



Policies And Procedures On Infection Control

MINISTRY OF HEALTH MALAYSIA



Policies And Procedures On Infection Control

**Quality Medical Care Section,
Medical Development Division,
Ministry of Health Malaysia**

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FORWARD

BY THE DIRECTOR-GENERAL OF HEALTH OF MALAYSIA

A highly effective strategy in reducing healthcare-associated infections in hospitals is through the proper implementation and practice of policies and procedures on infection control by healthcare providers committed to this vital patient safety effort.

This revised edition of 'Policies and Procedures on Infection Control' Guideline is intended to assist healthcare providers to keep track and adhere to best practices in the control of hospital infection in hospitals. The availability of this guideline will also ensure uniformity of practice in infection control in all Ministry of Health (MOH) hospitals in the country.

Infection control policies and procedures, when consistently applied and integrated into all systems and processes, will yield the desired outcome. i.e. reduced infection rates. It is my fervent hope that all relevant parties will adopt the various recommendations set out in this guideline in their infection control activities for more efficient and effective infection control in our hospitals, thereby minimising the healthcare-associated infection rates in our hospitals.

Finally, I wish to congratulate the Guideline Committee Members from the National Infection and Antibiotic Control Committee and the Medical Development Division, MOH for their efforts in producing and revising the 'Policies and Procedures on Infection Control' Guideline 2010. Obviously much time and commitment have been given by them to produce this guideline and I would like to commend them for a job well done. As the saying goes, "There is no elevator to success; you have to take the stairs".

Thank you.



TAN SRI DATO' SERI DR. HJ. MOHD. ISMAIL MERICAN

MESSAGE FROM THE DEPUTY DIRECTOR-GENERAL OF HEALTH (MEDICAL)

This is the 2nd edition on Policies and Procedures on Infection Control Guideline, which was first published in 2001. The Guideline Committee Members from the National Infection and Antibiotic Control Committee, together with the Quality in Medical Care Section, of the Medical Development Division have put in much effort to revise and update this new edition, and I would like to commend them on their efforts.

Efforts at preventing healthcare associated infections in hospitals remain an ongoing and difficult challenge in the medical care setting. Practising good infection control measures can significantly reduce patient morbidity and mortality in hospitals and has been proven to be cost-effective as well.

The need to have one common policy and procedure on infection control guideline, to be adopted and practised by all hospitals under the auspices of the Ministry of Health (MOH), is of utmost importance. It will not only ensure standardization of infection control activities in hospitals, but will also facilitate the future monitoring and audit system on infection control.

To ensure successful implementation of the guideline's recommendation, all training on infection control for our healthcare providers in the MOH will need to utilise the guideline, as it will serve as a valuable technical resource on infection control activities.

It is my hope that the implementation of this guideline by our healthcare providers, will enhance the quality of healthcare provided to our patients in MOH hospitals in our noble efforts to ensure patient-centred care.



DATUK DR. NOOR HISHAM BIN ABDULLAH

MESSAGE FROM THE CHAIRPERSON OF GUIDELINE COMMITTEE

The review of the Policies and Procedures on Infection Control Guideline has been a necessary endeavor to reflect developments and advancements to the current infection control practices, in order to provide a more up-to-date guide for healthcare providers.

The first edition of this guideline has been reviewed in its entirety, resulting in a completely revised 2nd edition. This Policies and Procedures on Infection Control Guideline has been developed based on evidence from various international policies and procedures in infection control.

The changes of notes include updated details on the structure, functions and management in the chapters on hospital infection and antibiotic control committee, implementation of healthcare associated infections surveillance as well as hospital outbreak management and sterilization.

This edition also includes new chapters on isolation precautions and updates on standard precautions, hand hygiene, PPE, transmission based and design of isolation room. Various clinical practices and processes, activities to reduce the common healthcare associated infections and infection control in specific healthcare settings are also noteworthy additions to this guideline.

Guideline committee members who contributed to the chapters are well recognized as authorities or leaders in the field of infection control. It is my utmost hope that all healthcare providers will benefit from this Policies and Procedures on Infection Control Guideline. A vote of thanks are in order for chapter writers and coordinators, the Quality in Medical Care Section, Medical Development Division and all those involved in one way or another, for their support, dedication and commitment in making this guideline a reality.



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CONTENTS

Page

Forward by the Director-General of Health, Malaysia.....	i
Message from the Deputy Director-General of Health (Medical).....	ii
Message from the Chairman of Guideline Committee.....	iii
Advisors.....	iv
Guideline Committee Members List.....	iv
Contributors List.....	v
Acknowledgement.....	vi

Chapters

1. Hospital Infection and Antibiotic Control Committee.....	1
2. Healthcare Associated Infection Surveillance.....	7
3. Isolation Precaution.....	13
3.1 Standard Precaution.....	13
3.2 Transmission Based.....	15
3.3 Hand Hygiene.....	26
3.4 Personal Protective Equipment.....	29
3.5 Design of Isolation Rooms.....	37
4. Clinical Practice.....	41
4.1 Aseptic Technique.....	41
4.2 Urinary Catheter Care.....	44
4.3 Wound Care.....	47
4.4 Enteral Feeding.....	48
4.5 Parental Nutrition.....	51
4.6 Blood and Blood Product.....	54
4.7 Disinfection of Endoscopes.....	55
5. Prevention of Healthcare Associated Infections.....	61
5.1 Urinary Tract Infection.....	61
5.2 Surgical Site Infection.....	64
5.3 Nosocomial Respiratory Infection.....	70
5.4 Intravascular Catheter-Related Infections.....	72

6.	Infection Control in Specific Healthcare Setting.....	81
6.1	Neonatal Intensive Care Unit.....	81
6.2	General Intensive Care Unit.....	87
6.3	Operation Theater.....	92
6.4	Nephrology and Heamodialysis Unit.....	102
6.5	Dental Practice.....	109
6.6	Central Sterile Services.....	115
6.7	Mortuary.....	118
6.8	Burns.....	125
6.9	Haematology and Oncology Unit.....	129
6.10	Laboratory.....	132
7.	Tuberculosis.....	141
8.	Hospital Outbreak Management.....	147
9.	Occupational Health and Safety.....	149
10.	Environmental.....	153
10.1	Infection Control During Construction and Renovation.....	153
10.2	Operation Theater Commissioning.....	157
11.	Sterilization.....	163
12.	Principles of Antibiotic Surveillance.....	169
13.	Specific Organism Related Information.....	175
13.1	Multi-Resistant Organism.....	175
13.2	Methicillin Resistant Staphylococcus Aureus.....	178
13.3	Vancomycin Resistant Enterococci.....	183
13.4	HIV	186
13.5	Dengue	187
13.6	Malaria	189
13.7	Fungal Infections	191
14.	References.....	194
15.	Appendixes	
•	Appendix A.....	197
•	Appendix B.....	203
•	Appendix C.....	208

1. HOSPITAL INFECTION AND ANTIBIOTIC CONTROL COMMITTEE

1.1 Roles of Hospital Infection and Antibiotic Control Committee

1. The Hospital Infection and Antibiotic Control Committee (HIACC) of MOH is responsible for developing policies and procedures related to infection control and antibiotic usage in the hospital and its affiliated health facilities.
2. The HIACC will act as a source of expertise on matters relating to infection and antibiotic usage.
3. The HIACC advises the Hospital Director on the technical matters related to Infection Control in the hospital.
4. The policies and procedures of the HIACC should be in line with the principles and general policies set out by the National Infection and Antibiotic Control Committee (NIACC).

1.2 Infection Control Doctor (ICD)

1. The ICD is the Chairman of HIACC and is responsible for the day-to-day management of infection control in the hospital.
2. The ICD will be appointed by the hospital director. The ICD should have appropriate training and experience in matters relating to infection and antibiotic control. Infection control should make up a portion of his/her daily activities.
3. The ICD will refer to the HIACC for major matters of policy development and for the management of outbreaks in accordance to the major outbreak policy.

1.3 Chairman of HIACC

1. The chairman should have the training, experience, commitment and seniority needed to provide effective leadership of the HIACC. A senior clinician, preferably with a background in infectious disease or microbiology, is best suited for the position.
2. In the absence of the ICD, the meeting will be chaired by another consultant microbiologist or Infectious Disease Physician (IDP).
3. In large hospitals, a secretary to the HIACC maybe appointed by the hospital director to assist the Chairman. The secretary maybe chosen from the members of the HIACC.

1.4 Membership of the HIACC

The members should include:

- The Infection Control Doctor (Chairman)
- Medical Microbiologist (if not available, scientific officer in microbiology)
- The Infectious Disease Physician / Paediatrician

- The Infection Control Sister or the most senior infection control nurse (ICN)
- The Director /Deputy Director of the hospital
- A consultant virologist
- A consultant physician or surgeon
- A consultant pediatrician
- A consultant anaesthesiologist /intensivist
- A representative each from all major clinical departments (preferably at specialist or consultant level)
- The Nursing Director.
- A pharmacist
- Senior representative from the hospital support service concessionaire.

If a member is unable to attend, a representative should be sent.

1.5 Invited attendance

The following may be co-opted by the Chairman to attend for specific items as indicated by the agenda:

- Other clinical consultants
- The Financial Manager
- Nursing sisters of specific clinical areas
- The Hospital Engineer(s)
- The Head of Dietetics
- The Central Sterile Supplies Department (CSSD) Manager
- The Operation Theater Matron/ Sister
- The Senior health inspector in-charge of the public health unit.

In addition, post graduate trainees in medical microbiology or infectious diseases may be invited to attend as observers as part of their in-service training.

1.6 Agenda of the meetings

At each meeting the committee should:

1. Discuss the agenda prepared by the Chairman.
2. Report on the incidence and prevalence of 'alert' organisms and important infectious diseases.
3. Report on the occurrence and nature of any outbreaks of infection, and on incidents involving microbiological hazards (e.g. needle sharp injuries)
4. Report on on-going targeted surveillance of healthcare associated infections

5. Evaluate and report on antibiotic usage and resistance patterns and recommend remedial measures when appropriate.
6. Develop and maintain policies for the promotion of good infection control and antibiotic usage guidelines in MOH.
7. Review outbreaks of infection and advice managers on how outbreaks might be managed and prevented.
8. Assist in the planning and development of services and facilities (construction and demolition activities) in the hospital on issue which are relevant to infection control and antibiotic usage.
9. Monitor and advice on specific areas of hygiene and infection control, catering, CSSD, ventilator and water services, occupational health, pharmacy, operating theatres, endoscopy, etc.
10. Develop programs for the education of staff and students about infection control practices and policies and appropriate antibiotic prescribing.
11. Financial planning and monitoring of budget and expenses of infection control activities.

1.7 Frequency of meetings

1. Meetings must be held at least twice a year. (The hospital director or the deputy director should be in attendance).
2. 1 week notification of the date of the meeting and the agenda should be given.
3. The Hospital Director's Office will provide secretarial help and logistics support to the HIACC in conducting the meetings and activities. All minutes must be endorsed by the chairman and sent in a timely fashion to the Hospital Director.
4. There should be adequate designated space and computers(s) with internet facilities provided to the Infection Control Team.

1.8 Circulation of minutes

1. Minutes should be kept and verified.
2. Minutes should be sent to all members and to those who attended the meeting. In addition, copies should be sent to:
 - The Hospital Director
 - The Dean of the Medical and Allied Health Faculties using the hospital as teaching facilities
 - Heads of Departments and Units

1.9 Emergency meetings and outbreak control

1. The Chairman may convene an emergency meeting of the Infection Control Committee at any time and all members or their representative will be notified by telephone.

2. Emergency meetings are arranged for the control of outbreaks of infection and when the infection Control Team requires additional support and notification of the problem in accordance with the major outbreak policy.
3. The Chairman will chair all emergency meetings, and is in charge of the technical aspect of outbreak control measures.

1.10 Administrative arrangements

1. The Infection Control Team, is responsible for the day-to-day infection control activities of the hospital and reports directly to the Chairman of the HIACC
2. The HIACC draws up policies on all aspects of prevention and control of infections for the hospital.
3. These policies must receive the support of the hospital's management.
4. In the absence of separate activity budget code for infection control, the budget for the costs of infection control is part of the Medical Microbiology budget and for the unpredictable and ad-hoc activities such as large outbreaks or hospital wide campaigns, it will be borne by the hospital's operational budget.

1.11 The Infection Control Nurse (ICN)

1. The Infection Control Nurse(s) is a full-time member of the Hospital's Infection Control Team, which is headed by the Infection Control Doctor.
2. The ICN is responsible to the ICD but is professionally accountable to the Director via the appropriate Nursing Director within the nursing hierarchy.
3. The primary duties of the nurse are to assist the Infection Control Doctor with the prevention and control of infection in hospital.
4. This is achieved through the implementation of infection control policies and procedure, and by educating hospital and non-hospital personnel.
5. The number of ICN should conform to the Ministry's norm of 1 ICN:110 beds.

1.12 Duties and responsibilities of the infection Control Nurse

The Infection Control Nurse must:

Clinical

1. Liaise closely with the hospital medical microbiologist and clinicians.
2. Supervise and advise on isolation technique policies and procedures generally and in specific clinical situations.
3. Provide clinical advice and support to nurses, midwives, health visitors and other non-clinical personnel on infection control issues.
4. Analyze and provide feedback on microbiology reports to head of department.

5. Provide clinical advice and support to other health care professionals, ancillary staff and external agencies concerned with social issues arising from infection control matters.
6. Provide guidance and support to the ward link infection control nurses.

Surveillance

1. Coordinate surveillance activities for the hospital.
2. Collect relevant information on behalf of the Infection Control Team including point prevalence studies on healthcare-associated infections, clinical / antibiotic audits, hand hygiene compliance etc

Coordination/Organization of Infection Control Activities

1. Identify potential infection hazards and suggest appropriate remedial action to relevant personnel.
2. Work with the hospital Infection Control Team to identify, investigate and control outbreaks of infection.
3. Collaborate with the infection Control Team and clinicians about the routine monitoring of units, such as the intensive care and special care baby units, particularly vulnerable to infection.

Administrative

1. Participate in the development and implementation of the infection control policies.
2. Monitor compliance with infection control policies, including activities directly associated with audit.
3. Preparing timely reports.
4. Advise staff on the various aspects of infection control and occupational health safety.

Education**The Infection Control Nurse will:**

1. Participate in informal and formal teaching programmes for all healthcare workers.
2. Keep abreast with recent advances by reading relevant literature and attending appropriate courses, meetings and exhibitions.
3. Advise staff with regards to the microbiologic hazards in occupational health safety.
4. Participate and coordinate infection control-related educational campaigns as instructed by the HIACC.

Research and Quality Improvement Activities

1. Participate with the microbiologists and appropriate clinical staff on research projects that is related to hospital infection.

2. Evaluate implementation of infection control technique.
3. Audit infection control activities

1.13 Ward Link Nurse (WLN)

The WLN is the Ward Sister of each ward with sufficient nursing experience and who are in authority with staff and doctors in the ward. They are to undertake the WLN role alongside their other ward duties.

The WLN act as a link between the staff and doctors in the ward and the infection control team, and are accountable to the Nursing Director and the infection control team on areas related to infection control.

Duties and Responsibilities of WLN

Supervision on infection control practices

1. Ensure hand hygiene is being practice in ward
2. Ensure compliance to aseptic technique.
3. Proper cleansing and sterilization according to standard procedures
4. Proper storage of sterile instrument and linen
5. Proper segregation of waste disposal
6. Proper specimen collection and dispatch
7. Isolation of patients as required.

Surveillance

1. Participate in the national point prevalence survey
2. Assist in monitoring of alert organism such as MRO/MRSA/ESBL
3. Assist in the prevention and reporting of sharp injuries among staff
4. Collection and reporting of HCAI and outbreaks.
5. Audit activities

Education

1. Immediate reference and advice on matters related to infection control, abiding to infection control guidelines and standard precaution guidelines.
2. Disseminate, educate and create awareness on infection control to new health care workers in the wards.

Research

1. Assist in carrying out research, application on evidence based practices and the conducted of quality improvement activities.

2. HEALTHCARE ASSOCIATED INFECTION SURVEILLANCE

2.1 Introduction

Surveillance is one of the most important components of an effective infection control program. It is defined as the systematic collection, analysis, interpretation, and dissemination of data about the occurrence of HCAs in a definite patient population.

2.2 Purpose of Surveillance

1. To establish and maintain a database describing endemic rates of HCAs. Once endemic rates are known then the occurrence of an epidemic can be detected when infection rates exceed baseline values.
2. To identify trends manifested over a finite period, such as shifts in microbial pathogen spectrum, infection rates, etc.
3. To provide continuous observation of HCAs cases for the purpose of prevention and control.
4. To obtain useful information for establishing priorities for infection control activities.
5. To quantitatively evaluate control measures effectiveness for a definite hospital population.
6. To enhance the role and authority of the infection control team in the hospital through participation in ward rounds, consultations and education of healthcare workers.

2.3 Main components of Surveillance system

1. Definition of HCAI

Infections that occur more than 48 hours after admission (It must be taken into account that different infections have different incubation periods, so that each occurrence must be evaluated individually to determine the relationship between its occurrence and hospitalization).

2. Case Definition

Each case definition must be standardized and consistent. The case definition used nationwide will be that of CDC definitions. (Refer to Appendix A for 'Definitions of HCAI' developed by CDC.)

- i. Daily review of all positive culture results
(Manually / Lab information system / Automated disc reader)
- ii. Informed by infection control link nurse when diagnosed by clinician.
- iii. Identified during ward rounds / antibiotic rounds / Infectious disease rounds / ICU rounds.
- iv. Actively looking for cases in targeted surveillance and follow-up these cases.

2.4 Types of Surveillance

1. National surveillance
2. Hospital – wide (total) surveillance
3. Periodic surveillance
4. Prevalence studies
5. Targeted surveillance

National Surveillance

Type of Surveillance	Methods
Targeted organisms : MRSA / ESBL	Results collected daily and submitted monthly to Quality in Medical Care section, MOH (refer Appendix B for sample form)
Point Prevalence Study	1 day prevalence surveillance, hospital wide. Conducted twice a year on the same day throughout the nation (refer appendix C for sample form)
Needle stick injury	Reported yearly during the National Infection and Antibiotic Control Committee meeting.

Participated by all state hospitals, specialist hospitals, Universities hospitals (USM / UKM / UM) and district hospitals providing microbiology cultures.

Hospital Surveillances

- * Choice of types of surveillance depends on the requirements of the individual hospital and must be agreed by the Hospital Infection and Antibiotic Control Committee members.

Type of Surveillance	Methods
Total Surveillance	▪ The most comprehensive surveillance method; it entails collection of data for all infections in all hospitalized patients. ▪ Monthly infection rates are calculated to determine overall hospital rates and rates by site, care unit, service, pathogen, and surgical procedure. ▪ Advantage: this is useful for establishing baseline and comparative data. ▪ Disadvantage: requires enormous amounts of time and labor.

Type of Surveillance	Methods
Periodic Surveillance	▪ Surveillance performed at specified intervals (e.g. every three months); each time, the focus is on one specific infection site or on a definite patient population at increased risk of infection. ▪ In another version, periodic surveillance is performed on one or several units for a specified time period and then shifts to another unit or units. By rotating from unit to unit, infection control specialists are able to survey the entire hospital during the year. ▪ Advantage: leaves more time for other measures. ▪ Disadvantage: protracted time required to accumulate sufficient data for establishing valid baselines.
Prevalence studies	▪ The number of active infections is counted over a specified time period. Active infections are defined as all manifest infections present at the time of the survey or patient is still under treatment for the infection. ▪ Advantage: this is usually a quick method. It can provide adequate data on epidemiologically important infections within a facility and can serve as a basis for developing of future targeted surveillance. ▪ Disadvantages: Results must be very carefully interpreted. Prevalence rates are usually higher than incidence rates ▪ One cannot draw conclusions infection risk factors. It is important to choose the correct denominator. ▪ This method can be useful for validating data from of total surveillance.
Targeted : - “High risk” patients	▪ The focus in this type of epidemiological surveillance is on patients at increased risk of nosocomial infections (e.g: post-surgical patients, ICU patients, and patients receiving mechanical ventilation). ▪ The denominator of the incidence rate formula should contain only data on patients belonging to the “high risk” group. ▪ Infection risk indices can and must be used.

Type of Surveillance	Methods
	- Advantages: permits concentration of effort on areas where infection control measures may have the greatest effect and better use of limited resources; takes into account differences in infection risk for different patient populations. - Disadvantage: may miss clusters or outbreaks of infections not included in the surveillance program.
Targeted : -pathogen type -infection site	- This approach involves surveillance of infections at the same site (bacteremia, UTI, LRI, SSI, etc.) or caused by the same pathogen, usually one that is epidemiologically significant (MRSA, Vancomycin-resistant Enterococcus species). - Advantage: permits concentration of efforts on those areas where control measures may be most effective. - Disadvantage: may miss clusters or outbreaks of infections not included in the surveillance program. - It is necessary to use the appropriate denominator

2.5 Data Collection

1. Collect essential data from lab forms of all MRO /suspected HCAI /clusters (Refer 'HCAI infection surveillance form' in Appendix B).
2. Verify cases from the patient's BHT and discussion with the doctor in-charge /link-nurse /ward sister.
3. Exclude non HCAI cases and complete the HCAI form.
4. All patients must be followed up and subsequent events must be recorded.
5. All data related to the investigations of an outbreak i.e. environment, patients, or staff should be documented.

2.6 Tabulation of Data

1. Daily (group the suspected and confirmed cases according to type of MRO or infections)
2. Special T-cards or boards can be used to monitor the cases daily (patient location / pathogen /infection sites /risk factors).
3. A SPCC (Statistical Process Control Chart) shall be use to monitor the trend of infections for certain organisms or site of infection. Measuring trend in percentage.
4. In house 'Control Chart' to monitor the number of infections with MRO.

5. Reports bi-annually and as required if there is an outbreak or when needed.

2.7 Analysis and interpretation of data

Factors to be considered when using formulas for calculation of infection rates in a selected patient population:

1. Numerator data: number of patients with specified type of infection or number of infections.
2. Denominator data: 1) number of admissions or discharges. 2) Number of patients undergoing a specific procedure. 3) Total patient days. 4) Total invasive device days (ventilator days /CVC days /Urinary catheter days etc)
3. Provision should be made for adjusting data to account for differences among the study population.

2.8 Preparation and dissemination of reports

1. Compile and prepare summary reports and communicate the information to individuals who can authorize changes that improve treatment outcomes.
2. All information should be reported to the HIACC Chairman.
3. The coordinator shall communicate with the key persons from the clinical services and hospital administration.
4. Every outbreak shall be followed by a complete report.

Note :

3. ISOLATION PRECAUTION

3.1 Standard Precautions

The purpose of isolating patients is to prevent the transmission of micro-organisms from infected or colonized patients to other patients, hospital visitors, and health care workers (who may subsequently transmit to other patients or become infected or colonized themselves). Two-tier approach is currently employed. This includes **STANDARD PRECAUTIONS** (which applies to all patients) and **TRANSMISSION-BASED PRECAUTIONS** (which apply to patients with documented or suspected infection or colonization with certain micro-organisms).

Standard Precautions are designed to reduce the risk of transmission of micro-organisms from both recognized and unrecognized sources of infection in the hospital. **Standard Precautions applies to all patients regardless of their diagnosis.** Standard Precautions shall be implemented when contact with any of the following are anticipated:

- Blood
- All body fluids, secretions and excretions, with the exception of sweat regardless of whether or not they contain visible blood.
- Non-intact skin (this includes rashes)
- Mucous membranes

3.1.1 Standard Precautions Requirements

1. **Hand hygiene:** (*see section on hand hygiene*) must be practiced promptly after touching blood, body fluids, secretions or excretions whether or not gloves were worn. In addition, hand hygiene must be practiced after gloves are removed and between patient contacts. Finally, hand hygiene must be practiced when tasks or procedures on the same patient involve different body sites in order to prevent cross-contamination between body sites.
2. **Gloves:** (*see section on PPE*) clean gloves must be worn when touching blood, body fluids, excretions, secretions and contaminated items and when performing venipuncture.
3. **Mask, eye protection & face shield** (*see section on PPE*): must be worn during procedures or patient care activities that are expected to generate splashes or sprays of blood, body fluids, secretions and excretions. For example, suctioning, irrigating a wound, performing certain laboratory tests, etc.
4. **Gown or Apron** (*see section on PPE*): must be worn to protect skin and to prevent soiling of clothing during procedures or patient care activities that are expected to generate splashes or sprays of blood, body fluid, secretions and excretions.

5. **Patient care equipment:** (*see chapter on Disinfectants & Sterilisation*) must be cleaned according to protocol with MOH-approved disinfectant before being used for another patient.
6. **Linen:** Place contaminated linen directly into a laundry bag in the isolation room/ area with minimal manipulation or agitation to avoid contamination of air, surfaces, and persons.
7. **Waste management:**

Clinical waste includes:

- Discarded sharps;
- Laboratory and associated waste directly associated with specimen processing;
- Human tissues, including material or solutions containing free-flowing blood; and
- Animal tissue or carcasses used in research.

Related waste includes:

- Cytotoxic waste
- Pharmaceutical waste
- Chemical waste
- Radioactive waste.

General waste includes other wastes that do not fall into the above categories

Waste segregation:

- Domestic waste – Bin lined with black bag.
- Clinical waste (non sharp) – Bin lined with yellow bag.
- Clinical waste (sharps) – Sharps bin

8. **Management of spills**

Small spills - Remove with absorbent material, wipe with Sodium hypochlorite 1:10.

Large spills - Cover spillage with absorbent material, pour Sodium hypochlorite 1:10 and leave for 5-10 min. Wipe up with absorbent material and place in yellow bin.

OR

Sprinkle chloride granules leave for 5-10 min. Scoop with brush and dust pan and discard into clinical waste bin. Mop the area with Sodium hypochlorite 1:100.

9. **Needles and other sharps:** Sharps must not be passed directly from hand to hand and handling should be kept to a minimum. Do not recap, bend, break, or hand-manipulate used needles. Place used sharps in puncture-resistant container.
10. **Respiratory hygiene/cough etiquette:** Instruct symptomatic persons and health care workers to cover their mouths/noses when coughing or sneezing, use and dispose of tissues, perform hand hygiene after hands have been in contact with respiratory secretions and wear surgical mask if tolerated or maintain spatial separation, >3 feet if possible.

3.2 Transmission-based

These precautions apply to selected patients, based on a suspected or confirmed clinical syndrome, a specific diagnosis, or colonization or infection with epidemiologically important organisms. These precautions are to be implemented in conjunction with standard precautions. Three types of transmission-based precautions have been developed; airborne, droplet and contact. Few diseases (e.g. varicella, influenza) may require more than one isolation category. (See table 1 & 2). Essential elements of each isolation category are outlined below;

Airborne Precautions	
Designed to prevent the transmission of diseases by droplet nuclei (particles <5 µm) or dust particles containing the infectious agent. These particles can remain suspended in the air and travel long distances. If the particles are inhaled, a susceptible host may develop infection. Airborne precautions are indicated for patients with documented or suspected tuberculosis (pulmonary or laryngeal), measles, varicella, or disseminated zoster.	
Patient Placement	In descending order of preference; 1. Negative pressure room en-suite bath 2. Single room (nursed with door closed) and en-suite bath 3. Single room 4. Cohort (not recommended unless absolutely necessary) – consult Physicians /microbiologists
Respiratory protection	Wear respiratory protection when entering the room of a patient with known or suspected infectious pulmonary tuberculosis. Susceptible persons should not enter the room of patients known or suspected to have measles or (rubeola) or varicella (chickenpox) if other immune caregivers are available. If susceptible persons must enter the room of a patient known or suspected to have measles (rubeola) or varicella, they should wear respiratory protection. Persons immune to measles (rubeola) or varicella need not wear respiratory protection
Face shield/eye protection	As per standard precautions <i>(For procedures/activities likely to generate splashes/sprays of blood, body fluids, secretions and excretions)</i>
Gloves and Hand washing	As per standard precautions <i>(When touching blood, body fluids secretions, excretions, contaminated items, mucous membranes, non intact skin)</i>

Gown	As per standard precautions <i>(For procedures/activities likely to generate splashes/sprays of blood, body fluids, secretions and excretions)</i>
Patient Transport	Limit the movement and transport of the patient from the room to essential purposes only. If transport or movement is necessary, minimize patient dispersal of droplet nuclei by placing a surgical mask on the patient.

Droplet Precautions

Designed to prevent the transmission of diseases by large particle (droplet) (particles > 5 µm) or dust particles containing the infectious agent. Unlike droplet nuclei, droplets are larger, do not remain suspended in the air, and do not travel long distances. They are produced when the infected patient talks, coughs, or sneezes, and during some procedures (e.g., suctioning and bronchoscopy). A susceptible host may become infected if the infectious droplets land on the mucosal surfaces of the nose, mouth, or eye.

Patient Placement	No special air handling or ventilation required In descending order of preference; 1. Single room with en-suite bath 2. Single room 3. Cohort – place the patient in a room with a patient(s) who has active infection with the same microorganism but with no other infection. 4. In the general ward, but maintain a spatial separation of at least 3 feet between infected patient and other patients and visitors. Place an isolation trolley/tray* at the entrance of the isolation zone.
Respiratory protection	Wear mask when working within 3 feet of the patient. If placed in a single room, wear mask before entering the room.
Face shield/eye protection	As per standard precautions <i>(For procedures/activities likely to generate splashes/sprays of blood, body fluids, secretions and excretions)</i>
Gloves and Hand washing	As per standard precautions <i>(When touching blood, body fluids secretions, excretions, contaminated items, mucous membranes, non intact skin)</i>

Gown	As per standard precautions <i>(For procedures/activities likely to generate splashes/sprays of blood, body fluids, secretions and excretions)</i>
Patient Transport	Limit the movement and transport of the patient from the room to essential purposes only. If transport or movement is necessary, minimize patient dispersal of droplet nuclei by placing a surgical mask on the patient.

Contact Precautions

Used to prevent the transmission of epidemiologically important organisms from an infected or colonized patient through direct (touching the patient) or indirect (touching contaminated objects or surfaces in the patient's environment) contact.

Patient Placement	In descending order of preference; 1. Single room with en-suite bath 2. Single room 3. Cohort – place the patient in a room with a patient(s) who has active infection with the same micro organism but with no other infection. 4. In the general ward with an isolation tray/trolley* beside the bed.
Respiratory protection	As per standard precautions <i>(For procedures/activities likely to generate splashes/sprays of blood, body fluids, secretions and excretions)</i>
Face shield/eye protection	As per standard precautions <i>(For procedures/activities likely to generate splashes/sprays of blood, body fluids, secretions and excretions)</i>
Gloves and Hand washing	In addition to Standard Precautions, wear gloves (clean, non-sterile gloves are adequate) when entering the room. During the course of providing care for a patient, change gloves after having contact with infective material that may contain high concentrations of microorganisms (fecal material and wound drainage). Remove gloves before leaving the patient's environment and wash hands immediately with soap or a waterless antiseptic agent.

	After glove removal and hand washing, ensure that hands do not touch potentially contaminated environmental surfaces or items in the patient's room to avoid transfer of microorganisms to other patients or environments.
Gown	In addition to Standard Precautions, wear a gown/apron (a clean, non-sterile gown/apron is adequate) when entering the room if you anticipate that your clothing will have substantial contact with the patient, environmental surfaces, or items in the patient's room, or if the patient is incontinent or has diarrhea, an ileostomy, a colostomy, or wound drainage not contained by a dressing. Remove the gown before leaving the patient's environment. After gown removal, ensure that clothing does not contact potentially contaminated environmental surfaces to avoid transfer of microorganisms to other patients or environments
Patient-Care Equipment	Dedicate the use of noncritical patient-care equipment such as thermometer, stethoscope, BP set to a single patient (or cohort of patients infected or colonized with the pathogen requiring precautions). If these items must be shared, they should be cleaned and disinfected before reuse.
Patient Transport	Limit the movement and transport of the patient from the room to essential purposes only. If transport or movement is necessary, use clean linen. Cover all open wounds before transport.

* Isolation tray/trolley must contain the following items: nonsterile gloves, nonsterile gowns, surgical masks, thermometer, BP set, stethoscope, alcohol hand rub.

Table: 1 Isolation Precautions For Various Infections

Diseases	Isolation Precautions	Duration of Isolation
Abscess - Dressing covers and contains discharge adequately. - No dressing or dressing does not contain discharge adequately.	Standard	
	Contact	

Diseases	Isolation Precautions	Duration of Isolation
HIV / AIDS	Standard	
Amoebiasis	Standard	
Dengue	Standard	
Candidiasis	Standard	
Cryptococcosis	Standard	
Diphtheria – Pharyngeal	Droplet	Until off antibiotics and 2 cultures taken at least 24 hours apart are negative
Endometritis	Standard	
Enteroviral infections	Standard	
Epiglottitis, due to Haemophilus influenzae	Droplet	Until 24 hours after starting effective therapy
Clostridium difficile enterocolitis	Contact	Duration of illness
Gastroenteritis • If incontinent or diapered	Standard	Duration of illness
	Contact	
Hepatitis A • If incontinent or diapered	Standard	In children 3 to 14 years of age maintain precautions until 2 weeks after onset of symptoms; and in others, until 1 week after onset of symptoms.
	Contact	
Hepatitis B, HbsAg Positive	Standard	
Hepatitis C, E, and other unspecified non-A, non-B	Standard	
Herpes simplex • Encephalitis • Mucocutaneous, Primary or disseminated • Mucocutaneous, Recurrent (skin, genital, oral)	Standard	
	Contact	Duration of illness
	Standard	
Herpes Zoster (Varicella-Zoster) • Localised in normal host • Disseminated • Localised in Immunocompromised patient	Contact	Duration of illness. Persons susceptible to varicella(chicken pox)are also at risk for developing varicella when exposed to patients with herpes zoster lesions; therefore, susceptibles should not enter the room if other immune caregivers are available.
	Airborne & Contact	

Diseases	Isolation Precautions	Duration of Isolation
Histoplasmosis	Standard	
Impetigo	Contact	Until 24 hours after starting effective therapy
Infectious Mononucleosis	Standard	
Influenza	Droplet	Duration of illness
Legionnaires' disease	Standard	
Leptospirosis	Standard	
Lice (Pediculosis)	Contact	
Malaria	Standard	
Measles	Airborne	Duration of illness
Melioidosis	Standard	
Meningitis • Haemophilus influenzae, <i>known or suspected</i> • Meningococcal, <i>known or suspected</i> • Other bacterial • Aseptic • Fungal	Droplet	Until 24 hours after starting effective therapy
Meningococccemia	Droplet	Until 24 hours after starting effective therapy
Mumps	Droplet	For 9 days after onset of swelling
Mycobacteria, Atypical • Pneumonia • Wound	Standard	
Mycobacterium tuberculosis	Airborne & Droplet	2 weeks after start of treatment
MRO/MRSA • Wound bacteremia • Pneumonia	Contact Droplet	Until eradicated Cover wound with adequate dressing Wear mask
Nocardia	Standard	
Pertusis (Whooping cough)	Droplet	Maintain precautions until 5 days after patient is placed on effective therapy
Pneumonia • Atypical Myoplasma Pneumonia • Pneumocystis carinii	Droplet Standard	Duration of illness Avoid placement in the same room with an immunocompromised patient

Diseases	Isolation Precautions	Duration of Isolation
•Adenovirus/RSV/Influenza •Chlamydia •Other Bacterial	Droplet & Contact Standard Standard	Duration of illness
Poliomyelitis	Standard	
Rabies	Standard	
Rheumatic fever	Standard	
Rubella (German measles)	Droplet	Until 7 days after the onset of rash
Scabies	Contact	
Streptococcal disease (Group A streptococcus) Skin, wound, burns •No dressing or dressing does not contain discharge adequately •Dressing covers and contains discharge adequately	Contact	Until 24 hours after starting effective therapy
Syphilis	Standard	
Tetanus	Standard	
Toxic shock syndrome (Staph)	Standard	
Toxoplasmosis	Standard	
Typhoid (Salmonella Typhi) •If incontinent or diapered	Standard Contact	
Typhus	Standard	
Urinary tract infection including pyelonephritis	Standard	
Varicella (chicken pox)	Airborne & Contact	Maintain precautions until all lesions are crusted. The average incubation period for varicella is 10 to 21 days. Discharge exposed but susceptible patients if possible. Place exposed susceptible patients on Airborne Precautions beginning 10 days after exposure and continuing until 21 days after last exposure (up to 28 days if VZIG has been given). Susceptible persons should not enter the room of patients on precautions if other immune caregivers are available.

