**	Yellow colored non-chlorinated plastic bags
	(b)Animal Anatomical Waste	Yellow colored non-chlorinated plastic bags
	(c) Soiled Waste	Yellow colored non-chlorinated plastic bags
	(d) Expired or Discarded Medicines	Yellow colored non-chlorinated plastic bags or

CATEGORY	TYPE OF WASTE	TO BE COLLECTED IN
	(e) Chemical Waste	Yellow coloured containers or non-chlorinated plastic bags
	(f) Chemical Liquid Waste	Separate collection system leading to effluent treatment system
	(g) Discarded linen, mattresses, beddings contaminated with blood or body fluid	Non-chlorinated yellow plastic bags or suitable packing material
	(h) Microbiology, Biotechnology and other clinical laboratory waste	Autoclave safe plastic bags or containers
RED	**Contaminated Waste (Recyclable)**	Red colored non-chlorinated Plastic bags or containers
WHITE (TRANSLUCENT)	**Waste sharps including Metals**	Puncture proof, leak proof, tamper proof containers
BLUE	**(a) Glassware**	Cardboard boxes with blue colored marking
	(b) Metallic Body Implants	Cardboard boxes with blue colored marking

DISPOSE YOUR WASTE HERE
FOOD
PAPER
OTHERS
PLASTERS
COTTON SWABS
EXPIRED MEDICINES
CYTOTOXIC DRUGS
BLOOD BAGS
CATHETERS
SYRINGES
WITHOUT NEEDLES
URINE BAGS
NEEEDLES
SYRINGES WITH
FIXED NEEDLES
SCALPEL BLADES
SHARPS
GLASSWARE
METALLIC
BODY
GENERAL
WASTE
BLUE

10.2 THE PROCESS FLOW OF BIOMEDICAL WASTE MANAGEMENT IN AIIMS HOSPITAL

A. GENERATION

Waste is generated from different areas in the hospital. Major part of it is the general waste which after segregation is dealt as per the Municipal Solid Waste (Management & Handling) Rules, 2000. Most part of biomedical waste is, however, produced in the laboratories, OTs and inpatient areas during dressings and other procedures. Excluding the general waste, the hospital and the centers on an average generate 2000 Kgs of biomedical waste daily.

B. SEGREGATION

This step is vital to a good biomedical waste management system. It may be defined as the separation of various waste into the colour coded bins/ plastic bags or other colour coded containers. The best course of action is to segregate the waste at the point of generation itself by the generator.

C. PRE-TREATMENT

At AIIMS, there are needle destroyers available in every area of patient care for destruction of needles and syringes. As per the rules, the microbiology and laboratory waste are treated with 1% hypochlorite solution according to the NACO guidelines.

D. COLLECTION AND INTRA-MURAL TRANSPORT

The biomedical waste generated in different areas of the hospital is collected by an outsourced agency. The waste is collected on a daily basis (once/twice daily) depending on the pre-planned collection schedule from various collection points agreed upon by the agency. The collection in the morning hours is done by 8:00 am and in the evening hours before closure of the facility. No waste is allowed to be kept in the hospital for more than 24 hours. The waste is collected in the colour coded bags, loaded on to the dedicated and covered trolleys and transported to the temporary storage area.

E. TEMPORARY STORAGE

The biomedical wastes collected from different areas are brought in to a common point where they are stored temporarily till the next vehicle is loaded for final transportation. The temporary storage area in the hospital is

located behind the New Emergency ward and to the side of the Cath lab of the CN Center. The loaded vehicle leaves the hospital premises at three different times during the day (at 10:00 am; 2:00 pm and 6:00 pm) to the final treatment site.

F. FINAL DISPOSAL

The biomedical waste collected is finally disposed from the hospital in the loading vehicles to the common biomedical waste treatment facility operated by the outsourced vendor. There in, the waste is treated by incineration or autoclave as per guidelines at the treatment facility.

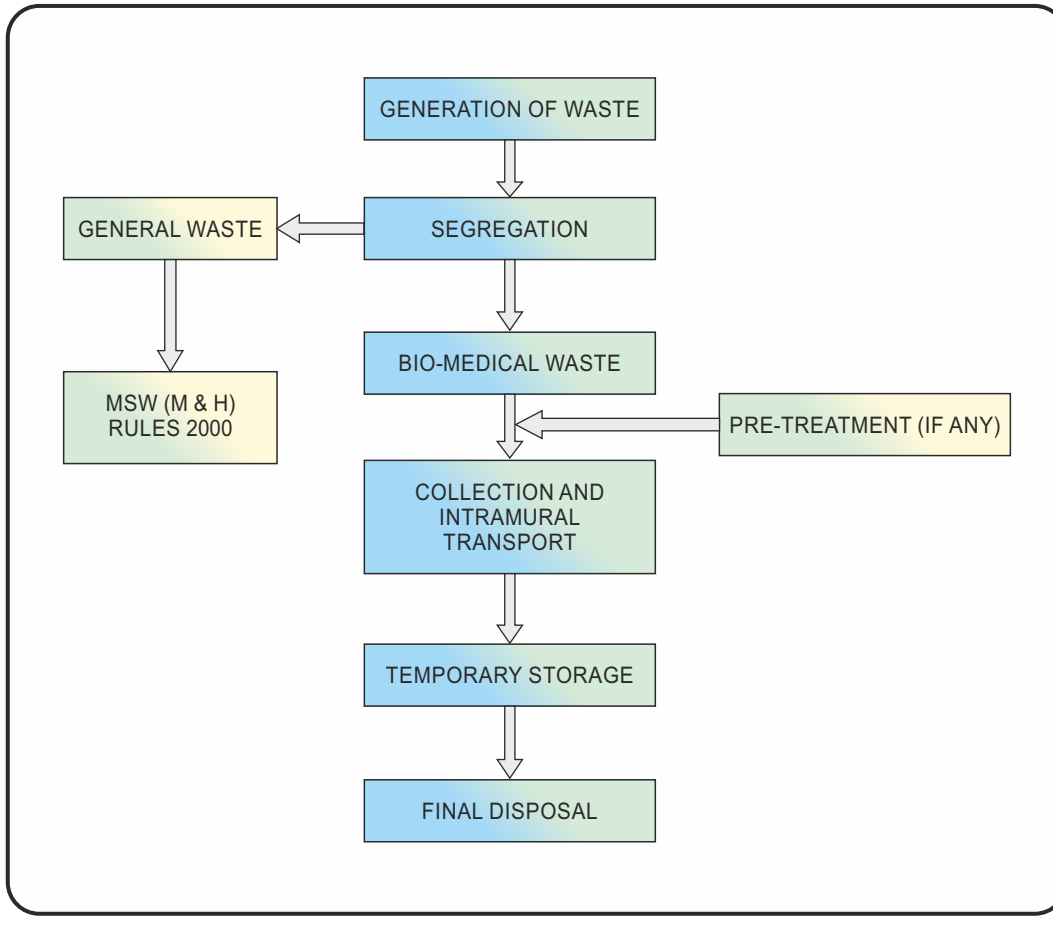


Figure 8: Process flow of waste generated in the hospital

10.3 STAFF SAFETY CONSIDERATIONS:

1. The staff handling the biomedical waste should ensure sufficient personal protection with heavy duty gloves, masks, gumboots, rubber aprons and caps.
2. All workers involved in this work must be made aware of the hazardous nature of this work.
3. All workers should be immunized against tetanus and Hepatitis B.
4. Persons suffering from any contagious or infectious disease should be restricted from doing this hazardous work till deemed fit by competent physician.
5. All needle stick injuries sustained by the staff are reported and record maintained in the Emergency Medicine department.

10.4 TRAINING

1. AIIMS has a well-designed awareness and training programme for all categories of workers involved in handling and disposal of biomedical waste.
2. Posters containing information on segregation of biomedical waste into different colour coded bins are displayed at strategic points.
3. All resident doctors and nurses at AIIMS are trained on this aspect as a part of induction training in the institute.
4. Apart from this, there are frequent workshops and training programs to promote awareness regarding the biomedical waste management policy at

CHAPTER 11

ANTIBIOTIC STEWARDSHIP PROGRAM

11.1 INTRODUCTION

Antibiotics have been considered as 'miracle drugs' saving enumerable lives from deadly infections and enabling modern science to reap benefits of high impact discoveries such as organ transplantation and cancer chemotherapy. Discovery of a number of antibiotics (penicillin, chloramphenicol and streptomycin) in 1940s and 1950s, Time magazine ran a story saying that "remedies are now in our backyard". During this period, as there was significant improvement in life expectancy as result of availability of antibiotics to treat infections, discovery of vaccines and improved sanitation.