Diseases	Isolation Precautions	Duration of Isolation
Wound Infections •Dressing covers and contains discharge adequately •No dressing or dressing does not contain discharge adequately	Standard Contact	

Table 2: Clinical Syndromes Requiring Empiric Precautions to Prevent Transmission Pending Confirmation of Diagnosis

Clinical Syndrome	Potential Pathogens	Empiric Precautions
Diarrhea		
Acute diarrhea in a incontinent/ diapered patient	Enteric Pathogens	Contact
Diarrhea in a patient with history of recent antibiotic use	<i>Clostridium difficile</i>	Contact
Meningitis		
Meningitis	<i>Neisseria Meningitidis</i>	Droplet
Generalised exanthems/rash		
Petechial/echymotic with fever	<i>Neisseria Meningitidis</i>	Droplet
Vesicular	Varicella	Airborne & Contact
Erythematous maculopapular with coryza and fever	Measles	Airborne
Respiratory Infections		
Atypical pneumonia	Influenza	Droplet
CXR suggestive of Pulmonary tuberculosis	Mycobacterium Tuberculosis	Airborne
Risk of multidrug resistant organism		
History of infection or colonization with multidrug resistant organism	Resistant Bacteria	Contact
Skin or Wound Infection		
Abscess or draining wound that cannot be covered	<i>Staphylococcus aureus</i> , Group A streptococcus	Contact

3.2.1 Practice of isolation

1. Patient placement

- Appropriate patient placement is a significant component of isolation precautions.
- Determine patient placement based on the following principles:
 - Route(s) of transmission of the infectious agent
 - Risk factors for transmission in the infected patient
 - Risk factors for adverse outcomes resulting from healthcare-associated infection in other patients in the area.
 - Availability of single-patient rooms
- Give priority to the following types of patients /infections when single rooms are scarce
 - Source patient has poor hygienic habits, contaminates the environment, or cannot be expected to assist in maintaining infection control precautions to limit transmission of microorganisms (i.e., infants, children, and patients with altered mental status).
 - Source patient has uncontained secretions, excretions or wound drainage.
For patients with obligate or preferential airborne infections which include pulmonary tuberculosis, measles and chickenpox.
 - Cohorting: When single rooms are scarce patients with epidemiological and clinical information suggestive of a similar diagnosis may be allowed to share a room, but with a spatial separation of ≥ 1 m.
- In cohorted areas minimize patient mingling.
- For airborne/droplet transmission ask patients to wear surgical mask and ensure room is well ventilated
- Increase the cleaning of common areas including bath / toilet facilities (e.g. 4–6 hourly).
- Place alcohol hand rubs beside each patient bed.
- Avoid sharing of equipment, but if unavoidable, ensure that reusable equipment is appropriately disinfected between patients
- Isolation trolley/tray with all the necessary PPE must be available at the entrance of the cohorted area.
- Assigning or cohorting healthcare personnel to care only for patients infected or colonized with a single target pathogen limits further transmission of infectious agents to uninfected patients but is difficult to achieve in the face of current staffing shortages in hospitals and in non-hospital healthcare sites.
- For critical / seriously ill patients: patients who will require close monitoring, isolation requirements should not compromise clinical care. For such patients the options are
 - o Arrange for intensive monitoring (equipment / personnel with appropriate PPEs) to be placed in the isolation facility or
 - o Bring patients out into open area with cohorting requirements (only if the mode of potential spread is contact / droplet)

2. Signs, BHT, Isolation tray/trolley

- Place appropriate signs on the door/ patient screen/bed stand to indicate the type of isolation precaution required for the patient.
- The case records, X-rays and observation charts must not be taken into the isolation room or cohorted areas.
- An isolation tray/trolley is required to be placed outside each isolation room/ area, unless an ante room with adequate storage facilities is available.

3. Equipment /Supplies

- As far as possible, dedicate the use of non-critical patient care equipments such as thermometer, BP set, stethoscope to a single patient.
- Non-critical items, such as commodes, intravenous pumps, and BP sets, must be thoroughly cleaned and disinfected prior to use on another patient
- All disposable supplies or items that cannot be cleaned must be discarded when the patient is discharged from the isolation rooms.

4. Visitor Policy for Infection Control

The support offered to patients by visitors is of great importance in their recovery and well being. A few simple principles will ensure the visitor's and the patient's safety from exposure to communicable diseases.

- Visitors are discouraged from entering isolation rooms of patients in airborne and droplet isolation. They are expected to wear the same PPE that a health care worker would wear performing the same activity.
- All visitors who are involved in caring of patients should be educated on standard precaution, which include use of PPE and hand hygiene. This applies to activities such as changing bed linen, bathing or toileting.
- Patients and family member/guardian must be counseled and given emotional support.
- In outbreak situations unnecessary visits should be discouraged. Those who choose to visit should wash their hands as they enter and leave the area and comply with all other hygiene practices in place. Alternative ways of communicating with the patient during this time include telephone and written notes.
- Visitors with uncontrolled symptoms of coughing, sneezing, or diarrhea should refrain from visiting.

5. Dishes, Glasses, Cups, Eating Utensils and Medications

- No special precautions are needed for dishes, glasses, cups, or eating utensils. The combination of hot water and detergents used in hospital dishwashers is sufficient to decontaminate dishes, glasses, cups, and eating utensils. If hot water or adequate conditions for cleaning utensils and dishes are not available, disposable products should be used.

- Any medications/IV solutions, tube feedings or baby formula taken into an isolation room that is not used must be discarded when patient is discharged.

6. Transportation of patients

- Limit the movement and transport of patients who require isolation and ensure that such patients leave their rooms/isolated areas only for essential purposes.
- When patient transport is necessary, it is important that, appropriate barriers (e.g., masks, impervious dressings) are worn or used by the patient to reduce the opportunity for transmission of pertinent microorganisms to other patients, personnel, and visitors and to reduce contamination of the environment.
- Any patient with a draining wound or skin lesions should be dressed with a clean hospital gown before leaving the room. Cover all open wounds before transport.
- Personnel in the area to which the patient is to be taken must be notified of the impending arrival of the patient and of the precautions to be used to reduce the risk of transmission of infectious micro-organisms.
- Procedures for these patients should be scheduled at times when they can be performed rapidly and when waiting areas are less crowded
- Use routes of transport that minimize exposures of staff, other patients and visitors

7. Cleaning

- Isolation rooms are to be cleaned daily.
- Cleaning **MUST** precede disinfection. Items and surfaces cannot be disinfected if they are not first cleaned of organic matter (patient excretions, secretions, dirt, soil, etc).
- To avoid possible aerosolization of ARD pathogens, damp cleaning (moistened cloth) rather than dry dusting or sweeping should be performed
- Horizontal surfaces and dust collecting areas, sites in the immediate patient environment, sites HCWs often contact should be cleaned regularly and on discharge
- To facilitate daily cleaning, keep areas around the patient free of unnecessary supplies and equipment.
- Do not spray (i.e. fog) occupied or unoccupied rooms with disinfectant. This is a potentially dangerous practice that has no proven disease control benefit
- To facilitate cleaning, and to reduce the potential for aerosolization caused by use of a vacuum cleaner, isolate patients in uncarpeted rooms/areas,
- Upon discharge of the patient, isolation rooms will receive terminal cleaning.

3.3 Hand Hygiene

3.3.1 Introduction

Pathogenic organisms from colonized and infected patients (and sometimes from the environment) transiently contaminate the hands of staff during normal clinical activities and can then be transferred to other patients. Hand transmission is one of the most important methods of spread of infectious agents in health care facilities. Proper hand hygiene is an effective method for preventing the transfer of microbes between staff and patients. Increasing in hand-washing compliance by 1.5 – 2 fold would result in a 25-50% decrease in the incidence of healthcare associated infections.

3.3.2 Performing Hand Hygiene

- Soap and water is as effective as hand washing preparations containing antimicrobial agents for decontaminating hands and removing transient microorganisms.
- However, water and preparations containing antimicrobial agents are more effective in removing resident microorganisms than those without an antimicrobial agent. Kill residents only for surgery.
- Alcohol-based hand rubs are more effective in destroying transient microorganisms than antimicrobial hand washing agents or soap and water, and give a greater initial reduction in hand flora. Alcohol-based hand rubs with emollients added will cause less skin irritation and drying to hands (1-3% glycerol). However hand rubs containing alcohol alone as the active ingredient have no residual effect. Hands that are visibly soiled or potentially grossly contaminated with dirt or organic material must be washed with liquid soap and water.
- Liquid products should be stored in closed containers and dispensed from disposable containers or containers which can be thoroughly washed and dried before refilling. Do not add soap to a partially empty soap dispenser.
- When bar soaps are used, they should be changed frequently. Small bars and soap racks (to promote drying) are recommended.
- Gloves should not be regarded as a substitute for hand hygiene. A glove is not always a complete impermeable barrier (20-30% of surgical gloves are punctured during surgery). An alcoholic rub or hand wash should be performed after removing gloves and before sterile gloves are worn.
- Proper technique for decontamination of hands is probably of greater importance than the agent used. See figures for the technique of hand washing and antisepsis

3.3.3 Five (5) Moments in Hand Hygiene

1. Before and after having direct contact with patients: A single act of hand hygiene (with an alcohol hand-rub or an antimicrobial soap) after one patient and before the next patient suffices to decontaminate your hands if you are not re-contaminating your hands in-between patients (as in talking on the telephone, handling objects, etc.). A good rule of thumb is that if you apply an alcohol hand-rub as you leave one patient and are still rubbing your hands together as you arrive at the next patient then there is no need to repeat hand antisepsis.

2. Before handling an invasive device for patient care, regardless of whether or not gloves are used.
3. After contact with body fluids or excretions, mucous membranes, non-intact skin, or wound dressings.
4. If moving from a contaminated body site to a clean body site during patient.
5. After contact with inanimate objects (including medical equipment) in the immediate vicinity of the patient.

Perform hand wash when hands are visibly dirty.

Wash hands with plain or antimicrobial soap and water or rub hands with an alcohol-based formulation before handling medication or preparing food.

3.3.4 Surgical scrub

1. Remove rings, wrist-watch, and bracelets before beginning the surgical hand preparation
2. When performing surgical hand antisepsis using an antimicrobial soap, long scrub times are not necessary. Recommended duration in 2-3 minutes but not exceeding 5 minutes and should include wrists and forearms.
3. If hands are visibly soiled, wash hands with plain soap before surgical hand scrub.

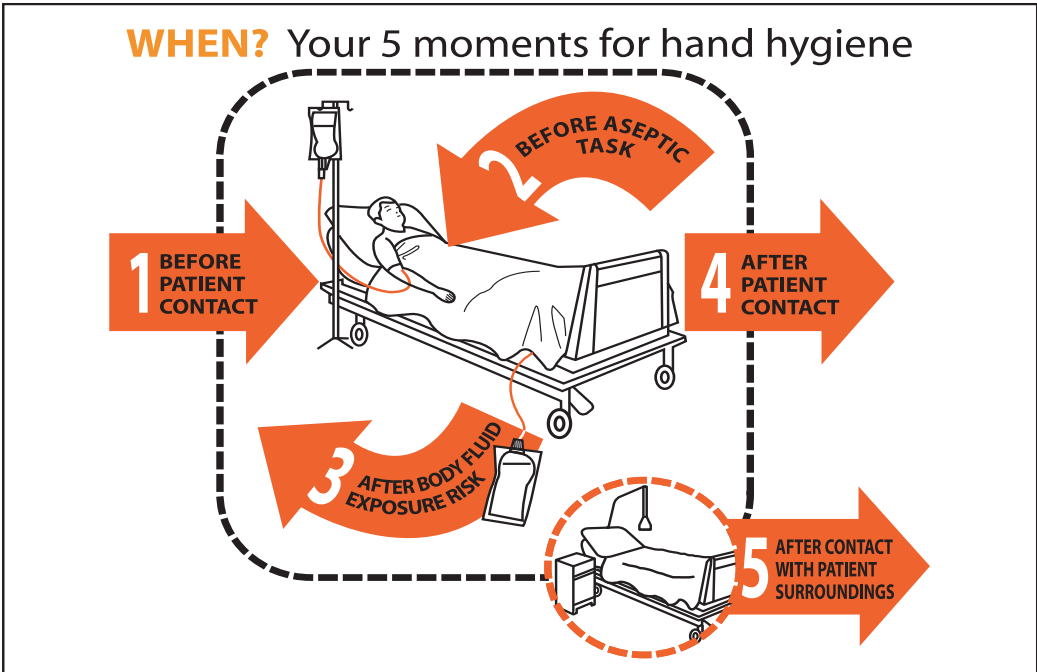
Sterile disposable or auto clavable nailbrushes may be used to clean the fingernails only, but not to scrub the hands. A brush should only be used for the first scrub of the day

3.3.5 Institutional responsibilities

1. Make improved hand-hygiene an institutional priority and provide administrative and financial support.
2. Provide an alcohol-based hand-rub at the entrance to the patient's room and/or at the bedside, as well as other convenient locations. Placing alcohol-based hand rub dispensers near the point of care has been associated with increased compliance by health care workers with recommended hand hygiene procedures.
3. To provide an alternative to alcohol-based hand-rubs for decontaminating hands, provide antimicrobial soap in all patient care areas where soap is provided (i.e. all sinks with a soap dispenser).
4. Solicit input from health care workers regarding the feel, fragrance, and skin tolerance of products, such as soap, alcohol hand-rub and gloves.

Monitor health care workers' adherence to hand-hygiene practices and provide information regarding the workers' performance.

The 5 Moments in Hand Hygiene



How to handrub? RUB HANDS FOR HAND HYGIENE! WASH HANDS ONLY WHEN VISIBLY SOILED! Duration of the entire procedure : 20-30 sec.	How to handwash? WASH HANDS ONLY WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB! Duration of the entire procedure : 40-60 sec.
1 Dip all fingers of right hand into left palm filled with hand rub solution, pour hand rub solution over to right palm and dip all fingers of left hand into handrub solution,	1 Rub hands palm to palm,
2 rub hands palm to palm,	2 right palm over left dorsum with interlaced fingers and vice versa,
3 right palm over left dorsum with interlaced fingers and vice versa,	3 palm to palm with fingers interlaced,
4 palm to palm with fingers interlaced,	4 backs of fingers to opposing palms with fingers interlocked,
5 backs of fingers to opposing palms with fingers interlocked,	5 rotational rubbing of left thumb clasped in right palm and vice versa,
6 rotational rubbing of left thumb clasped in right palm and vice versa,	6 rotational rubbing of left thumb clasped in right palm and vice versa,
7 rotational rubbing of right wrist clasped in left palm and vice versa	7 rotational rubbing of right wrist clasped in left palm and vice versa
8 once dry, your hands are safe	

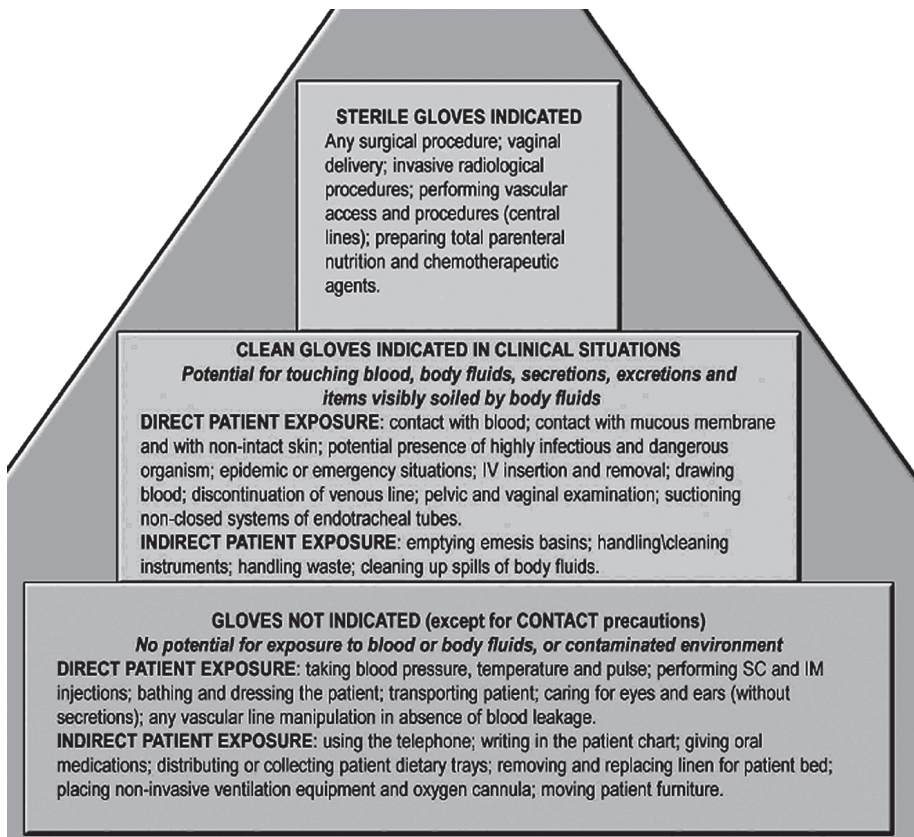
3.4 Personal Protective Equipment (PPE)

Primary uses of PPE are to protect staff and reduce opportunities for transmission of microorganisms in hospital. Select protective equipment on the basis of an assessment of the risk of transmission of microorganisms to the patient, and the risk of contamination of health care practitioners' clothing and skin by patients' blood, body fluids, secretions and excretions.

3.4.1 Gloves

Glove wearing by HCWs is recommended for two main reasons:

1. To prevent microorganisms which may be infecting, commensally carried, or transiently present on HCWs' hands from being transmitted to patients and from one patient to another; and
2. To reduce the risk of HCWs acquiring infections from patients.



Gloves **do not** replace the need for hand washing. Contamination of the hands may occur when gloves are removed and some gloves have small perforations that may allow contamination of the hands.

Gloves must be discarded after each care activity for which they were worn in order to prevent the transmission of microorganisms to other sites in that individual or to other patients. Wear gloves only when indicated – otherwise they become a major risk for germ transmission.

3.4.2 Isolation Gowns and Aprons

1. Clinical and laboratory coats or jackets worn over personal clothing for comfort and/or purposes of identity are not considered PPE.
2. Disposable plastic aprons should be worn when there is a risk that clothing or uniform may become exposed to blood, body fluids, secretions and excretions, with the exception of sweat.
3. Full body gowns need only be used where there is the possibility of extensive splashing of blood, body fluids, secretions or excretions and should be fluid repellent.
4. However, when contact precautions are used to prevent transmission of an MDRO, donning of both gown and gloves prior to room entry, regardless of the anticipated level of contact, may reduce unanticipated contact with an MDRO in the environment.
5. The practice of routine gowning upon entrance into an intensive care or other high-risk area does not prevent colonization or infection of patients.
6. Removal of isolation gowns before leaving the patient care area is advised to prevent opportunities for possible contamination outside the patient's room.

3.4.3 Face Protection: Masks, Goggles, Face Shields

1. Masks are used for three primary purposes in healthcare settings:
 - a. to protect health care workers from contact with infectious material from patients e.g: respiratory secretions and sprays of blood or body fluids as defined in standard and droplet precautions.
 - b. placed on healthcare workers when engaged in procedures requiring sterile technique to protect patients from exposure to infectious agents carried in a healthcare worker's mouth or nose,
 - c. placed on coughing patients to limit potential dissemination of infectious respiratory secretions from the patient to others (i.e: Respiratory Hygiene/Cough Etiquette).
2. Procedures that generate splashes or sprays of blood, body fluids, secretions, or excretions (e.g., endotracheal suctioning, bronchoscopy, invasive vascular procedures) require either a face shield (disposable or reusable) or mask and goggles
3. Two types of mask available, the surgical and particulate respirator (N95) used to prevent inhalation of small particles that may contain infectious agents transmitted via the airborne route.
4. Personal eyeglasses and contact lenses are NOT considered adequate eye protection.

5. Disposable or non-disposable face shields may be used as an alternative to goggles. As compared with goggles, a face shield can provide protection to other facial areas in addition to the eyes.
6. Removal of a face shield, goggles and mask can be performed safely after gloves have been removed, and hand hygiene performed.

3.4.4 Respiratory protection

1. Personal respiratory protection is required when dealing with micro-organisms that spread by airborne route. Respirators are also currently recommended to be worn during the performance of aerosol-generating procedures (e.g: intubation, bronchoscopy, suctioning) patients with SARS Co-V infection, avian influenza, pandemic influenza and other unknown respiratory syndromes. In these instances, surgical masks are not effective protection.
2. Respiratory protection currently requires the use of a respirator with N95 or higher filtration.

3.4.4.1 Fit test

1. All health care facilities using these respirators must have a mechanism to regularly conduct risk assessment to validate the need for respiratory protection to the staff, and conduct periodic training on correct usage of the respirators.
2. Fit testing: A fit test is used to determine which respirator fits the user adequately and to ensure that the user knows when the respirator fits properly.
3. When selecting particulate respirators, US NIOSH-certified N95, EU FFP2 or equivalent model with inherently good fit characteristics (i.e., adequate fit to > 95% of wearers) are preferred and could theoretically relieve the need for fit testing.
4. A user-seal check (formerly called a “fit check”) should be performed by the wearer of a respirator each time a respirator is donned to minimize air leakage around the face piece. See figure.
5. Caps and boots covers are not very useful.

3.4.5 Respiratory hygiene/cough etiquette

Controlling the spread of pathogens from infected patients (source control) is key to avoid transmission to unprotected contacts. For diseases transmitted through large droplets and/or droplet nuclei, respiratory hygiene/cough etiquette should be applied by all individuals with respiratory symptoms.

All individuals (HCWs, patients and visitors) with signs and symptoms of a respiratory infection should:

- Cover their mouth and nose when coughing/sneezing;
- Use tissues, handkerchiefs, cloth masks or medical masks if available, as source control to contain respiratory secretions, and dispose of them into the waste containers;

- Use a medical mask on a coughing/sneezing person when tolerated and appropriate; and perform hand hygiene.

Hospital should promote respiratory hygiene/cough etiquette:

- Promote the use of respiratory hygiene/cough etiquette by all HCWs, patients and family members with acute febrile respiratory illness;
- Educate HCWs, patients, family members, and visitors on the importance of containing respiratory aerosols and secretions to help prevent the transmission of respiratory diseases;
- Consider providing resources for hand hygiene (e.g. dispensers of alcohol-based hand rubs, hand-washing supplies) and respiratory hygiene (e.g. tissues); areas of gathering, such as waiting rooms, should be prioritized.

Sequence of a particular respirator seal check



- 1 Cup the respirator in your hand with the nosepiece at your fingertips allowing the headbands to hang freely below your hand



- 2 Position your respirator under your chin with the nosepiece up



- 3 Pull the top strap over your head resting it high at the back of your head. Pull the bottom strap over your head and position it around the neck below the ears



- 4 Place fingertips of both hands at the top of the metal nosepiece. Mould the nosepiece (USING TWO FINGERS OF EACH HAND) to the shape of your nose. Pinching the nosepiece using one hand may result in less effective respirator performance



- 5 Cover the front of the respirator with both hands, being careful not to disturb the position of respirator

5A Positive seal check

- Exhale sharply. A positive pressure inside the respirator = no leakage. If leakage, adjust position and/or tension straps. Retest the seal.
- Repeat the steps until respirator is sealed properly

5B Negative seal check

- Inhale deeply. If no leakage, negative pressure will make respirator cling to your face.
- Leakage will result in loss of negative pressure in the respirator due to air entering through gaps in the seal

Putting on PPE (when all PPE items are needed)



- 1
 - Identify hazards & manage risk. Gather the necessary PPE.
 - Plan where to put on & take off PPE.
 - Do you have a buddy? Mirror?
 - Do you know how you will deal with waste?



- 2 Put on a gown



- 3 Put on particulate respirator or medical mask;
perform user seal check if using a respirator



- 4 Put on eye protection e.g. face shield/goggles
(consider anti-fog drops or fog resistant goggles)
Caps are optional : if worn, put on after eye protection



- 5 Put on gloves
(over cuffs)

Taking off PPE



- 1
 - Avoid contamination of self, others & the environment
 - Remove the most heavily contaminated item first

Remove gloves & gown:

- peel off gown & gloves and roll inside, out
- dispose gloves and gown safely



- 2 **Perform hand hygiene**



- 3
 - Remove cap (if worn)
 - Remove goggles from behind
 - Put goggles in a separate container for reprocessing



- 4 Remove respirator from behind



- 5 **Perform hand hygiene**

PERSONAL PROTECTIVE EQUIPMENT (PPE)

For Infectious Diseases Requiring Airborne Infection Isolation & Contact Precautions

PROCEDURE FOR DONNING PPE:

- ✓ Decontaminate hands with an alcohol-based hand rub or wash with antimicrobial soap/water**
- ✓ Put on approved respirator (N-95 or higher)**
- ✓ Put on hair cover (if recommended or required)**
- ✓ Put on a face shield or goggles (wear goggles for aerosol-generating procedures)**
- ✓ Put on gloves**

PROCEDURE FOR REMOVING PPE:

Avoid contaminating your hands while removing PPE. If hands do become contaminated during the procedure at any time, DECONTAMINATE immediately with alcohol-based hand rub or antimicrobial soap. Never touch face gear without first decontaminating hands or re-gloving with a clean pair of gloves. Use biohazardous trash container for used PPE.

1. Remove gloves Peel off one glove by turning inside out. Place fingers inside cuff of other glove and pull off, inside out. 	3. Decontaminate hands Use an alcohol-based hand rub or antimicrobial soap. 	6. Remove head cover Remove by grasping fingers under elastic to lift off head. 
2. Remove gown Be careful not to touch the front, contaminated area. Untie all strings at back of gown, slide hands under inside back edges at the neck and pull off turning inside out and rolling gown as it is removed. Discard in appropriate receptacle. 	4. Put on clean pair of gloves 	7. Remove respirator Remove by straps. Avoid touching front and contact with eyes. 
5. Remove face shield and/or goggles Avoid touching front and contact with eyes. 	8. Remove gloves and decontaminate hands 	

3.5 Design of Isolation Rooms

Patients who need airborne isolation should be placed in well ventilated areas with a directional airflow from health care worker to the patient. Adequate ventilation is commonly defined by air exchange rate. It is desirable to achieve ≥ 12 air change rates per hour (ACH). The air should flow from corridors (cleaner areas) into isolation rooms (less clean areas) to prevent spread of contaminants to other areas.

3.5.1 Ventilation

This can be achieved by three possible strategies,

1. Natural ventilation

This may be an option provided the isolation areas are away from other parts of the hospital, and are built in places predicted to have good prevailing winds year round.

The air should be directed from patient caring areas to outside open areas not regularly used for transit of persons.

Inside the airborne precaution room, the patient should be placed near the exterior wall, close to open window(s), instead of close to the inner wall.

2. Use of exhaust fans

In places where natural ventilation is not suitable, and fully mechanically-ventilated airborne precaution rooms cannot be installed due to limited resources, the use of exhaust fans (with adequate pre-testing and planning) may help to increase ACH rates and generate negative pressure in the rooms.

The fans should be installed on exterior wall(s) where room air can be exhausted directly to the outdoor environment free of transit of persons.

The size and number of exhaust fans needed depend on the targeted ACH, which must be measured and tested before use. The position of exhaust fans with relation to doors and windows should be carefully planned to avoid short circuiting.

3. Use of mechanical ventilation

The engineering requirements for a mechanically ventilated negative pressure rooms are as follows,

- Negative pressure (greater exhaust than supply air volume);
- Pressure differential of 2.5 Pa (0.01-in. water gauge);
- Air flow volume differential >125-cfm exhaust versus supply;
- Well sealed room, approximately 0.5-sq. ft. leakage;

- Clean to dirty air flow;
- Continuous electronic monitoring of room pressure with (audible/visual) alarm
- >12 air changes per hour (ACH) for new or renovation, 6 ACH for existing facilities
- Exhaust to outside or HEPA-filtered if re-circulated.
- Back-up emergency power supply fans, alarms and monitoring systems

3.5.2 Interior of Isolation Rooms

The design, materials and construction of the interior surfaces of an isolation room must facilitate cleaning and minimize dust collection areas without compromising patient care and comfort.

Some of the desired elements include

- Continuous impervious flooring such as welded vinyl covered up the wall
- Minimization of horizontal surfaces
- Sealed, monolithic ceiling with sealed access panels
- Windows to the exterior to be locked shut and sealed
- Design considerations should allow for adequate view of the isolated patient, without health care personnel having to enter the room
- clinical hand wash basin
- Wall-hung toilet pan and basin
- Wall-mounted soap dispensers
- Hand rub dispensers
- Disposable towel holders
- Storage for clean personal protective equipment
- Provision of two-way intercommunication system between the patient's room and the nurses' station
- All building requirements pertaining to isolation facilities should be referred to the technical guidelines from the planning division for further details

3.5.3 Routine performance monitoring and maintenance

The nursing care plan of the isolated patient must include daily monitoring and documentation of room and anteroom pressures. When a room is not occupied, room pressure should be checked monthly.

System performance monitoring of ACH, pressure differentials, filtration efficiencies and calibration of electronic monitoring devices by engineering staff should be undertaken every three months. Engineering department should keep a logbook of these activities.

3.5.4 Preparation of the isolation room/area

- Ensure appropriate room ventilation (e.g. 12 ACH).
- Post signage on the door.
- Before being allowed into the isolation areas, visitors should consult the nurse in charge, who is also responsible for keeping a visitor record. A roster of all staff working in the isolation areas should also be kept for possible outbreak investigation and contact tracing.
- Remove all non-essential furniture; the remaining furniture should be easy to clean, and should not conceal or retain dirt or moisture within or around it.
- Stock PPE supply and linen outside the isolation room/area (e.g. in the change room).
- Stock the sink area with suitable supplies for hand washing, and with alcohol-based hand rub near the point-of-care and room door.
- Place appropriate waste bags in a bin. If possible, use a touch-free bin.
- Place a puncture-proof container for sharps disposal inside the isolation room/area.
- Keep the patient's personal belongings to a minimum. Keep water pitchers and cups, tissue wipes, and all items necessary for attending to personal hygiene within the patient's reach.
- Stethoscope, thermometer, blood pressure cuff, and sphygmomanometer should be dedicated to the patient, non-critical patient-care equipment if possible.
- Any patient-care equipment that is required for use by other patients should be thoroughly cleaned and disinfected before use.
- Set up a trolley outside the door to hold PPE. A checklist may be useful to ensure that all equipment is available
- Place an appropriate container with a lid outside the door for equipment that requires disinfection or sterilization.
- Keep adequate equipment required for cleaning or disinfection inside the isolation room/area and ensure scrupulous daily cleaning of the isolation room/area.
- A telephone or other method of communication should be set up in the isolation room/area to enable patients or family members/visitors to communicate with HCWs in order to minimize the necessity for HCWs to enter the room/area.
- Educational information on necessary precautions and procedures should be readily available and accessible (for example, in the form of information pamphlets, or posters, located adjacent to the isolation room) for staff, patients and visitors, while ensuring there is no breach of medical confidentiality.

3.5.5 Setting up temporary quarantine areas in outbreak situations requiring airborne isolation

When choosing areas in the hospital for this purpose, chose preferably, rooms with individual ventilation systems (e.g: room or window fan coil units that do not re-circulate to other parts of the building).

However the air should flow from corridors (cleaner areas) into isolation rooms (less clean areas) to prevent spread of contaminants to other areas. Inside the room the airflow must be from health care worker to the patient. In existing areas that are totally mechanically ventilated with central ventilation systems, the installation of additional controls/modifications may be the best choice.

Opening windows in a mechanically-ventilated room not designed for natural ventilation is undesirable because the system is not designed for this practice and the ventilation features are not predictable. The modifications that can be carried out depend on the ventilation characteristics of the existing patient room and needs to discuss with the engineering support services.

4. CLINICAL PRACTICE

4.1 Aseptic Technique

The aseptic technique is a method to prevent transmission of microorganisms from various sources to a patient by creating a microorganism-free environment, maintaining sterility of instruments and preventing microbial contamination during various clinical procedures performed on a patient. The components of the aseptic technique are as follows;

4.1.1 Non-touch technique

1. Non-touch technique is the most essential part of the aseptic technique.
2. The most effective way of maintaining sterility of sterilized instruments and other items
3. Contact with the ungloved hand and any other non-sterilized object renders the instrument or item non-sterile.
4. Work processes need to be coordinated so that the sterile or disinfected item or instrument does not come into contact with non-sterile items.

4.1.2 Minimizing Microorganisms on Hands By Hand Hygiene

(Refer section on hand hygiene)

1. Hand hygiene is a must before and after performing any clinical procedure. This practice maintains the cleanliness of the HCW hands, at all times, by reducing the quantity of bacteria on them.

4.1.3 Rendering The Hand Sterile by Wearing Sterile Gloves

1. Sterilized gloves are worn to render the hand sterile since hand hygiene alone will only reduce the number of bacteria on it.
2. During the gloving process, touch only the inside surface of the glove with the non-gloved hand. The outside of the glove can be touched with the gloved hand.
3. Once gloved, do not touch non-sterile areas or articles with the gloved hand. Remember that the patient's skin is non-sterile.
4. If the glove is punctured or torn, replace it.
5. When working alone, perform tasks that do not require a sterile hand first before gloving. For example, when preparing sets / instruments for a procedure, open the set and put in additional items or lotions first. Open the outer envelope of the gloves packet before washing the hand.
6. In most instances it is better for an assistant / partner to perform tasks that do not require a sterile hand.

7. When one hand is required to perform a task requiring contact with a non-sterile object or surface, consciously identify the contaminated hand and perform procedures with the other hand. These situations include:
 - o When performing urinary catheterization hold the labia minora or prepuce of penis with the non-dominant hand (usually left).
 - o Cleanse the urethra and insert the catheter with the dominant sterile hand (usually right).
 - o When performing laryngeal suction (e.g. in a patient with a tracheostomy) hold the non-sterile sucker tubing with the left hand and the sterile suction catheter with the right hand.
 - o When performing tracheo-bronchial suction on a ventilated patient, the aseptic technique is possible only if two care providers perform the task.
 - o One person disconnects and reconnects the ventilator tubing to the endotracheal /tracheostomy tube. The other person performs the suction with a sterile catheter.

4.1.4 Minimizing bacteria at entry points

1. Depends on the site where the procedure is to be performed.
2. The patient's skin harbour commensals (e.g. *Staphylococcus epidermidis*), which are harmless on the skin surface but may induce disease in the blood circulation or through it to distant sites like heart valves, the urinary tract, the biliary tract, the lungs or the brain.
3. The patient's skin can never be made sterile, but the amount of bacteria can be reduced by applying on the skin antiseptics such as: Povidone iodine 10% weight per volume equivalent to 1% available iodine, 70% alcohol, Chlorhexidene 1:200 or mixtures of these.

4.1.5 Creating a sterile field

1. There should be a sterile area within which instruments used for the intended procedure can be placed without danger of it being contaminated by contact with non-sterile objects, such as the patient's body, the HCW body, non-sterile instruments, equipment, body fluids etc
2. A sterile field is created by covering the patient's body and work surfaces with drapes made of sterilized fabric or synthetic sheets. It is important for the sterile field to be wide enough to accommodate the instruments used and for the HCW to perform his/her tasks.
3. The amount of skin exposed should be the minimum possible.
4. It must be realized that contamination of the sterile field will cause contamination of the instruments within it.
5. The care provider is allowed to be in contact with the sterile field if a sterile gown is worn. If only a glove is worn then the rest of the body should not come into contact with the sterile field.

6. The air is part of the sterile field. If procedures are performed in a properly designed procedure room or operation theatre, the content of micro-organisms in it is considered minimal and instruments are not rendered non-sterile on exposure to air. However exposure to air for a long duration (e.g. by leaving sets open for long periods) increases the risk of contamination by dust and other particles

4.1.6 Maintaining sterility of instruments / disposable items during a procedure

1. The non-touch technique is also used to ensure that instruments or items remain sterile during a procedure. The person opening packets / envelopes must ensure that the inside of the packet is not touched.
2. He / she transfers it by letting it drop on to the sterile field. Another method is for the person receiving the item to grasp the item or the inside package from the packet with a gloved hand or sterile forceps without touching the exterior of the packet.
3. The entire sterile instruments / disposable items (such as lines and catheters) should lie within a sterile field. Special care must be taken when using long lines or wires e.g. guide wires.
4. Problems arise when the sterile catheter or tubes need to be connected to non-sterile connectors. Below are some of the situations when some of these problems occur and how they can be resolved:
 - o When inserting a central line, introduce the IV catheter and all connecting tubes into the sterile field. After the catheter is inserted, pass the end of the intravenous tubing (used to puncture the IV solution bag) to the assistant.
 - o The assistant connects the tubing to the bag and the fluid is run in to prime the line. The other end remains sterile in the sterile field and is then connected to the intravenous catheter.
 - o A similar technique is used when inserting chest drains, peritoneal dialysis catheters and urinary catheter. Place all tubes and containers into the sterile field.
 - o The person performing the procedure should secure the connections before passing the containers (underwater seal bottles /urine containers /dialysate bags) to the assistant

4.2 Urinary Catheter Care

The urinary tract is one of the most common site of infection. Most urinary tract infection is following instrumentation of urinary tract, mainly urinary catheterization. One of the most important infection control measures is to limit the use of urinary catheterization to carefully selected patients. However, if there is a need to perform urinary catheterization, sterile procedure must be observed.

Urinary catheters may be use as a short term measure or long term as in indwelling catheter. The following are general principle of urinary catheter insertion to reduce the infection of urinary tract.

4.2.1 General principles of urinary catheter insertion

1. Personnel

Only personnel trained on the correct technique of insertion can perform aseptic catheter insertion. Hospital personnel and others who take care of catheters should be given periodic in-service training stressing the correct technique of insertion, care and potential complications of urinary catheterization.

2. Catheter use

Urinary catheter should be inserted only when necessary and left in place only when as long as necessary. For selected patients other method of urinary drainage such as condom catheter drainage, suprapubic catheterization and intermittent urethral catheterization, can be useful alternatives to indwelling urethral catheterization.

3. Hand hygiene

Hand hygiene should be practice before and after any manipulation of the catheter site or apparatus.

4. Catheter insertion

Catheter should be inserted using aseptic technique and sterile equipments glove, drape, sponges, an appropriate antiseptic solution for peri-urethral cleaning, a single used packet of lubricant jelly should be use for insertion. Non-touch technique should be practice.

Use as small a catheter as possible, consistent with good drainage should be use to minimized urethral trauma. Indwelling catheter should be properly secured after insertion to prevent movement and urethral traction. Use of silicone type catheter may be considered in long term indwelling catheter. After insertion the date of insertion should be documented.

5. Close sterile drainage

A sterile continuously closed drainage system should be maintained. The catheter and drainage tube should not be disconnected unless the catheter must be irrigated. If breaks occur in aseptic technique, disconnection, of leakage occur, the collecting system should be replaced using aseptic technique after disinfecting the catheter tubing junction.

6. Irrigation

Irrigation should be avoided unless obstruction is anticipated, as might occur with bleeding with prostatic or bladder surgery, closed continuous irrigation may be used to prevent obstruction. To relieve obstruction due to clots, mucous or other causes, an intermittent method of flushing may be used. Continuous irrigation of the bladder with antimicrobials has not proven to be useful and should not be performed as a routine infection prevention measure. The catheter tubing junction should be disinfected before disconnection.

A large volume and a sterile syringe and sterile irrigant should be used and then discarded. The person performing irrigation should use aseptic technique.

If the catheter becomes obstructed and can be kept open only by frequent irrigation, the catheter should be changed since it is likely that the catheter itself is contributing to the obstruction.

7. Specimen collection

If small volumes of fresh urine are needed for examination, the distal end of the catheter, or preferably the sampling port if present, should be cleansed with a disinfectant, and urine then aspirated with a sterile needle and syringe. Larger volume of urine for special analyses should be obtained aseptically from the drainage bag.

8. Urinary flow

Unobstructed flow should be maintained. Occasionally, it is necessary to temporarily obstruct the catheter for specimen collection or other medical purposes.

To achieve free flow of urine;

- The catheter and collecting tube should be kept from kinking.
- The collecting bag should be emptied regularly using a separate clean collecting container for each patient. (Change glove for each patient).
- Poorly functioning or obstructed catheters should be irrigated or if necessary, replaced.
- Collecting bag should always be kept below the level of the bladder. Always hang drainage bag at bedside below groin level to allow gravity drainage and maintain unobstructed urine flow. Do not allow urine to flow from bag or tube back into bladder as the flow of urine may be contaminated and can cause urinary tract infection.

9. Meatal care

Catheter care should consist of good personal hygiene around the meatal area carried out on a regular basis. Wiping after bowel cleaning should be carried out from front to back to avoid infection.

10. Catheter change interval

Do not change catheters at arbitrary fixed intervals. However to prevent encrustation, non silicone catheter may need to be changed 2 or 3 weeks. Change only when necessary, such as when tube is obstructed, discolored etc.

Catheter should be removed from post operative patients as soon as possible. Indwelling catheterization is preferable to intermittent catheterization for some groups of post operative patients in the reduction of complications.

11. Spatial separation of catheterized patients

Spatially separating infected and uninfected patients with indwelling catheters is not necessary.

12. Bacteriologic monitoring

Regular bacteriologic monitoring of catheterized patients as an infection control measure is not recommended.

4.3 Wound Care

The need for dressing or wound care depends on the type of wound, which includes incision wound, abrasions, bedsores, ulcers, wound at site of drains and others.

The attending physician may require different wound technique for each type of wound. However, the choice of wound dressing should be large enough to cover and protect the wound site and tissue around it. It should allow circulation of air to the skin, secured to prevent slippage and is comfortable for the patient.

4.3.1 General principles of wound care

1. Hand hygiene

Proper hand hygiene before and after attending to a wound is mandatory. Sterile gloves should be worn after performing hand hygiene before starting the procedure.

2. Technique

- Practice a 'non-touch' technique. All instruments used during wound dressing must be sterile or autoclaved.
- Use sterile water as a cleaning liquid unless some other solution is recommended by doctor.
- Cover the entire wound and do not exposed the wound to prevent bacterial contamination. Use non adhesive gauze that promotes wound healing.
- Used gloves and soiled dressing must be properly disposed off into the clinical waste plastic bag.

3. Environment

- Maintain a clean environment to minimize dust. High dusting or vacuum cleaning should finish an hour before dressing round begins.
- Infected wound must be detected early. To prevent spread, precautions such as cohorting the patient may be required.
- Wound care in the ward should begin with the uninfected wound first, then followed by the infected or dirty ones.

4.4 Enteral Feeding

4.4.1 Introduction

Enteral Feeding is nutrition provided through the gastrointestinal tract, which includes feeding given via tube and oral. Enteral Feeding preparation and formulation is very complex and should be individualized according to patient's disease conditions and needs.

Contaminated formulas may cause gastrointestinal complications such as diarrhea and vomiting. Colonization of feeding tubes may cause tube occlusion and degradation while colonization of the stomach has been associated with nosocomial infections.

Therefore, minimizing potential microbial contamination is crucial to ensure patient achieve optimal nutrition and prevent serious infection and complications related to enteral feeding. This will promote faster recovery rate, shorten hospital stay and reduce overall cost.

The risk of contamination occurs during preparation, administration, and storage of the formula and the design of feeding system used. Powder or liquid concentrates prepared on-site poses high infection risk and commercially prepared feeds are known to have lower infectious complications. Bacterial contamination of enteral feeds most commonly **arises from exogenous sources.**

4.4.2 Routes Of Feeding

1. Oral
2. Tube Feeding
 - a. Nasogastric
 - short term feeding for 4 to 6 weeks
 - b. Enterostomy postpyloric
 - Long term feeding for > 6 weeks
 - c. Gastrostomy/Duodenostomy/Jejunostomy/Percutaneous endoscopic gastrostomy/ Percutaneous endoscopic jejunostomy
 - Long term feeding

4.4.3 Causes Of Microbial Contamination And Preventive Measures

Causes of Contamination	Preventive Measures
Personnel	1. Health care worker with active diarrhea should not handle enteral formula until they have been cleared. 2. Open skin lesions should be covered to prevent potential contamination with bacteria.

Causes of Contamination	Preventive Measures
Physical facility	1. There should be a room equipped with the necessary facilities for the preparation of enteral feeds following aseptic technique for the whole hospital and proper delivery system to the wards. 2. The preparation area should be clean and hand washing facilities must be made available.
Touch contamination during preparation and administration	1. Practice hand hygiene before handling formula or administration system. 2. Use disposable gloves. 3. Sanitise all equipments and surfaces used for formula preparation 4. When using decanted formula, sanitise the container before opening. 5. Avoid touching any part of container or the administration system that will come into contact with the formula (e.g: the container feeding port, piercing pin on the feeding set).
Formula preparation Adding water or other substances, or using procedures that increases handling of formulas or administration systems increases the potential for contamination.	1. Use commercial formulas and avoid blenderised foods. 2. Avoid adding water, colorants, medications or other substances directly to formula. 3. Use clean technique to add medication to the feeding tube if cannot be given by other route. 4. Use full strength formula. For GI intolerance, reduce administration rate instead of diluting the formula. 5. Reduce handling by using closed feeding system. 6. Label product, date and time of preparation on the container.
Administration and prolonged hang time Regardless of administration system, all tube-feeding formulas have risk of microbial growth. Prolonged hang time is associated with unacceptable microbial levels.	1. Limit hang time of refilled formula to 24 hours. 2. Limit hang time of decanted formula to 8 – 12 hours. 3. When using decanted formula, allow feeding to empty completely and rinse before adding fresh formula. 4. Avoid topping up freshly prepared formula until all the previous formula in feeding bag is completely administered. 5. Flush feeding tube with sterile /boiled water. 6. Change feeding set every 24 hours.

Causes of Contamination	Preventive Measures
Unsafe storage and transportation Even low-level contamination can grow logarithmically in nutrient-rich solutions at warm temperatures.	1. Keep prepared formula at suitable temperature until ready for use. Freshly prepared formula is a better option. 2. Cover, label and refrigerate unused, opened and reconstituted formula. Discard after 48 hours if unused. 3. Do not allow refrigerated formulas to sit at room temperature for more than 20 minutes before feeding. 4. Do not freeze or over heat the formula. 5. Do not reheat with microwave oven.
Reuse of feeding sets	1. Prolong use of feeding systems causes significant contamination. 2. Discard feeding sets and containers according to instructions.
Touch contamination during setup and cross infection in hospitals occurs mainly via hand.	1. Practice hand hygiene before handling feeding systems. (Using clean, disposable gloves may be beneficial) 2. Avoid touching any portion of the feeding system that will come into contact with formula. (E.g., the container feeding port, piercing pin on the feeding set). 3. Reduce handling by using pre-filled containers. 4. Reduce the number of times that a delivery system must be disconnected. 5. Use clean technique when refilling or changing feeding containers. 6. Assemble feeding systems on a clean, dry, disinfected surface (not on the patient's bed)

4.5 Parenteral Nutrition

4.5.1 Introduction

Infectious-related complications may be a major threat to patient receiving centrally infused parenteral nutrition (PN). In many cases, these patients are predisposed to infections because of compromised immunity or infections located in the urinary tract, lungs or wounds. However, infections may develop consequent to solution contamination during preparation. This may be due to a lack of aseptic technique.

should only be use when clinically indicated and the line must not remain inside longer than necessary Because PN solution is a good medium for bacteria growth and its administration through central venous line gives systemic access, complications such as contamination, infection and sepsis are possible risks.

PN differs from other modes of intravascular therapy in many ways:

- PN tubing usually remain in place much longer than most other catheters
- PN solutions support the growth of microorganisms, especially gram-negative bacteria and *Candida* sp.
- The underlying disease of the patient increases the risk of acquiring HCAs.

Contamination can occur during:

- Preparation of PN
- Insertion of catheter
- Manipulation of catheter
- Prolonged hanging time

Assembling of PN tubing must be under strict aseptic technique.

4.5.2 Preparation of PN

- Prepare PN strictly under aseptic technique and clean room environment.
- Only trained staffs are allowed to do the compounding.
- All qualified staff is required to wear Personnel Protective Equipments (PPE) before they enter the clean room.

4.5.3. Catheter care-related factors *(refer to section intravascular line)*

1. Selection of catheter insertion site

- Use a single lumen catheter unless multiple ports are essential for the management of the patient.

- If triple lumen catheter or a pulmonary arterial catheter infusion port is used for PN administration, a single lumen must be dedicated for PN only. This should be labeled and dated and must not be used for other purposes. There should not be any entries to the PN line except for lipid infusions or in emergency situations.

2. Procedure for insertion of catheter (*refer to intravascular line*)

3. Surveillance of the PN line

- PN solutions hung, but not infused shall be discarded after 24 hour and ready to use (commercial preparation) bag after 48 hour
- Evaluate the patient at least 8 hours or every shift for evidence of cannula-related complications
- Visually inspect the catheter site if the patient has developed pain or tenderness at the insertion site, fever without obvious source, or symptoms of local bloodstream infection
- Observe signs of infections: redness, inflammation or purulent drainage from insertion site
- Do not routinely perform surveillance cultures of PN devices used during intravascular access

4. A dedicated lumen used for PN line should be identified and not be used for other purposes

The following are contraindicated when using a central venous lumen for PN:

- Transfusions of blood or blood products
- Drawing of blood samples
- Bolus injection of drugs
- Simultaneous administration of IV solution
- Measurement of CVP
- Aspiration of blood for routine lab tests
- Addition of medication to TPN

5. Replacement of PN tubing and filters

- **Preparation PN 2 in 1**
 - a. If filter 0.2 micron 24 hour is used, change filter, tubing and bag after 24 hours.
 - b. If filter 0.2 micron 96 hour is used, only change the tubing and bag after 24 hours and discard filter after 96 hour.
 - c. Change administrative set for lipid with or without filter 1.2 micron filter for 24 hours.
- Preparation PN 3 in 1 shall be infused with a 1.2 micron filter. The tubing, filter and bag should be changed every 24 hours.
- Change the tubing and filter if the system slows. Flushing or irrigation of the system should be avoided.

- Between changes of components, the IV system should be maintained as a closed system as much as possible.

4.5.4 Nursing considerations for PN

- PN solution that is not opened or used should be returned to Pharmacy
- Administer PN solution at a constant rate.
- Assess and document vital signs, electrolyte and glucose monitoring, fluid input/output and routine weights accurately.
- Observe for skin rashes, flushing, color changes or other adverse or allergic type reaction and notify the doctor/pharmacist.
- Notify the doctor immediately if sepsis, suspected
- When there is no other obvious source for the fever, removal of the PN catheter maybe considered.

4.5.5 Storage

- Refrigerate PN solutions on arrival to ward or unit and remove one hour before infusion allowing standing in room temperature.
- TPN preparations should be returned to the Pharmacy when:
 - Cloudy or particulate matter is present
 - Orders are modified or discontinued and bag had not been hung.

4.6 Blood and Blood Products Transfusion

Blood transfusion may save life. It should be appropriately screen for infectious agents to reduce the risk of transmitting infectious diseases .Only compatible blood and blood products are to be transfused.

4.6.1 General Principles.

All blood products should be considered potentially infectious and should be handled with glove. Medicine should not be added intravenously with the blood or blood product that is being transfused.

The practical basis of precautionary measures taken during transfusion of blood and blood product involves procedures to protect portal of entry, thus preventing:

- i. Access of microorganism into the host tissue.
- ii. Cross contamination.

4.6.2 Specific practices (transport, storage, transfusion, dispose)

- Insert intravenous line by aseptic technique.
- Choose a site on an upper extremity which will minimize patient discomfort and restriction of movement. Avoid the groin, lower extremities and bony prominences because these sites have high risk of infection.
- Inspect the supplied units of blood and blood product for date of expiry, cracks and leaks. Do not use leaking blood bag, return it back to blood bank.
- Blood or blood product bag should be kept in a blood box as recommended by blood bank during transportation to the ward.
- Ensure that the correct blood and blood product is given to the intended patient. Follow local procedure manual of patient identification.(Reference: Transfusion practice guidelines for clinician and laboratory personnel, MOH)
- Label date and time of onset of transfusion.
- Transfusion of red cells must be started within 30 minutes of removing them from refrigeration and should be completed within four hours.
- Platelet and plasma must be transfused immediately.
- The red blood cell packs should be stored at 2-6° Celsius.
- Monitor the patient's pulse rate, temperature and blood pressure during transfusion. Stop transfusion immediately if fever or hypotension occurs, as this may be signs of septicaemic shock.
- After completion of blood transfusion, the used blood bags and intravenous giving set should be tightly secured and put inside into the transparent bag. DO NOT disconnect GIVING SET from blood bag. Sent immediately to blood bank for proper disposal.
- DO NOT reused intravenous GIVING SET for the next fluid transfusion.

4.7 Disinfections of Endoscopes

4.7.1 Introduction

Understanding of infection control in its application to GI endoscopy is important as to prevent the possibility of transmission of infection. Thus compliance with the disinfection guidelines is the key factor in determining endoscopic safety, and posed virtually no risk of patient-borne transmission (Hepatitis C, Hepatitis B, HIV, *Salmonella*, *Pseudomonas aeruginosa*, *Enterobacteriaceae*) or environmental organisms (SARS-CoV, Avian influenza A virus [H5N1]).

Glutaryldehyde has been most commonly used disinfection in endoscopy previously, but other newer products such as Succine-diadehyde (Gigasept 4%) and Paracetic Acid & Hydrogen Peroxide (Perascope) has been in the market recently.

The ideal choice of disinfection should be based on the following factors:-

- Effective against a wide range of organisms including blood-borne viruses
- Compatible with endoscopes, accessories and endoscope re-processors
- Non-irritant and safe for users
- Environmentally friendly for disposal
- Stability of the solution for the specified duration of use
- Able to be reused for the specified period
- Cost-effective (include costs of the appropriate automatic endoscopic re-processors (AER), storage space, conditions required for use, and staff protection measures)

It is of utmost important to protect against chemical used during cleaning and disinfection in order to avoid from toxic and allergic reactions. Separate purpose-designed rooms for cleaning and disinfection must be well ventilated and disinfections should be used within a closed system.

Diseases may also be transmitted from patient to endoscopic personnel. Therefore, protection from direct contact with the endoscopes and accessories is essential.

For the protection of the staff during the disinfection procedure the following apparel or equipment has been recommended:-

- Gloves long enough to cover the forearms, preferably sterile gloves to protect arms from splashes
- Long sleeves waterproof gowns. Preferably should be changed between patients or when it gets contaminated
- Goggles to prevent conjunctiva irritation and protect the splashes
- Face masks to reduce inhalation of vapour

In local circumstances, training and resources may vary but high standards of disinfection must always be maintained.

4.7.2 Definitions

Cleaning

Removal of blood, secretions and debris from endoscopes and accessories

Disinfection

Reduction of number of viable micro-organisms on a device to a level that is appropriate to be used safely on a patient where sterilisation of the device is not necessary. Disinfection may also be undertaken as a preliminary step to sterilisation, if necessary. Disinfection should be carried out immediately after cleaning and immediately prior to use.

Sterilization

Validated process used to render a device free from all forms of viable micro-organisms.

Endoscopic accessories

All devices used in conjunction with an endoscope to perform diagnosis and therapy, excluding peripheral equipment.

Single-use accessories

Also called “disposable”, these are provided in a sterile state ready for use. The opening of a sterile package implies immediate use, as is routine in surgery. After a single-use device has been used, all materials should be properly disposed of. Under no circumstances should a single-use device be reused.

Reusable accessories

All reusable accessories should be sterilised. The sterilisation should be carried out after proper cleaning, as detailed below. Manufacturers provide validated standard reprocessing parameters (dilution, temperature and time) for cleaning, disinfection and sterilisation.

4.7.3 Cleaning – Rinsing – Disinfection – Sterilisation Sequence

Non-compliance with guideline is the chief factor compromising the safety of endoscope reprocessing. The consequence of failure to follow recommendation may not be only transmission of pathogens (due to pathological material from one patient being produced into the next patient), but also misdiagnosis instrument malfunction, and a shortened instrument lifespan.

Preliminary-cleaning

Preliminary-cleaning starts before the endoscope is detached from the light source/video-processor and the reprocessing begins as soon as the endoscope is removed from the patient.

1. Wipe down insertion tube with a detergent-soaked gauze
2. Place the distal end of the endoscope into the enzymatic detergent solution which is diluted according to the manufacturer's instruction.

3. Aspirate enzymatic detergent solution alternating with air several times through the biopsy/suction channel. Finished by suction of air.
4. Irrigate the water/air channel with water, then air, checking for blockage. (Flushing the biopsy/suction and air/water channels will expel secretion, preclude drying of organic and inorganic debris on lumen surfaces, and may also remove large numbers of micro-organisms).
5. Check for bite marks or other surface irregularities.
6. Detach the endoscope from the light source/video-processor pump
7. Attach protective video cap (water resistant cap).
8. Transfer the endoscope to the reprocessing room.

Leakage Testing

Conduct leakage testing according to manufacturer's instruction before immerse the endoscope in a disinfectant. This test will detect any damage to the interior or exterior of the endoscope as to prevent expensive repairs later.

1. Attach leakage tester and turn on the pump to pressurize the scope.
2. Remove all the detachable parts of the endoscope.
3. Prior to immersion, confirm the bending section has expanded.
4. Immerse entire endoscope in clean water.
5. Perform leakage test. Observe at the insertion tube, distal bending section and the universal cord, looking for bubbles coming from the interior of the scope
6. Angulate the tip in all directions during test
7. Remove endoscope from water.
8. Detach tester after tip has deflated.

Cleaning

1. Immerse the endoscope and valves in a sink/basin filled with low-foaming enzymatic detergent solution of proven efficacy, at the appropriate dilution and specific time according to the manufacturer's instructions.
2. Wash all debris from the outer surface of endoscope by brushing and wiping the instrument under the detergent as to prevent from splashing of contaminated fluid.
3. Brush the distal end with a soft toothbrush. Special attention is paid to the air/water outlet nozzle and the bridge/elevator where fitted.
4. Brush all accessible channels (insertion tube, universal cord and cylinder portions of the suction channel, and instrument channel port) with a brush-tipped wire designed for this purpose, to remove all organic (eg. blood, tissue) and other residues. Brush at least three times through each channels, cleaning the brush between each brush. Clean in detergent with a soft toothbrush each time it emerges.
5. For endoscopes with elevators, brush the elevator-wire channel.
6. Attach all cleaning adapters to suction, biopsy, air and water channels.

7. Using a syringe, flush all channels with detergent which is diluted according to the manufacturer's instruction to remove the debris.
8. For endoscopes with elevators or auxiliary-water feeding, flush detergent solution into elevator-wire channel/auxiliary-water channel.
9. Rinse all channels (including elevator-wire/auxiliary-water channels, if applicable) and removable parts under running clean water thoroughly as to remove residual debris and detergent.
10. Expel the water as much as possible by forced air through all channels.
11. Dry the exterior of the endoscope with gauze to prevent dilution of the liquid chemical.

Manual Disinfection

1. Immerse the endoscope in a basin of high-level disinfection (HLD), prepared according to the manufacturer's instructions in term of dilution and temperature.
2. Using a syringe, irrigate all channels (including elevator-wire/auxiliary-water channels, if applicable) with disinfection. For complete microbial destruction, make sure there is no air pockets remain within the channels.
3. Soaked the endoscope in the HLD according to the disinfectant manufacturer's recommended time and temperature.
4. Flush each channel (including elevator-wire/auxiliary-water channels, if applicable) with air before removing the endoscope from the HLD.

Rinsing After Manual Procedure

1. Rinse the endoscope internally and externally with clean water as to prevent exposure and potential injury of skin/mucous membrane from chemical residue.
2. For endoscopes with elevators or auxiliary-water feeding, flush water into elevator-wire channel/auxiliary-water channel.
3. Rinse all the removal parts of the endoscope with water.

Drying

1. Use syringe to inject air through air, water and suction channels, expelling the rinse water.
2. For endoscopes with elevators or auxiliary-water feeding, inject air to flush water from elevator-wire channel/auxiliary-water channel.
3. Flushed the channels (including auxiliary-water/elevator-wire channels, if applicable) with 70-90% alcohol to assist in drying the interior channel surfaces.
4. Purge again all channels (including auxiliary-water/elevator-wire channels, if applicable) with air. Air assists alcohol in evaporating any retained moisture.
5. Wipe the exterior surface of endoscope, eye, light guide connector, plugs and all removal parts before connecting the endoscope to the light source.
6. The endoscope is ready to use after fitting back the valves and active air/suction channels as well as the suction channel.

7. Disinfection should be done after every procedure.
8. Do not attach the removal parts to the endoscope for storage.

Automatic Reprocessing

1. When using the automated re-processor the staff must be ensured to follow the manufacturer's instructions.
2. In automatic endoscope reprocessing (AER) the endoscope and endoscope components are placed in the re-processor, and all the channel connectors attached according to AER and endoscopic instructions.
3. Reprocessing programmer is about 20-30 minutes, depending on the disinfection used.
4. This is followed by cleaning and drying procedures, as drescribed in manual description.

Storage

1. Ensure proper drying prior to storage.
2. Hand vertically preferably in a vertical position to facilitate drying.
3. Remove all removal parts according to manufacturer's instructions.
4. Uncoil insertion tubes.
5. Use a well ventilated room or special storage cabinet for reprocessed endoscopes only. This will encourage continued air drying of the surfaces and prevent undue moisture build up, thereby discouraging any microbial contamination of the cabinet surfaces.

Endoscopic accessories

1. Rinse all the endoscopic accessories with water.
2. Clean by brushing with detergent.
3. Immerged all the endoscopic accessories into the disinfectant diluted according to manufacturer's instruction.
4. Rinse the clean accessories with clean water.
5. Dry the accessories with a non-shedding cloth.
6. Clean once a week using the Olympus ultrasonic washer.

Endoscopies for patients with Hepatitis B and C, and HIV and other immunocompromised states

1. All cases should be schedules as the last cases for the session.
2. The endoscope should be disinfected according to the manufacture instruction before the procedure as to ensure the eradication of all opportunistic pathogens.
3. The instrument should be immersed in the disinfectant diluted according to manufacturer's instructions.

5. PREVENTION OF HEALTHCARE ASSOCIATED INFECTIONS

5.1 Urinary Tract Infection

5.1.1 Introduction

Urinary tract infections (UTIs) are common type of HCAs, accounting for 20% of all infections in Malaysian hospitals. In addition, several studies have reported that about 80% of UTIs occur following instrumentation, primarily catheterization. The usually benign nature of catheter-associated UTIs and the perception that they are easily treated by antibiotics may inhibit aggressive measures for both their prevention and their recognition

5.1.2 Indications for Catheterization

Placement of an indwelling catheter should be performed only when indicated. It should be removed as soon as possible.

The accepted indications for catheterization are:

1. For short-term (days) management of incontinence (the inability to control urination) or retention (the inability to pass urine) not helped by other methods.
2. To measure urine output over several days in critically ill patients
3. To instill medications
4. For treatment of bladder outlet obstruction
5. For post-operative management of surgical patients with impaired bladder function

5.1.3 Recommendations To Prevent Catheter-Related UTI

1. Personnel

- Only persons who know the correct technique of aseptic insertion and maintenance of the catheter should handle catheters.

2. Catheter Use

- Urinary catheters should be inserted only when necessary and left in place only for as long as it is required. They should not be used solely for the convenience of patient-care personnel.
- For selected patients, other methods of urinary drainage such as condom catheter drainage, suprapubic catheterization, and intermittent urethral catheterization may be more appropriate.

3. Hand hygiene

- Hand hygiene should be done immediately before and after any manipulation of the catheter site or apparatus.

4. Catheter Insertion

- Catheters should be inserted using aseptic technique and sterile equipment.
- Gloves, drape, sponges, an appropriate antiseptic solution for peri-urethral cleaning, and a single-use packet of lubricant jelly should be used for insertion.
- As small a catheter as possible, consistent with good drainage, should be used to minimize urethral trauma.
- Indwelling catheters should be properly secured after insertion.

5. Closed Sterile Drainage

- The catheter collection system should remain closed and not be opened unless absolutely necessary for diagnostic or therapeutic reasons eg irrigation.
- If breaks in aseptic technique, disconnection, or leakage occur, the collecting system should be replaced using aseptic technique after disinfecting the catheter-tubing junction.

6. Irrigation

Continuous irrigation should be avoided unless indicated (e.g. after prostatic or bladder surgery).

- Continuous irrigation of the bladder with antimicrobials has not proven to be useful and should not be performed as a routine infection prevention measure.
- The catheter-tubing junction should be disinfected before disconnection.
- If the catheter becomes obstructed, the catheter should be changed.

7. Specimen Collection

- If small volumes of fresh urine are needed for examination, the distal end of the catheter, or preferably the sampling port if present, should be cleansed with a disinfectant, and urine then aspirated with a sterile needle and syringe.
- Larger volumes of urine for special analyses should be obtained aseptically from the drainage bag.

8. Urinary Flow

- Unobstructed flow should be maintained.
- Urine flow through the catheter should be checked several times a day to ensure that the catheter is not blocked.
- Collecting bags should always be kept below the level of the bladder.

9. Meatal Care

- Clean the urethral meatal area after each bowel movement or when soiled.

10. Catheter Change Interval

- Indwelling catheters should not be changed at arbitrary fixed intervals. To avoid encrustation, the maximum duration for silicone-coated latex catheter is 14 days.

11. Bacteriologic Monitoring

- The value of regular bacteriologic monitoring of catheterized patients as an infection control measure has not been established and is not recommended.

5.2 Surgical Site Infections

5.2.1 Microbiology of surgical site infections

The pathogens isolated from SSIs have not changed markedly. The common source of pathogens is the endogenous flora of the patient's skin, mucous membranes, or hollow viscera (Table X). Therefore, the pathogens isolated from infection differ, primarily depending on the type of surgical procedure. In clean surgical procedures, in which the gastrointestinal, gynecologic, and respiratory tracts have not been entered, *Staphylococcus aureus* from the exogenous environment or patient's skin flora is the usual cause of infection. In other categories of surgical procedures, including clean-contaminated, contaminated, and dirty, the polymicrobial aerobic and anaerobic flora closely resembling the normal endogenous microflora of the surgically excised organ are the most frequently isolated pathogens.

Other sources of SSI pathogens are from distance focus such as in patients with prosthesis or implant place during the surgery, surgical personnel, operating environment, surgical tools, instruments, and materials brought to the field during an operation.