However, indiscriminate use of antibiotics has led to rapid emergence of antimicrobial resistance (AMR) making practically all of these "miracle drugs" ineffective. With the pipeline of development of new antibiotics being dry, and the AMR scaling at unprecedented levels, the World today is on the verge of "pre-antibiotics" era. Jim O'Neill, a famous British economist, in a series on four reviews papers on AMR, estimated that the global burden of extra deaths due to drug-resistant infections can be 10 million people every year by 2050, and it can result in loss of economic output equivalent to current world economy ($100 trillion).

In the face of crisis of AMR, improving the use of antibiotics in order to optimize use of whatever is left is an important public health issue today. The accumulating evidence support that that a hospital based program (Antibiotics stewardship program; ASP) can help in judicious use of antibiotics and thus improving beneficial outcomes and minimizing harmful effects such as toxicity, AMR, iatrogeneses and the cost of care. Centre for Disease Control (CDC) has recommended adoption of ASP in acute care settings.

ASP refers to a program that promotes judicious use of antibiotics. The ASP activities include appropriate selection of antimicrobial agent with correct dose, route, duration and minimum toxicity for treatment of bacterial infections.

The ASP requires a formal program, dedicated teams and identified policies and procedures.

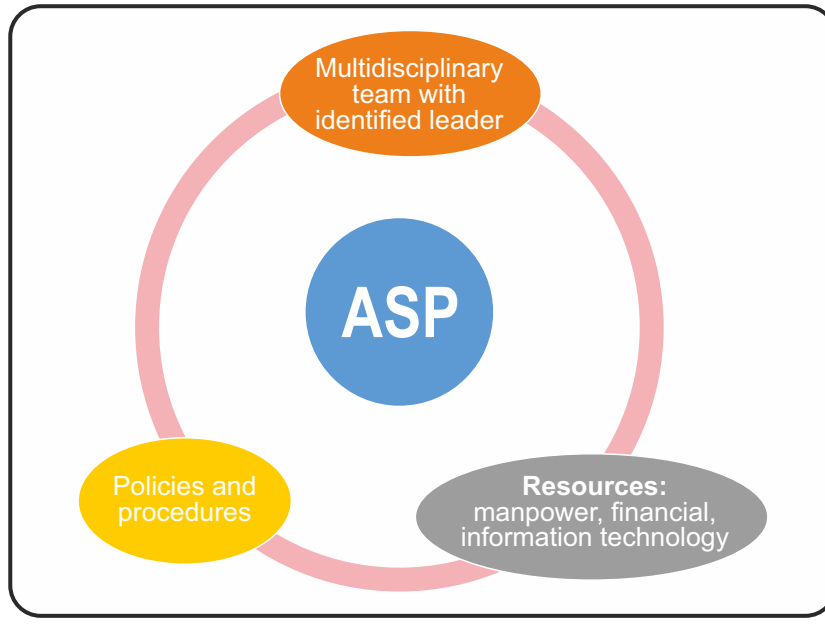


Figure 11.1: Elements of Antibiotic Stewardship Policy (ASP)

Success of ASP requires implementation of a formal program with an identified leader preferably a physician. The leader must be committed to the program and must hold accountability for its outcome. The leader should ideally be full time for large institutions or at least allocates sufficient time for its activities. There should be a multidisciplinary team consisting of a microbiologist, a pharmacist, infectious disease specialist, hospital administrator, and information technology (IT) expert. An IT expert can play a pivot role in ASP by leveraging on IT potential for efficient data management and feedback. ASP team must work hand-in-hand with hospital infection control (HIC) team. Coordinated activities of ASP and HIC teams can produce significant improvement in patient safety, successful treatment of infections and reducing cost.

The commitment of top leadership of institution is crucial for success of ASP. The institution leadership must empower the ASP team and provide required resources.

11.2 MAIN COMPONENTS OF ASP

The following are main components of ASP. The team should be prudent to develop insight about the prevalent circumstance in the hospital and prioritize interventions and introduce them in a gradual manner.

1. INITIATE appropriately

    a. Identify RIGHT patient needing antibiotics. Do not give antibiotics without proper indications (e.g. viral infections, non-infectious illness).

    b. Perform cultures before administering the first dose of antibiotics. The system should enabled in such a way that there is a culture of taking specimen for culture before antibiotics are initiated. Nurses should be empowered to take cultures if the physician had forgotten to order for the same.

    c. Choose the antibiotic agent that is suited to the suspected pathogen. Make sure the suspected pathogen is likely to be sensitive to empiric antibiotics based on sensitivity pattern of the pathogen in previous reports in a given facility

    d. Avoid antibiotics that have overlapping spectrum (e.g. combination of quinolones and cephalosporin)

    e. Whenever indicated, initiate antibiotics without any delay

    f. Specify the duration of therapy as per the indication

2. ADMINISTER appropriately

    a. Use appropriate dose and frequency (consult standard formulary)

    b. Monitor the patient for toxicity of antibiotics and make appropriate amendment to therapy (e.g. modifying doses and/or frequency if nephrotoxicity)

    c. Modify antibiotics therapy once the culture and sensitivity results are available

    d. Antibiotic therapy must be reviewed at all transitions and whenever there is a change in patient's condition and the therapy must be amended appropriately

3. Give a "TIME OUT" to antibiotics at 48 hours of therapy

    a. Once culture reports are available, consider STOPPING OR DE-ESCALATING the therapy based on culture and other investigation report and clinical course of the patient

4. MAKE EXPERTISE pertaining to ASP available at point of care

    a. Develop expertise in antibiotic use and make this available to end-user at the point of care (e.g. guidelines for different disease conditions, making a drug formulary for institutional use).

5. MONITOR and share data

   a. Monitor and share data and provide feedback on antibiotic utilization, AMR, adverse events, cost, and adherence to ASP practice.

At present different clinical specialities follow antibiotic policy based on their AMR data and special needs of the patients admitted in their speciality.

CHAPTER 12

STAFF HEALTH SERVICES PROGRAM

Hospital personnel may acquire infections from or transmit infections to patients, other personnel, household members, or other community contacts. In general, health care personnel who have contact with patients, body fluids or specimens have a higher risk of acquiring or transmitting infections than do other health care personnel who have only brief causal contact with patients and their environment (e.g. beds, furniture, bathrooms, food trays, medical equipment). These are carried out under the aegis of Employee Health Scheme of AIIMS.

12.1 GOALS AND OBJECTIVES

The objectives of staff health service programme are:

1. Educating personnel about the principles of infection control and stressing individual responsibility for infection control.
2. Collaborating with the infection control team in monitoring and investigating potentially harmful infectious exposures and outbreaks among personnel.
3. Providing care to personnel for work related illnesses or exposures.
4. Identifying work –related infection risks and instituting appropriate preventive measures.

12.2 ELEMENTS OF INFECTION CONTROL PRACTICES FOR STAFF

The following elements are configured to attain infection control goals amongst healthcare workers at AIIMS hospital:

1. **Coordination** with various departments.
2. **Medical evaluation:** This includes medical examination before placement to ensure that personnel are not placed in jobs that would pose undue risk of infection to them, other personnel, patients, or visitors. Immunization history is important. Periodic evaluations should be done for specific job assignments, for evaluation or work-related problems.
3. **Personnel health and safety education:** Education is provided for infection control program so that the staffs understand its rationale and comply with the

guidelines.

4. **Immunization programs:** Optimal use of vaccines to prevent transmission of vaccine-preventable diseases is advocated to HCW as shown in tables 12.1 (pre-exposure). Management of occupational exposure of pregnant personnel to infectious agents is shown in Table 12.3.

5. **Management of job –related illnesses and exposures:** Guidelines for post –exposure use of vaccines /immunoglobulins are summarized in Table 12.2. Decisions on work restrictions are followed as per the advice of the treating doctor.

6. **HIV:** The regimens for post - exposure prophylaxis HIV are shown in Figures 12.2 and 12.3 and the Table 12.4 as per the guidelines of NACO.

7. **Counseling** is undertaken to provide individually targeted information regarding various health issues:

   a) Risk and prevention of occupationally acquired infections.

   b) Risk of illnesses or adverse outcome after exposure.

   c) Management of exposure, including risks and benefits of post –exposure prophylaxis.

   d) Potential consequence of exposure or communicable diseases for family members, patients and other personnel.