5.2.2 Surgical site infection prevention guidelines

An SSI prevention measure can be defined as an action or set of actions intentionally taken to reduce the risk of an SSI. Many measures are directed at reducing opportunities for microbial contamination of the patient's tissues or sterile surgical instruments; others are considered as adjunctive, such as using antibiotics prophylaxis or avoiding unnecessary traumatic tissue dissection.

5.2.3 Preoperative measures

5.2.3.1 Preparation of the patient:

1. Whenever possible, identify and treat all infection remote to the surgical site before elective operation and postpone elective surgeries on patients with remote site infections until the infection has resolved.
2. As far as possible, shortened the pre-operation hospital stays.
3. Do not remove hair preoperatively unless the hair at or around the incision site will interfere with the operation.
4. If hair needs to be removed, it is done immediately before operation, preferably using electric clippers and not razor blade.
5. Adequate control of blood glucose levels in all diabetic patients.
6. Encourage stop smoking cigarettes, cigars, pipes, or any other form of tobacco consumption (minimum at least 30 days prior to the surgery).
7. Do not withhold necessary blood products transfusion.

8. Encourage patients to shower or bathe at least the night before the operative day. Gross contamination around and at the incision site should be should be thoroughly cleaned.
9. Although it is not recommended, but it is preferably and advisable to:
 - Taper or discontinue systemic steroid use (when medically permissible).
 - Improve patients' nutrition status prior to the surgery.
10. Each individual surgical discipline should come out with discipline specific and procedures specific pre-operative preparation, e.g., bowel prep in colorectal surgery.

5.2.3.2 Surgical team members

1. Keep nails short and do not wear artificial nails.
2. Do not wear hand or arm jewelry.
3. Clean underneath each fingernail prior to performing the first surgical scrub of the day.
4. Perform a preoperative surgical scrub for at least 2 to 5 minutes using an appropriate antiseptic.
5. After performing the surgical scrub, keep hands up and away from body (elbow in flex position) so that water runs from tips of the fingers toward the elbow. Dry hand with sterile towel and don a sterile gown and gloves.
6. Limit the number of surgical team members in the OR.
7. Provide Continuous Professional Development (CPD) on Infection prevention, SSI and other appropriate topic for the hospital staffs especially for OR and surgical based ward staffs.

5.2.3.2.1 Management of infected or colonized surgical personnel

1. Educate and encourage surgical personnel who have signs and symptoms of a transmissible infectious illness to report conditions promptly to their supervisors who have the authority to restrict or even remove personnel from duty.
2. Develop well-defined policies concerning patient-care responsibilities when personnel have potentially transmissible infectious conditions. These policies should govern work restriction and clearance to resume work after an illness that required work restriction.
3. Obtain appropriate cultures from, and exclude from duty, surgical personnel who have draining skin lesions until infection has been ruled out or personnel have received adequate therapy and infection has resolved.
4. Do not routinely exclude surgical personnel who are colonized with organism such as *S. aureus* (nose, hands, or other body site) or group A *Streptococcus*, unless such personnel have been linked epidemiologically to dissemination of the organism in healthcare setting.

5. Adhere to the CDC recommendations for Prevention of HIV and HBV Transmission during Invasive Procedures as below.
6. Adhere to the recommendations for HIV Infection Guide Book from our MOH's Clinical Practice Guidelines.

CDC recommendation for prevention of HIV and HBV transmission during invasive procedures	
1.	Health care workers with exudative lesions or weeping dermatitis should cover any unprotected skin, or they should not provide patient care until the damage skin has healed.
2.	Hands should be washed after every patient contact.
3.	Health care workers should wear gloves when contact with blood or body substances is anticipated; double gloves should be used during operative procedures; hands should be washed after gloves are removed.
4.	Gowns, plastic aprons, or both should be worn when soiling of clothing is anticipated.
5.	Mask and protective eyewear or face shield should be worn if aerosolization or splattering of blood or body substances is expected.
6.	Resuscitation devices should be used to minimize the need for mouth-to-mouth resuscitation.
7.	Disposable containers should be used to dispose of needles and sharp instruments.
8.	Avoid accidents and self-wounding with sharp instruments by following these measures: • Do not recap needles. • Use needleless systems when possible. • Use cautery and stapling devices when possible. • Pass sharp instruments in metal tray during operative procedures.
9.	In case of an accidental spill of blood or body substance on skin or mucous membranes, do the following: • Rinse the site immediately and thoroughly under water. • Wash the site with soap and water. • Document the incident.
10.	Blood specimens from all patients should be considered hazardous at all times.
11.	Prompt attention should be given to spills of blood or body substances, which should be cleaned with an appropriate disinfectant.

5.2.3.2 Antimicrobial prophylaxis

1. Administer a prophylactic antibiotic agent only when indicated, and select it based on its efficacy against the most common pathogens causing SSI for a specific operation, and also adhere to MOH Antibiotic Guidelines.
2. Administer by IV route the initial dose of prophylactic antibiotic agent, timed such that a bactericidal concentration of the drug is established in serum and tissues when the incision is made. Maintain therapeutic levels of the agent in serum and tissues throughout the operation and until, at most, a few hours after the incision is closed in the operating room.
3. Before elective colorectal operations, mechanically prepare the colon by use of enemas and cathartic agents. Administer non-absorbable oral antimicrobial agents in divided doses on the day before the operation.
4. For high risk cesarean section, if indicated administer the prophylactic antibiotic agent immediately the umbilical cord is clamped.

5.2.4 Intra-operative measures

5.2.4.1 Operating room (OR) environment

1. The OR should be maintained under positive pressure ventilation (2.5 Pa in relation to corridors and adjacent areas).
2. Maintained adequate air exchanges (minimum of 15/hour, of which at least 3 should be fresh air).
3. Filter all air, re-circulated and fresh air, through the appropriate recommended filters.
4. Optimum room temperature (around 21° C).
5. Keep OR room doors closed except as needed for passage of equipment, personnel, and the patient.
6. Limit the number of personnel entering and also the movement of personnel in the OR.
7. Consider performing implant operations in OR supplied with ultraclean air (laminar flow).

5.2.4.2 Cleaning and disinfection of environmental surfaces

1. When visible soiling or contamination with blood or other body fluids of surfaces or equipment occurs during an operation, use approved hospital disinfectant to clean the affected areas before the next operation.
2. Do not perform special cleaning or closing of OR after contaminated or dirty operation.
3. Do not use tacky mats at the entrance to the OR suite or individual ORs for disinfection control.
4. Wet vacuum the OR floor after the last operation of the day or night with an approved hospital disinfectant.

5.2.4.3 Microbiologic sampling

1. Do not perform routine environment sampling of the OR. Perform microbiologic sampling of OR environment surfaces or air only as part of an epidemiologic investigation, or when there is gross violation of the OR sterility, or when there is an increased in SSIs.

5.2.4.4 Sterilization and disinfection of surgical and other medical instruments

1. **Critical items** - instruments or objects that enter directly into the vascular system or sterile areas of the body. These items should be sterilized according to the recommended approved sterilization methods; such as steam under pressure, dry heat, ethylene oxide, or other approved methods. Flash sterilization should only be used for emergency situation with the conditions that the instruments must be already manually cleaned, decontaminated, and properly arranged in the container before sterilization. Implantables should not be flash sterilized.
2. **Semi-critical items** - instruments or objects that come into contact with mucous membranes or skin that is not intact (bronchoscopes and gastroscopes), such items generally require high-level disinfection that kills all microorganisms except bacterial spores. The approved disinfectants are glutaraldehyde 2%, and orthophthalaldehyde (OPA) which is a newer agent approved by FDA. In order to achieve high-level disinfection, make sure that the internal and external surfaces and channels should come into contact with the disinfecting agent for a minimum of 20 minutes.
3. **Non-critical items** - instruments or objects that come in contact with intact skin (e.g., blood pressure cuffs). They generally require only washing or scrubbing with a detergent and warm water or disinfection agents such 70% alcohol.
4. Reuse of single-use medical devices is not encouraged although the implied cost is a major concern.

5.2.4.5 Surgical attire and drapes

1. The mask must fully covers the mouth and nose when entering the OR if an operation is about to begin or already under way, or when sterile instruments are exposed. The mask must be wear throughout the operation.
2. Wear a cap or hood to fully cover hair on the head and face when entering the OR.
3. Wear sterile gloves if a scrubbed surgical team member. Put on gloves after donning a sterile gown.
4. Use surgical gowns and drapes that are effective barriers when wet.
5. Change scrub suits whenever it is soiled, contaminated, and/or penetrated by blood or other potentially infectious materials.
6. Double gloving for any invasive surgical procedures.
7. Special surgical gown/attire e.g., space suit in arthroplasty surgery, because of the potential prolonged serious morbidity/mortality post-op complication if SSI set in.

5.2.4.6 Asepsis and surgical technique

1. Adhere to principles of asepsis when placing instruments or devices.
2. Assemble sterile equipment and solution immediately prior to use.
3. Use sharp surgical blade or scissor to avoid unnecessary soft tissue trauma.
4. Handle tissue gently, maintain effective hemostasis, minimize devitalized tissue and foreign bodies, and eradicate dead space at the surgical site.
5. Use delayed primary skin closure or leave an incision open to heal by second intention if the surgeon considers the surgical site to be heavily contaminated.
6. If drainage is necessary, use a closed suction drain. Place drain through a separate incision distant from the operative incision. Remove the drain as soon as possible.

5.2.5 Post-operative care measures

1. Protect with sterile dressing for 24 to 48 hours postoperatively an incision that has been closed primarily.
2. Separate post-operation clean surgical wound patients from infected patients, assigned delicate separate areas for them.
3. Maintain post-op glucose control.
4. Wash hand before and after dressing changes and any contact with the surgical site.
5. Do not unnecessarily open the wound or change dressing.
6. When an incision dressing must be changed, use sterile technique.
7. Educate patient and family members regarding proper incision care, symptoms of SSI, and the need to report such symptom.
8. Discharge post-operation patient early, as soon as they are fit to be discharged.

5.2.6 Developed a good surveillance system to study the incident of SSI.

1. Use CDC definitions of SSI for identifying SSI among surgical inpatients and outpatients.
2. Use method that accommodates available resources and data needs for the surveillance.
3. Periodically calculate operation specific SSI rates stratified by variables shown to be associated with increased SSI risk (e.g., NNIS risk index).
4. Report appropriately stratified operation specific SSI rates to surgical team members. The frequency and format for such rate computations will be determined by the surgical load, the objectives of the local and national, continuous quality improvement initiatives.

5.3 Nosocomial Respiratory Infection

Pneumonia is one of the three most common HCAs. The risk factors for nosocomial pneumonia are extremes of age, severe underlying disease, immunosuppression, depressed sensorium, cardiopulmonary disease, and post thoraco-abdominal surgery. Patients who are mechanically ventilated are at risk for ventilator-associated pneumonia.

Most bacterial nosocomial pneumonias occur by aspiration of bacteria colonizing the oropharynx or upper gastrointestinal tract of the patient. Intubation and mechanical ventilation greatly increase the risk of nosocomial bacterial pneumonia because they alter first-line patient defenses.

5.3.1 Prevention of Person-to-Person Transmission of Bacteria

1. Wear gloves when in contact with mucous membranes, handling respiratory secretions or objects contaminated with respiratory secretions. Hand hygiene should be performed after removal of gloves.
2. Change gloves and decontaminate hands between contacts with different patients
3. Change gloves between contacts with a contaminated body site and the respiratory tract or respiratory device on the same patient.
4. Wear a mask and an apron or gown when anticipate soiling of respiratory secretions from a patient (e.g. intubation, tracheal suctioning, tracheostomy, bronchoscopy) and change it after procedure and before providing care to another patient.
5. Use a sterile, single-use catheter, if the open-method suction system is employed. Use only sterile fluid to remove secretions from suction catheter if the catheter is to be used for re-entry into the patient's lower respiratory tract.

5.3.2 Precautions for prevention of aspiration

1. Remove devices such as endotracheal, tracheostomy, oro/ nasogastric tubes from patients as soon as they are not indicated.
2. Perform orotracheal rather than nasotracheal intubation unless contraindicated.
3. When feasible, use an endotracheal tube with subglottic suctioning to allow drainage of tracheal secretions that accumulate in the subglottic area.
4. Ensure that secretions are cleared from above the endotracheal tube cuff before deflating the cuff in preparation for tube removal or before moving the tube.
5. Elevate the head of the bed 30 – 45 degrees of a patient on mechanical ventilation or at high risk for aspiration (e.g. on oro or nasoenteral tube)
6. Routinely verify appropriate placement of the feeding tube.
7. Routinely assess the patient's feeding tolerance by measuring residual gastric volume and adjust the rate and volume of enteral feeding to avoid regurgitation.

5.3.3 Prevention of Postoperative Pneumonia

The following patients are high risk for developing postoperative pneumonia:

- i. Age ≥ 60 years
 - ii. History of chronic lung disease or smoking
 - iii. On steroids for chronic conditions
 - iv. History of chronic alcohol consumption
 - v. Impaired sensorium
 - vi. History of cerebrovascular accident with residual neurologic deficit
 - vii. General anaesthesia
 - viii. Upper abdominal or thoracic surgery
 - ix. Emergency surgery
 - xi. Obesity
1. Patients at risk should receive pre and postoperative instructions on deep breathing exercises and incentive spirometry.
 2. Encourage all postoperative patients to take deep breaths and ambulate them as soon as possible postoperatively, unless medically contraindicated.
 3. Provide adequate postoperative analgesia to facilitate effective coughing and deep breathing.

5.3.4 Sterilization or disinfection and maintenance of respiratory equipment and devices

1. For sterilization or disinfection of respiratory equipment, refer policy and procedure of nosocomial infection in general intensive care unit.
2. Do not routinely sterilize or disinfect the internal machinery of mechanical ventilators
3. Do not routinely change the ventilator breathing circuit on the basis of duration of use. Change the ventilator breathing circuit when visibly soiled.
4. Drain and discard periodically any condensate in the circuit. Take precautions not to allow the condensate to drain towards the patient.
5. Use sterile water to fill bubble-through humidifiers.
6. Do not routinely change more frequently than every 48 hours an HME that is in use on a patient. Change when it malfunctions mechanically or becomes visibly soiled.
7. Change the oxygen delivery system (tubing, nasal prongs or mask) that is in use on one patient when it malfunctions or becomes visibly contaminated or between uses on different patients.
8. Clean, disinfect, rinse with sterile water and dry nebulizers between treatments on the same patient. Replace nebulizers with those that have undergone sterilization or high-level disinfection between uses on different patients.

9. Use only sterile fluid for nebulization, and dispense the fluid into the nebulizer aseptically. Use aerosolized medications in single dose vial whenever possible.
10. Change the mouthpiece of a peak flow meter or the mouthpiece and filter of a spirometer between uses on different patients.
11. Change entire length of suction-collection tubing and canisters between uses on different patients.
12. Between uses on different patients, clean reusable components of the anaesthetic breathing system, inspiratory and expiratory breathing tubing, y-piece, reservoir bag, humidifier, and tubing, and then sterilize or subject them to high-level liquid chemical disinfection or pasteurization in accordance with the device manufacturers' instructions. A bacterial-viral filter placed between the y-piece and the mask or endotracheal tube serves to protect the patient and the anaesthesia delivery system from contamination.

5.4 Intravascular Catheter-Related Infections

5.4.1 Surveillance

1. Monitor the catheter sites visually or by palpation through the intact dressing on a regular basis, depending on the clinical situation of individual patients. If patients have tenderness at the insertion site, fever without obvious source, or other manifestations suggesting local or BSI, the dressing should be removed to allow thorough examination of the site
2. Encourage patients to report any changes in their catheter site or any new discomfort.
3. Record the date of catheter insertion and removal, and dressing changes. **Do not routinely culture catheter tips.**

5.4.2 Hand hygiene

1. Observe proper hand hygiene.
2. Palpation of the insertion site should not be performed after the application of antiseptic, unless aseptic technique is maintained.

5.4.3 Aseptic technique during catheter insertion and care

1. Maintain aseptic technique for the insertion and care of intravascular catheters. Wearing clean gloves rather than sterile gloves is acceptable for the insertion of peripheral intravascular catheters if the access site is not touched after the application of skin antiseptics.
2. Sterile gloves should be worn for the insertion of arterial and central catheters.
3. Change the dressing on intravascular catheters using aseptic technique.

5.4.4 Catheter insertion

Do not routinely use arterial or venous cut down procedures as a method to insert catheters

5.4.5 Catheter site care

1. For cutaneous antisepsis - Disinfect clean skin with an appropriate antiseptic before catheter insertion and during dressing changes. Although a 2% chlorhexidine-based preparation is preferred, tincture of iodine, an iodophor, or 70% alcohol can be used.
2. Allow the antiseptic to remain on the insertion site and to air dry before catheter insertion.
3. Allow povidone iodine to remain on the skin for at least 2 minutes, or longer if it is not yet dry before insertion.
4. Do not apply organic solvents (e.g: acetone and ether) to the skin before insertion of catheters or during dressing changes.

5.4.6. Catheter-site dressing regimens

1. Use either sterile gauze or sterile, transparent, semipermeable dressing to cover the catheter site
2. Tunneled CVC sites that are well healed might not require dressings.
3. If the patient is diaphoretic, or if the site is bleeding or oozing, a gauze dressing is preferable to a transparent, semi-permeable dressing
4. Replace catheter-site dressing if the dressing becomes damp, loosened, or visibly soiled.
5. Change dressings at least weekly for adult and adolescent patients depending on the circumstances of the individual patient.
6. Do not use topical antibiotic ointment or creams on insertion sites (except when using dialysis catheters) because of their potential to promote fungal infections and antimicrobial resistance.
7. Do not submerge the catheter under water. Showering should be permitted if precautions can be taken to reduce the likelihood of introducing organisms into the catheter (e.g., if the catheter and connecting device are protected with an impermeable cover during the shower).

5.4.7. Selection and replacement of intravascular catheters

1. Select the catheter, insertion technique, and insertion site with the lowest risk for complications (infectious and noninfectious) for the anticipated type and duration of IV therapy.
2. In adults, use an upper- instead of a lower-extremity site for catheter insertion. Replace a catheter inserted in a lower-extremity site to an upper-extremity site as soon as possible. In pediatric patients, the hand, the dorsum of the foot, or the scalp can be used as the catheter insertion site.
3. Promptly remove any intravascular catheter that is no longer essential. Do not routinely replace central venous or arterial catheters solely for the purposes of reducing the incidence of infection.
4. Replace peripheral venous catheters at least every 72–96 hours in adults to prevent phlebitis. Leave peripheral venous catheters in place in children until IV therapy is completed, unless complications (e.g: phlebitis and infiltration) occur.
5. When adherence to aseptic technique cannot be ensured (i.e: when catheters are inserted during a medical emergency), replace all catheters as soon as possible and after no longer than 48 hours
5. Use clinical judgment to determine when to replace a catheter that could be a source of infection (e.g: do not routinely replace catheters in patients whose only indication of infection is fever). Do not routinely replace venous catheters in patients who are bacteremic or fungemic if the source of infection is unlikely to be the catheter.
6. Replace any short-term CVC if purulence is observed at the insertion site, which indicates infection.

7. Replace all CVCs if the patient is hemo-dynamically unstable and CRBSI is suspected.
8. Do not use guidewire techniques to replace catheters in patients suspected of having catheter-related infection.

5.4.8. Replacement of administration sets*, needleless systems, and parenteral fluids

5.4.8.1. Administration sets

1. Replace administration sets, including secondary sets and add-on devices, no more frequently than at 72-hour intervals, unless catheter-related infection is suspected or documented.
2. Replace tubing used to administer blood, blood products, or lipid emulsions (those combined with amino acids and glucose in a 3-in-1 admixture or infused separately) within 24 hours of initiating the infusion (If the solution contains only dextrose and amino acids, the administration set does not need to be replaced more frequently than every 72 hours).
3. Replace tubing used to administer propofol infusions every 6 or 12 hours, depending on its use, per the manufacturer's recommendation.

5.4.8.2. Needleless intravascular devices

1. Change the needleless components at least as frequently as the administration set.
2. Change caps no more frequently than every 72 hours or according to manufacturers' recommendations.
3. Ensure that all components of the system are compatible to minimize leaks and breaks in the system.
4. Minimize contamination risk by wiping the access port with an appropriate antiseptic and accessing the port only with sterile devices.

5.4.8.3. Parenteral fluids

1. Complete the infusion of lipid-containing solutions (e.g: 3-in-1 solutions) within 24 hours of hanging the solution.
2. Complete the infusion of lipid emulsions alone within 12 hours of hanging the emulsion. If volume considerations require more time, the infusion should be completed within 24 hours.
3. Complete infusions of blood or other blood products within 4 hours of hanging the blood.

5.4.9. IV-injection ports

Clean injection ports with 70% alcohol or an iodophor before accessing the system.**B. Cap all stopcocks when not in use.**

5.4.10 Preparation and quality control of IV admixtures

1. Admix all routine parenteral fluids in the pharmacy in a laminar-flow hood using aseptic technique.
2. Do not use any container of parenteral fluid that has visible turbidity, leaks, cracks, or particulate matter or if the manufacturer's expiration date has passed.
3. Use single-dose vials for parenteral additives or medications when possible.
4. Do not combine the leftover content of single-use vials for later use.
5. Multidose should be discouraged whenever possible.
6. If multidose vials are used;
 - Refrigerate multidose vials after they are opened if recommended by the manufacturer.
 - Cleanse the access diaphragm of multidose vials with 70% alcohol before inserting a device into the vial.
 - Use a sterile device to access a multidose vial and avoid touch contamination of the device before penetrating the access diaphragm.
 - Discard multidose vial if sterility is compromised.

5.4.11. In-line filters

Do not use filters routinely for infection-control purposes.

5.4.12. Prophylactic antimicrobials

Do not administer intranasal or systemic antimicrobial prophylaxis routinely before insertion or during use of an intravascular catheter to prevent catheter colonization or BSI

5.4.13 Central Venous Catheters, Including PICCs, Hemodialysis, and Pulmonary Artery Catheters, in Adult and Pediatric Patients.

5.4.13.1 General principles

1. Use a CVC with the minimum number of ports or lumens essential for the management of the patient.
2. Use totally implantable access devices for patients who require long-term, intermittent vascular access. For patients requiring frequent or continuous access, a PICC or tunneled CVC is preferable.
3. Use a fistula or graft instead of a CVC for permanent access for dialysis.
4. Do not use hemodialysis catheters for blood drawing or applications other than hemodialysis except during dialysis or under emergency circumstances.
5. Use povidone-iodine antiseptic ointment at the hemodialysis catheter exit site after catheter insertion and at the end of each dialysis session only if this ointment does not interact with the material of the hemodialysis catheter per manufacturer's recommendation.

5.4.13.2 Selection of catheter insertion site

1. Weigh the risk and benefits of placing a device at a recommended site to reduce infectious complications against the risk for mechanical complications (e.g., pneumothorax, subclavian artery puncture, subclavian vein laceration, subclavian vein stenosis, hemothorax, thrombosis, air embolism, and catheter misplacement).
2. Use a subclavian site (rather than a jugular or a femoral site) in adult patients to minimize infection risk for non-tunneled CVC placement.
3. Place catheters used for hemodialysis and pheresis in a jugular or femoral vein rather than a subclavian vein to avoid venous stenosis if catheter access is needed.

5.4.13.3 Maximal sterile barrier precautions during catheter insertion

1. Use aseptic technique including the use of a cap, mask, sterile gown, sterile gloves, and a large sterile sheet, for the insertion of CVCs (including PICCS) or guidewire exchange.
2. Use a sterile sleeve to protect pulmonary artery catheters during insertion.

5.4.13.4 Replacement of catheter

1. Do not routinely replace CVCs, PICCs, hemodialysis catheters, or pulmonary artery catheters to prevent catheter-related infections.
2. Do not remove CVCs or PICCs on the basis of fever alone. Use clinical judgment regarding the appropriateness of removing the catheter if infection is evidenced elsewhere or if a noninfectious cause of fever is suspected.
3. Guidewire exchange:
 - Do not use guidewire exchanges routinely for non-tunneled catheters to prevent infection.
 - Use a guidewire exchange to replace a malfunctioning non-tunneled catheter if no evidence of infection is present.
 - Use a new set of sterile gloves before handling the new catheter when guidewire exchanges are performed.

5.4.13.5 Catheter and catheter-site care

1. General measures

Designate one port exclusively for hyperalimentation if a multilumen catheter is used to administer parenteral nutrition.

2. Antibiotic lock solutions

Do not routinely use antibiotic lock solutions to prevent CRBSI. Use prophylactic antibiotic lock solution only in special circumstances (e.g., in treating a patient with a long-term cuffed or tunneled catheter or port with a history of multiple CRBSIs despite optimal maximal adherence to aseptic technique).

3. Catheter-site dressing regimens;

- Replace the catheter-site dressing when it becomes damp, loosened, or soiled or when inspection of the site is necessary.
- Replace dressings used on short-term CVC sites every 2 days for gauze dressings and at least every 7 days for transparent dressings, except in those pediatric patients in which the risk for dislodging the catheter outweighs the benefit of changing the dressing.
- Replace dressings used on tunneled or implanted CVC sites no more than once per week, until the insertion site has healed.

4. Ensure that catheter-site care is compatible with the catheter material.

5. Use a sterile sleeve for all pulmonary artery catheters.

5.4.13.6 Additional Recommendations for Peripheral Arterial Catheters and Pressure Monitoring Devices for Adult and Pediatric Patients

1. Use disposable, rather than reusable, transducer assemblies when possible in selection of pressure monitoring system.
2. Do not routinely replace peripheral arterial catheters and pressure monitoring system to prevent catheter-related infections.
3. Replace disposable or reusable transducers at 96-hour intervals. Replace other components of the pressure monitoring system (including the tubing, continuous-flush device, and flush solution) at the time the transducer is replaced.
4. General measures in care of pressure monitoring systems;
 - Keep all components of the pressure monitoring system (including calibration devices and flush solution) sterile.
 - Minimize the number of manipulations of and entries into the pressure monitoring system. Use a closed-flush system (i.e., continuous flush), rather than an open system (i.e., one that requires a syringe and stopcock), to maintain the patency of the pressure monitoring catheters.
 - When the pressure monitoring system is accessed through a diaphragm rather than a stopcock, wipe the diaphragm with an appropriate antiseptic before accessing the system.
 - Do not administer dextrose-containing solutions or parenteral nutrition fluids through the pressure monitoring circuit.
5. Sterilization or disinfection of pressure monitoring systems

Use disposable transducers. Sterilize reusable transducers according to the manufacturers' instructions if the use of disposable transducers is not feasible

6. Recommendations for Umbilical Catheters

Replacement of catheters;

- Remove and do not replace umbilical artery catheters if any signs of CRBSI, vascular insufficiency, or thrombosis are present.

- Remove and do not replace umbilical venous catheters if any signs of CRBSI or thrombosis are present.
- Replace umbilical venous catheters only if the catheter malfunctions.

Catheter-site care;

- Cleanse the umbilical insertion site with Alcoholic chlorhexidine 2% before catheter insertion. Avoid tincture of iodine because of the potential effect on the neonatal thyroid.
- Do not use topical antibiotic ointment or creams on umbilical catheter insertion sites because of the potential to promote fungal infections and antimicrobial resistance.
- Add low doses of heparin (0.25—1.0 F/ml) to the fluid infused through umbilical arterial catheters.
- Remove umbilical catheters as soon as possible when no longer needed or when any sign of vascular insufficiency to the lower extremities is observed. Optimally, umbilical artery catheters should not be left in place >5 days.
- Umbilical venous catheters should be removed as soon as possible when no longer needed but can be used up to 14 days if managed aseptically.

Note :

6. INFECTION CONTROL IN SPECIFIC HEALTHCARE SETTING

6.1 Neonatal Intensive Care Unit

6.1.1 Introduction

The prevention, control, and surveillance of infections within the Neonatal Services, includes the newborn in special care and neonatal intensive care nurseries.

6.1.2 Personnel

6.1.2.1 Employee Health

- Personnel must understand the risks of transmission of contagious diseases to newborns and report acute infections to their immediate supervisor.
- Personnel with airborne infections should not work.
- Personnel with exudative hand dermatitis, staphylococcal skin lesions, or herpetic hand lesions should not perform direct patient care.
- Needle stick/sharps injuries must be reported immediately in accordance with hospital policy documented in the Infection Control Manual.

6.1.2.2 Education

- The principles of infection control are presented during staff orientation. Policies specific to Neonatal Unit are covered during orientation to the nursery.
- All staff will attend regular in-services in Infection Control practices, including hand hygiene, sharps safety, Personal Protective Equipment , and medical waste training.

6.1.2.3 Personal Protective Equipment

- The routine use of gowns has not been supported by systematic review of literature. However, expert opinion suggests that protective clothing should be worn by all health care practitioners when contamination with blood, body fluids, secretions, and excretions (with the exception of sweat), or when close contact with the patient, materials or equipment may lead to contamination of the clothing with microorganisms.
- Personnel will wear a scrub suit when doing invasive procedures
- Gloves must be worn for invasive procedures, contact with sterile sites, and non-intact skin, mucous membranes, and all activities that have been assessed as carrying a risk of exposure to blood, body fluids, secretions and excretions; and when handling sharp or contaminated instruments.

- Gloves should be worn as single use items. Put gloves on immediately before an episode of patient contact or treatment and remove them as soon as the activity is completed. Change gloves between caring for different patients, or between different care/treatment activities for the same patient.
- Mask and eye protection or face shield must be worn to protect the mucous membranes of the eyes, nose, and mouth during procedures that are likely to generate splashes or sprays of blood, body fluids, secretions, and excretions.
- Gloves should be worn by personnel taking care of infants with respiratory viral infections to reduce the risk of accidental self-inoculation.
- A closed incubator may be used in maintaining barrier precautions, but since surfaces and entry ports readily become contaminated by hands, the outside of the incubator should always be considered contaminated.

6.1.3 Procedures

1. Full aseptic techniques should be observed whenever invasive techniques are performed on the patient, which include sterile gowns, masks and gloves.
2. Remove used gloves and wash hands before attending to another patient or before going to another location. The gloves are to be disposed of immediately after each use as clinical waste.
3. Blood and secretion specimens are not to be placed on the writing table.
4. Care of IV lines :
 - Full aseptic technique for insertion of central venous lines. Chlorhexidine in alcohol may be used prior to the setting of arterial line, except in ELBW infants where aqueous chlorhexidine can be used. However, the optimal antiseptic agent for skin antisepsis is not known.
 - Povidone iodine may be used prior to setting arterial line in older infants. Residual iodine on the skin should be removed with sterile water or normal saline.
 - Dressings are changed whenever there is contamination with blood.
 - Keep three way taps ports clear of blood contamination at all times and the port not to be left open to air, and must be spigotted if not in use.
 - IV line tubing which is temporarily disconnected should be protected from contamination.
 - TPN lines should be a closed system with no other infusions running with it. In-line filters should be used.
 - Injections of drugs should preferably be without needle and given through an injection port.
 - IV cannulae are to be removed when no longer required; after 5–7 days, or if there are signs of local inflammation.

6.1.4 Handwashing

- Adherence to good hand hygiene is mandatory.
- Rings, watches, and bracelets should not be worn while providing patient care. All jewelry should be removed before hand hygiene as this interferes with effective handwashing. Cuts and abrasions should be covered with waterproof dressings.
- All personnel will perform a 2-3 minute scrub with an antiseptic soap prior to beginning patient care in the nursery and upon re-entering the nursery care area. This scrub should include all areas of the hands and arms to the elbows. 4% chlorhexidine is the recommended handwashing preparation.
- Alcoholic Chlorhexidine 4% as a fast acting skin rub disinfectant may replace handwashing especially in situations where there is no visible contamination of the hands and decontamination is needed urgently.
- The handrub solution must come into contact with all surfaces of the hand. The hands must be rubbed together vigorously, paying particular attention to the tips of the fingers, the thumbs and the areas between the fingers, and until the solution has evaporated and the hands are dry.
- Hands that are visibly soiled or potentially grossly contaminated with dirt or organic material must be washed with liquid soap and water first.
- A 10-15 second wash will be performed before and after patient contact or after contaminating the hands.
- Hands must be washed after gloves are removed.
- Other healthcare workers involved with neonatal care, including radiographers, physiotherapists and occupational therapists must observed strict hand hygiene before and after attending to these neonates.

6.1.5 Newborn Isolation

- Most infections in newborns do not require special isolation precautions. General newborn care measures will prevent transmission of most infections between newborns.
- For most infections, where air control is not necessary, an isolation area can be defined in the nursery or NICU .
- Infants suspected or diagnosed with infections transmitted by contact or droplets (i.e., rubella, mumps, pertussis, and RSV) may require special precautions. A distance of at least three feet should separate infected infants from other patients.
- Cohorting of infants may be used at times of nosocomial outbreaks. All patients with multiresistant organism infection should be clearly identified.
- There are no special restrictions for admission of infants born outside the hospital. They should be treated the same as infants born in the hospital. Infants suspected or diagnosed with certain infections (i.e., varicella, measles, TB) require special precautions. Infants of mothers with perinatal varicella or measles should also be isolated. Isolation needs are determined by the mode of transmission of the pathogen involved, the number of infected or colonized newborns, and the care required by those newborns. The use of a negative pressure room can be considered where appropriate.

6.1.6 Infected Mother

- The obstetric medical officer should notify the paediatrics medical officer of all infections suspected or diagnosed in maternal patients.
- Transmission from mother to newborn usually occurs during delivery. The advisability of maternal-infant contact will be discussed and decided on an individual basis.
- If a mother develops a fever or infection while the infant is rooming in, she will be evaluated on an individual basis by the Paediatric doctor as to the advisability of the infant remaining with the mother.
- Postpartum separation of the mother and newborn is rarely indicated.
- Untreated active pulmonary tuberculosis in the mother is an indication for separation until the mother is no longer considered contagious (usually after 14 days of treatment).
- The uninfected newborn of the mother with peripartum varicella should be separated until maternal lesions have dried.
- Separation should be considered if the mother has extensive *Staph. aureus* infection with drainage not contained by dressings.
- *Breast-feeding* is rarely dangerous to the infant. Contraindications are:
 - Maternal HIV infection
 - HSV lesions around the nipples

6.1.7 Newborn

6.1.7.1 Feeding

- Mother / infant specific breast milk or colostrum only is used. Breast milk from one mother can be given to another mother's infant only with counseling and permission from the recipient's mother and for non-Muslim mothers.
- Breast pump apparatus are changed between patients, washed in soap and water and then soaked in disinfectants such as Presept and rinsed through with cooled boiled water before next use.
- Breast milk is collected and stored in a clean manner. Milk will be expressed into clean containers.
- Milk may be stored in the refrigerator for a maximum of 72 hours or frozen for three (3) months.
- Frozen milk should be thawed quickly for no more than 15 minutes under warm water with precautions to prevent contamination. After thawing, milk should be used promptly or stored in the refrigerator for no longer than 24 hours. Any prepared milk at room temperature that is unused after 2 hours should be discarded.
- Infant formula can be stored in the ward refrigerator at temperature of 4°C for 24 hours.
- Continuous infusion tube feeding should be set up with the same aseptic precautions used for intravenous fluids. Syringes of milk should be changed at least every two hours, and tubing every shift.

6.1.7.2 Skin care

- Maternal blood and secretions will be removed with sterile cotton sponges and sterile water once the newborn's temperature has stabilized. Gloves will be worn for handling of all infants until this has been done.
- Localized cleaning of the diaper area and other soiled areas will be carried out as needed, using sterile water.
- Whole body bathing and antiseptic soaps are not necessary for routine care but may be indicated in outbreaks.

6.1.7.3 Cord care

- The cord will be cut and tied using aseptic technique.
- The umbilical cord stump is left to dry or may be cleaned with alcohol daily.

6.1.7.4 Eye care

- At delivery, the newborn's eyes should be cleansed with sterile cotton to remove secretions and debris.
- Profuse purulent discharge within the first day of life should be informed immediately to the paediatric doctor to treat as gonococcal conjunctivitis until proven otherwise
- Eyes may become infected with water-borne organisms in humid incubators or from contamination with respiratory tract secretions.
- Care must be taken to prevent contamination of the eyes with drips from suction catheters after suctioning the nasopharynx or endotracheal tube.

6.1.8 Infant Contact with Mothers and Visitors

Infants rooming with their mothers should not be handled by non-family members. Family members may hold the infants after proper handwashing.

- Visitation is not allowed during sterile procedures.
- Only parents are allowed to visit in the neonatal wards. Routine handwashing should be performed. Parents may visit at any time.
- Parents or visitors who are sick eg. respiratory or diarrheal illness, should not visit.

6.1.9 Patient Care Equipment.

- Disposable items are utilized as much as possible where available.
- All infant care units are cleaned and disinfected between each use. Equipment will be labeled cleaned and stored ready for use.
- All infants are transferred to a clean bassinet, incubator or radiant warmer every seven days.
- Ventilator circuits and tubing are replaced after 72 hours.
- Air filters from incubators should be changed every three months. Fan, unit, and housing unit will be cleaned with a damp cloth on a weekly basis.

- Equipment assigned to a single patient such as resuscitation bags, masks, and other items in contact with the newborns skin or mucous membranes should be replaced and sterilized or receive high-level disinfection on a regular basis.
- Clean/sterile gear is stored in a dry, clean area away from contaminated area or supplies.
- Sterile supplies and equipment are preferably stored in closed cabinets or shelves that are elevated at least 8-10 inches off the floor and 18-20 inches from the ceiling. Sterile or clean supplies must never be stored on the floor.
- Examining equipment, such as stethoscopes and ophthalmoscopes should be reserved for use with one patient or decontaminated with alcohol between patients.

6.1.10 Housekeeping

- The nursery should be kept clean and dust free. The ward sister /senior staff nurse is responsible for supervising the cleaning of their areas.
- Cleaning methods that minimize dust dispersal should be used. Cleaning and dusting of the accessory areas (windows, shelves, and counters) will be done daily with an approved hospital disinfectant. Phenolic solutions should not be used.
- Where a piece of equipment is used for more than one patient, e.g., weighing machine, it must be cleaned following each and every episode of use.
- Floors and other horizontal surfaces are cleaned daily with an approved hospital disinfectant. Phenolic solutions (i.e., LPH) are not to be used on incubators or other surfaces in direct contact with the newborns.
- All blood spills should be attended to immediately.
- No food or drinks are allowed in patient care area.

6.1.11 General Policies

- Soiled linen will be handled according to hospital policy. Clean linen and gowns will be stored in closed cabinets.
- Needles, syringes, and sharps are disposed of (uncapped and uncut) into puncture-resistant sharp containers. Be careful to avoid injury.
- Staff will report promptly, all occupational injuries or infectious exposures to the hospital Occupational Safety and Health committee for treatment and follow-up.

6.2 General Intensive Care Unit

Many infectious agents are present in the intensive care unit. Patients may develop infections during their stay in the unit while healthcare workers may be infected during the course of their duties. It is therefore important for all healthcare workers working in the intensive care units to observe infection control measures strictly to minimise nosocomial infections.

For **Standard Precautions, Transmission-based (Additional) Precautions** and **Hand Hygiene**, refer to Chapter 3 on Isolation Precautions.

6.2.1 Healthcare Workers and Visitors

1. All healthcare workers shall remove their white clinical coats before entering the unit.
2. There is no necessity to change footwear or use shoe covers upon entering the unit.
3. All healthcare workers shall perform hand hygiene with antiseptic soap and water or alcohol-based hand rub upon entering and before leaving the unit.
4. Staff nurses shall change out of their uniforms and wear ICU attire/OT suits while working in the unit. It is advisable for those who wear headscarves to change to caps while on duty. Headscarves or ties if worn shall be neatly tucked into blouses/shirts.
5. Wearing of bangles or bracelets is not allowed during patient care. Ear studs (not dangling earrings) and flat band rings are allowed. Wristwatches and flat band rings must be removed when performing hand hygiene.
6. Sleeves shall be rolled up above the elbow when handling patients and equipments.
7. Healthcare workers with transmittable infections are advised not to work in the unit until treated.
8. Visitors shall be limited to not more than two per patient at any one time.
9. Visitors shall be instructed on hand hygiene practices before and after visiting.
10. Visitors shall not be discouraged from having contact with the patients e.g. touching. However, they shall be instructed to observe transmission-based precautions whenever applicable.

6.2.2 Personal Protective Equipment

1. Wearing of gloves does not replace hand hygiene. Perform hand hygiene both before wearing and after removing gloves.
2. Wear sterile gloves when performing procedures requiring a sterile field or involving sterile areas in the body e.g. arterial cannulation, central venous cannulation, tracheal suction, bronchoscopy, wound dressing, lumbar puncture, tracheostomy and urinary catheterisation.
3. Wear non-sterile gloves when touching blood, saliva, body fluids or secretions, excretions, contaminated items or surfaces, mucous membranes and non-intact skin.

4. Change gloves when performing separate procedures, from a contaminated to a clean body site on the same patient.
5. Wear surgical mask and protective eyewear or face shield to protect mucous membranes of the eyes, nose and mouth during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions e.g., tracheal intubation, tracheal suction and tracheostomy.
6. Wear gown (clean, non-sterile) or plastic apron during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions or excretions, e.g. chest physiotherapy, wound dressing, sponging, tracheal intubation, tracheal suction.
7. Remove gloves, soiled gown or apron promptly and perform hand hygiene after removal. Do not use the same gown, apron or gloves on different patients.
8. Refer to table below for common procedures and recommendations for personal protective equipment.

Procedures	Gloves		Gown		Goggle/ Eye Shield	Apron
	Sterile	Non-Sterile	Sterile	Non-Sterile		
Arterial cannulation	✓				✓	✓
Bone marrow aspiration	✓		✓		✓	
Bronchoscopy	✓			✓	✓	
Blood sampling for culture	✓					✓
Central venous catheter, haemodialysis catheter insertion	✓		✓		✓	
Chest tube insertion	✓		✓		✓	
Lumbar puncture	✓		✓		✓	
Nasogastric tube insertion		✓				✓
Peripheral venous cannulation		✓			✓	✓
Pulmonary artery catheterisation	✓		✓		✓	
Peritoneal dialysis catheter insertion	✓		✓		✓	
Urinary catheterisation	✓					✓

Tracheal intubation		✓			✓	✓
Tracheostomy	✓		✓		✓	
Tracheostomy tube change	✓				✓	✓
Tracheal suctioning	✓				✓	✓
Ventilator tubing change	✓				✓	✓
Wound dressing	✓					✓
Physiotherapy		✓			✓	✓
Sponging		✓				✓

Note : Mask is to be worn for all the above procedures

6.2.3 Ward Environment

1. The ward shall be kept tidy and neat at all times.
2. Flowers and plants are not allowed in patient-care areas.
3. Patients who are infected or colonised shall be nursed in isolation rooms if available or cohorted in a designated area or cubicle.
4. The cleaning schedule shall be followed, with adequate daily cleaning of all work areas. Cleaning tasks shall follow in the order from 'clean' to 'dirty'.
5. Floors shall be cleaned according to cleaning schedule or as necessary. Brooms shall not be used in clinical areas. Use dust-retaining mops, which are specially treated or manufactured to attract and retain dust particles.
6. Clean and disinfect high touch areas (work areas, bedrails, drip stands, bedside nursing tables, keyboards, light switches, doorknobs) with medium-level disinfectant at least daily or when visibly dirty.
7. Sinks, hand basins and surrounding floor and wall areas shall be cleaned at least daily, or more frequently as required.
8. Handbasins shall ideally be equipped with nontouch taps with antisplash devices. Antiseptic hand wash in non-refillable dispensers and disposable paper towels shall be readily available.
9. Clean wall, blinds or window in patient-care areas when visibly dusty or soiled and when patients are discharged.
10. Curtains in patient-care areas shall be changed weekly and when patients are discharged. Use plastic curtain that can be decontaminated regularly (e.g. daily) if feasible.

11. Protect mattresses and pillows with water impermeable material. Clean and disinfect between patients.
12. Standard precautions apply in spills management. Confine and contain the spill by using paper towels or disposable absorbent material to absorb the bulk of the blood or body substances. Spills shall be cleaned up before the area is disinfected. Avoid aerosolisation of spilled material.
13. Terminal disinfection must be done when a patient is discharged. The bed, all reusable items and equipments in the room/area are to be cleaned and then disinfected. The bed can be used for the next patient only when it is completely dry. If possible, open the windows to air the room. The room can be used for the next admission only when it is completely dry.

6.2.4 Medical Instruments and Equipment

1. All reusable medical items must be thoroughly decontaminated before disinfection or sterilisation. If not adequately decontaminated, disinfection or sterilisation is not effective.
2. All packaged and wrapped sterile items must be transported and stored while maintaining the integrity of packs to prevent contamination. If a sterile item is suspected of being unsterile (e.g. damaged packaging) the item must not be used.
3. Reusable equipment must not be used for another patient until it has been appropriately cleaned and/or disinfected.
4. Each patient shall have his/her own set of bedside equipment e.g. stethoscope, BP cuff, thermometer.
5. Surfaces of computers, keyboards and non-critical medical equipments e.g. physiologic monitors, ventilators, infusion pumps shall be cleaned at least daily with a low or intermediate level instrument grade disinfectant and allowed to air dry. Use washable keyboard covers if feasible. Alternatively cover keyboard with 'clingwrap' and change daily.

6.2.5 Respiratory Equipment

1. Use only sterile water/fluid for respiratory care e.g. suctioning, filling of humidifiers and nebulisers.
2. Use a closed system for filling of sterile water into heated water humidifier.
3. Do not routinely change the ventilator breathing circuit on the basis of duration of use. Change the ventilator breathing circuit when visibly soiled.
4. Drain and discard periodically any condensate in the circuit. Take precautions not to allow the condensate to drain towards the patient.
5. Do not routinely change the heat-moisture exchanger more frequently than recommended by the manufacturer. Change when it malfunctions mechanically or becomes visibly soiled.
6. Change the oxygen delivery system (tubing, nasal prongs or mask) that is in use on one patient when it malfunctions or becomes visibly contaminated or between uses on different patients.

7. Clean, disinfect, rinse with sterile water and dry nebulisers between treatments on the same patient. Replace nebulisers with those that have undergone sterilisation or high-level disinfection between uses on different patients.
8. Use only sterile fluid for nebulisation, and dispense the fluid into the nebuliser aseptically. Use aerosolised medications in single dose vials whenever possible.
9. Change the mouthpiece of a peak flow meter or the mouthpiece and filter of a spirometer between uses on different patients.
10. Change the entire length of suction-collection tubing and canisters between uses on different patients.
11. Closed-suction system for tracheal suctioning is recommended for infectious respiratory cases.

6.3 Operation Theatre

This policy deals principally with all operating theatre procedures in MOH. All staff must practice 'standard precaution' when handling blood and body. When a patient is known to have an 'inoculation risk' such as hepatitis B or HIV, additional measures may be taken for certain surgical procedures.

6.3.1 Maintaining a Safer Environment in the Surgical Procedure Area

1. Specific rooms should be designated for performing surgical/clinical procedures and for processing instruments and other items.
2. It is important to control traffic and activities in these areas since the number of people and the amount of activity influence the number of microorganisms that are present and therefore influence the risk of infection.

6.3.2. Location of the Operating Theatre Suites

1. Operating theatres may be located in either purpose-built units or in converted hospital accommodation.
2. Separated from the main flow of hospital traffic and from the main corridors; however, it should be easily accessible from surgical wards and emergency rooms.
3. The floor should be covered with antistatic material, and the walls should be painted with impervious, antistatic paint e.g: polyurethane paint, epoxy paint to reduce dust levels and allows for frequent cleaning. The surfaces must withstand frequent cleaning and decontamination with disinfectant.

6.3.3. Layout of the Operating Theatre

1. The operating theatre should be zoned and access to these zones should be under control of OT personnel.
2. Aseptic and clean areas should be separated from the outer areas.
3. Physical barriers are needed in order to restrict access and to maintain unidirectional movement of air in converted theatre units.
 - i. **Outer zone:** This zone should contain:
 - A main access door
 - An accessible area for the removal of waste
 - A sluice
 - Storage for medical and surgical supplies
 - An entrance to the changing facilities.

ii. **Clean or semi-restricted zone:** This zone contains:

- The sterile supplies store
- An anesthetic room
- A recovery area
- A scrub-up area
- A clean corridor
- Rest rooms for the staff.

Staff must change into theatre clothes and shoes before entering this area, but there is no need for a mask, gloves, or a gown. There should be unidirectional access from the above area to the aseptic area i.e. the operating theater, preferably via the scrub-up area. The OT should be restricted to just the personnel involved in the actual operation.

iii. **Aseptic or restricted zone:** This zone should be restricted to the working team. It includes:

- The operating theatre.
- The sterile preparation room (preparation of sterile surgical instruments and equipment)

Staff working in this area should change into theatre clothes, should wear masks and gowns, and, where necessary, should wear sterile gloves.

6.3.4 Doors

1. The doors to the OT should be kept closed except as necessary for passage of the patient, personnel, supplies and equipment. If the door is left open, the positive air pressure in the hallway should be operational.
2. Disrupted pressurization mixes the clean air of the OT with the corridor air, which has a higher microbial count. Cabinet doors should remain closed.

6.3.5. Temperature and Humidity

1. The temperature and the humidity play a very important role in maintaining staff and patient comfort. It must be carefully regulated and monitored continuously.
2. Room temperature must be maintained between 18°C to 21°C at all times.
3. Humidity should be maintained at 50% to 60%.
4. The operating room should be 1°C cooler than the outer area. This aids in the outward movement of air because the warmer air in the outer area rises and the cooler air from within the operating theatre moves to replace it.

6.3.6. Standard Ventilator for Conventional Operating Theatres

1. The air flow and microbiological air quality should be assessed on commissioning, after renovation/repair or outbreak of an infectious disease in the theatre or elsewhere within the theatre suite.
2. For non-emergency repairs, the Infection Control Team must be notified by the manager in charge of the theatre, at least a week in advance, so that microbiological air sampling and tests for positive pressure ventilation can be performed if deemed necessary by the team.
3. The minimum standard for microbiological air counts for conventional operating rooms is 35 CFU (colony-forming unit)/m³ when the theatre is empty. There should be less than 35 CFU colony-forming unit/m³ of *Aspergillus*'s spp when empty.
4. Airflow from ceiling to floor and directed under positive pressure; higher in operating room than in the corridor.
5. The air within the operating room should be at a positive pressure compared with other theatre suites and with the external corridors, and there should be at a range of 15 -25 ACH (air changes per hour).
6. Ideal set-up for the air exchanges is at minimum of 15 times per hour at least 3 exchange of fresh air.
7. The theatre ventilator must be checked regularly, and maintained by an appropriately qualified engineer. Written records of all work on the ventilation system must be kept by the Engineering Department.
8. Coarse and fine air filters must be replaced regularly according to the manufacturer's instruction or when the pressure differential across the filter indicates that a change is required.
9. There must be adequate control of temperature and humidity within the theatre to prevent infection and also to provide a comfortable working environment.
10. Additional ventilation units must be not be introduced into the theatre without consultation with the Infection Control Team.
11. Frequency of monitoring temperature, ACH and humidity according to the HSIP of the hospital.

6.3.7. Ultra clean air or laminar air flow systems.

1. Laminar airflow is designed to move free air particle over the aseptic operating field in one direction. It can be designed to flow vertically or horizontally and is usually combined with a high efficiency particulate air (HEPA) filters. HEPA filters remove particles > 0.3 micron in diameter with an efficiency of 99.97%.
2. Ultraclean air can reduce the incidence of infection especially for implant operations. The air from ultra clean air or laminar flow systems used for high-risk surgery must be tested microbiologically every 3 months. Preferably, room should be equipped with laminar air flow system with a unidirectional ventilation system in which filtered, bacterial free air is circulated over the patient and return to receiving air inlet (HEPA filter).

3. There must be no more than 1 colony-forming unit/m³ when the theatre is empty with the air-flow system running. There should be no more than 10 colony - forming unit/m³ over the operating table and no more than 20 colony-forming at the corners of the room

6.3.8 Type of Air supplied to the operating theatre

1. Plenum Ventilation

This is the most frequently used system in general purpose operating rooms.

2. Laminar Flow Ventilation (Ultra Clean Ventilation)

This system is unidirectional and delivers air flow over the operating table of 300ACH.

3. Wall Mounted Air Conditioners:

These are installed in some tropical countries more for comfort than for clean air delivery. They should not be used as air delivery systems. The units are usually mounted on the hot outside wall and the air is directed down and back onto the unit itself (towards the wall). The operating table does not receive any significant air changes and the bacterial counts remain unaffected.

4. Free-standing Air Conditioners:

These are cooling units with no filtration of air and therefore do not fulfill the criteria for air delivery systems, especially for an OT.

Plenum and laminar flow ventilation is preferred in OT, the wall mounted air conditioners and free standing air conditioners are not preferred.

6.3.9. Protective Clothing for Use in the Operating Theatre

The use of barriers minimizes a patient's exposure to microorganisms that might be shed from the skin, mucous membranes, or hair of surgical team members as well as protects surgical team members from exposure to blood and to blood-borne pathogens.

1. Theatre attire should include such as items as sterile gloves, caps, masks, gowns or waterproof aprons, and protective eyewear.
2. All personnel entering the operation theatre should have good personal hygiene e.g.: Bath and Shampoo. All personnel should change to new scrub suite which is 'lint free' before entering the theatre.
3. The operation theatre should have specific written policy and procedure for proper attire to be worn. The attire should be changed if wet or grossly soiled.
4. Cap is worn to protect gross contamination from hair during procedures. The cap worn should not be less than 40 grams of weight.
5. Change footwear before entering operation theatre area. Footwear should comfortable, supportive, able to minimize fatigue and provide personnel safety.
6. A single disposable 3-ply surgical mask to be worn in restricted area which is 95% efficient in filtering microbes from droplet particles in exhalation and also filter inhalation. Fluid resistant mask is an advantage. Change mask when necessary when wet or after it has been removed for other purposes.

6.3.10. Surgical Hand Scrubbing *(Refer to hand hygiene section)*

1. A thorough hand wash for 5 minutes for first operation using antiseptic lotion with brush on finger nails and followed by rubbing method to all the rest of the fingers and hands including 2" above elbow. Rinse thoroughly with clean water.
2. Dry hands and arms using sterile towel. The top half of the sterile towel is held in one hand while the opposite hand and forearm is dried.
3. A rotating motion beginning at the hand and working toward the elbow is used for drying. When the first hand and forearm are dry, the towel half of the towel that is unused is grasped with the dry hand, and the opposite hand and forearm is then dried. Care is taken not to return to an area that is already dried.
4. For subsequent cases, a 2 minutes recommended hand rub with alcohol base is sufficient and dry hand as stated above.

6.3.11. Gowning

1. The sterile gown is put on after drying the hands and arms with a sterile towel. Sterile gowns may be reusable or disposable.
2. The gown should be constructed of a material that provides a barrier to prevent the passage of microorganisms from the surgical team to the patient and vice versa. Gowns should be lint free as possible, free from tears or holes, fluid resistant or fluid proof.
3. Reusable gowns eventually lose their barrier qualities with repeated laundering. Quality monitoring should be in place to ensure that only gowns of appropriate quality are used.

6.3.12. Gloving

1. Gloves are donned after gowning. The sterile gloves are put on by two ways: by closed method technique and open method technique.
2. The closed gloving method is preferred for establishing the initial sterile field.
3. The open gloving method is used when changing a glove during a surgical procedure or when donning gloves for procedures not requiring gowns.
4. Sterile gloves donned should be rinsed or wiped with sterile water or sterile saline prior to the surgical incision in order to remove the glove powders.

6.3.13. Draping

1. Drapes serve as a barrier to prevent the passage of micro-organism between sterile and non-sterile area. Sterile drapes are used to create a sterile surface around the incision site. Draping is also use for sterile supplies and equipments. This area is referred to as a sterile field.
2. The sterile field includes the patient, furniture and other equipment that is covered with sterile drape. The sterile field is isolated from unsterile surface and items.
3. Draping should always be done from a sterile area to an unsterile area. Draping the area nearest to the scrub person first. Once the drape is applied, it should not be adjusted.

4. Sterile drapes are positioned over the patient in such a way that only minimal area of skin around the incision site is exposed.
5. Drape maybe reusable or disposable. Criteria of drape must be water resistant, lint free, flame resistant and able to provide an effective barrier to prevent passage of microorganism from non-sterile to sterile area.

6.3.14. Establishing a Sterile Field

1. All items used in the sterile field must be sterile.
2. A sterilization indicator (tape) must be applied to each sterile package /item used. Where penetration is of concern, a chemical indicator should be inserted into each Packet.
3. All tables and flat surfaces must be dry dust free prior to the placement of sterile bundles and /or supplies.
4. The instrument table is draped with a repellent drape prior to the placement of instrument and supplies. The instrument table is considered sterile only at top level.
5. All draped tables should be moved by the circulating nurse whose hands should be placed below the drape, on the table leg.
6. Ring stands if used, must be draped with a water repellent drape. When the scrub nurse moves the ring stand, she does so by placing her hands inside the basin.
7. The gown is considered sterile from axilla level to the table level in front only and from the elbow to the stockinette cuff. The gown should have a barrier front and sleeves. Wrap around gowns should be turned by a sterile person. If a sterile instrument is used by a non sterile person to turn the gown, the instrument should be discarded after use.

6.3.15 Dispensing of the Sterile Supplies

1. Supplies should be opened as close as possible to the time that the surgical procedure is to commence.
2. Each package is checked for the expiry date and wrapper integrity prior to opening. Fabric and paper wrapper items should be use within one month, heat sealed packages for up to one year and commercial items as stated on the package. (to check for integrity of the pack and indicator on pack)
3. The edges of envelope wrapped packages are opened away from circulating nurse with corners secured before presenting it to the scrub nurse.
4. Peel back packages should be carefully opened to ensure proper adhesive separation and prevent tearing of the package.
5. The scrub nurse should take each item directly from the package held by the circulating nurse. Careful placement of items on the sterile field is acceptable if the hand of the circulating nurse is covered by the wrap and does not extend over the sterile field.
6. Sterile supplies are handled as little as possible and once positioned should not be moved and / or shifted.

7. Once supplies are opened they should not be left unattended. Sterile set-ups should not be covered for future use.
8. Non sterile person should not reach over the sterile field. Sterile persons should not reach over non sterile areas.
9. Fabric or paper wrapped sterile items which are dropped on the floor should be considered non sterile and should not be used.
10. Once the patient has entered the theatre where sterile supplies have been opened, those supplies may only be used on that particular patient. These supplies should be discarded in the event of cancellation.
11. Large bundles of packages should be opened on a flat surface and not while holding it in the hand.
12. Opened sterile bottles should be used for only one patient. The entire contents of bottle should be dispensed or the remainder discarded.
13. Care should be taken when pouring solutions to avoid splashing. The scrub nurse should hold the edge of the table so that circulating nurse need not reach over the sterile field to pour. The solution should be poured in a slow steady stream.

6.3.16 Maintaining the Sterile Field

1. Precautions should be taken to prevent moisture contamination and subsequent strike-through by using water resistant materials.
2. The scrub team should remain close to and face the sterile field. Movement is only from sterile to sterile areas. When changing positions the scrub personnel will pass front to front or back to back. They should avoid changing levels, they either sit or stand. Talking should be kept to a minimum. Scrub personnel should not lean on sterile areas.
3. The unscrubbed team should remain at least one foot (30cm) from the sterile field. Movement is from non sterile to non sterile area. They should not pass between sterile areas.
4. Breaks in aseptic technique should be monitored, documented and corrective action taken as soon as possible.
5. A sterile field is maintained by:
 - Placing only sterile items within the sterile field.
 - Opening, dispensing, or transferring sterile items without contaminating them.
 - Considering items located below the level of the draped client to be non sterile.
 - Not allowing sterile personnel to reach across non sterile areas or vice versa or to touch non sterile items.
 - Recognizing and maintaining the service provider's sterile area.
 - When gowned this area extends from chest to the level of the sterile field; sleeves are sterile from 5 cm above the elbow to the cuff. The neckline, shoulders, and back are considered to be non sterile areas of the gown.

- Recognizing that the edges of a package containing a sterile item are considered non sterile;
- Recognizing that a sterile barrier that has been penetrated (wet, cut or torn) is considered contaminated;
- Being conscious of where your body is at all times and moving within or around the sterile field in a way that maintains sterility;
- Not placing sterile items near open windows or doors.

6.3.17 Management of infectious cases that requires additional precaution. e.g.TB, MRO.

1. Pre-operative Management

- Appropriate personal protective equipments should be worn when managing hazardous procedures..
- All infectious cases should be listed last, unless emergency situation. Terminal cleansing will have to be done after this. Patient to be sent straight from ward to the operation room.
- All personnel involved should be informed regarding the infectious case.
- Proper specific disposable and protective attire to be used by all personnel.
- Personnel involved should be kept to the minimal..
- Only specifically required equipment should be kept in the operation room.

2. Intra operative

- Induction of patient to be done on operation table in the theater. Disposables items should be use wherever possible..
- Gentle handling during draping is required to minimize aerosol contamination of environment.
- Additional protective face shield should be worn during the procedure to protect splashes.
- Any operating attire to be changed as soon as possible when soiled during the procedure.
- All the clinical waste should be thrown onto the clinical waste bin, and sharps to be disposed into sharp bin by the person handling the sharp.

3. Post operative

- Surgical instruments should be sent to CSSD as soon as possible.
- Whenever it is not possible to do so (after office hours –soak in disinfectant for 30 min, pick up to rinse and pack for CSSD cm), the blood should be wiped off the instruments and rinsed with water and soaked with high–level disinfectant adhering to manufacturer’s recommendations and then sent to CSSD. (to confirm with CSSD section- stuck!!!!)
- All laboratory specimens must be in clean secure containers and placed into the biohazard specimen plastic bag before being send to pathology.

- Any contamination to the outside of containers should be cleaned with sodium hypochlorite 1:100. Ensure the containers are tightly sealed to avoid spillage.
- Any linen used in operating room will be placed in alginate red linen bag to be treated and laundered in hot water.
- The room and all equipment should be decontaminated with solution sodium hypochlorite 1:100 and leave to dry. The room can be reused once it's dry.

6.3.18. Waste and Linen

1. Waste should always be disposed of with minimal handling because there is a risk of blood-borne pathogen transmission.
2. Body fluids should be disposed of in the sluice by staff with appropriate protective clothing such as gloves, aprons, and eye protection.
3. Used linen should be contained in hampers or in soiled laundry bags at the point of use. Linen that is saturated with body fluids should be placed in fluid proof bags.
4. Other contaminated waste should be handled and disposed of according to the facility's medical waste process.

6.3.19. Cleaning of the Operation theatre

There should be a simple, clear, cleaning policy that can be adhered to easily. The cleaning equipment for the operating room must be dedicated and kept separate from the outer zone.

1. Initial cleaning (at the beginning of the day)

- Clean floors and all horizontal surfaces operating/ procedure tables, examination couches, chairs, trolley tops or Mayo stands, lamps, counters, and office furniture with a cloth dampened with water to remove dust and lint that may have accumulated over night.

2. Concurrent cleaning (between cases)

- Clean operating/procedure tables, examination couches, trolley tops or Mayo stands, lamps, counters, and any other potentially contaminated surfaces in operating theatres and procedure rooms with a cloth dampened with a disinfectant solution.
- Immediately clean spills of blood or other body fluids with a chlorine solution. Clean visibly soiled areas of the floor, walls, or ceiling with a mop or cloth dampened with a disinfectant solution.
- Discard waste when plastic bags of waste containers that are 2/3 full. Discard safety (sharps disposal) boxes, when they are 2/3 full.
- Do not perform special cleaning or closing of the operating theatres after contaminated or dirty operations. (revise as in SSI section)
- Thorough, routine cleaning is sufficient to provide a safe environment for subsequent cases given the high frequency of air changes in the well designed OT.

3. Terminal cleaning (end of the day)

- Clean all surfaces – including counters, tables, sink, lights, door handles with detergent, water and low level disinfectant then dry.
- Pay particular attention to operating/procedure tables, making sure to clean the sides, base, and legs thoroughly.
- Clean sluice with warm water and detergent. Wipe over non-metallic surfaces and equipment.
- Clean the floors with a mop soaked in a disinfectant solution. Check sharp bins and remove and replace them if they are 2/3 full.
- Clean non-clinical equipment and containers.

6.4 Nephrology and Hemodialysis Unit

A. HAEMODIALYSIS

6.4.1 Haemodialysis unit water supply and air conditioning

1. The water supply to the dialysis machines must be supplied separately, and include standard filtration and reverse osmosis units (RO) to minimize the risk of exposure to pyrogens and endotoxins. The water used for haemodialysis should comply with the requirement of the Association of the Advancement Medical Instrumentation (AAMI) or the European Pharmacopoeia standards.
2. For high flux haemodialysis or haemodiafiltration, ultrapure water should be used.
3. The water treatment system should be designed to allow routine disinfection of the entire system, including the distribution system and the connections to the dialysis machine. The entire system should be disinfected at least once a month.
4. Microbial testing of the water samples (including endotoxin level) should ideally be carried out at least once a month. The water samples should be taken before the reverse osmosis unit (RO), immediately after the RO and at the first, middle and final distribution point.
5. Taps and sinks must be adjusted to avoid excessive splashing and spray.

6.4.2 Staff health

1. All staff working in the unit should have immunisation to hepatitis B if not already immune.
2. Any staff that develops hepatitis must avoid direct patient care until serological markers and liver function tests indicate that they are no longer infective.
3. All staff must practice standard precautions to minimize percutaneous and mucous membrane exposure to the inoculation-risk viruses (Standard Precautions)

6.4.3 Hand hygiene

1. Hand hygiene is the single most important measure for the prevention of the spread of infection.
2. At the beginning of each day, staff should wash their hands thoroughly with soap and water.
3. Disposable gloves should be worn when caring for the patient or touching the patient's equipment at the dialysis station.
4. Gloves should be removed and hand hygiene should be performed between each patient or station.

6.4.4 Inoculation risks and body fluids (*refer to sharp injuries*)

1. All staff must be aware of the infection risk from body fluids, blood, needles and sharps and must ensure that others are not exposed to these hazards.
2. Disciplinary action may be taken against any employee who is shown to be responsible for the careless disposal of hazardous items.
3. Discard sharps only into sharps bins.
4. Never fill sharps bins more than three-quarters full.
5. Do not leave needles and sharps lying around for somebody else to clear up.
6. Needles should not be re-sheathed but if re-sheathing is unavoidable then a safe one-handed technique must be used.
7. Blood spillages must be cleared up at once.
8. Wear non-sterile disposable latex gloves and a plastic apron.
9. Small spills may be covered with chlorine releasing granules and then cleared away with paper towels.
10. Large spills are best soaked up with paper towels first and then the area decontaminated with 1% hypochlorite.
11. Discard gloves, apron and paper towels into a yellow bag for incineration.
12. Splashes of blood or any other body fluid on to the skin should be washed off at once with soap and water.
13. Gloves should be worn for any procedure involving blood and body fluids or contact with broken skin or mucous membranes.
14. Staff with broken skin on their hands should wear gloves for handling any body fluid.
15. If an accident occurs, the protocol for dealing with sharps injuries and mucosal exposure must be followed immediately (*see Sharp Injuries and Mucosal Exposure*).

6.4.5 Screening of patients for HIV and hepatitis viruses

1. Until the HIV, Hepatitis B and Hepatitis C status of a dialysis patient is known; all patients must be treated as potentially infective.
2. Known positive patients should be dialysed in the unit using dedicated haemodialysis machine in a dedicated area or room.
3. All patients will be routinely screened for HIV, Hepatitis B and Hepatitis C before being accepted to the Hemodialysis programme.
4. All susceptible patients undergoing chronic haemodialysis treatment should be routinely screened for HIV, Hepatitis B and Hepatitis C once every six months.

6.4.6 Hepatitis B immunization

1. All patients who are susceptible to hepatitis B infection should be offered Hepatitis B vaccine followed by measurement of anti-Hepatitis Bs antibodies, as early as possible in the course of their disease.

2. It should be noted that the antibody response rate in these patients is lower than in the general population and hence the vaccination dose and schedule should follow those recommended for haemodialysis patients (refer vaccine).

6.4.7 Connection to dialysis machine in HIV patients

1. It is necessary to have a dedicated machine for HIV-positive patients but all venous pressure transducers must be changed between patients.
2. Disposable dialysers should be used and dialysers should not be reprocessed.
3. Staff should wear eye glasses or visors to protect against the spray of blood that may occur when inserting needles into the patient.