8. Records are maintained of all accidental HAI acquired by the staff with utmost confidentially.

Accidental exposures to be reported to Officer I/C Employees Health Services, Casualty Consultant in-charge and the Casualty Medical Officer

TABLE 12.1: PRE-EXPOSURE PROPHYLAXIS TO INFECTIONS

GENERIC NAME	SCHEDULE	INDICATIONS	MAJOR PRECAUTIONS AND CONTRAINDICATIONS	SPECIAL CONSIDERATIONS
Hepatitis B recombinant vaccine	0, 1, 6 months, intramuscular, in deltoid.	Health care personnel at risk of exposure to blood and body fluids	History of anaphylactic reactions to common baker's yeast; not contraindicated in pregnancy	No therapeutic or adverse effects on HBV infected persons. Serologic response to vaccine may be tested.
Measles live virus vaccine	2 doses, one month apart, subcutaneous	Healthcare personnel without documentation of (a) receipt of live vaccine, (b) physician diagnosed measles, or (c) laboratory evidence of immunity	Pregnancy; immunocompromised state; history of anaphylactic reaction after gelatin ingestion or receipt of neomycin, recent receipt of immune globulin	MMR is the vaccine of choice if the recipient is also susceptible to mumps and/or rubella
Rubella live virus vaccine	Single dose, subcutaneous	Healthcare personnel, especially female, who lacks documentation of receipt of live vaccine on or after their first birthday, or of laboratory evidence of immunity	Pregnancy; immunocompromised state; history of anaphylactic reaction after receipt of neomycin	Women pregnant when vaccinated or who become pregnant within 3 months of vaccination should be counseled on the risk to the fetus; the risk is negligible; MMR is the vaccine of choice if the recipient is also susceptible to mumps and/or measles

TABLE 12.2: POST EXPOSURE PROPHYLAXIS FOR HEALTHCARE PERSONNEL

DISEASE	PROPHYLAXIS	INDICATIONS	PRECAUTIONS/ SPECIAL CONSIDERATIONS/ CONTRAINDICATION
Diphtheria	Benzathine penicillin, 1.2 MU IM, single dose or Erythromycin (1g/day)PO X 7 days	For healthcare personnel exposed to diphtheria	Administer one dose of Td to previously immunized if no Td has been given in ≤ 5 years
Hepatitis A	One IM dose IG 0.02 ml/ kg given within 2 weeks of exposure in deltoid/gluteal muscle	May be indicated for health care personnel exposed to feces of infected persons during outbreaks	Persons with IgA deficiency; do not administer within 2 weeks of MMR or within 3 weeks after varicella vaccine
Hepatitis B	HBIG 0.06 ml/kg IM as soon as possible (and within 7 days) after exposure (with 1 dose of Hepatitis B vaccine given at different body site); if HB vaccine is not given, 2nd dose of HBIG should be given after 1 month		
Meningococcal disease	Rifampicin 600 mg PO 12 hrs for 2 days, or Ceftriaxone 250 mg IM, single dose; or Ciprofloxacin 500 mg PO, single dose	Personnel with direct contact with respiratory secretions from infected persons without the use of proper precautions.	
Pertussis	Erythromycin 500 mg qid PO or Trimethoprim-Sulphamethoxazole 1 tab bid PO for 14 days after exposure	Personnel with direct contact with respiratory secretions or large aerosol droplets from respiratory tract of infected persons	
Rabies	For those never vaccinated, HRIG 20 IU/kg, half infiltrated around wound and HDVC or chick embryo vaccine 1.0 ml IM on day 0,3,7,14,28	Personnel who have been bitten by human being or animal with rabies or have had scratches, abrasions, open wounds, or mucous membranes contaminated with saliva	Personnel who have previously been vaccinated, give rabies vaccine 1.0 ml IM on days 0 and 3; no HRIG is necessary
Varicella Zoster	VZIG for 30-40 kg: 500 Unit IM, for >40 kg: 625 Units IM	Personnel known or likely to be susceptible to varicella and who have close and prolonged exposure to an infected person, particularly those at high risk of complications, such as pregnant or immunocompromised persons	

TABLE 12.3: MANAGEMENT OF EXPOSURE IN PREGNANT HEALTHCARE PERSONNEL

AGENT	POTENTIAL EFFECT ON FETUS	RATE OF PERINATAL TRANSMISSION	MATERNAL SCREENING	PREVENTION
CMV	Hearing loss; congenital syndrome	15% after primary maternal infection; symptomatic 5%	Antibody provides some but not complete protection against clinical disease. Routine screening is not recommended	Standard precautions
Hepatitis B	Hepatitis; development of chronic infection in infant	HBe Ag positive: 90%, HBe Ag negative: 0-25%	HBs Ag routine screening recommended	Vaccine and HBIG to infant
Hepatitis C	Hepatitis	2-5%	Anti-HCV, RNA in reference lab; routine screening not recommended	Standard precautions
Herpes simplex	Mucocutaneous lesions, sepsis, encephalitis, congenital malformations (rare)	Unlikely from nosocomial exposure; primary 33-50%, recurrent 4%	Antibody testing not useful; inspection for lesions at delivery	Standard precautions
Human Immunodeficiency virus	HIV infection; AIDS	8-30%	Antibody by ELISA	Anti-retroviral therapy for mother. Anti-retrovirals for baby, birth onwards
Measles	Prematurity; abortion	Rare	History, antibody	
Rubella	Congenital syndrome	40-50% overall; 90% in the first 12 weeks	Antibody	Vaccine before pregnancy, droplet precautions for acute infections; contact precautions for congenital rubella
Tuberculosis	Hepatosplenomegaly, pulmonary, bone, CNS infection	Rare	Skin test, symptom directed imaging	ATT for disease; airborne precautions
Varicella zoster	Malformations (skin; limb; CNS; eye) ; chickenpox	Total 25%; congenital syndrome 0-4%	Antibody	VZIG within 96 hours of exposure if susceptible; airborne and contact precautions.

12.3 POST-EXPOSURE PROPHYLAXIS FOR HIV

i. Occupational exposure:

Occupational exposure refers to exposure to potential blood-borne infections (HIV, HBV and HCV) that occurs during performance of job duties.

"Exposure" which may place an HCP at risk of blood-borne infection is defined as:

- a percutaneous injury (e.g. needle-stick or cut with a sharp instrument),
- contact with the mucous membranes of the eye or mouth,
- contact with non-intact skin (particularly when the exposed skin is chapped, abraded, or afflicted with dermatitis), or
- contact with intact skin when the duration of contact is prolonged (e.g. several minutes or more) with blood or other potentially infectious body fluids.

ii. Who is at risk?

- **Professionals with frequent blood exposures:**
  - Interns and medical students
  - Nursing staff and students
  - Physicians
  - Surgeons
  - Emergency care providers
  - Dentists
  - Labour and delivery room personnel
  - Laboratory technicians
  - Health facility cleaning staff and clinical waste handlers

iii. What is the risk?

The average risk of acquiring HIV infection after different types of occupational exposure is low compared to risk of infection with HBV or HCV. In terms of occupational exposure the important routes are needle stick exposure (0.3% risk for HIV, 9–30% for HBV and 1–10% for HCV), and mucous membrane exposure (0.09% for HIV).

TABLE 12.4: HIV TRANSMISSION RISK OF VARIOUS ROUTES*	
Exposure route	**HIV**
Blood transfusion	90–95%
Perinatal	20–40%
Sexual intercourse	0.1 to 10%
Vaginal	0.05–0.1%
Anal	0.065–0.5%
Oral	0.005–0.01%
Injecting drugs use	0.67%
Needle stick exposure	0.3%
Mucous membrane splash to eye, oro-nasal	0.09%
Note: Needle-stick exposure for HBV is 9–30% and for HCV is 1–10%	

*Source: NACO Antiretroviral therapy guidelines for HIV-infected adults and adolescents including post-exposure prophylaxis 2007.

iv. What is infectious and what is not?

TABLE 12.5: POTENTIALLY INFECTIOUS BODY FLUIDS	
Exposure to body fluids considered 'at risk'	**Exposure to body fluids considered 'not at risk' unless these secretions contain visible blood**
Blood	Tears
Semen	Sweat
Vaginal secretions	Urine and faeces
Cerebrospinal fluid	Saliva
Synovial, pleural, peritoneal, pericardial fluid	
Amniotic fluid	
Other body fluids contaminated with visible	