6.4.8 Disinfection and disposal at the end of haemodialysis

1. Staff must take care to avoid accidents with re-useable sharp instruments.
2. Gloves and an apron must be worn.
3. On completion of the haemodialysis treatment, all used dialysers and blood lines should be placed in a leak proof containers/bags when transporting them from the dialysis station to the reprocessing or disposal area.
4. All machines should be cleaned with a 0.1% hypochlorite solution.
5. Normal cleaning is adequate for the beds, mattresses, lockers and other furniture, unless contaminated by blood or other body fluids in which case the spillage procedure is followed.
6. Blood-stained linen must be placed in a special bag which is labeled "Biohazard".
7. Heavily blood-soaked linen should be placed in yellow bag for incineration.

6.4.9 Infection Control Precautions for all Patients

1. Disposable gloves MUST be worn whenever caring for the patient or when touching the patient's equipment (including the haemodialysis machine) at the haemodialysis station. The disposable gloves MUST be removed and hands MUST be washed between patients or dialysis stations.
2. Items taken into a dialysis station should be disposed of, dedicated for a single patient or cleaned and disinfected before using on other patients.
3. Dialysis chairs, table, haemodialysis machines etc MUST be cleaned and disinfected between patients.
4. Clean area should be clearly designated for handling and storage of medications, unused disposables, equipments and machines.
5. Venous and arterial pressure transducers filter/protector should be used and these should be changed between each patient and should not be reused.
6. Common cart should not be used to deliver medications or food to patients. If common cart has to be used, the cart must not be moved from one dialysis station to another and should remain in a designated area of sufficient distance from dialysis stations.

6.4.10 Management of Hepatitis B positive patients

1. Requires the same infection control precautions recommended for all haemodialysis patients.
2. Hepatitis B Ag positive patients should be dialysed in separate room using separate machines, equipment and supplies.
3. Staff caring for Hepatitis Bs Ag positive patients MUST not care for hepatitis B susceptible patients (anti Hepatitis Bs antibody negative) at the same time
4. Dialysers may be reprocessed but this MUST be done at dedicated reprocessing area and dedicated reprocessing machines

6.4.11 Management of Hepatitis C positive patients

1. Requires the same infection control precautions recommended for all haemodialysis patients
2. Hepatitis C positive patients should be dialysed in separate room using separate machines, equipment and supplies.
3. Staff caring for Hepatitis C positive patients MUST not care for Hepatitis C negative patients at the same time
4. Dialysers may be reprocessed but this MUST be done at dedicated reprocessing area and reprocessing machines
5. Hepatitis C positive patients who acquired sustained response after antiviral treatment should continue to be dialysed with machines at dialysis station dedicated for Hepatitis C positive patients. However it is preferred that these patients are dialysed during the first shift.

6.4.12 Other infection control procedures

1. Standard 'no-touch' dressing changes and care of intravascular catheters should be performed according to the ward nursing procedures.
2. Patients with temporary or cuffed tunneled dialysis catheters should be screened for carriage of *Staphylococcus aureus*, particularly methicillin-resistant strains (MRSA), and MRSA eradication should be attempted with a short course of nasal mupirocin and topical chlorhexidine.

B. CONTINUOUS AMBULATORY PERITONEAL DIALYSIS (CAPD)

6.4.13 Catheter insertion

1. Patients should be screened for staphylococcus (nasal swab) before surgical insertion of the catheter.
2. Carriers of *Staph aureus* (MSSA or MRSA) should be treated with nasal mupirocin and topical antiseptics in order to clear staphylococcal carriage before the catheter is inserted.

3. On the day of catheter insertion, the patient should shower using 4% aqueous chlorhexidine applied to their whole body to reduce skin flora.
4. Prophylactic antibiotics are indicated, at the discretion of the renal physician, before insertion of the catheter.
5. If the patient has concurrent skin sepsis, insertion must be delayed until the skin is normal.
6. If this is not possible, an antibiotic active against the causative organism should be administered just before catheter insertion and continued for 24 hours.
7. The intra-abdominal catheter must be inserted with full aseptic precautions.

6.4.14 Care of the CAPD system

1. The patient must receive adequate instruction on how to change the dialysis bags and how to maintain the exit with aseptic precautions at all times.
2. Patients should not immerse or wet the exit site during bathing. It is easier to keep the exit site dry by showering.
3. Only sterile pyrogen-free dialysate fluid designed for CAPD must be used.
4. If dialysis bags must be warmed, it should be done in a dry heating system and water baths must not be used.
5. Hands must be cleaned with chlorhexidine skin cleanser or alcoholic chlorhexidine.
6. The exit site must be cleaned and dressed daily using 10% aqueous providon iodine or 0.5% chlorhexidine. The exit site should be patted dry after cleansing. Gentamicin cream should be applied to the exit site after cleansing.
7. All dried blood and secretions must be removed using fresh gauze swabs before each application of skin disinfectant. However it is important not to forcibly remove crusts or scabs during cleansing as this would cause a break in the skin and may lead to exit site infection.
8. The exit site is covered with a sterile non-occlusive dressing.
9. The connecting tubing and connectors must be changed approximately 6 monthly by the renal unit staff.
10. The catheter and proximal tubing must be securely anchored to the abdominal wall to prevent unnecessary movement around the exit site.

Recurrent CAPD infection

1. Patients who develop more than two to three infections per year should have their infection control techniques review and receive additional instruction in the prevention of peritonitis.
2. Infection with unusual environmental pathogens may require a review of those procedures carried out at the patient's home.

ADDITIONAL GUIDELINES ADAPTED FROM THE DOQI and CDC

MANAGEMENT OF THE INFECTIVE PATIENT (HBV, HCV, HIV)

Due to the nature of haemodialysis treatment and the likelihood of receiving multiple blood transfusions, long term haemodialysis patients have a higher risk of acquiring Hepatitis B virus (HBV) and Hepatitis C virus (HCV) infections compared to the normal population.

Once infected these patients are more likely to become chronic carriers. Hence, the seroprevalence of HBV and HCV in haemodialysis patients is higher than in the general population.

Even with meticulous and regular sterilization procedures for haemodialysis machines and disposable components and practice of standard precautions against infections from blood products and body fluids, the risk of acquiring HBV and HCV with haemodialysis treatment remains.

Therefore it is prudent to adopt additional measures to reduce the risk:

- 1) All patients subjected to chronic haemodialysis treated must have their blood tested for HBV, HBC and HIV every 3 months.
- 2) Patients who are positive for HbsAg should be dialyzed with separate machines at separate haemodialysis station and not shared by seronegative patients.
- 3) The following rooms/facilities used for Hepatitis B sAg positive patients should be separated from HbsAg negative patients:
 - a) Reprocessing area for disposable
 - b) Dialysis treatment room.
- 4) Patients who are Hepatitis C positive should also be dialysed with dedicated machine at dedicated haemodialysis station and not to be shared with Hepatitis C negative patients. The dialysis treatment room and the reprocessing area should be separated from Hepatitis C negative patients.
- 5) For HIV positive patients, disposable should not be re-used and a separate room or home haemodialysis is preferred. The disposal of blood lines, dialysers and dialysate is made according to the recommendation of the Ministry of Health.
- 6) Seronegative patients should be immunised against hepatitis B (if HbsAb-ve) using 40ug of vaccine at 0, 1 and 6 months with Recombivax HB® or at 0,1,2 and 6 months with Engerix B®. Staff of haemodialysis units are routinely immunized.
- 7) Monitoring for patients who are Hepatitis BsAg positive;—3 monthly LFT, HbsAg; 6 monthly alpha-fetoprotein; yearly ultrasound of the liver.
- 8) Monitoring for patients who are Hepatitis C positive: 3 monthly LFT; 6 monthly alpha-fetoprotein; yearly ultrasound of the liver.

PREVENTION OF COMPLICATIONS : INFECTION

Infections Control Measures

Staff and patient education should include instruction on infection control measures for all haemodialysis access sites.

RATIONALE

In haemodialysis patients, poor personal hygiene is a risk factor for vascular access site infections. Therefore, haemodialysis patients with poor personal hygiene habits should be taught how to improve and maintain their personal hygiene.

In addition, there is a higher rate of infections in haemodialysis patients when new or inexperienced dialysis staff manipulates the patient's vascular access. Because of this, all dialysis staff should be trained in infection control procedures. Documenting educational materials and objectives must be part of patient's records and staff orientation records.

Tracking the occurrence of infections can help identify the source and allow corrective action to be taken. Ongoing quality assurance, risk management, or CQI efforts should be in place to monitor the incidence of infections, to evaluate the response to patient and staff education, and identify future educational needs.

6.5 Dental Practice

6.5.1. Introduction

In the Dental Clinic, standard infection control precautions are taken. These precautions are procedure-specific and not patient-specific. This means that the same set of precautions are taken for each type of procedure irrespective of whether the patient is known to be infected with a blood-borne virus. (Refer to standard precaution section).

6.5.2 Personal Protective Equipment (PPE)

1. Gloves

- Clean examination gloves must be worn when examining or performing any non surgical dental procedures
- Examination gloves (preferably double layer) may also be worn when performing extraction of teeth.
- Sterile gloves (preferably double layer) must be worn when performing surgical procedures
- Heavy-duty (utility) gloves must be worn when cleaning contaminated instruments and when cleaning clinical contact surfaces must be puncture and chemical resistant - preferably nitrile.
- Heavy-duty gloves can be reused but must be considered contaminated and handled appropriately until properly disinfected.(refer to CSSD chapter).Gloves must be discarded if their barrier properties become compromised.

2. Masks, Protective Eyewear, Face Shields and Protective Clothing

- When performing procedures that are likely to generate debris, sprays and splashes both the operator and the assistant must use;
 - o surgical masks which cover both the mouth and nose
 - o appropriate protective eyewear (goggles or face shields)
 - o protective gowns which are fluid resistant (preferably disposable)
- Single and 2-ply masks should no longer be used.
- Protective eyewear or face shields must be cleaned with soap and water and disinfected with an appropriate disinfectant after use on each patient

6.5.3 Patient Protection

1. Only sterile instruments must be used on patients during oral procedures
2. All clinical contact surfaces must be disinfected appropriately before the patient sits on the dental chair
3. All patients must wear clean bibs (ideally disposable) when undergoing non surgical procedures.

4. For surgical procedures, sterile drapes should be used.
5. Patients should wear protective eyewear against physical damage to the eye from propelled and dropped objects. Protective eyewear must be cleaned with soap and water and disinfected with an appropriate disinfectant after use on each patient.

6.5.4. Cleaning, Disinfection and Sterilization of Dental Equipment and Instruments

1. Methods (refer disinfection section)

- Critical instruments (contacts non intact oral tissue) examples include forceps, scalpels, bone chisels, scalers and burs must be packaged and heat sterilized.
- Semi-critical instruments (contacts the oral environment and intact oral mucosa) examples include amalgam condensers, mouth mirrors, dental hand pieces and digital radiography sensors should also be packaged and heat sterilized. If heat sterilisation is not possible - should receive minimum of high level disinfection.
- Non-critical instruments (contacts only intact skin) examples include x-ray cone, position indicator device for x-ray cone, and face bow, should be cleaned and disinfected appropriately after each use

2. Instrument processing area in the dental clinic

- Instruments must moved in a single loop from dirty through clean to sterile without doubling back and should therefore be divided into 3 areas:
 - o decontamination area for receiving, cleaning, and decontamination,
 - o packaging area for sorting and packaging,
 - o sterilising area for sterilization and storage.

3. Instrument cleaning (refer to CSSD chapter)

- Instruments should be wiped of visible blood immediately after use in the surgery before transporting to the instrument processing area.
- Instruments should be soaked in holding solution in a puncture-resistant container if cleaning is not performed immediately.
- Instruments to be washed by hand instruments should be soaked in a disinfectant solution (at least intermediate level) before washing.
- Appropriate PPE which includes utility gloves, masks, protective eyewear and protective clothing must be worn during cleaning.
- Hand cleaning is the least desirable method because there is direct hand contact with contaminated / sharp instruments. Clean only 1 or 2 instruments at a time using a long-handled brush and scrub instruments while submerged to minimise splashing.
- Automated cleaning equipment such as washer-disinfectors and ultrasonic cleaners do not require hand cleaning of instruments and they also do not require pre-cleaning disinfection if disinfectant solutions or heat disinfection is used in the cleaning process. These methods are therefore safer and more efficient than manual cleaning. Use recommended solutions and follow manufacturers' instructions

- It is advisable to soak the instruments in a lubricant and a rust and corrosion inhibitor before packing. Follow the manufacturer's instructions for this.
- **Before final sterilization, instruments should still be handled as though contaminated and handled using gloves.**

4. Packaging

Critical and semi-critical instruments that are heat sterilized, must be packaged, or placed into container systems to maintain sterility of the processed item after sterilization

5. Sterilization

- When processing any of the following items a vacuum autoclave (Type S or Type B) will be required packaged items i.e. for storage purposes hollow items, such as dental hand pieces or cannulae porous items, such as drapes or gowns.
- When processing only solid, un-packaged instruments and none of the above items, a Type N (downward displacement) autoclave will be sufficient.
- Sterilization of unwrapped instruments is usually only for flash sterilization i.e. sterilization of items for immediate use

6. Storage

- After sterilization instruments must be stored in an enclosed area.
- Packages must be inspected before use to verify barrier integrity and dryness.
- First in, first out system should be observed.

6.5.5. Cleaning and Disinfection of Treatment Room

1. Clinical contact surfaces

- Clinical contact surfaces are surfaces that might become contaminated with blood and during a procedure and include the dental chair, light handles, dental chair controls, dental radiographic equipment, chair side computers etc.
- Avoid contact with non-working surfaces once treatment has commenced
- For disinfection of clinical contact surfaces use:
 - low level disinfectants when the surfaces are not visibly contaminated,
 - intermediate level disinfectants when the surfaces are visibly contaminated with blood.
 - high level disinfectants are usually not used as they may be toxic to the personnel or damage the surfaces.
- Because of the risks associated with exposure to chemical disinfectants and contaminated surfaces chemical and puncture resistant gloves and other PPE must be worn during the cleaning process.

2. Cleaning of Dental unit waterlines

- Flush lines for 1 minute each morning.
- Flush hand pieces with air/water for 20 to 30 seconds before use on a patient.
- Satisfactory reduction of microbiological counts from waterlines cannot be achieved by above methods only
- Dental units should have a separate water reservoir system to the hand pieces
- Dental units should filter water from the domestic water supply
- Hand pieces should have anti-retraction valves

Consider using a dental unit with a self-contained water purification system

3. Dental hand pieces

Dental hand pieces must be **sterilised** and re-process before use on each patient in accordance to manufacturer's instructions.

- Flush hand piece air/water lines with bur inserted prior to removing hand piece from hose
- Clean and dry hand piece
- Clean and lubricate hand piece using an appropriate cleaning and lubricating spray. - It is advisable to use an automated hand piece cleaning and lubricating system for this purpose.
- Pack and autoclave.
- Non autoclavable hand pieces should not be used. If the use of such a hand piece is unavoidable, the hand piece must be wiped thoroughly with a high level disinfectant after flushing with the cleaner and lubricant. If the hand piece needs to be reused immediately, a rapidly acting disinfectant (i.e. alcohol based) is used
- Flush air/water lines in hose before re-attaching hand piece
- Open package and lubricate, using a separate cleaning and lubricating spray canister
- Attach to hose and expel excess lubricant (with bur inserted).

4. Components permanently attached to dental unit waterlines

- Examples include handles or dental unit attachments of saliva ejectors, high-speed air evacuators, and air/water syringe.
- These are likely to become contaminated with blood and body fluids during a procedure.
- They can be covered with protective barriers that are changed after each procedure.
- If not covered during use, they must be cleaned and disinfected with an appropriate disinfectant after use on each patient.

5. Other non-autoclavable equipment

- Examples include shade guides, glass slabs, the handles and tips of light curing units and pulp testers
- Must be cleaned and disinfected with an appropriate disinfectant after use on each patient
- As an alternative, whenever possible, cover such equipment with a protective barrier that is changed between patients.

6.5.6 Dental Radiology Asepsis

1. Gloves (non sterile) must be worn and Other PPE (e.g. mask, and gowns) should be used appropriately.
2. All film holders must be washed and sterilized after use.
3. X-ray tube head and control panel can be barrier-protected during use - barriers changed between patients if it has come into contact with the personnel's gloved hands or contaminated film packets. If it is not barrier protected, it should be cleaned and then disinfected with an appropriate disinfectant.
4. After exposure, the radiograph must be wiped with a disposable gauze or paper to remove blood and saliva. Alternatively, the radiograph may be placed in a barrier envelope to prevent contamination of the outer film packet.
5. The radiograph should be placed in a container (e.g. disposable cup) for transport to the developing area.
6. Digital radiography sensors and imaging plates should be cleaned and either sterilized or high level disinfected after use on each patient. If this cannot be done, the sensors / imaging plates should be barrier-protected during use.
7. After removal of the barrier, the sensor should be disinfected with an appropriate disinfectant. Use only disinfectants recommended by the manufacturer.

6.5.7. Dental Laboratory Materials and Equipment

1. Items from the laboratory;
 - Should be cleaned and disinfected with at least an intermediate level disinfectant prior to placement in the patients' mouths
 - Materials that are to be used in surgical procedures should be subjected to heat sterilization or if this is not possible, the item must be chemically sterilized.
2. Items bound for the laboratory
 - Should be first cleaned to remove saliva, blood and debris and disinfected using at least an intermediate level disinfectant.
 - This cleaning and disinfection must be done in the surgery.
 - Containers or plastic bags should be used for transportation of these items.
 - PPE should be used at least until items have been disinfected.

- Laboratory items that become contaminated but do not normally contact the patient examples include burs, polishing points, rag wheels, articulators, case pans, and lathes should be cleaned and sterilized or disinfected according to manufacturers' instructions
- If manufacturer instructions not available, clean and heat-sterilize heat-tolerant items and clean and disinfect other items with at least an intermediate level disinfectant

6.6 Central Sterile Supply Department

6.6.1 Introduction

The objective of the CSSD is to provide efficient and effective central sterilization service and supply sterile items required by the wards, theatre and clinical departments in hospital so as to efficiently prevent and control infection. It is responsible for the processing, sterilization and quality control of all sterile supplies and equipment used in the hospital.

6.6.2 Physical Layout of CSSU

Central Service are divided into two 2 areas, designated as clean and dirty. These two areas are to be physically divided, and the integrity of each area to be maintained.

- The clean area is use for processing and sterilization of clean items, to include the preparation and packaging of instrument and sets. The sterilizers are located in this area.
- The dirty area is use for decontamination of all soiled items, including the washing and drying of contaminated items.

Only clean items will be taken into the processing area, and traffic will be strictly controlled. Only properly attired personnel will enter the clean processing area and decontamination area. Central Service personnel are responsible for maintaining each area as designated.

6.6.3 Operational Policies

1. General

- Sterilizations of all instruments and material shall take place in the CSSU, except
 - o Pharmaceutical products
 - o Specimen container and media
- All returned items shall be treated as potentially infectious /contaminated regardless whether they have been used or not.
- Sterile supplies shall be issued from the sterile issuing area according to schedule.
- All commercially packed items should have the outer cover eg. 'soft good' remove before placing in the vicinity of packing / sterile area.
- All work and materials must follow the specific direction to prevent contamination.

2. Personnel

- Staff should be trained in the field of sterilization and operating autoclave machine.
- Staff should change to standard attire, including cap and foot wear.

- Staff / personnel should follow the disinfection and sterilization policy and practice and standard precaution guideline practice.
- Staff with skin ailments should not work in CSSU.
- Long finger nails, inclusive of artificial nail and heavy make-up are not allowed in CSSU.

3. Safety

- The department shall identify safety precaution and measures for their work areas.
- Personal Protective Equipment (PPE) must always be worn accordingly.
- Equipment operating instruction shall be available at the site of the equipment.
- Staff handling chemical should follow the manufacturer's guideline.

6.6.4 Instruments

1. Contaminated instrument following manufactures guideline.
2. Instrument used on Biohazard case must be double bagged, labeled biohazard and sent to CSSU as soon as possible after informing CSSU staff.
3. When the CSSU is closed, decontamination is carried out at users place following the guidelines 'disinfection and sterilization policy and practice'.

6.6.5 Packing

All packing methods and wrapping procedures must allow for removal of air and direct contact of the sterilant with the contents of the package. Sterilization wrapping paper should be use instead of linen as packaging material.

6.6.6 Sterilization

1. Heat sensitive items should be sterilized by low temperature sterilizer
2. All sterilized items shall have name of item, date of sterilization, code number of packer and load number of sterilizer on the package.
3. Sterility will be determined by inspecting the integrity of the package for sign of damage or contamination, handling and storage condition. Sterility is event-related; it is not time-related unless the package contains unstable components such as drug or chemical.
4. Re-processing of single used devices should be discouraged.

6.6.7 Storage and preparation rooms

1. Sterile store is used for storage of sterile items only
2. Only authorized personnel shall be allowed to enter the sterile store
3. Bulk store is used for storage raw materials with non-sterile consumables
4. Linen room is use for preparation and storage of linen only.

6.6.8 Maintenance

Ensure that all machines/equipment are maintained in good condition and planned preventive maintenances (PPM) carried out according to the schedule.

- Safety check for autoclave accordingly (refer to checklist or log for items)
- Breakdown shall be reported immediately and ensure that action is taken within the time stipulated.

6.6.9 Movement of instruments

- Update record of inventory
- Document movements of supplies

6.6.10 Waste Management

- Follow standard management of waste segregation and disposal.

6.7 Mortuary

6.7.1 Introduction

With cessation of life, there is neither the reticulo-endothelial system nor the blood brain barrier presence to restrict the translocation of microorganisms within the dead human remains. Therefore, these microorganisms and bacteria pose serious threat to forensic pathology personnel working in mortuary.

The post mortem room is a source of potential hazards and risk, not only to pathologist and anatomical pathology technician, but also to visitors to the mortuary and those handling the body after necropsy. Post mortem staffs have legal responsibilities to be aware of and to minimize these changes.

Safety and infection control policy in mortuary is an issue not only relevant to the team performing the autopsy, but also has direct implications regarding the protection of environment. For the purpose of infection control, the mortuary complex may be seen operationally as comprising of;

- 1) **Clean areas** – reception areas, offices, consultation and viewing room.
- 2) **Transitional areas** – vehicle bay, areas of body freezers, specimen preparation room and changing room.
- 3) **Dirty areas** – post mortem rooms.

The principal biological risks faced by mortuary workers are the infection caused by *Mycobacterium tuberculosis*, the blood borne hepatitis, HIV and agents responsible for Transmissible Spongiform Encephalopathy (TSE) such as variant Creutzfeldt Jacob Disease (vCJD). All of these pathogens retain their infectivity after death. The presence of such pathogen may not become known until the gross examination.

Risks of health during post mortem examinations are primarily related to airborne and blood borne infection routes. Autopsy transmitted infections may occur via several routes such as:

- Percutaneous injury leading to direct cutaneous inoculation
- Contact with droplets via preexisting breaks in skin and mucosal surfaces (eyes, mouth and nose)
- Aerosol exposure
- Ingestion

In mortuary setting there are ten areas to be covered in order to achieve the safety level as explained below.

6.7.2 Collection of body from ward

In performing the duty to collect body from ward, medical attendants are at risk of in contact with **infectious material**. **The following precautions must be taken:**

1. When handling bodies never smoke, eat, chew, drink or take any other actions that will bring hands into contact with the mouth, eyes or nose.

2. Make sure that any open wounds, particularly on the hands, are covered with waterproof dressing.
3. Gloves and apron must be worn due to possibility of either hands or clothing being contaminated with blood or body fluids.
4. When there is serious risk of infection, bodies will normally be enclosed in a leak-proof body bag which under no circumstances should be opened before reaching the mortuary and instruction given by the pathologist/medical officer performing the autopsy.
5. Do not touch any spillage of body fluid outside the body bag until proper decontamination done in the mortuary setting.
6. Any special clothing put on work in the mortuary must be removed before leaving and hands must be thoroughly washed with proper hand washing technique after handling the body.

6.7.3 Receiving body from outside (BID cases)

1. The precaution measures taken in collecting and handling body from wards must be exercised in receiving BID cases.

6.7.4 Body storage

1. All bodies must be identified and correctly labeled. Any that cannot be properly identified, and particularly those for which there is no satisfactory medical record, must be labeled and treated as 'danger of infection' cases unless additional information becomes available.
2. All bodies labeled as 'danger of infection' should be totally enclosed in a leak-proof bag.
3. Bodies are stored temporarily before post mortem examination or when examination not required in cases where cause of death has been given by clinician and therefore not medico-legal cases in a body freezer with temperature maintained at 4°C.

6.7.5 Post mortem procedure

The post mortem procedures are divided into:

- routine case autopsy
- high risk case autopsy

All tools must be kept sharp, clean and ready to use.

1. Routine case autopsy

- Protective Personal Equipment (PPE) such as , sleeved surgical shirt and trousers, surgical gown, disposable waterproof apron, double gloves, cap, mask and water proof boot must be worn.
- Examination techniques must ensure that liquid dispersion and splashing is minimized and that all instruments likely to cause puncture wounds and cuts are handled properly.

- Limit the operators to three persons to reduce risk of contaminations and sharp injuries.
- Instruments must never be passed from hand to hand during an examination. They must be set out on a table for selection in accordance with the pathologist's preferred practice.
- If needles used for the collection of blood or body fluid, forceps are used to remove the needles from syringe and discard into sharp bins. Needles must not be re-sheathed.
- During dissection of the body, the only sharp instrument present on the table should be dissection knives. Scalpel or scissors used whenever applicable.
- Blades or scalpels should not be changed until they have properly disinfected.
- Evisceration should not be undertaken by the staff until full risk assessment has first been carried out by the pathologist/medical officer responsible for the examination and method of evisceration of either Virchow or Rokitsansky type applied.
- In opening the rib cage, hand cutters used on the costal cartilage. The cut ends and any other exposed bones covered with surgical gauzes/towels to prevent accidental contacts that may cause cuts or puncturing the operator's skin.
- Dissection of organs after evisceration may be carried out either at the autopsy table on a non-slip and impervious surface.
- The weighing of organs should be undertaken in close proximity and great care taken to avoid splashing and droplet dispersion.
- Intestines should be opened under deep sink but not running tap. Blunt end scissors used when applicable.
- Particular care should be exercised when opening the skull for removal of brain. Air powered oscillating saw with remote exhaust port is preferable than the conventional saw.
- At the end of the examination, operators involved must ensure that all clothing, etc worn during examination is disposed off correctly or treated as infected linen.
- Hands must be thoroughly washed with disinfectants following proper hand washing technique.

2. High risk autopsy

- If suspicion of a high risk infection exists, the body should already be in a sealed body bag. After checking the identity, details of the body should be entered into the mortuary register. If it is not bagged, it should be done immediately and placed in the refrigerator.
- The pathologist should then be notified that the body is in the main mortuary and a time should be arranged when the post mortem can be carried out in an infection isolation room.

- The mortuary technician should prepare the post mortem room before examination by:
 - ***Making up a solution of the appropriate disinfectants (as in routine) in one of the trays (about 4 or 5 litres is usually sufficient)***
 - ***Placing out 3 separate kits of clothing for the pathologist, the technician and the circulator comprise of:***
 - Disposables - barrier gown, apron, face mask (N95/N100), cap, latex glove
 - Full face protective visor and
 - Gumboots.
- All the above should be worn over the normal post-mortem room clothes i.e. a sleeved surgical shirt and trousers.
- Ten minutes before the pathologist arrives to do the autopsy technician should change into the above clothing and move the body, still in the body bag, into the autopsy room and place on the autopsy table.
- There should be no observers within the autopsy room for high risk cases (exception may need to be made for homicide/suspicious death).
- On entering the autopsy room, the pathologist should open the body bag as far as is necessary to complete the post mortem and place the neck block under the deceased's neck and the body bag.
- Any clothing can be removed or cut off, but should remain in the body bag.
- One technician will be solely responsible for the opening and removal of organs.
- The pathologist will handle the incised materials. The pathologist and technician will not handle sharp tools or instruments at the same time.
- Where possible, disposable instruments and tools will be used.
- The circulator will remain uncontaminated and the pathologist and technician will not work in the absence of the circulator.
- The circulator will also be on the lookout for any risks associated with the presence of sharp tools and splashing. Any warnings issued by the circulator or pathologist must be instantly obeyed by all three present.
- The autopsy should be carried in the body bag so all spillage is contained. Wadding can be used to soak spillage which is then packed into the body bag cavities when autopsy complete.
- When the post mortem is complete, the body is reconstructed using surgical staples (to prevent needle stick injury), whenever possible to reduce needle stick injury.
- Once the incisions have been stapled, the body bag is sealed containing the body, clothes/shroud and any wadding that was used at post mortem.
- The outside of the body bag should be washed over with the appropriate disinfectant and left for 1 hour.

- All disposable clothing and boots are removed by the pathologists at the post mortem room door or decontamination dock and discarded as infectious waste. The technician then places the boots into the appropriate disinfectant to soak.
- After the appropriate time the body bag can be swilled off with water and then placed into another clean body bag, which is sealed and over-sealed with bio-hazard tape.
- The name of the deceased is then written on the body bag in marker pen (and any jewellery, if present).
- The post mortem table is wiped down with the appropriate disinfectant (there should be no fluid spillage onto the table if the autopsy was carried out in the body bag) and swilled with water. Boots are swilled in water and dried.
- The yellow bags are re-bagged into another yellow bag, and with the sharp bins, are sealed with bio-hazard tape and taken to the clinical waste collection point.
- Surgical tops and bottoms are placed into relevant contaminated laundry bags and pathologist and technician shower before changing into outside clothes and leaving the mortuary.
- The undertakers who will carry out the funeral should be notified that the body is infected and that when they come to collect the body the proper coffin should be brought (not a stretcher or shell).
- When they come for the body, the body bag will not be opened but placed directly into the coffin.
- The undertakers will be told of the potential risks of contamination and that:
 - The body bag should not be opened
 - The body should not be embalmed; and
 - Relatives should be discouraged from viewing the body. If the relatives insist they may see the face only, and must not touch or kiss it.
 - The undertakers should then sign for the body in the mortuary register through the words 'INFECTED BODY', written in red ink so they aware that the body they have collected is infected.
 - The fridge that the body was on should then be wiped over with appropriate disinfectant, left for 1 hour and swilled with water.

3. Procedure for post-mortem examination of known or suspected CJD/ Spongiform encephalopathy (refer the document from mortuary)

- The procedure for examination high risk cases including HIV, hepatitis and tuberculosis, can be used for examination of cases with known or suspected spongiform encephalopathy which is also practiced by the Neurosciences Unit at the Queen Elizabeth Hospital in Birmingham.
- The only differences that will be required being:
 - o A dedicated set of equipment only for CJD cases must be used to avoid contaminating all other sets; and

- o Type I or II safety cabinet needs to be available for storage and handling of retained tissue specimens.
- o Biosafety Level-3 autopsy room.

6.7.6 Specimen handling

1. Histology

- Tissue specimens for histology should be placed in appropriately sized containers that will allow them to be totally submerged in at least 10 times their volume of fixative solution. Great care should be taken to ensure that the outside of these containers is properly decontaminated before placing them into a plastic bag which is labeled with hazard warning labels, prior to transportation to the laboratory.
- Large specimens should be retained in the mortuary until fixation is considered to be complete.
- Routine fixatives for histology, based on formaldehyde, rapidly inactivate tuberculosis, hepatitis and HIV organisms, and hence, once adequately fixed, no hazard arises from trimming or cutting of paraffin embedded tissue block.

2. CJD/spongiform encephalopathies (refer to mortuary document/SOP)

- Brain should be fixed in 10% formal saline (or equivalent) without phenol or any other chemicals and dissected, if possible in Class 1 microbiological safety cabinet, or on a disposable surface using hand, eye and face protection. Dissection in a shallow tray will limit dispersal of contaminated fluids onto work surfaces, which must be decontaminated afterwards and any residual material incinerated. It is advisable to use disposable instruments wherever possible dissection.
- All tissues for histological examination should be fixed in formalin without the addition of phenol which reacts deleteriously with formic acid. Unfixed frozen tissues should be clearly labeled 'Risk of Infection' and handled accordingly. Exposure of brain tissue blocks to 96% formic acid for 1 hour after formalin fixation has been shown to be effective in substantially reducing CJD infectivity, although it may make large blocks of tissue brittle and difficult to cut. If tissues are to be processed by machine, they should be washed again in formalin, since formic acid may damage plastic containers.
- Tissue processing fluids, xylene and other laboratory waste should be disposed by incineration after absorption with saw dust. Disposable microtome blades should be used to cut brain sections from CJD cases, and should be incinerated after use. Histological sections are not regarded as being significant infectivity and can be additionally decontaminated after cover slipping by wiping with 96% formic acid.
- Remaining tissue unprocessed for histology should be placed into its container which will be resealed and should remain inside the category 3 safety cabinet until its ultimate disposal by incineration.

3. Other laboratory samples

Fresh tissue/body fluids that are to be sent to laboratories (i.e. for microbiological or toxicological analysis) should be placed in a sealed leak proof container and then placed inside a transport bag with biohazard or similar warning labels.

6.7.7 Body cleaning and disposal

1. Routine autopsy cases after being sawn and clean with running water are given to relatives for last rites.
2. High risk cases are handled as for high risk autopsy.
3. No relatives or undertakers are allowed to enter into the body storage areas. They are only allowed to come in at viewing area with supervision from mortuary staff.
4. When, for religious purposes, there is requirement to wash the body, those concerned must be clearly warned of any risk that may exist. In such a case, the participants in the ceremony should be advised about the precautions they must take to help reduce the possibility of contracting the infection or passing it on, and must be made to understand the possible consequences to themselves and others with whom they may subsequently come in contact with. (The activities should be supervise by the mortuary staff)

6.7.8 Clinical waste

Most of the waste arising from post mortem examinations is defined as clinical waste and falls into two distinct groups and four subcategories which are:

1. Waste for incineration
 - Disposable, generally single use items such as paper shrouds, swabs, dressings, protective clothing and gloves.
 - Human tissues and body fluids.
 - Discarded syringes, needles and other disposable 'sharps', which must be placed in a 'sharps' bin immediately after use.
 - Xylene, formalin and alcohol.
2. Disposal to drain
 - Non-contaminated fluids which must be flushed with plentiful running tap water.