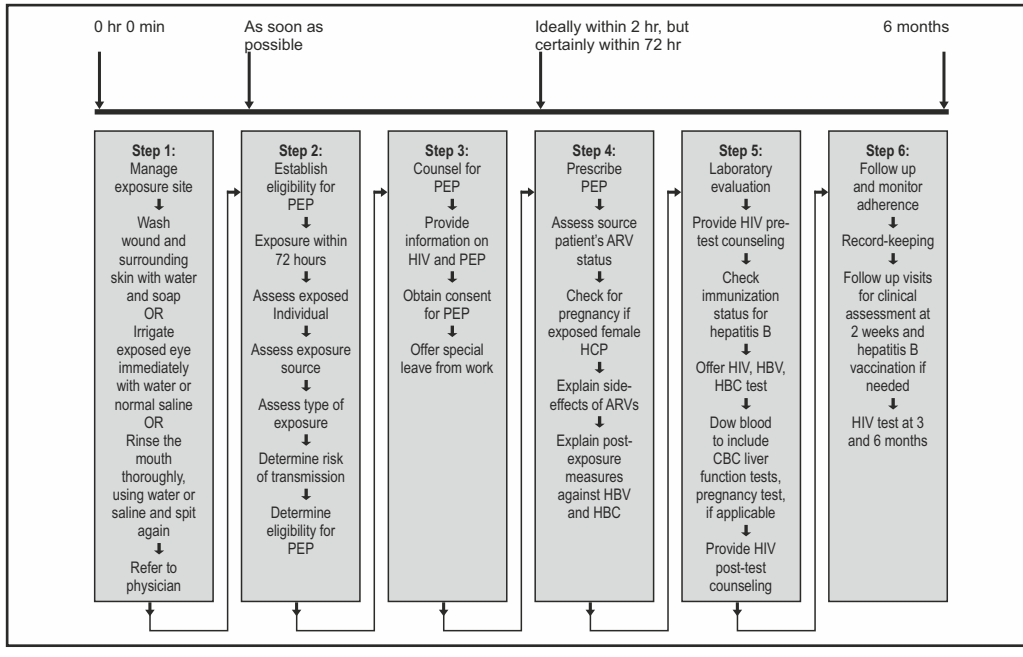


FIGURE 12.1: STEPS FOR MANAGING OCCUPATIONAL EXPOSURE

Step 1: First aid in management of exposure

For skin - if the skin is broken after a needle-stick or sharp instrument:

- ☐ Immediately wash the wound and surrounding skin with water and soap, and rinse. Do not scrub.
- ☐ Do not use antiseptics or skin washes (bleach, chlorine, alcohol, betadine).

After a splash of blood or body fluids on unbroken skin:

- ☐ Wash the area immediately
- ☐ Do not use antiseptics

For the eye:

- ☐ Irrigate exposed eye immediately with water or normal saline. Sit in a chair, tilt head back and ask a colleague to gently pour water or normal saline over the eye.
- ☐ If wearing contact lens, leave them in place while irrigating, as they form a barrier over the eye and will help protect it. Once the eye is cleaned, remove the contact lens and clean them in the normal manner. This will make them safe to wear again
- ☐ Do not use soap or disinfectant on the eye.

For mouth:

- Spit fluid out immediately
- Rinse the mouth thoroughly, using water or saline and spit again. Repeat this process several times
- Do not use soap or disinfectant in the mouth
- Consult the designated physician of the institution for management of the exposure immediately.

Don'ts
○ Do not panic
○ Do not put injured finger in mouth
○ Do not squeeze wound to bleed it
○ Do not use bleach, chlorine, alcohol, betadine, iodine or any antiseptic or detergent

Step 2: Establish eligibility for PEP

The HIV seroconversion rate of 0.3% after an AEB (accidental exposure to blood) (for percutaneous exposure) is an average rate. The risk of infection transmission is proportional to the amount of HIV transmitted, which depends on the nature of exposure and the status of the source patient. A baseline rapid HIV testing of exposed and source person must be done for PEP. However, initiation of PEP should not be delayed while waiting for the results of HIV testing of the source of exposure. Informed consent should be obtained before testing of the source as per national HIV testing guidelines.

First PEP dose within 72 hours

A designated person/trained doctor must assess the risk of HIV and HBV transmission following an AEB. This evaluation must be quick so as to start treatment without any delay, ideally within two hours but certainly within 72 hours; PEP is not effective when given more than 72 hours after exposure. The first dose of PEP should be administered within the first 72 hours of exposure. If the risk is insignificant, PEP could be discontinued, if already commenced.

Assessing risk of transmission

Exposure is defined under three categories based on the amount of blood/fluid involved and the entry port. These categories are intended to help in assessing the severity of the exposure but may not cover all possibilities.

Table 12.6: Categories of exposure	
Category	**Definition and example**
Mild exposure	mucous membrane/non-intact skin with small volumes E.g.: a superficial wound (erosion of the epidermis) with a plain or low calibre needle, or contact with the eyes or mucous membranes, subcutaneous injections following small-bore needles.
Moderate exposure	mucous membrane/non intact skin with large volumes **OR** percutaneous superficial exposure with solid needle E.g. : a cut or needle stick injury penetrating gloves
Severe exposure	percutaneous with large volume e.g.: an accident with a high calibre needle (>18 G) visibly contaminated with blood; a deep wound (hemorrhagic wound and/or very painful); transmission of a significant volume of blood; an accident with material that has previously been used intravenously or intra-arterially.
The wearing of gloves during any of these accidents constitutes a protective factor. ***Note:*** In case of an AEB with material such as discarded sharps/needles, contaminated for over 48 hours, the risk of infection is negligible for HIV, but still remains significant for HBV. HBV survives longer than HIV outside the body.	

Step 3: Counselling for PEP

Exposed persons (clients) should receive appropriate information about what PEP is about and the risk and benefits of PEP in order to provide informed consent for taking PEP. It should be clear that PEP is not mandatory.

Psychological support

Many people feel anxious after exposure. Every exposed person needs to be informed about the risks, and the measures that can be taken. This will help to relieve part of the anxiety. Some clients may require further specialised psychological support.

Document exposure

Documentation of exposure is essential. Special leave from work should be considered initially for a period of two weeks. Subsequently, it can be extended based on the assessment of the exposed person's mental state, side effects and requirements.

Step 4: Prescribe PEP

Deciding on PEP regimen

There are two types of regimens:

- ☐ Basic regimen: 2-drug combination
- ☐ Expanded regimen: 3-drug combination

The decision to initiate the type of regimen depends on the type of exposure and HIV serostatus of the source person.

- In the case of a high risk exposure from a source patient who has been exposed to or is taking antiretroviral medications, consult an expert to choose the PEP regimen, as the risk of drug resistance is high. Refer/consult expert physician. Start 2-drug regimen first.

Table 12.7: HIV PEP Evaluation

Exposure	**Status of Source**		
	HIV+ and Asymptomatic	**HIV+ and Clinically symptomatic**	**HIV status unknown**
Mild	Consider 2-drug PEP	Start 2-drug PEP	Usually no PEP or consider 2-drug PEP
Moderate	Start 2-drug PEP	Start 3-drug PEP	Usually no PEP or consider 2-drug PEP
Severe	Start 3-drug PEP	Start 3-drug PEP	Usually no PEP or consider 2-drug PEP

Seek expert opinion in case of

- Delay in reporting exposure (> 72 hours).
- Unknown source
- Known or suspected pregnancy, but initiate PEP
- Breastfeeding mothers, but initiate PEP
- Source patient is on ART
- Major toxicity of PEP regimen.83

Step 5: HIV chemoprophylaxis

Table 12.8: Dosage of drugs for PEP

Medication	**2-drug regimen**	**3-drug regimen**
Zidovudine (AZT)	300 mg twice a day	300 mg twice a day
Tenofovir	300 mg once a day	300 mg once a day
Lamivudine (3TC)	150 mg twice a day	150 mg twice a day
Protease Inhibitors	**1st choice** Lopinavir/ritonavir (LPV/r) 400/100 mg twice a day or 800/200 mg once daily with meals **2nd choice** Nelfinavir (NLF) 1250 mg twice a day or 750 mg three times a day with empty stomach **3rd choice** Indinavir (IND) 800 mg every 8 hours and drink 8–10 glasses (1.5 litres) of water daily	
Note: If protease inhibitor is not available and the 3rd drug is indicated, one can consider using Efavirenz (EFV 600 mg once daily). Monitoring should be instituted for side effects of this drug eg CNS toxicity such as nightmares, insomnia, etc. * Fixed Dose Combination (FDC) are preferred, if available. Ritonavir requires refrigeration.		

Because post-exposure prophylaxis (PEP) has its greatest effect if begun within two hours of exposure, it is essential to act immediately. The prophylaxis needs to be continued for four weeks. Exposure must be immediately reported to designated authority and therapy administered. Never delay start of therapy due to debate over regimen. Begin with basic 2-drug regimen, and once expert advice is obtained, change as required. A combination of 2-drugs: (Zidovudine + Lamivudine) OR (Tenofovir + Lamivudine) may be used for the basic 2-drug PEP regimen.

Step 6: Follow-up of an exposed person

Whether or not post-exposure prophylaxis is started, a follow up is needed to monitor for possible infections and to provide psychological support.

Clinical follow-up

In the weeks following an AEB, the exposed person must be monitored for the eventual appearance of signs indicating an HIV seroconversion: acute fever, generalized lymphadenopathy, cutaneous eruption, pharyngitis, non-specific flu symptoms and ulcers of the mouth or genital area. These symptoms appear in 50%-70% of individuals with an HIV primary (acute) infection and almost always within 3 to 6 weeks after exposure. When a primary (acute) infection is suspected, referral to an ART centre or for expert opinion should be arranged rapidly.

An exposed person should be advised to use precautions (e.g., avoid blood or tissue donations, breastfeeding, unprotected sexual relations or pregnancy) to prevent secondary transmission, especially during the first 6–12 weeks following exposure. Condom use is essential.Drug adherence and side effect counselling should be provided and reinforced at every follow-up visit. Psychological support and mental health counselling is often required.