6.7.9 Visitors

1. Those visitors who decide to observe the autopsy may do so in the observation area overlooking the autopsy tables. Access to the area should be via a direct route bypassing the dirty areas in mortuary.
2. No one may enter the autopsy room without first putting on the protective clothing deemed necessary for the occasion. They must subsequently upon leaving the autopsy room required to wash their hands or may be required to shower before putting on their own clothing. Protective clothing worn during autopsy must be removed and deposit in the bins provided.

6.7.10 Quality control

Mortuary facilities must undergo regular maintenance and the efficacy of such equipments i.e. fridge, ventilation systems, local exhaust systems, fume cabinets and PPEs are regularly measured and monitored.

6.8 Burns

6.8.1 Introduction

Patients with burn injuries are highly susceptible to infection as a result of altered physical defense mechanism by the injury. Prevention of infection in patients with burn injury has been recognized as in any other patient population. These include strict aseptic technique during dressing changes or other invasive procedures and using isolation room in treating patient with major burn or those infected with multiple drug resistant organism. Strategies for prevention of infection and control are described in these guidelines:

6.8.2 Environmental Control

The major difference separating the patient with burn injury from other patient population is the presence of open wounds. These wounds are susceptible to be colonized or infected by organism/s from the patient's own flora, or from other patient, personnel caring the patient and the environment. Wound drainage cannot be adequately contained in a dry, occlusive dressing especially during the initial period following burn injury or surgery.

6.8.3 Burn unit setting

Standard precautions should be followed when caring for all patients with burn injury.

Routine cleaning, disposal of waste and gathering of soiled linen is essential to keep the unit as clean as possible.

Minimize contamination in the environment by using laminar flow units whenever possible and proper maintenance of the air conditioning system.

1. Common cubicles

- Common cubicles are used for patient with minor burn (Less than 20% TBSA burn)
- Patient treated in the common cubicles should have a spacial separation to ensure physical separation at least 3 feet from other patients.
- Individual sink for hand hygiene or Hand scrub should be provided to prevent cross contamination among patients.

2. Isolation room

Patient with major burn (More than 20% TBSA burn) or patient infected with multiple drug resistant organisms should be treated in the Isolation room. The concept of barrier techniques should be followed to reduce the environmental contamination present around the patient (*refer MOH guidelines for contact precaution*).

3. Treatment room

i. Common treatment room

Common treatment room should be used with caution as this will risk contaminating the surrounding environment and dressing materials stored within the vicinity. Change of dressing is best done by the patient's bedside.

ii. Hydrotherapy room

Hydrotherapy and its related equipments should be disinfected with high-level disinfection in between patients.

**It is difficult to disinfect the pipelines, drains or tanks as these aquatic environments will be continuously inoculated by organisms from patients and the caregivers.*

4. Plants and flowers

Plants and flowers should not be allowed in the Burn unit as they harbor gram negative organisms such *Pseudomonas* species and fungi. These organisms may colonize the burn wound and many are intrinsically resistant to multiple antibiotics.

5. Toys

Pediatric patient with burns should be restricted to non porous and washable toys only. This should be designated to individual patient use only, and thoroughly disinfect after use or before giving to another patient.

6.8.4 Patient Care Items and Equipments

All equipments and surfaces (such as beds, side rails, tables, wheelchairs and trolleys) should be adequately decontaminated (*Refer MOH guidelines for disinfection*).

1. Non invasive items

- Non critical items such as blood pressure cuffs, oxygen mask, nasal prongs, tubing, stethoscopes, bedpans, wheelchair, infusion pumps if used on areas without dry, occlusive dressings, may need high-level disinfection.
- These items should be restricted to an individual patient treated in the isolation room.

2. Invasive items

- This refers to the care of endotracheal/ tracheostomy tube, intravascular catheter and continuous bladder catheterization.

Intravascular catheter should be placed through unburned skin, preferably at a sufficient distance from the wound to prevent contamination at the insertion site. If insertion of catheters is placed within or near the burn wound, appropriate dressing is required to cover the site of insertion.

Prevention of UTI includes removal of the catheter as soon as it is no longer required for monitoring of urine output, maintaining a closed urinary drainage system, and performance of urinary catheter care.

6.8.5 Care Givers For Patient In The Burn Unit

1. Care givers working short hours in the Burn unit

This refers to doctors, paramedics, therapist, nutritionist and technical staff who are handling patients or equipments in the burn unit for short hours.

Requirement:

- Wear shoe cover or slippers provided before entering the unit.
- Remove white coat before entering the unit
- Hand hygiene before and after attending each patient.
- Use disposable glove, surgical mask and disposable gown during handling of each patient.
- Strict aseptic technique when performing procedure or change of dressing.
- Follow contact precaution technique when entering the isolation room.

2. Full time Care givers

- Change to burn unit attire (if available).
- Wear shoe cover or slippers provided before entering the unit.
- Comply to Hand hygiene..
- Use disposable glove, surgical mask and disposable gown during handling of each patient.
- Strict aseptic technique when performing procedure or change of dressing.
- Follow contact precaution technique when entering the isolation room.
- Remove burn unit attire before leaving the unit.
- Parent/guardian accompanying their child should be supervised when handling patient. They should follow the contact precaution technique if their child is nursed in the isolation room.

6.8.6 Visitors

1. Only one visitor per patient is allowed at one time.
2. Wear disposable gown, shoe cover or slippers provided before entering the unit.
3. Hand hygiene should be supervised by the ward staff.
4. Physical contact should be limited especially for patient treated in the isolation room.

6.8.7 Care of the Burn Wound

1. Bathe patient daily in the hydrotherapy room.

*(*Exceptions are given to very ill patient; patient post wound debridement and skin grafting, or dressings that don't require daily changes)*

2. Dressings should be removed in the hydrotherapy room and disposed immediately.
3. Patient should be covered with a clean dressing towel before returning to their bed.
4. The Hydrotherapy room and its related equipments should be disinfected with high level disinfectant in between patients.
5. Patient colonized with multiple drug resistant organisms should be cleaned last if common hydrotherapy/ shower room is used.
6. All wounds should be covered with a clean dressing towel until the next dressing is done. Aseptic technique should be followed when inspecting the wound.
7. Wound dressing should be done under strict aseptic technique.
8. Dressing should be kept clean and dry to prevent contamination to the surrounding area.
9. Wounds that are left exposed such as face should be covered with topical ointment.

6.8.7 Culturing and Surveillance

1. Swab culture should be taken from the burn wound on admission from patient who is being transferred from other unit or hospital.
2. Tissue culture or tissue biopsy should be taken when clinical infection is suspected.
3. Routine wound swabs are not encouraged.

6.8.9 Antibiotic Policy

1. The use of antibiotic should be tailored to the specific susceptibility patterns of organism or documented infections such as pneumonia, urinary tract infection or wound infection.
2. Prophylactic antibiotic is recommended for immediate peri-operative period during wound debridement and skin grafting to cover the risk of transient bacteraemia and should be discontinued after 24 hours.

6.9 Haematology and Oncology Unit

6.9.1. Introduction

1. Haemato-oncology patients are immunocompromised. The predisposing factors are neutropaenia, monocytopenia, lymphopenia, qualitative phagocytic defects and complement deficiency, hyposplenism, humoral deficiency as well as cellular immune dysfunction.
2. In addition, many patients have damage to their skin and mucous membranes as a result of chemotherapy-induced mucosal barrier injury to the oro-gastrointestinal tract.

6.9.2 Common pathogens and sites of infection

1. The common pathogens include bacterial commensals from the gastrointestinal tract or skin and fungi including candida, aspergillus and other species.
2. Opportunistic infections include toxoplasma, cryptococcus, pneumocystis and cryptosporidium as well as infection or reactivation of viruses.
3. The common portals of infection include the oro-pharynx, periodontium, perianal, colon skin, lung and esophagus.

6.9.3 Patient hygiene

1. Patients should be advised to rinse orally 4-6X/day with sterile water, normal saline or sodium bicarbonate. Patients should be advised to brush their teeth at least twice a day with a soft-bristled toothbrush. Fixed orthodontics and space retainers should not be worn.
2. Patients are advised to bath daily with a mild soap with attention to good perineal hygiene.
3. Avoid the use of rectal thermometers, enemas, suppositories or rectal examinations.
4. Dental clearance should be performed 10-14days before induction of chemotherapy.
5. Skin sites should be inspected daily.

6.9.4 High risk neutropaenic diet

1. A low microbial diet is recommended to reduce the number of pathogens in food
2. Attention should be paid to food preparation. Raw meats should be handled on separate surface.
3. Food handlers should wash their hands before and after handling food.
4. Consumption of raw or undercooked meats or eggs or foods that may contain these e.g. mayonnaise, hollandaise sauce is not allowed.

5. Avoid fresh salads, fresh fruits, raw peanuts and seeds and raw or undercooked seafood.
6. Avoid naturopathic foods that may contain moulds. Pepper is to be avoided.
7. Sterile foods, on the other hand are expensive, tasteless and not proven in benefit
8. Low microbial diet should continue at least 3 months after chemotherapy or autologous stem cell transplant. In allogenic stem cell transplant, it should continue until all immune-suppressives are stopped.

6.9.5 Facilities

1. Isolation in single rooms is beneficial in the setting of aplastic anaemia, induction therapy of high risk AML patients especially elderly and in haemopoietic stem cell transplant setting. All haemato-oncology patients should be placed in single rooms where possible. Where not possible, they can be nursed in open cubicles with isolation facilities made available when necessary e.g. during MRSA or ESBL-infections.
2. For isolation rooms, HEPA filter with a capacity of maintaining <3/10,000 atmospheric particles of 0.3microns with > 12 air exchanges per hour will remove bacteria and fungal spores. This is most effective to prevent hospital acquired aspergillus. The use of laminar air flow rooms is controversial.
3. Isolation rooms should have self-closing doors and well-sealed windows. Avoid false ceilings. Flooring and wall finishing can be scrub, non-porous and easily disinfected. A constant positive pressure of >2.5 Pa between the patient's room and hall way should be maintained. Back-up emergency power should be available.
4. Wards and rooms should be regularly cleaned at least once a day. Avoid vacuuming. Any water leaks should be attended to within 72 hours.
5. Avoid construction or renovation areas during transportation of patients to other facilities e.g. X-ray. Patients should wear an N95 mask if this is unavoidable.
6. Any construction or renovation activities adjacent to the units should be discussed with the infection control unit before proceeding. (Refer to section on construction and renovation)
7. Patients with concomitant active infectious diseases e.g. tuberculosis or measles should be nursed in isolation room with negative pressure with an adjacent anteroom.
8. Equipment should be cleaned regularly and disinfected at least once a week.
9. Plants – fresh or dried and soft toys are prohibited. Only toys, games and videos that can be cleaned are allowed.

6.9.6 Personnel precautions

1. Health care workers should practice standard precautions. Personnel should wear surgical masks when entering rooms. They should practice hand hygiene with alcohol based hand rubs before entering and after leaving rooms. Gloves should be worn after entering room and washing hands and discarded before exiting.

2. Health-care workers should practise hand hygiene before and after any direct contact with patients.
3. Personnel should also comply to the immunization policy of the hospital. Generally health-care workers should be immune to measles, mumps, rubella, varicella and influenza.
4. Personnel with active upper respiratory infection should avoid attending to patients.

6.9.7 Visitors

1. Written policies for visitors should be documented and made available.
2. Restriction to visitor numbers to two per patient at any one time is recommended. Visitors are requested to practice hand hygiene before any contact with patient and should not sit on patient's bed.
3. Children under 12 years are not allowed.
4. Visitors who have communicable infections e.g. upper respiratory tract infections, recent exposure to communicable infections, active shingles, recent vaccination within 6 weeks should not be permitted.

6.9.8 Surveillance cultures

1. Routine bacteria and fungal cultures of asymptomatic patients, environment, equipment and devices are not recommended.
2. Colonization with MRSA may be eradicated with 0.2% chlorhexidine or mupirocin. This may be indicated during outbreaks.
3. An outbreak e.g. twofold or greater increase in aspergillus infections during any 6 month period may suggest a lapse in infection control procedures and attention to environment or ventilation should be carefully evaluated.

6.10 Laboratory

6.10.1 General Principles

In this topic, references are made to the relative hazards of infective microorganisms by risk group (WHO Risk Groups 1, 2, 3 and 4). This risk group classification is to be used for laboratory work only. This risk group classification is to be used for laboratory work only. Table 1 describes the risk groups.

Table 1. Classification of infective microorganisms by risk group

Group	Risk	Type of infective organism
1	no or low individual and community risk	A microorganism that is unlikely to cause human or animal disease.
2	moderate individual risk, low community risk	A pathogen that can cause human or animal disease but is unlikely to be a serious hazard to laboratory workers, the community, livestock or the environment. Laboratory exposures may cause serious infection, but effective treatment and preventive measures are available and the risk of spread of infection is limited.
3	high individual risk, low community risk	A pathogen that usually causes serious human or animal disease but does not ordinarily spread from one infected individual to another. Effective treatment and preventive measures are available
4	high individual and community risk	A pathogen that usually causes serious human or animal disease and that can be readily transmitted from one individual to another, directly or indirectly. Effective treatment and preventive measures are not usually available.

- Laboratory facilities are designated as Biosafety Level 1 (basic), Biosafety Level 2 (basic), Biosafety Level 3 (containment), Biosafety Level 4 (maximum containment).
- Biosafety level designations are based on a composite of the design features, construction, containment facilities, equipment, practices and operational procedures required for working with agents from the various risk groups.
- The assignment of an agent to a biosafety level for laboratory work must be based on a risk assessment. Such an assessment will take the risk group as well as other factors into consideration in establishing the appropriate biosafety level.
- Table 2 summarizes the facility requirements at the four biosafety levels.

Table 2. Summary of biosafety level requirement

	Biosafety Level			
	1	2	3	4
Isolation ^a of laboratory	No	No	Yes	Yes
Room sealable for decontamination	No	No	Yes	Yes
Ventilation:				
- Inward airflow	No	Desirable	Yes	Yes
- controlled ventilation system	No	Desirable	Yes	Yes
- HEPA-filtered air exhaust	No	No	Yes/No ^b	Yes
Double-door entry	No	No	Yes	Yes
Airlock	No	No	No	No
Airlock with shower	No	No	No	Yes
Anteroom	No	No	Yes	-
Anteroom with shower	No	No	Yes/No ^c	No
Effluent treatment	No	No	Yes/No ^c	Yes
Autoclave:				
- on site	No	Desirable	Yes	Yes
- in laboratory room	No	No	Desirable	Yes
- double-ended	No	No	Desirable	Yes
Biological safety cabinet	No	Desirable	Yes	Yes
Personnel safety monitoring capability ^d	No	No	Desirable	Yes

a Environmental and functional isolation from general traffic

b Dependent on location of exhaust (see chapter 4)

c Dependent on agent (s) used in the laboratory

d For example. Window, closed-circuit television, two-way communication

Thus, the assignment of a biosafety level takes into consideration the organism (pathogenic agent) used, the facilities available, and the equipment practices and procedures required to conduct work safely in the laboratory.

6.10.2 Guidance And Recommendations

Diagnostic and health-care laboratories (public health, clinical or hospital-based) must all be designed for Biosafety Level 2 or above. As no laboratory has complete control over the specimen it receives, laboratory workers may be exposed to “high risk group” organisms. Therefore, standard precautions should always be adopted and practiced, as well as to promote good (i.e. safe) microbiological techniques (GMT).

6.10.3 Code of Practice

This code is a listing of the most essential laboratory practices and procedures that are basic to GMT. Each laboratory should adopt a safety or operation manual that identifies known and potential hazards, and specifies practices and procedures to eliminate or minimize such hazards. The most important concepts are listed below.

6.10.3.1 Access

1. The international biohazard warning symbol and sign must be displayed on the doors of the rooms where microorganisms of Risk Group 2 or higher risk groups are handled. (Table 1)
2. Only authorized persons should be allowed to enter the laboratory working areas.
3. Laboratory doors should be kept closed.
4. Children should not be authorized or allowed to enter laboratory working areas.

6.10.3.2 Personal protection

1. Laboratory coveralls, gowns or uniforms must be worn at all times. The coat/gown should be removed before leaving the laboratory and placed on the area provided.
2. Appropriate gloves must be worn for all procedures that may involve direct or accidental contact with blood, body fluids and other potentially infectious materials. After use, gloves should be removed aseptically and hands must then be washed.
3. Personnel must wash their hands after handling infectious materials and before leaving the laboratory working areas.
4. Protective devices must be worn whenever necessary to protect the eyes and face from splashes, impacting objects and sources of artificial ultraviolet radiation.
5. Any cuts, abrasions or other skin lesions must be properly covered to protect them against contamination before starting work.
6. Eating, drinking, smoking, applying cosmetics and handling contact lenses is prohibited in the laboratory working areas.
7. Storing human foods or drinks anywhere in the laboratory working areas is prohibited.

6.10.3.3 Procedures

1. Materials must not be placed in the mouth.
2. Any technical procedures should be performed in a way that minimizes the formation of aerosols and droplets.
3. The use of hypodermic needles and syringes should be limited. They must not be used as substitutes for pipetting devices
4. All spills, accidents and overt or potential exposures to infectious materials must be reported to the laboratory supervisor. A written record of such accidents and incidents should be maintained.
5. A written procedure for the clean-up of all spills must be developed and followed.
6. Contaminated liquids must be decontaminated (chemically or physically) before discharge to the sanitary sewer. An effluent treatment system may be required, depending on the risk assessment for the agent(s) being handled.
7. Written documents that are expected to be removed from the laboratory need to be protected from contamination while in the laboratory.

6.10.3.4 Laboratory working areas

1. The laboratory should be kept neat, clean and free of materials that are not pertinent to the work.
2. Work surfaces must be decontaminated after any spill of potentially dangerous material. At the end of the working day all working surfaces must be decontaminated.
3. All contaminated materials, specimens and cultures must be decontaminated before disposal. Decontamination shall be done for any reusable materials
4. Packing and transportation must follow applicable national and/or international regulations.

6.10.3.5 Biosafety management

1. It is the responsibility of the laboratory director (the person who has immediate responsibility for the laboratory) to ensure the development and adaption of a biosafety management plan and a safety or operations manual.
2. The laboratory supervisor (reporting to the laboratory director) should ensure that regular training in the laboratory safety is provided.
3. Personnel should be advised of special hazards, and required to read the safety or operation manual and follow standard practices and procedures. The laboratory supervisor should make sure that all personnel understand these. A copy of the safety or operations manual should be available in the laboratory.
4. There should be an arthropod and rodent control programme.
5. Appropriate medical evaluations, surveillance and treatment should be provided for all personnel in the case of need, and adequate medical records should be maintained.

6.10.4 Laboratory Design And Facilities

Special attention should be paid to the conditions that are known to pose safety problems. These include:

1. Formation of aerosols
2. Work with large volumes and/or high concentrations of microorganism
3. Overcrowding and too many equipments
4. Infestation with rodents and arthropods
5. Unauthorized entrance
6. Workflow: use of specific samples and reagents

6.10.4.1 Design features

1. Ample space must be provided for the safe conduct of the laboratory work and for cleaning and maintenance.
2. Walls, ceilings and floors should be smooth, easy to clean, impermeable to liquids and resistant to the chemicals and disinfectants normally used in the laboratory. Floors should be slip-resistant.
3. Bench tops should be impervious to water and resistant to disinfectants, acids, alkalis, organic solvents and moderate heat.
4. Illuminations should be adequate for all activities. Undesirable reflections and glare should be avoided.
5. Laboratory furniture should be sturdy. Open spaces between and under benches, cabinets and equipment should be accessible for cleaning.
6. Storage space must be adequate to hold supplies for immediate use and thus prevent clutter in bench tops and in aisles. Additional long-term storage space, conveniently located outside the laboratory working areas, should also be provided.
7. Space and facilities should be provided for the safe handling and storage of solvents, radioactive materials, and compressed and liquefied gases.
8. Facilities for storing outer garments and personal items should be provided outside the laboratory working areas.
9. Facilities for eating and drinking and for rest should be provided outside the laboratory working areas.
10. Hand-washing facilities, with running water if possible, should be provided in each laboratory room, preferably near the exit door.
11. Doors should have vision panels, appropriate fire rating, and preferably be self-closing.
12. At Biosafety Level 2, an autoclave or other means of decontamination should be available in appropriate proximity to the laboratory.
13. Safety systems should cover fire, electrical emergencies, emergency shower and eyewash facilities.

14. First-aid areas or rooms suitable equipped and readily accessible should be available.
15. In the planning of new facilities, consideration should be given to the provision of mechanical ventilation systems that provide an inward flow of air without recirculation. If there is no mechanical ventilation, windows should be able to be opened.
16. Considerations should be given to the installation of a separate air conditioning system to control the heat gain from equipment with high heat outputs, e.g. fridges and incubators. It is preferable to use a sealed type of unit that recirculates cooled air into the room.
17. A dependable supply of good quality water is essential. There should be no cross-connections between sources of laboratory and drinking water supplies. An anti-backflow device should be fitted to protect the public water system.
18. There should be reliable and adequate electricity supply and emergency lighting to permit safe exit. A stand-by generator is desirable for the support of essential equipment such as incubators, biological safety cabinets, freezer, etc.,
19. There should be a reliable and adequate supply of gas. Good maintenance of the installation is mandatory.

6.10.5 Laboratory Equipment

Technically with good procedures and practices, the use of safety equipment will help to reduce risks when dealing with biosafety hazards. The laboratory director should ensure that adequate equipment is provided and that it is used properly. Equipment should be selected to take account of certain general principles, i.e. it should be:

1. Design to prevent or limit contact between the operator and the infectious material.
2. Constructed of materials that are impermeable to liquids, resistant to corrosion and meet structural requirements.
3. Fabricated to be free of burrs, sharp edges and unguarded moving parts.
4. Designed, constructed and installed to facilitate simple operation and provide for ease of maintenance, cleaning, decontamination and certification testing; glassware and other breakable materials should be avoided, whenever possible.

6.10.5.1 Essential biosafety equipment

1. Biological safety cabinets Class II, to be used whenever:
 - All infectious materials are handled; such materials may be centrifuged in the open laboratory if sealed centrifuge safety cups are used and if they are loaded and unloaded in a biological safety cabinet.
 - There is an increased risk of airborne infection.
 - Procedure with a high potential for producing aerosols are used; these may include centrifugation, grinding, blending, vigorous shaking or mixing, sonic disruption and opening of containers of infectious materials

2. Electric transfer loop incinerators may be used inside the biological safety cabinet to reduce aerosol production.
3. Screw-capped tubes and bottles.
4. Autoclaves or other appropriate means to decontaminate infectious materials.
5. Petri dishes must be placed in racks or baskets, both for transport and storage.
6. Plastics disposable Pasteur pipettes, whenever available, to avoid glass
7. Equipment such as autoclaves and biological safety cabinets must be validated with appropriate methods before being taken into use. Recertification should take place at regular intervals, according to the manufacturer's instructions.

6.10.6 Health And Medical Surveillance

The employing authority, through the laboratory director, is responsible for ensuring that there is adequate surveillance of the health of laboratory personnel. The objective of such surveillance is to monitor for occupationally acquired diseases. Appropriate activities to achieve these objectives are:

1. Provision of active or passive immunization where indicated
2. Facilitation of the early detection of laboratory-acquired infections.
3. Exclusion of highly susceptible individuals (e.g. pregnant woman or immuno-compromised individuals) from highly hazardous laboratory work.
4. Provision of effective personal protective equipment and procedures.

Guidelines for the surveillance of laboratory workers handling microorganism at Biosafety Level 2

1. A pre-employment or pre-placement health check is necessary. The person's medical history should be recorded and a targeted occupational health assessment performed.
2. Records of illness and absence should be kept by the laboratory management

6.10.7 Waste Disposal and Decontamination

Identification and separation system for infectious materials and their containers should be adopted. Categories should include:

1. Non-contaminated (non infectious) wastes can be reused or recycled or disposed of as general, "household".
2. Contaminated (infectious) "sharps" – hypodermic needles, scalpels, knives and broken glass. These should always be collected in puncture-proof containers fitted with covers and treated as infectious.
3. Contaminated material for decontamination by autoclaving and thereafter washing and reuse or recycling.

4. Contaminated material for autoclaving and disposal.
5. Contaminated material for direct incineration.

6.10.8 Chemical, Fire, Electrical, Radiation and Equipment Safety

A breakdown in the containment of pathogenic organisms may be indirect result of chemical, fire, electrical or radiation accidents. It is therefore essential to maintain high standards of safety in these fields in any microbiological laboratory.

6.10.9 Transport of Infectious Substances

Transport of infectious and potentially infectious materials is subject to strict national and international regulations. These regulations describe the proper use of packaging materials, as well as other shipping requirements.

Laboratory personnel must ship infectious substances according to applicable transport regulations. Compliance with the rules will:

1. Reduce the likelihood that packages will be damaged and leak, and thereby
2. Reduce the exposures resulting in possible infections
3. Improve the efficiency of package delivery.

The basic triple packaging system

1. This packaging system consists of three layers: the primary receptacle, the secondary packaging and the outer packaging.
2. The primary receptacle containing the specimen must be watertight, leak proof and appropriately labeled as to content. The primary receptacle is wrapped in enough absorbent materials to absorb all fluid in case of breakage or leakage.
3. A second water tight, leak proof packaging is used to enclose and protect the primary receptacle (s). Several wrapped primary receptacles may be placed in a single secondary packaging. Volume and/or weight limits for packaged infectious substances are included in certain regulatory texts.
4. The third layer protects the secondary packaging from physical damage while in transit. Specimen data forms, letters and other types of information that identify or describe the specimen and identify the shipper and receiver, and any other documentation required must also be provided. Add diagram

6.10.10 Training Programme

A continuous, safety training programme is essential to maintain safety awareness among laboratory and support staff. Laboratory supervisors, with the assistance of the biosafety officer and other resource persons, play the key role in staff training. The effectiveness of all safety and health training, depends on management commitment, motivational factors, adequate initial job training, good communications, and ultimately the organization's goals and objectives.

Note :

7. TUBERCULOSIS

7.1 Introduction

The risk of TB transmission between patients to health care workers (HCW) and vice versa in a health-care setting is real. There is recent increase in the incidence of tuberculosis (TB) among health care workers documented. The need to have a good, effective and updated policy on infection control for tuberculosis in health care setting is urgent.

The risk of TB transmission from one person to the other depends on the infectiousness of patient, duration of exposure and environmental conditions.. The chain of transmission can be reduced by isolating patient with active disease, starting effective anti-tuberculosis treatment and taking appropriate control measures. Infection control policies for special healthcare settings are developed and reviewed regularly.

7.2 Hierarchy of TB infection Control

7.2.1 Administrative controls (managerial)

The most important measures of TB infection control is to prevent exposure and reduce transmission to health care workers and patient.

1. Written TB Infection Control Plan.
2. Workplace Risk Assessment
3. Triage and screening of patients
4. Early diagnosis, prompt treatment and isolation
5. Training and education of health care workers
6. Patient education e.g. cough hygiene

7.2.2 Environmental control

Prevent the spread and reduce the concentration of infectious droplet in the air.

Type of environmental control includes:

1. Maximizing natural ventilation through open and free flow ambient air with open windows
2. More complex methods
 - Ventilation system e.g. local exhaust ventilation (LEV).
 - Negative pressure rooms or airborne infection isolation (AII) room.
 - High Efficiency Particulate Air (HEPA) filtration to remove infectious particles.
 - Ultraviolet germicidal irradiation (UVGI) to sterilize the air.

7.2.3. Personel protective equipment (PPE)

The use of appropriate PPE is important and HCW must be trained to use PPE correctly.

7.2.4 Screening for HCW

Health care workers should be screened for Tuberculosis whenever they are symptomatic. Chest radiograph and Tuberculin Skin Test are not routinely recommended.

7.3 Infection control in specific area

7.3.1 Inpatient setting

1. All patients with infectious or potentially infectious Tuberculosis should be placed in (Airborne Infection Isolation /Negative Pressure) All room if possible. However, if All room is not available, TB patients should be cohorted from non tuberculosis patient, infectious from non infectious TB patients.
2. Isolation ward or area for TB patients should have maximum natural ventilation, mechanical ventilation by local exhaust ventilation and air cleaning methods such as HEPA filter and/or Ultraviolet Germicidal Irradiation (UVGI) whenever appropriate.
3. All patients suspected or confirm TB should be educated about the importance of cough etiquette (refer to std precaution) and wear surgical or close the mouth/nose when sneezing or coughing
4. All health care workers handling infectious TB patients should use PPE properly, ideally at least N95 mask. HCW handling non infectious or un-confirmed cases should use N95 whenever possible.
5. Only minimum number of visitors should be allowed to visit active TB patient in the Ward. Protections for visitor are similar to medical staff.

7.3.2 Sputum induction area/room

1. Sputum induction should be performed in an area or room with local exhaust ventilation (e.g., booths with special ventilation) or alternatively in a room that meets the requirements of an All room.
2. N95 disposable respirator should be worn by HCWs performing sputum inductions on a patient with suspected or confirmed infectious TB disease.
3. After sputum induction is performed, allow adequate time before performing another procedure in the same room.
4. Patients with suspected or confirmed infectious TB should wear surgical mask after the procedure.

7.3.3 Outpatient and emergency department

1. Triage. Triaging patient at the counter should be done to identify high risk patients by history taking (patient with history of cough for more than 2 weeks). Specific waiting area or room for patients are recommended.

2. Signage directing patients with chronic cough to go to specific or identified counter. These patients should be provided with surgical mask.
3. Provide N95 respirator for HCW in-charge of triaging.
4. Educate patient with suspected or confirmed infectious TB disease on strict respiratory hygiene and cough etiquette.
5. Sputum induction room should be made available at OPD.
6. Ideally patients should be seen in a designated consultation room for TB equipped with appropriate environmental control, good ventilation with or without UV light. HCW should be protected using N95.

7.3.4 Dental Clinic

1. Dental HCWs should routinely identify and document whether the patient has symptoms or signs of TB disease. Educate patient with suspected or confirmed infectious TB on strict respiratory hygiene and cough etiquette.
2. Non-urgent dental treatment should be postponed, and these patients should be promptly referred to an appropriate medical /respiratory unit for further assessment.
3. These patients should be kept in the dental health-care setting as short as possible.
4. For urgent dental cases for a patient who has suspected or confirmed infectious TB disease, dental care should be provided in a setting that meets the requirements for an All room (if available).N95 must be used while performing procedures on such patients.

7.3.5 Pharmacy

Cut down patient mix/movement at pharmacy – patient to collect medication at chest clinic or special counter at pharmacy or other options.

Dispensing should be done at special counter and positive pressure from pharmacy area out.

1. Allocate special code number or counter for TB infectious patients to collect anti-TB drugs or other medications.
2. Pharmacist or assistant pharmacist on duty at that counter must wear N95 mask when dealing with Tb infectious patients.
3. Provide priority service to TB patients to minimize the length of time spent in the department.

7.3.6 Intensive Care Unit (ICU)

1. ICUs with a high volume of patients with suspected or confirmed TB disease should have at least one All room. Place ICU patients with suspected or confirmed infectious TB disease in an All room, if possible.
2. Where All is not available, portable air cleaning system e.g. HEPA filter should be installed in ICU wards.

3. Place a bacterial filter on the patient's endotracheal tube (or at the expiratory side of the breathing circuit of a ventilator) preferably models specified by the manufacturer to filter particles 0.3 μ m in size in both the unloaded and loaded states.
4. Closed suction system should be used.

7.3.7 Operating theatre

1. General policy and procedures on environmental control must be strictly adhered.
2. Procedures should be scheduled for patients with suspected or confirmed TB disease when a minimum number of HCWs and other patients are present in the surgical suite, and at the end of the day to maximize the time available for removal of airborne contamination.
3. An N95 disposable respirator should be used by HCW when dealing with infectious or potentially infectious TB patient in OR
4. Post-operative recovery of a patient with suspected or confirmed TB disease should be in an All room in any location where the patient is recovering.
5. If an All or comparable room is not available for surgery or postoperative recovery, air-cleaning technologies can be used. However, the infection control committee should be involved in the selection and placement of these supplemental controls.

7.3.8 Bronchoscopy Suite

1. Postpone non-urgent procedures on TB patients until the patient is determined to be noninfectious.
2. In urgent cases (e.g. massive haemoptysis), bronchoscopist and the assistants should wear N95 respirator and face shield for protection.
3. Air cleaning system should be installed in the bronchoscopy suite.
4. Ventilation system must be operated and maintained efficiently.

7.3.9 Laboratories (*refer to laboratory section*),

1. Personnel who work with mycobacteriology specimens should:
 - Be trained in methods that minimize the production of aerosols and
 - Undergo periodic competency testing including direct observation of their work practices.
 - Prepare for prompt corrective action following a laboratory accident.
 - Follow good laboratory practice at all time and accept responsibility for correct work performance to assure the safety of fellow workers.
 - Tuberculosis culture laboratory must have a well-maintained and properly functioning biological safety cabinet (BSC), with HEPA filter and/or air supply system.

2. All specimens suspected of containing *M. tuberculosis* (including specimens processed for other microorganisms) should be handled in a Class I or II biological safety cabinet (BSC).
3. Standard personal protective equipment should be available and consists of:
 - Laboratory coats - which should be left in the laboratory before going to non-laboratory areas.
 - Disposable gloves - Gloves should be disposed of when work is completed, the gloves are overtly contaminated, or the integrity of the glove is compromised.
 - Face protection (e.g., goggles, full-face piece respirator, face shield, or other splatter guard) should also be used when manipulating specimens inside or outside a BSC.
 - Respiratory protection (N95) should be worn when performing procedures that can result in aerosolization outside a BSC.
 - Laboratory workers who use respiratory protection should be trained on respirator use and care, and fit testing.
4. Appropriate ventilation should flow from clean to contaminated areas.
 - In peripheral lab, windows should be located in such a way that air currents do not pass over the area of smear preparation in the direction of the laboratory worker preparing the smears.
 - In culture laboratories, air should be continuously extracted to the outside of the laboratory at a rate of six to twelve air changes per hour. Supply and exhaust air devices should be located on opposite wall with supply air provided from clean areas and exhaust air taken from less clean areas.

Note :

8. HOSPITAL OUTBREAK MANAGEMENT

8.1 Introduction

All health care facilities especially major hospitals would have an on going surveillance activities for healthcare associated infection (HCAI). The usual level of occurrence or incidence of an infection within the facility is usually known and this would be considered as the mean control limit. However, an upper control limit of the occurrence of the infection should be identified in order to serve as an alert line for the Infection Control Team (ICT) to investigate for a probable outbreak.