Laboratory follow-up

Exposed persons should have post-PEP HIV tests. HIV-test at 3 months and again at 6 months is recommended. If the test at 6 months is negative, no further testing is recommended.

12.4 DEAD BODY PACKING OF HIV/HBV INFECTED INDIVIDUALS

All dead bodies are potentially infectious and "STANDARD PRECAUTIONS" should be implemented for every case. Although most organisms in the dead body are unlikely to infect healthy persons, some infectious agents may be transmitted when persons are in contact with blood, body fluids or tissues of dead body of person with infectious diseases. To minimize the risks of transmission of known and also unsuspected infectious diseases, dead bodies should be handled in such a way that workers' exposure to blood, body fluids and tissues is reduced.

When handling of dead bodies:

1. Avoid direct contact with blood or body fluids from the dead body.
2. Put on personal protective equipment (PPE) including: Gloves, water resistant gown/ plastic apron over water repellent gown, and surgical mask.

Use goggles or face shield to protect eyes, if there may be splashes.

Procedure

1. Ascertain that the death is declared and certified by the doctor on duty. Ensure that the necessary forms are filled and signed by the person concerned.
2. Close the eyes immediately, straighten the arms laid at the sides. Straighten the legs. Any dentures that have been removed are to be replaced and the mouth is closed. Support the chin with jaw bandage. The head should be elevated on a pillow.
3. In order to keep the body in normal position and the body should be cared for immediately after the death and before rigor mortis develops.
4. The body should be cared with reverence
5. Make sure any wounds, cuts and abrasions, are covered with waterproof bandages or dressings**.**
6. Extreme caution should be exercised when removing sharp devices. They should be directly disposed into a sharps container with precaution.
7. Remove all the appliances used for the patient i.e. Ryle's tubes, urinary catheter oxygen catheters, all the comfort devices, blankets, drainage tubes and soiled dressings. Adhesive marks are removed.
8. Remove the ornaments of any type from the dead body: list and entrust it to the closed relative and obtain receipt for the delivery of the same. Any other belongings of the patient that was entrusted at the time of admission also should be checked and entrusted to the relatives.
9. The body is bathed, hair combed and dressed in clean clothes. Pack vagina rectum and nose with gauze or cotton. A perineal pad and diaper is applied to prevent escape of urine and stool.
10. Place Four identification label first at the left wrist, at chest, over the Mortuary sheet of the packed body and over the transparent polythene cover with details of the name, age sex, UH ID no., ward, bed no., diagnosis, cause of death, complete address, date and time of death.
11. Place hands over the chest and tie the thumbs and wrists to together
12. The toe and ankles tied together
13. Place clean bed sheet under the body. Fold the top of the sheet over the face and shoulders.
14. Hold the bottom end of the sheet over the feet and then cover the body by folding the sheet from sides and fix with tapes and bandages

15. Place the 3rd identification tag over the mortuary sheet. Cover with transparent plastic bag which should be zippered closed. Pins are NOT to be used.
16. The outside of the polythene bag of body should be wiped with 1% Sodium Hypochlorite solution and allow to air dry
17. After removing dead body from the ward environmental surfaces, instruments and transport trolleys should be properly decontaminated.
18. Bio medical Waste should be disposed as per the guidelines
19. Remove personal protective equipment after handling of the dead body. Then, perform hand hygiene immediately.

It is important to instruct the patient relatives that the dead body

- Should NOT be removed from the transparent polythene bag
- Unzipping of the transparent polythene bag is NOT allowed
- Encourage them to take directly to cremation/burial ground.

APPENDIX-I

DEFINITIONS OF INFECTION SITES

INFECTION SITE: Symptomatic urinary tract infection

CODE: UTI-SUTI

DEFINITION: A symptomatic urinary tract infection must meet at least one of the following criteria:

Criterion 1: Patient has at least one of the following signs or symptoms with no other recognized cause: fever ($\geq 38^0$C), urgency, frequency, dysuria, or suprapubic tenderness,

and

patient has a positive urine culture, that is, $\geq 10^5$ microorganisms per cm^3 of urine with no more than two species of microorganisms.

Criterion 2: Patient has at least two of the following signs or

symptoms with no other recognized cause: fever ($\geq 38^0$C), urgency, frequency, dysuria, or suprapubic tenderness,

and

at least one of the following:

a. Positive dipstick for leukocyte esterase and/or nitrate
b. Pyuria (urine specimen with $\geq$10 WBC/mm^3 or $\geq$3 WBC/high power field of unspun urine)
c. Organisms seen on Gram stain of unspun urine
d. At least two urine cultures with repeated isolation of the same uropathogen (gram-negative bacteria or *S. saprophyticus*) with $\geq 10^2$ colonies/mL in nonvoided specimens
e. $\geq 10^5$ colonies/mL of a single uropathogen (gram-negative bacteria or *S. saprophyticus*) in a patient being treated with an effective antimicrobial agent for a urinary tract infection
f. Physician diagnosis of a urinary tract infection
g. Physician institutes appropriate therapy for a urinary tract infection

Criterion 3: Patient ≤1 year of age has at least one of the following signs or symptoms with no other recognized cause: fever (>38^{0}C), hypothermia (<37^{0}C), apnea, bradycardia, dysuria, lethargy, or vomiting

COMMENTS:

- Urine cultures must be obtained using appropriate technique, such as clean catch collection or catheterization.
- In infants, a urine culture should be obtained by bladder catheterization or suprapubic aspiration; a positive urine culture from a bag specimen is unreliable and should be con- firmed by a specimen aseptically obtained by catheterization or suprapubic aspiration.

INFECTION SITE: ASYMPTOMATIC BACTERIURIA

CODE: UTI-ASB

DEFINITION: An asymptomatic bacteriuria must meet at least one of the following criteria:

Criterion 1: Patient has had an indwelling urinary catheter within 7 days before the culture, and

patient has a positive urine culture, that is, ≥10^5 microorganisms per cm^3 of urine with no more than two species of microorganisms, and

patient has no fever (>38^{0}C), urgency, frequency, dysuria, or suprapubic tenderness.

Criterion 2: Patient has not had an indwelling urinary catheter within 7 days before the first positive culture, and

patient has had at least two positive urine cultures, with repeated isolation of the same microorganism, and no more than two species of microorganisms, and

patient has no fever (>38^{0}C), urgency, frequency, dysuria, or suprapubic tenderness.

COMMENTS:

- A positive culture of a urinary catheter tip is not an acceptable laboratory test to diagnose bacteriuria.
- Urine cultures must be obtained using appropriate technique, such as clean catch collection or catheterization.

INFECTION SITE: SURGICAL SITE INFECTION (SUPERFICIAL INCISIONAL)

CODE: SSI-(SKIN) except following the NNIS operative procedure, CBGB. For CBGBa only, if infection is at chest site, use SKNC (skin-chest) or if at leg (donor) site, use SKNL (skin- leg)

DEFINITION: A superficial SSI must meet the following criteria:

Infection occurs within 30 days after the operative procedure, and

involves only skin and subcutaneous tissue of the incision, and

patient has at least one of the following:

a. Purulent drainage from the superficial incision
b. Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision
c. At least one of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness, or heat, and superficial incision is deliberately opened by surgeon, unless incision is culture-negative
d. Diagnosis of superficial incisional SSI by the surgeon or attending physician

REPORTING INSTRUCTIONS:

- Do not report a stitch abscess (minimal inflammation and discharge confined to the points of suture penetration) as an infection.
- Do not report a localized stab wound infection as SSI, instead report as skin or soft tissue infection, depending on its depth.
- Report infection of the circumcision site in newborns as SST- CIRC. Circumcision is not an NNIS operative procedure.
- Report infection of the episiotomy site as REPR-EPIS. Episiotomy is not an NNIS operative procedure.
- Report infected burn wound as SST-BURN.
- If the incisional site infection involves or extends into the fascial and muscle layers, report as a deep incisional SSI.
- Classify infection that involves both superficial and deep incision sites as deep incisional SSI.
- Report culture specimen from superficial incisions as ID (incisional drainage).

INFECTION SITE: SURGICAL SITE INFECTION (DEEP INCISIONAL)

CODE: SSI-[ST (soft tissue)] except following the NNIS operative procedure, CBGB. For CBGB only, if infection is at chest site, use STC (soft tissue-chest) or if at leg (donor) site, use STL (soft tissue-leg)

DEFINITION: A deep incisional SSI must meet the following criteria:

Infection occurs within 30 days after the operative procedure if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operative procedure, and

involves deep soft tissues (e.g., fascial and muscle layers) of the incision, and

patient has at least one of the following:

a. Purulent drainage from the deep incision but not from the organ/space component of the surgical site
b. A deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms: fever (>38^{0}C) or localized pain or tenderness, unless incision is culture-negative
c. An abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination.
d. Diagnosis of a deep incisional SSI by a surgeon or attending physician

REPORTING INSTRUCTIONS:

- Classify infection that involves both superficial and deep incision sites as deep incisional SSI.
- Report culture specimen from deep incisions as ID.

INFECTION SITE: LABORATORY-CONFIRMED BLOODSTREAM INFECTION

CODE: BSI-LCBI

DEFINITION: Laboratory-confirmed bloodstream infection must meet at least one of the following criteria:

Criterion 1: Patient has a recognized pathogen cultured from one or more blood cultures, and

organism cultured from blood is not related to an infection at another site.

Criterion 2: Patient has at least one of the following signs or symptoms: fever (>38^{0}C), chills, or hypotension, and

at least one of the following:

a. Common skin contaminant (e.g., diphtherioids, *Bacillus* spp., *Propionibacterium* spp., coagulase-negative staphylococci, or micrococci) is cultured from two or more blood cultures drawn on separate occasions
b. Common skin contaminant (e.g., diphtherioids, *Bacillus* spp., *Propionibacterium* spp., coagulase-negative staphylococci, or micrococci) is cultured from at least one blood culture from a patient with an intravascular line, and the physician institutes appropriate antimicrobial therapy
c. Positive antigen test on blood (e.g., *Haemophillus influenzae*, *Streptococcus pneumoniae*, *Neisseria meningitidis*, or group B Streptococcus),

and

signs and symptoms and positive laboratory results are not related to an infection at another site.

Criterion 3: Patient ≤1 year of age has at least one of the following signs or symptoms: fever (>38^{0}C), hypothermia (<37^{0}C), apnea, or bradycardia,

and

at least one of the following:

a. Common skin contaminant (e.g., diphtherioids, *Bacillus* spp., *Propionibacterium* spp., coagulase-negative staphylococci, or micrococci) is cultured from two or more blood cultures drawn on separate occasions
b. Common skin contaminant (e.g., diphtherioids, *Bacillus* spp., *Propionibacterium* spp., coagulase-negative staphylococci, or micrococci) is cultured from at least one blood culture from a patient with an intravascular line, and physician institutes appropriate antimicrobial therapy
c. Positive antigen test on blood (e.g., *H. influenzae*, *S. pneumoniae, N. meningitidis*, or group B Streptococcus)

and

signs and symptoms and positive laboratory results are not related to an infection at another site.

REPORTING INSTRUCTIONS:

- Report purulent phlebitis confirmed with a positive semi- quantitative culture of a catheter tip, but with either negative or no blood culture, as CVS-VASC.
- Report organisms cultured from blood as BSI-LCBI when no other site of infection is evident.
- Pseudobacteremias are not nosocomial infections.

INFECTION SITE: CLINICAL SEPSIS

CODE: BSI-CSEP

DEFINITION: Clinical sepsis must meet at least one of the following criteria:

Criterion 1: Patient has at least one of the following clinical signs or symptoms with no other recognized cause: fever (>38^{0}C), hypotension (systolic pressure <90 mm Hg), or oliguria (<20 cm^3/hr), and

blood culture not done or no organisms or antigen detected in blood, and

no apparent infection at another site, and

physician institutes treatment for sepsis.

Criterion 2: Patient ≤1 year of age has at least one of the following clinical signs or symptoms with no other recognized cause: fever (>38^{0}C), hypothermia (<37^{0}C), apnea, or bradycardia, and

blood culture not done or no organisms or antigen detected in blood, and

no apparent infection at another site, and

physician institutes treatment for sepsis.

REPORTING INSTRUCTION:

- Report culture-positive infections of the bloodstream as BSI- LCBI.

INFECTION SITE: DISSEMINATED INFECTION

CODE: SYS-DI

DEFINITION: Disseminated infection is infection involving multiple organs or systems, without an apparent single site of infection, usually of viral origin, and with signs or symptoms with no other recognized cause and compatible with infectious involvement of multiple organs or systems.

REPORTING INSTRUCTIONS:

- This code should be used primarily for viral infections involving multiple organ systems (e.g., measles, mumps, rubella, varicella, erythema infectiosum). These infections often can be identified by clinical criteria alone. Do not use this code for nosocomial infections with multiple metastatic sites, such as with bacterial endocarditis; only the primary site of these infections should be reported.
- Do not report fever of unknown origin (FUO) as DI-SYS.
- Report neonatal "sepsis" as BSI-CSEP.
- Report viral exanthems or rash illness as DI-SYS.

APPENDIX-II

The following ***surveillance activities*** are being carried out by the Department of Microbiology with the help of infection control nurses:-

1. Regular checks are done for the sterility /disinfection of the articles used in the various areas of the hospital including OTs, ICUs, Procedure Rooms, and other high risk areas, once in 3 weeks basis. The articles and instruments/equipment used in the ward areas and special OPDs are also monitored from time to time depending on the infection rates.

   A sterile cotton swab is used to collect the surface culture. Various article like ventilator tubing, venti mask, Ambu bag, suction tubing, dressing trays, drums with dressing, Cheatle forceps, thermometers, laryngoscope, etc. are sampled after disinfection or in between patient use after decontamination. These swabs are transported to the lab. They are incubated at 37°C overnight in glucose broth. The next day it is cultured on blood agar and MacConkey's agar, and incubated again at 37°C overnight. The culture plates are inspected, for any growth which is identified by the standard bacteriological methods.

   If positive, the reports are immediately brought to the notice of the faculty/sister-in-charge of the area concerned, and control measures, advice regarding decontamination or disinfection is provided by the Microbiologists/Infection Control Nurses.

2. All the solutions used in the hospital area e.g. saline, sterile water, filtered water, IV fluids, TPN etc. are sampled and cultured to test for their sterility on a once in 20-25 days & whenever a demand is being raised by the clinicians from all the areas specially OTs, ICUs and other high risk areas. These fluids are added to the glucose broth medium and Sabouraud's dextrose medium and incubated at 37°C for 48 hours. If there is a growth in the broth then it is sub-cultured on Blood agar and MacConkey's agar and incubated again at which is identified 37°C overnight. The culture plates are inspected, for any growth which is identified by the standard bacteriological methods.

3. In–use test for disinfectants – The working solutions of the disinfectants being used in the hospital are sampled at different times during their use. These are diluted 1:10 in nutrient broth. 0.01ml of this dilution is cultured on to nutrient agar plates in 10 sections in duplicate. One plate is incubated at 37°C and another

at room temperature. Presence of growth in 5 or more sections of these drops is considered unsatisfactory. The reports are immediately brought to the notice of the faculty–in-charge of the area concerned and accordingly advised by the Microbiologists/ Infection Control nurses.

4. The efficacy of glutaraldehyde is tested at site using the "sterilog strips (3M)"at regular intervals besides the "in – use test".

5. Air sampling – This is carried out by the expose plate method using mannitol salt agar (MSA). OTs, ICUs, and other high risk areas are sampled at 20-25 days interval. In this method, the plate is exposed in the area concerned for half an hour and then transported to the lab. It is incubated at 37°C for 48 hours. Presence of yellow colored colonies are suggestive of *Staphylococcus aureus*. These are counted in number, and any number in the OT, and more than 10 colonies in other areas are considered unsatisfactory. The reports are immediately brought to the notice of the faulty/sister-in-charge of the area concerned with suggestions for improvement by the Microbiologists. It is also recommended to be conducted after any major renovation activity, terminal disinfection and fogging.

6. Autoclave checks – The autoclaves of the CSSD are monitored every week by the Biological indicators. Presently we are using *Geobacillus stearothermophilus* ampules (3M-attest –strips). These are loaded in the autoclave at 4 different sites and sent to the Microbiology lab. They are incubated at 56°C as per the manufacturer's instructions. If positive, the reports are immediately brought to the notice of the CSSD In-charge for appropriate measures.

7. Epidemiologically determined sampling–Finger-Print/Nasal swab of the persons working the wards is taken whenever indicated. Fungal culture is also collected when required.

8. Testing of the water supply for the bacterial quality –the tap water supply of hospital and other areas of the campus are tested weekly for the coliform counts by the multiple tube method (MPN counts/100 ml of water). If found, beyond satisfactory level, appropriate measure and treatment is suggested. Fecal coliforms are further identified by doing indole at 44°C and testing the ability to produce acid and gas from lactose.

Areas from which environmental sampling is done –

Operation Theaters	Intensive Care Units
a) Main O.T.	a) AB-2 ICU
b) Orthopedics O.T.	b) C-2 ICU
c) Maternity O.T	c) C-3 NICU - A
d) Emergency O.T	d) AB-4/Peritoneal Dialysis Room
e) Surgery Minor O.T.	e) Hemodialysis Ward
f) Urology Minor O. T.	f) D-4 ICU
g) ENT Minor O.T.	g) AB-5 ICU
h) MTP & Endometrial Biopsy O.T.	h) D-5 Dialysis Room
i) Dermatology Minor O.T.	i) D-5 ICU
	j) D-6 ICU
	k) D-7 HDU
	l) AB- 8 ICU
	m) Pulmonary Medicine ICU
	n) NICU B1
	o) NICU B2
	p) Kidney Transplant Unit

Out Patient Departments: Dressing rooms in:

1. Ortho OPD
2. Surgery OPD
3. Pediatric surgery OPD

Emergency services:

1. Pediatric emergency
2. Main emergency
3. New emergency ward

Procedure Rooms

1. FNAC Room
2. Labour Room
3. Digital Substraction Angiography room
4. Endoscopy room:
    a. Adult: Gastroenterology OPD
    b. Pediatrics: C5 ward
5. Bronchoscopy Room
    a. Adult: 2nd floor pulmonary OPD, D2 ward, Pulmonary medicine ward
    b. Pediatrics: D5 ward

Schedule of activities for environmental sampling from the above areas:

<u>High risk areas</u>

1. In all the OTs and ICUs, air sampling by exposed plate is undertaken every 20-25 days interval.
2. Sterility samples are taken from all the ICUs at 20-25 days interval.
3. In–use solutions are also taken from the ICUs. In between Cidex is checked with the cold sterilog indicator.

<u>Ward areas</u>

1. Sterility samples once in month.
2. In–use solution, samples from each area.

CATEGORIES OF BIOMEDICAL WASTE

Category	Type Of Waste	Type Of Bag Or Container For Collection	Treatment And Disposal Option
Yellow	**(a) Human Anatomical Waste:** Human tissues, organs, body parts and fetus below the viability period (as per the Medical Termination of Pregnancy Act 1971, amended from time to time).	Yellow colored non-chlorinated plastic bags	Incineration or Plasma Pyrolysis or deep burial*
	(b)Animal Anatomical Waste : Experimental animal carcasses, body parts, organs, tissues, including the waste generated from animals used in experiments or testing in veterinary hospitals or colleges or animal houses.		
	(c) Soiled Waste: Items contaminated with blood, body fluids like dressings, plaster casts, cotton swabs and bags containing residual or discarded blood and blood components.		Incineration or Plasma Pyrolysis or deep burial* In absence of above facilities, autoclaving or micro-waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery.
	(d) Expired or Discarded Medicines: Pharmaceutical waste like antibiotics, cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc.	Yellow coloured non-chlorinated plastic bags or containers	Expired cytotoxic drugs and items contaminated with cytotoxic drugs to be returned back to the manufacturer or supplier for incineration at temperature >1200°C or to common bio-medical waste treatment facility or hazardous waste treatment, storage and disposal facility for incineration at >1200°C Or Encapsulation or Plasma Pyrolysis at >1200°C. All other discarded medicines shall be either sent back to manufacturer or disposed by incineration.

Category	Type Of Waste	Type Of Bag Or Container For Collection	Treatment And Disposal Option
	(e) Chemical Waste: Chemicals used in production of biological and used or discarded disinfectants.	Yellow coloured containers or non-chlorinated plastic bags	Disposed of by incineration or Plasma Pyrolysis or Encapsulation in hazardous waste treatment, storage and disposal facility.
	(f) Chemical Liquid Waste: Liquid waste generated due to use of chemicals in production of biological and used or discarded disinfectants, Silver X-ray film developing liquid, discarded Formalin, **infected secretions, aspirated body fluids,** liquid from **laboratories** and floor washings, cleaning, housekeeping and disinfecting activities etc.	Separate collection system leading to effluent treatment system	After resource recovery, the chemical liquid waste shall be pre-treated before mixing with other wastewater. The combined discharge shall conform to the discharge norms given in Schedule- III.
	(g) Discarded linen, mattresses, beddings contaminated with blood or body fluid.	Non-chlorinated yellow plastic bags or suitable packing material	Non- chlorinated chemical disinfection followed by incineration or Plasma Pyrolysis or for energy recovery. In absence of above facilities, shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery or incineration or Plasma Pyrolysis.
	(h) Microbiology, Biotechnology and other clinical laboratory waste: Blood bags, Laboratory cultures, stocks or specimens of microorganisms, live or attenuated vaccines, human and animal cell cultures used in research, industrial laboratories, production of biological, residual toxins, dishes and devices used for cultures.	Autoclave safe plastic bags or containers	Pre-treat to sterilize with non-chlorinated chemicals on-site as per National AIDS Control Organization or World Health Organization guidelines thereafter for incineration.

Category	Type Of Waste	Type Of Bag Or Container For Collection	Treatment And Disposal Option
Red	**Contaminated Waste (Recyclable)** (a) Wastes generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (without needles and *fixed needle syringes*) and vacutainers with their needles cut) and gloves.	Red coloured non-chlorinated Plastic bags or containers	Autoclaving or micro-waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent to registered or authorized recyclers or for energy recovery or plastics to diesel or fuel oil or for road making, whichever is possible. Plastic waste should not be sent to landfill sites.
White (Translucent)	**Waste sharps including Metals:** Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades, or any other contaminated sharp object that may cause puncture and cuts. This includes both used, discarded and contaminated metal sharps	Puncture proof, Leak proof, tamper proof containers	Autoclaving or Dry Heat Sterilization followed by shredding or mutilation or encapsulation in metal container or cement concrete; combination of shredding cum autoclaving; and sent for final disposal to iron foundries (having consent to operate from the State Pollution Control Boards or Pollution Control Committees) or sanitary landfill or designated concrete waste sharp pit.
Blue	**(a) Glassware:** Broken or discarded and contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes	Cardboard boxes with blue colored marking	Disinfection (by soaking the washed glass waste after cleaning with detergent and Sodium Hypochlorite treatment) or through autoclaving or microwaving or hydroclaving and then sent for recycling.
	b) Metallic Body Implants	Cardboard boxes with blue colored marking	

APPENDIX-IV

ATTACK RATE

It is defined as the ratio of the number of new infections divided by the number of those exposed (Susceptible individuals) in a given period usually expressed as a percentage.

INCIDENCE RATE

The ratio of the number of new infections or disease in a well-defined population in a given period to the number of individuals at risk in the population. At risk is frequently defined as the number of potentially exposed susceptible individuals. The rate is usually expressed as numbers of new cases per thousand per year.

MORBIDITY RATE

The ratio of the number of persons infected with a clinical disease to the number of persons at risk in the population during a defined period, it concurs with the incidence rate of a disease.

CRUDE INFECTION RATE

It is the most common measure of occurrence of an infection. It is defined as the ratio of infection per 100 admissions or discharge.

$$\textbf{Crude infection rate} = \frac{\text{Number of infections}}{\text{100 admissions or discharges}}$$

The crude infection rate can also be site specific. For example.

$$\textbf{Crude Bacteremia rate} = \frac{\text{Number of blood stream infections}}{\text{100 admissions or discharges}}$$

ADJUSTED INFECTION RATE

To derive a rate that represents changes in the HAI rate from one period to another, the crude infection rate is often adjusted by patient-days or number of procedures. This corrects for a patient being admitted in one month and discharged in another.

An example of an adjusted infection rate is the ratio of infection per 1,000 patient-days or 100 surgical procedures.

Adjusted infection rate = Number of infections

1000 patient-days

The crude infection rate does not adjust for risk factors for HAI that vary among patients. The risk –adjusted infection rate adjusts the rate by the major risk factor for the infections by the number of days that a medical device (central venous catheter, ventilator) is used.

Risk -adjusted infection rate = Number of infections in question
---
Number of days that a device is in place

Institutional HAI rates should preferably be adjusted for factors such as severity of illness.

3.5 COLLECTION OF DATA AND CALCULATION OF INDICES

No. of patients with documented HAI in that particular month in that particular area
Total number of admissions in that particular area in that particular month.
This value is multiplied by 100, to give the percentage of HCAI

2) Device Specific Rates

To have uniformity, decide on a particular time of the day when you count the device days. Suppose you take rounds around 11am, and then ensure that the device days are counted around that time daily throughout the month. This ensures that there is no ambiguity in the moving population in ICU (patients shifted for surgery, investigations, transfers etc.)

a) Catheter associated Urinary tract infection (CAUTI)
b) Central line associated Blood stream infections (CLBSI/CLABSI)
c) Ventilator associated pneumonia (VAP)
d) Device utilization ratio (DUR)
e) BSI Rate associated with Haemodialysis

The device associated infections are expressed in Device Days (DD)

Determine number of device-days used as denominator:

Device-days = total number of days of exposure to device (ventilator, central line, or urinary catheter) by all patients in selected population during selected time period.

E.g.-In an NICU, there are 7 patients on say Ventilator on day one, 8 patients on day two, 5 patients on day three and so on…

Add 7+8+5+ and so….on till the end of the month. The sum of the days would become **Ventilator days** for that month. It is similarly calculated for other infections.

Once the denominator of device days are known, device related infection rates can be calculated.

Patient days= total number of days that patients are in the ICU during selected time period e.g. In an NICU there are 10 patients on day one, 14 patients on day two, 12 patients on day three, and so on. Add these and the total number at the end of one month is your patient days.

Calculation of indices:

a) CLABSI= No. of CLABSI in that particular ICU X 1000
Central Line days

b) CAUTI = No. of CAUTI in that particular ICU X 1000
Urinary catheter days

c) VAP = No. of VAP in that particular ICU X 100
Ventilator days

d) **Device utilization ratio** = Device - days
Patient days

DUR indicates the magnitude of devices used.

- The DUR can range between 0 and 1.
- DUR of 0 - zero devices per patient on an average day (best scenario)
- DUR of 1 every patient had a device on an average day (worst scenario)

Example: NICU
For the past month, a neonatal ICU had 180 central line days and 225 patient-days:
DUR = 180 central line days = 0.80
225 Patient days

Conclusion: 80% of patient days were also central line days over the last month. Eight out of 10 NICU patients had a central line in place on an average day last month.

The denominator is simply calculated by counting the number of patients being haemodialysed each month and adding them together.

For example, if there were 45 patients in January, 40 in February and 50 in March, the denominator would be (45+40+50=135) 135 dialysis patient months for the 3 month surveillance period.

DEVICE-ASSOCIATED INFECTION RATES

A device –associated infection rate is specific example of a risk –adjusted infection rate. This method also allows the calculation of the device –associated, device –day rate, which is usually expressed per 1000 device-days.

Device-associated, device-day rate =

$$\frac{\text{Number of device –associated infection for specific site}}{\text{Number of device –days}} \times 100$$

Before calculating the risk –adjusted infection rate, certain steps should be followed:-

- Decide on the time period for the analysis (week, month, quarter, half or year).
- Select the patient population (ICU, HDU).
- Choose the site of infection that is to be calculated (numerator).
- The infection selected should be site and should occur in the selected population, the infection onset days should occur during the time period selected.

Once the device days are determined, infections such as urinary catheter-associated urinary tract infections would be calculated using the following formula:

$$\frac{\text{Number of catheter associated urinary tract infections}}{\text{Number of urinary catheter}} \times 1000$$

HOW TO CALCULATE THE NUMBER OR DAYS THAT A DEVICE IS IN PLACE

In January 2003, 20 patients on the first day of the month had urinary catheters, 19 on day 2, 15 on day 3, 25on day 4, 20 on day 5, 15 on day 6, and 15on day 7.

The number of patients with urinary catheters from days 1to 7 is added (20+19+15+25+20+15+15), yielding 129 urinary catheters –days for the first week. The total catheter-days for the entire month is the sum of the daily counts.

DEVICE – DAY UTILIZATION

To determine the percentage of patient-days to device-days, the device utilization ratio can be calculated. The device utilization day is specifically useful for measuring infection risk among patients in ICUs or HDUs.

$$\textbf{Device utilization} = \frac{\text{Number of device – days}}{\text{Number of patient – days}}$$

To calculate the number of patients–days, let us use an example: in January 2003, 20patients were in the unit on the first day, 20 on day 2, and 18 on day 3, 25 on day 4, 24 on day on 5, 20 on day 6, and 18 on day 7. To calculate the patient- days, we would add the number of patients in the unit from day 1 to 7. The total number of patients-days for the week is 145. Thus, the patient-days are the total number of patients that are in a unit during a selected time period .We had calculated above the total urinary catheter-days to be 129. Thus:

Device utilization = 129/145
=0.8897, or 89%

Eighty-nine percent of patient days were also urinary catheter-days of the first week of the month. Calculating the device–associated, device-day rate and utilization ration helps infection control personnel to assess how their hospital compares with the mean rates from other hospitals. Some caveats apply. If the denominator is small (< 50 device-days or patient- days), this ratio will be a good estimate of the "true" device utilization. Therefore, a longer time period should be chosen. Also, not all hospitals are similar to each other, so if huge variations in hospital infection rates are noted, reasons for these variations should be investigated.

APPENDIX-V

PEST CONTROL:

Various types of pests are found in the hospitals such as cockroaches, mosquitoes, bed bugs, bats and mice. They serve for the mechanical transmission of microorganisms. Some serve as active participants in the disease transmission process as a vector. Pests and insects tend to live in warm, moist areas with availability of food such as the wooden furniture, shafts, kitchen, pantry, changing rooms, drains, janitor closets, etc.

From a public health and hygiene perspective, arthropod and vertebrate pests should be eradicated from all indoor environments in the health-care facilities. Modern approaches to institutional pest management usually focus on:

a) eliminating food sources, indoor habitats, and other conditions that attract pests;
b) excluding pests from the indoor environments;
c) applying pesticides as needed.
d) engineering control measures like sealing windows, shafts, ensuring screens closing doors to the outside are in good repair.

Pest control methods employed at AIIMS:

At AIIMS, the policy of Integrated Pest Management is being implemented. Currently, this is being done by central warehousing corporation, an outsourced agency specializing in pest management. The various methods like physical and chemical adopted are as follows for different types of pests:

a) For rats: Local made sticking gums are used to trap the rats.
b) For bed bugs: The protocol for 3 days to be implemented in case of a bed bug reporting in an area:

Generally, the bed bugs are found in the mattress and even in the wooden furniture.

1. Exposure to heat, sunlight is being used to treat the furniture once a bed is reported. The room is kept vacant to follow the protocol for treatment of the bugs which is as follows:

   Step 1: The area/ room affected is treated by Dichlorvos (also known as DDVP, an organophosphate) for treatment of small enclosures; and propoxur (an n-methyl-carbamate).

Step 2: The engineering activity of filling up the crevices with cement where the bugs can hide as these sites are cool and dark.

a.) **For bats:** High lux white lights are installed in the shafts where the bats generally reside. This mechanism is used because the bats reside in dark, cool places.

b.) **For cockroaches:** The policy of removing the used utensils of patients/ attendants immediately after having food and cleaning it in the local pantry area is being strictly followed.

c.) **For houseflies, wasps, moths, gnats, and mosquitos:** Electric fly catcher machine has been installed in various ward/ office areas to trap and kill pests. They utilize the mechanism of specially made UV LED Beam & high efficient fan to trap and dehydrate flying nuisances like mosquitoes, biting midges etc. quietly, effectively and hygienically.

GLOSSARY OF TERMS

EPIDEMIOLOGY

It is defined as the study of the determinants and distribution of health and disease in populations.

HEALTHCARE ASSOCIATED INFECTIONS/NOSOCOMIAL INFECTIONS

Both these terms are used synonymously and are defined as the infections that develop after 48 hours of hospitalization. These are distinct from infections which may occur within 48 hours of hospitalization and are considered community-acquired.

CARRIER

Carrier is defined as an individual (host) who harbors microorganisms (agent) without evidence of disease and in some cases, without evidence of any immune response.

This carrier state may take place during the latent phase of incubation period as a part of asymptomatic disease or may be chronic following recovery from the disease. Carriers may shed organisms into the environment continuously or intermittently leading to transmission. Shedding and potential for transmission may be increased by other factors affecting the host, including infection by another agent.

COLONISATION

It is the multiplication of a micro-organism in a body site without the evidence of invasive infection. It may or may not be a precursor of infection. It may be a form of carrier state and is a potential method of transmission.

COMMUNICABLE PERIOD

It is defined as the time period in the natural history of an infection during which transmission may take place.

CONTACT

A contact can be defined as an exposed individual who might have been infected through transmission from another host or environment.

CONTAMINATION

The presence of an agent (e.g. microorganism) on a surface or in a fluid or material –when could be a potential source for transmission.

ENDEMIC

It can be defined as an unusual level or presence of an agent or disease in a defined population during a given period.

EPIDEMIC

It can be defined as an unusual, higher than expected level of infection or disease by a common agent in a defined population in a given period. This definition assumes previous knowledge of the usual or endemic levels.

INCUBATION PERIOD

It can be defined as the period between exposure to an agent and the first appearance of evidence of disease in a susceptible host.

INDEX CASE

Index case is the first case to be recognized in a series of transmissions of an agent in a host population. In semi–closed populations, as typified by chronic disease hospitals, the index case may first introduce an agent not previously active in the population.

INFECTION

The successful transmission of a microorganism to a host with subsequent multiplication, colonization, and invasion is called infection. Infection may be clinical or sub–clinical and may not produce identifiable disease.

ISOLATION

The physical separation of an infected or colonized host, including the individuals contaminated body fluids and environment materials, from the remainder of the risk population in an attempt to prevent transmission of the specific agent to the latter

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