DEFINITION OF HEALTHCARE ASSOCIATED INFECTION OUTBREAK (EITHER ONE)

1. Two or more associated cases occurs at the same time within same locality/ department
2. Greater than expected rate of infection compared with the usual background case for the place and time
3. In certain newly emerging disease e.g. Legionnaires infection or anthrax, will only require 1 single case.

In HCAI outbreak, clinical findings of reported cases should be reviewed closely. It is important to directly examine the patients, reviewing of the medical records and have a discussion with the doctor in-charge. A discrepancy between the clinical and laboratory findings may occur if an outbreak is factitious, for example due to laboratory error. An outbreak maybe judged minor or major after consideration of its complexity, number of person affected, pathogenicity of the organism involved, potential transmission and any unusual features.

8.2 Steps in Outbreak Investigation and Management

NO	PROCEDURES	RESPONSIBILITES
1.	A probable diagnosis of an outbreak arises from laboratory based surveillance or clinical report from a unit/department	ICN
2.	Investigate and gather information on the probable outbreak, both from microbiological data, environmental investigation and patient's placement and movement. Carry out mapping of cases.	ICN
3.	Suspect a true outbreak if cases appear to be linked in time, space or persons. Produce a preliminary report and hold the discussion.	ICCT

4.	Alert all parties involved of probable outbreak and carry out further investigations such as screening of involved patients, contacts and an environment microbiological samples to identify source, reservoir and mode of transmission.	ICN
5.	Produce report on the outcome of the investigations (possible primary source, microorganism, magnitude of an outbreak) and recommendation immediate actions to contain the outbreak and prevent further transmission.	ICCT
6.	Discussion at the ICCT level only if it is a minor outbreak. HIACC chairman will then inform Hospital Director if it is a major outbreak. Declare outbreak. Recommend closure of unit/ward if indicated.	ICCT/HIACC/ Hospital Director
7.	Check if infection control policies and procedures are breached.	ICN
8.	Administer outbreak control measures according to the known modes of transmission (airborne, droplet or contact) of the organisms and appropriate source control. (contaminated TPN, chlorhexidine).	ICCT
9.	Re-evaluate the outbreak situation and effectiveness of interventions. Take remedial action if the outbreak is still not contained.	ICCT
10.	Announce end of outbreak when no more new cases or the number of cases has reduced to usual mean control limit. (arbitrarily within 1 month)	HIACC
11.	A final report is produced at the end of the outbreak. Recommend on change of infection control policies or procedures if indicated	ICCT/HIACC
12.	Disseminate report to all relevant departments.	ICCT

For community outbreak involving other healthcare facilities consult 'SOP for potential infectious disease MOH 2004'Public Health Division

9. OCCUPATIONAL HEALTH AND SAFETY

9.1 Introduction

This policy applies to **all facilities within the Ministry of Health Malaysia**. This document outlines the prevention, reporting and management of sharps injuries, needlestick injuries and other percutaneous exposures to blood and body fluids which may potentially expose an employee to the risk of blood-borne viruses.

9.2 Policy Statement

The Ministry of Health aims to create awareness, reduce sharps injury and mucosal exposure to a reasonably practical level. Should an exposure occur, ensure timely and appropriate management of the exposure to reduce the risk of blood-borne pathogens to the affected employee.

Needlestick and sharps injuries will be managed by the Infectious Disease Unit /Infection Control Unit. There should be a clear designation of responsibilities in each facilities. All information must be made known to all staff.

9.3 Definitions of sharp injury

Sharps injury can be defined as injury from needle or other sharp device contaminated with blood or a body fluid and penetrates the skin percutaneously mucosal/ cutaneous exposure.

Blood borne pathogens are viruses that some people carry in their blood and which may cause severe disease in certain people and few or no symptoms in others. The virus can spread to another person even if the carrier is asymptomatic.

The main blood borne viruses of concern are:

- Hepatitis B virus (HBV)
- Hepatitis C virus (HCV)
- Human Immunodeficiency Virus (HIV)

Source patient is the person whose blood is present on the item that caused the sharps injury.

9.4 Responsibilities

1. **All head of facilities** are responsible for implementing this policy in their respective hospital. They must ensure that all employees are aware of this policy and of their responsibilities contained therein.
2. **Doctor in-charge (other than the affected HCW)** will be responsible for:
 - Obtaining informed consent from the source patient for HBV and HCV blood/ HIV tests

- Taking a 5ml blood sample from the source patient and sending it to the serology laboratory in microbiology for HBV,HCV and HIV.
 - Ensure immediate first aid has been administered to healthcare workers.
 - To make doctor in-charge/ infectious disease physician/ infection control unit aware as soon as possible if the source person is at risk or has been diagnosed with Hepatitis B, Hepatitis C or HIV.
- 3. The role of the **Infection Control /Occupational Health Unit** are:
 - To disseminate information throughout the hospital regarding the prevention and immediate management of sharps and needlestick incidents.
 - To ensure the timely and appropriate management of sharps and needlesticks incidents as and when they are reported to the Infection Control Unit.
 - To notify all sharps injury in reference to **“Sharps Injury Surveillance Manual 2007”**
- 4. The role of the **Infectious Disease / General Physician** are:
 - To assess the blood-borne viruses pathogen exposure risk to healthcare workers.
 - To assess Hepatitis B immunisation status of healthcare workers.
 - To support injured staff by counselling affected employees and by co-ordinating longer term follow-up as necessary.
 - To provide all necessary vaccinations and treatment, blood tests or referrals as appropriate.
- 5. **Employees** have an individual responsibility to ensure that sharps are always handled safely, disposed off correctly and safely and should be aware that it is an offence (under OSHA) to discard an item in such a way as to cause injury to others. They should:
 - Follow the sharps injury management guidelines and reporting arrangements found in Ministry Of Health **“Guidelines On Occupational Exposures 2007”**.
 - Report all needlestick incidents/ percutaneous exposures to the Occupational Health/ Infection Control Unit and ensure that they complete needlestick injury reporting forms (**see Sharps Injury Surveillance Manual 2007**)

9.5 Training

All new employees must attend an infection control briefing which includes

- the risk associated with blood and body-fluid exposure.
- the correct use and disposal of sharps
- the use of medical devices incorporating sharps protection mechanisms.

9.6 Arrangements

All staff upon entry to a health organisation should be screened and offered immunisation against Hepatitis B. This should be under jurisdiction of occupational health unit / staff clinic.

For the safe use and disposal of sharps, the following practices for the prevention and avoidance of needlestick and sharps injuries should be fully adopted by all health care workers who handle sharps. They should ensure that:

- Sharps are not passed from hand to hand.
- Handling of sharps is kept to a minimum
- Needles are not broken or bent before use or disposal
- Syringes or needles are not dismantled by hand and are disposed of as a single unit. (special setting -dental)
- Needles are never re-sheathed by hand.
- Staff takes personal responsibility for any sharps they use and dispose of them in a designated container at the point of use. (You Use, You Throw)
- Sharps container are not filled by more than three quarter and are stored in an area away from the public (especially out of reach of children)
- Sharps container must be adequate and strategically placed. It should be consistent with work process. As far as possible it should be as close to point of use.
- Safety devices should be considered whenever possible.
- Staff should be aware of this sharps injury policy.

9.7 Monitoring

The Occupational Health / Infection Control Unit will generate incident statistics relating to sharps and needlestick incidents, and investigate trends or specific incidents as appropriate. Further details are available in Sharps Injury Surveillance Manual, MOH 2007.

First aid application upon occupational exposure

Action to be taken in event of 'Sharps' injuries and Splashes of blood/Body Fluids to the Eyes/Mouth

Injured person

→ *'Sharps' /Needlestick injuries, bites and scratches
Encourage bleeding
by gently squeezing*



→ *Wash area with
soap and water*



→ *Cover with a
waterproof plaster*



→ *Splashes to eyes and/or mouth*



Rinse thoroughly with running water

→ *Complete Accident/Incident Report Form*

10. ENVIRONMENT

10.1 Infection Control During Construction and Renovation

10.1.1 Introduction

Construction and renovation activities in the hospital may be associated with transmission of pathogens such as filamentous fungi, including *Aspergillus* spp, *Candida* spp, *Fusarium* and also bacteria such as *Legionella* and *Nocardia*. The most commonly reported hospital construction-related infection is *Aspergillus*, which represent the greatest threat to neutropenic patients.

Construction and renovation activities in the hospital facility are associated with variable levels of risks to the patients and it is important to understand what these risks are. Activities that are associated with significant generation of dusts create appreciable risks to mainly immune compromised patients such as oncology, bone marrow transplant, burns and intensive care units such as NICU and ICU. Examples of these construction activities include new construction projects and major demolition of buildings. These activities create a lot of dust which may carry *aspergillus* spores. Moderate levels of dust may be associated with activities such as sanding of walls prior to painting, construction of new walls and major cabling activities. Inspection and noninvasive activities such as removal of ceiling board for visual inspection, painting and minor plumbing works are low risk activities that generally cause minor generation of dusts.

Patients who are at risk should be identified prior to the construction and renovation activities. Immunocompromised and ventilated patients are at high risks of construction-associated aspergillosis. These include cancer patients, transplant patients, neonatal intensive and adult intensive care patients and patients in the operating theater. Medium risk patients include endoscopy, cardiology, radiology and physiotherapy units. Office areas pose low risks to patients.

Pre-construction and renovation consultation should be carried out in advance between all the stakeholders, including hospital management, infection control unit, microbiology unit, security unit, project architects and engineers and the contractor. This will help to identify the scope and nature of work and also to assess the degree of risks and potential patient groups that may be affected. Close monitoring of filamentous fungi isolation rates, especially *aspergillus* by the microbiology laboratory and prompt feedback to infection control units may be helpful to implement control measures.

Procedures to contain or minimize dispersal of dust are necessary during construction activities. Examples include physical partitioning, rerouting of human traffic away from work areas, wet mopping and door mat placement at entrance, prompt debris removal, blocking and sealing of air vents where appropriate, and use of negative pressure at the construction sites. For specific containment measures, please refer to Facility Engineering Management Services Project Operational Guidelines.

Step One: Identify the construction activity type

Type A	Inspection and non-invasive activities e.g. removal of ceiling tiles for visual inspection, painting but not sanding, electrical work, minor plumbing that disrupts water supply to a localized patient care area.(e.g. one room)
Type B	Small scale, short duration activities that create minimal dust. e.g. Activities that require access to duct spaces, cutting of walls, ceilings, sanding of walls for painting, plumbing that requires disruption to water supply of more than one patient care area(> two rooms) for less than 30 minutes.
Type C	Any work that generates a moderate to high level of dust or requires demolition of any fixed building components such as counter tops, cupboards and sinks. Removal of floor coverings, ceiling tiles, new wall construction, major cabling activities, and any activity that cannot be completed within a single work shift. Major plumbing activities.
Type D	Major demolition, construction and renovation projects. e.g. New building project; Renovation requiring consecutive work shifts to complete.

Step Two: Identify the patient risk groups affected by the activity

Group One (Lowest Risk)	Office areas , public areas
Group Two (Medium Risk)	Unoccupied wards Outpatient clinics (except oncology) Physiotherapy Occupational Therapy Social Work Dietetic
Group Three (Medium to High Risk)	All patient care areas eg, General Paediatric Ward , General Medical Wards Emergency Rooms Physiotherapy respiratory function areas

Group Four (Highest Risk)	Oncology & Hematology Units Outpatient clinics for patients with cancer All Operating Rooms NICU ICU HDU SCN All cardiac catheterization & Angiography areas Sterile processing rooms Pharmacy admixture rooms All endoscopy areas
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Step Three : Match the construction activity type with the patient risk group on the Construction Class Matrix to establish the construction class.

Construction Class Matrix

Risk Group	Construction Activity Type A	Construction Activity Type B	Construction Activity Type C	Construction Activity Type D
Group One	I	II	II	III/IV
Group Two	I	II	II	IV
Group Three	I	III	III	IV
Group Four	I-III	III/IV	III/IV	IV

Step Four : Required Infection Control Precautions by Class

	During Construction Project	Upon Completion of Project
Class I	Execute work by methods to minimize raising dust. Immediately replace a ceiling board displaced for visual inspection.	Clean work area upon completion of task.
Class II	Provide active means to prevent airborne dust from dispersing into atmosphere. Water mist work surfaces to control dust while cutting. Seal unused doors with duct tape. Block & seal air vents. Place dust matt at entrance & exit of work area. Remove or isolate HVAC system in areas where work is being performed.	Clean work surfaces with hot water and detergent. Contain construction waste before transport in tightly covered containers. Wet mop &/or vacuum with HEPA-filtered vacuum before leaving work area. Remove isolation of HVAC system in areas where work is being performed.
Class III	Remove or isolate HVAC system where work is being done to prevent contamination of duct system. Complete all critical barriers i.e. plywood, plastic to seal area from non-work area. Maintain negative pressure within work site using HEPA equipped air filtration units. Contain construction waste before transport in tightly covered containers. Cover transport carts.	Remove barriers only after work is completed & site inspection done by Project Consultant/ Engineer. Remove barrier materials carefully to minimize spreading of dirt & debris. Wet mop area with hot water & detergent. Remove isolation of HVAC system in areas where work is being performed.
Class IV	Isolate HVAC system. Complete all critical areas. Maintain negative pressure within work site with HEPA filters. All personnel entering work site are required to wear shoe covers. Shoe covers must be removed upon exit.	Remove barrier material carefully. Contain construction waste. Cover transport carts. Vacuum work areas with HEPA-filtered vacuums. Wet mop area. Remove isolation of HVAC

10.2 Operation Theatre Commissioning

10.2.1 Introduction

The function of operating theater ventilation system is to prevent airborne microbial contaminants from entering surgical wounds. Under normal circumstances, source of airborne microbial contaminants are skin fragments released by staffs working in the theater. A proportion of these skin scales are contaminated with the normal skin flora (20 % are *Staphylococcus aureus*!) The rate of dispersions is increased in movements and number of individuals present in the theater.

10.2.2. Types of Operating Theaters

- Conventionally ventilated theater
- Ultraclean ventilated Theaters

10.2.3 Indication for Air Sampling

- On completion of new OT building
- On completion of repair work done in the OT complex
- During investigation of Infectious Disease Outbreak

10.2.4 Planning for Infection Control Commissioning / Re-commissioning

1. Receiver request to perform commissioning from authorized personnel
2. The following conditions have been met:
 - All new and refurbished work has been completed
 - All engineering commissioning procedures has been completed
 - Full clean of all surfaces must be completed. x3
 - Ventilation system has been running continuously for 24 hours (must not in setback setting)*
 - The OT must not be use during this time and no one allowed to come in during the sampling process
3. Get information on OT conditions from Support Service Maintenance
 - Temperatures in the OT and related adjacent rooms i.e (Scrub room, anesthetic room, preparation room, disposal room & corridor)
 - Humidity in OT room
 - Pressure differentials between the rooms
 - Air changes within each OT
4. Inform the OT Sister when the commissioning is to take place.

10.2.5 Air Sampling

10.2.5.1 Preparation

- Get the advice of Clinical Microbiologist/ Science officer prior to commissioning owing to the large factors that affect microbial air sampling results.
- Prepare the air sampler
 - Fully charge the battery
 - Get the sieve cap autoclaved a day before the process
 - Order the required number of culture plates required for sampling process (Nutrient agar /Blood agar)
- Change into clean OT attire (Sterile OT gown will have little effect on dispersions as the time gap between leaving the theatre and taking sample will cause dilution of the air in the OT)
- Prepare the sampling materials outside the OT. Clean the surface of a trolley with alcohol swabs, place a sterile wrapping paper. Place the sterile sieve cap, sterile gloves and alcohol swabs on a sterile gallipot on the trolley.
- Set the timing of the Air sampler to 10 minutes to sample optimally a volume of 1,000 liters of air. A shorter time will be allowed but the number of colonies isolated will be multiplied by a constant factor (follow manufacturer's instructions). The sample volume should not be less than 250 liters of air and not more than 1,000 liters as it will cause the agar to dry off.

10.2.5.2 Sampling method

- The number of samples taken depends on consensus of the ICCT. A single sample collected from each OT would be adequate if all the OT parameters are within normal range and there are no obvious defects seen.
- Only one staff shall set up the air sampler in the OT to minimize dispersion contamination.
- The air sampler should be placed in the middle of the OT table or secured on a trolley where the theater table is usually located.
- Using aseptic technique, place the culture plate into the air sampler.
- Once the air sampler has been set, the staff should leave the OT and close the door.
- Allow a few minutes gap to clear the air and using a remote or extension wire, start the air sampler.
- All doors must be closed and the theater empty until sampling is completed.
- Once the air sampler has stop, remove the plate and carefully place the cap, label the plate.(OT name/number, date, volume of air if not standardized)
- Once completed immediately send all the plates in the closed carrier container to the Microbiology laboratory.

10.2.5.3 Microbiology

- Check the plates label and the request form together with the ICN who perform the sampling.
- Incubate the plates at 37 0 C for nutrient agar and place the blood agar in the CO2 incubator with temperature at 37 0 C.
- Inspect the plates after 24 hours and count the colonies grown on each plate, note on the work sheet.

10.2.5.4 Results and Interpretation

- Reporting: ——— colonies /m³
- Interpretation of results: Aerobic cultures on non selective medium should not exceed 35cfu/m³ ventilating air.
- Fungal cultures may be indicated in some circumstances where fungal contamination were suspected. They are not done routinely for OT commissioning. Fungal cultures not exceed 35cfu/m³ ventilating air
- Agar used will be Sabaurouds plus chloramphenicol and gentamicin
- Interpretations will be the same as of bacterial counts.

10.2.6 Air Flow

1. The direction of air flow between rooms in a theater suite is used to ensure that there is no backflow of air from either dirty rooms or from contaminated areas in the hospital.
2. The ICN should carry out airflow visualization (smoke testing)
 - To observe for turbulent airflow particularly around the position of the OT table
 - Any backflow from the OT to adjacent rooms (anesthetic room, scrub room, disposal room, corridor)
3. Method: Smoke tube (follow manufacturers recommendation)
 - Break one end of the tube and attached it to the rubber bulb, then break the other end.
 - Press the bulb to create a puff of smoke, observe the existence of the smoke, it should dissolve within seconds of its creation under the air curtains.
 - Observe for any air turbulence under the air curtains, watch for the airflow at each of the 4 quadrants.
 - Near each door connecting to the adjacent room, press the bulb again to create a puff of smoke and watch for its direction with door closed and opened slightly.
4. Particle count
 - Charge the battery of the counter before the commissioning takes place
 - Check whether it is functioning.

- Select the differential count size on the menu
 - Place the counter on the OT table and press start
 - Take the reading once the reading stops.
 - The reading should be very minimum under the air curtain.
 - Measure at the center and at each of the 4 quadrants.
 - Results 0 for particles > 0.5um.
5. Report on completion of the commissioning
- Contents
 - Description of the OT room, reasons for testing, general nature of tests performed
 - Summary of test results and observations
 - Conclusions and recommendations
 - Tabulated results with interpretations

Example of report

HRPZ II MICROBIOLOGY REPORT

Subject: Recommissioning of OT Intan, and Zamrud following repair work done on ceilings due to leaking.

There are 4 OT rooms in OT intan (Intan 1, 2,3 & 4) and 2 OT rooms in OT Zamrud (Zamrud 1 & 2)

Site : 1st floor New OT Complex

Date : 21.07.08

Theater : Intan 1

Temperature : 20.0 C

Humidity : 52 %

Air changes : 20 ACH

Test performed	Result	Comment
1. Inspection of control and warning devices within the OT	In good condition	Complies
2. Bacterial count	21 cfu / m ³	Complies
3. Leakage around or through HEPA filter (detection by means of Electronic Particle Counter)	No evidence of leak	Complies
4. Smoke tests	1. There is a good airflow in all 4 quadrants 2. There are no areas of gross turbulence observed 3. There is a clear movement of air from the OT table towards the periphery and out through the outlet fins and from inside the OT room to the outside room.	Complies

Interpretation of results :

Conclusions :

Recommendations :

Note :

11. STERILIZATION

11.1 Introduction

The sterilization process provides the highest level of assurances that an item can be expected to be free of known viable pathogens and non pathogenic microorganisms, including spore. Bacteria spores are the most resistant of all living organisms due to the capacity to withstand external destruction agents.

11.2 Purpose

To monitor and enforce controls necessary to prevent cross infection according to infection control policies.

11.3 Definition

Sterilization - Is a process which achieves the complete killing or removal of all type of microorganism including spore

11.4 Methods of Sterilization

Selection of the agent used to achieve sterility depends primarily on the nature of the item to be sterilized. Sterilization process either physical or chemical and each method have its advantages and disadvantages. The following are available sterilizing agent:-

11.4.1 Thermal (physical)

- Steam under pressure/moist heat:-
Steam sterilizer in an autoclave is one of the most common form of sterilization.
- Hot air /dry heat:- Rarely use in CSSU.

11.4.2 Chemical / cold sterilizers

Chemical sterilization is used for instruments and other items that are heat-sensitive or when methods that require heat are unavailable.

- Ethylene oxide gas – its use should be discouraged.
- Hydrogen peroxide plasma/vapor/low Temperature Gas Plasma Sterilizers – It is use to sterilize metal and nonmetal surgical devices at low temperatures in a dry environment.

11.5 Monitoring The Sterilization Cycle

To ensure that instruments and supplies are sterile when used, it is essential that the sterilization process be monitored by.

11.5.1 Administrative monitoring

- Work practices must be supervised.
- Written policy and procedures are strictly followed by all personnel responsible for sterilizing and handling sterile supplies.
- Policies and procedures pertain to the following:
 - Decontaminating, cleaning and terminally sterilizing.
 - Packaging and labeling
 - Loading and unloading the sterilizer
 - Operating the sterilizer
 - Monitoring and maintaining the record of each cycle
 - Adhering to safety precaution and preventive maintenance protocol
 - Transporting sterile packages to the sterile storage room.
 - Cart should be enclosed.
 - Storage of sterile items
 - Handling of sterile items
 - Tracking and recalling items if an item in a particular load is not safe for use.

11.5.2 Mechanical Monitoring

Routine maintenance to check efficiency and accuracy of autoclave consist of the following:-

- **Dummy Run**

A complete sterilizing cycle carried out with an empty chamber to get rid of the remaining air in the chamber.

- **Recording Gauge**

In the form of charts, printouts, or gauges, this reflects the current status of cycle parameters (pressure, temperature and duration) during sterilization. Gauge should be calibrated at regular intervals against standard instruments by autoclave operator.

- **Leak Rate Test**

Pre vacuum steam sterilizer must be tested at least once a week for the rate of air leakage into the chamber during air removal and drying stages.

- **Thermocouple Test**

To detect temperature achieved and maintained during sterilization stage.

This procedure should be done during commissioning, after major repair and validation.

- **Bowie-Dick Test**

Test packs are run daily, to monitor the function pre-vacuum sterilizers and check the efficacy of vacuum system.

11.5.3 Chemical Monitoring

To show that items have been exposed to sterilization process. The indicators (internal and external) help to monitor the physical conditions within the sterilizer and alert personnel to detect malfunction and improper packaging/loading. Indicators do not establish sterility of an item.

11.5.4 Biological Monitoring

Positive assurance that sterilization conditions have been achieved can be obtained only through a biologic control test. Items should not be use if they do not pass the biological test.

Consecutive biologic monitors should be run:

- Each time the sterilizer is calibrated
- After repairs
- During installation of sterilizer
- Relocated
- Preferably daily or at least once a week, and with each load of implants
- 3 hours test by CSSU or 48 hour by lab

11.6 Pre-Sterilization Process

To achieve the sterilization process, the items to be sterilized should be pre-cleaned to lower the bio-burden to the lowest possible level. Decontaminate and cleaning of items should follow according to CSSU SOP.

11.7 Preparation for Sterilization

Surgical instruments, supplies and most medical devices must be prepared and packed so that their sterility can be maintained to the point of use.

11.7.1 Individual inspection and examination of instruments including

- Cleanliness
- Function of any instruments
- Integrity of instruments
- Lubricate and test for proper functioning

11.7.2 Packaging and wrapping of used items prior to sterilization

The packaging material chosen for sterile products must be non toxic and conform with the following basic principles:-

- It must allow sterilant contact
- Allow sterile presentation of the package contents.
- Permeability to air, steam and gaseous

- Able to stand heat / high temp.
- Resistance to penetration by microorganism
- Resistance to puncture and tear
- Good draping quality
- Free from loose fibers & particles
- Readily available

11.7.3 Type of packaging materials

- Sterilisation wrapping paper
- Sterilisation wrapping bag/pouches
- Linen wraps should be discourage

11.7.4 Sealing of Packs and Bags

The purpose of sealing is to maintain pack integrity. It is achieved by the use of heat sealers or sterilizing indicator tape.

11.8 Labeling

- Use sterilisation non toxic marker pen for labelling
- Objective of labeling is to identify the contents, quality assurance, inventory control and stock-rotating purposes.
- Labeling should be done before sterilization process. Labeling shall indicate name of pack, code number of packer and date of sterilization.

11.9 Loading the Load

- The items should be arranged and placed on sterilizer rack leaving space for air and steam circulation.
- No items should touch the chamber walls.

11.10 Unloading and Inspecting Sterile Items

- The sterilizer rack to be placed in a cooling room until the load is cool.
- The chemical indicator tape on each package should be checked for color changes.
- Check for the integrity of the pack
- The sterilized items must be cooled before storage

11.11 Sterile Storage

- Sterile items should be stored and handle in a manner that maintain the integrity of packs and prevent contamination from any source.
- The storage area shall be free of dust, insects and vermin.

- All items shall be stored above floor level by at least 250mm and from ceiling fixtures by at least 440mm, 60 mm from the wall and protected by direct sun light.
- Temperature within the storage area should range from 18°C - 22°C with relative humidity from 35% - 70%.
- The sterile items should be arranged according to the size (big sets singly, and small set not more than 3 stacks)
- 'First in, First out' (FIFO) is the principle to follow in the removal and replacement of sterile items in sterile storage.

11.12 Collection of Used Items

- Where ever possible all decontamination must be performed in CSSU. In situation where it is not possible e.g. after office hours, the items should only be pre-rinsed to remove debris and then pack.
- Procedure for the collection of used reusable items from wards, operating room and other user department shall adhere to hospital guidelines.
- Personnel involved in collection and receiving should practice standard precaution when handling used instruments and devices.
- Instruments should be contained during transport from point of used to the area where they will be cleaned and decontaminated.
- Use a separate trolley for the collection of used items and the delivery of sterile items.
- The container or trolley shall be cleaned with disinfectant e.g. 70% alcohol at the end of each collection round.

11.13 Distribution of sterile items

Distribution trolley should be covered or closed to ensure the sterile chain is maintained

Note :

12. PRINCIPLES OF ANTIBIOTIC SURVEILLANCE

12.1 Introduction

One of the major issue in our health care today is that of controlling the increase in antimicrobial resistance. Although multiple factors play a role in this problem, the selective pressures of inappropriate and widespread use of antimicrobials are considered as major contributors.

12.2 Establish a system

The establishment of a system to monitor antimicrobial use and responding to the data, in the context of external benchmarking has been a successful way to create changes in antimicrobial practice (Scott et al, 2002). Therefore, monitoring antimicrobial use or antimicrobial surveillance will serve as a tool for:

- Comparison in antimicrobial use within MOH by having national benchmark data (aggregated from all hospitals).
- Determine and identify antimicrobial use of concern that necessitate for a an audit/ feedback report
- Identify and develop strategies to improve antimicrobial control through multidisciplinary efforts involving Infectious Disease Physicians/Clinicians, Clinical Microbiologist/ Microbiologist, Pharmacist and Infection Control Nurses.

12.3 Surveillance on antimicrobial use

12.3.1 Antibiotic classes for antimicrobial surveillance

Antimicrobial surveillance for four types of antibiotic, from four different classes, was conducted in fifteen major hospitals within MOH since 2001. At present, there are 14 additional antimicrobial monitored, total of 18, as listed below :

1. Cephalosporin
 - Cefuroxime
 - Ceftriaxone
 - Cefoperazone
 - Ceftazidime
 - Cefotaxime
 - Cefoperazone/sulbactam
 - Cefepime

2. Carbapenems

- Imipenem
- Meropenem
- Ertapenem

3. Quinolones

- Ciprofloxacin
- Pefloxacin

4. Aminoglycoside

- Gentamicin
- Netilmicin
- Amikacin

5. Antibiotic indicated for MRSA infection

- Vancomycin
- Linezolid

6. Anti-pseudomonal penicillins

- Piperacillin/Tazobactam

12.3.2 Monitoring antimicrobial use using aggregated data on Defined Daily Dose (DDD)

Antimicrobial use express as Defined Daily Dose per 1000 patient days is accepted to be used as this is a WHO standard for drug utilization studies. DDD for each drug is as listed above [DDD] and the calculation is as follows:

Total Antibiotic Usage (Grams) for Adults Inpatient in a year = $\frac{\text{No of DDD's per year}}{\text{DDD* (from WHO)}}$

For 1000 adults inpatients days :

$\frac{\text{No of DDD's per year}}{\text{No of patients days/warded for that particular year}} \times 1000 = \text{No of DDD's per 1000 patients days}$

1. Each hospital shall send report on DDD every 6 months to National Infection Control and Antibiotic Control Committee. Data on DDD aggregated from all hospitals will be used as national benchmark data (aggregated from all hospitals) as a comparison to individual local data.
2. However, individual local data shall be reported according to discipline/ department on regular basis
3. It is recommended to have a national benchmark data specifically for Intensive Care Unit (ICU), considering its high usage of antimicrobial and higher incidence of antimicrobial resistance
4. It is also beneficial if each state have their own benchmark data from their secondary and tertiary hospitals which can be used to compare the prescribing pattern
5. A report of local monitoring data for hospital compared with national benchmark (i.e aggregate summary data from all hospital in this program) should be disseminated to all hospital
6. The aggregate benchmark data included numeric presentation of pooled means, medians, and key percentile distributions of prevalence of selected antimicrobial-resistant organisms and maybe stratified by certain specific discipline, such as ICU.
7. This report shall recognized excessive use of specific antimicrobial agents against problematic pathogen. Upon receiving the report, the respective hospital; through Hospital Infection and Antibiotic Control Committee (HIACC) shall give feedback and report to the main committee on any antimicrobial control practice and strategies to improve their control on specific antimicrobial of concern.

12.3.3 Correlation between antimicrobial use and resistance rate

Recent reports from the special task force of the American Society for Microbiology and from a joint committee of the Society of Healthcare Epidemiology of America and the Infectious Disease of America advocate that individual hospitals monitor the relationship between antimicrobial use and resistance within specific patient-care areas (Reports of the ASM Task Force on Antibiotic Resistance, 1995).

A graphic analysis done by Harbath et al (2001) can be used as an example to assess this relationship, it is done by plotting DDDs per 1000 patients days for specific antibiotic class of interest against susceptibility percentages of unique nosocomial isolates, according to time and space (i.e year and ward), third generation cephalosporin was plotted against *Enterobacteriaceae* for example (refer to Appendix 1).

Since we are monitoring both data of antimicrobial use and resistance rate, it will be more meaningful if we can plot both data in one graph. Therefore the committee have to select which antimicrobial use is to be plotted against which resistance rate of concern. Here are a few suggestions :

- Third generation cephalosporins and *ESBL*
- Cefoperazone/sulbactam and *Acinetobacter spp*

- Antipseudomonal cephalosporin/carbapenem/quinolone and *Pseudomonas spp*
- Vancomycin and MRSA

12.4 Determine and identify antimicrobial use of concern that necessitate for a audit/ feedback report.

1. Compliance to guidelines -Appropriateness –base on NAG
2. High usage – antibiotic specific
3. Resistance problems
4. High collateral damage (such as quinolones),
5. Antimicrobial use of concern as reported to HIACC shall necessitate for measure to improve antimicrobial control. Measures can be either for specific antimicrobial, specific area (such as surgical ward) or specific indication (such as antimicrobial for pneumonia).
6. We can adopt certain strategies to prevent and control the spread of antimicrobial resistance from Goldman et al (1996) and Rekha (2001). Goldman et al (1996) recommended a few outcome measures in monitoring empiric antimicrobial therapy:
 - No of patients infected with resistant strain to antimicrobial use/
No of patients given these antimicrobial
7. Cost/quantity of empiric antimicrobial administered in a specified period.

Recommendations by Rekha (2001) can be divided into antimicrobial prophylaxis and empiric antimicrobial therapy. Process measures for antimicrobial prophylaxis are recommended as follows:

- No of patients received inappropriate prophylactic antimicrobial
No of patients having procedures
- No of patients received antimicrobial prophylaxis for <24 hours
No of patients received antimicrobial prophylaxis
- No of patients received antimicrobial within 30 min -1H preceding surgical incision
No of patients received antimicrobial prophylaxis

Process measures for empiric antimicrobial therapy is as follows :

- No of inappropriate empiric regimens
No of patients received empiric therapy
- No of patients given empiric therapy without having a culture obtained
No of patients given empiric therapy

Mean/median time interval between initiation of empiric therapy and arrival of microbiology diagnosis in patients who eventually have a diagnosis

- No of patients with microbiology diagnosis received inappropriate empiric therapy
No of patients given empiric therapy
- Mean/median/duration of empiric therapy

12.5 Antimicrobial management program/strategies

Success of antimicrobial restriction in hospitals varies on the basis of the genesis of the antimicrobial resistance program. Workshop on Antimicrobial Resistance in Hospitals: Strategies to Improve Antimicrobial Use and Prevent Nosocomial Transmission of Antimicrobial-Resistant Microorganisms in 1994 under CDC have identify five strategic goals to optimize antimicrobial use (Goldman et al, 1996) :

- Optimizing antimicrobial prophylaxis for operative procedures
- Optimizing choice and duration of empiric therapy
- Improving antimicrobial prescribing by educational and administrative means
- Monitoring and providing feedback regarding antibiotic resistance
- Defining and implementing local guideline (National Antibiotic Guideline as reference)

Paterson, 2006 have recommended implementation of a program using a front-end approach and back end approach through discussion with and endorsements from the clinical departments that will be affected (e.g., the ICU, surgical department, emergency department, and outpatient clinics, as well as other affiliated hospitals).

1. Use of front end approach
 - Pre-approval before administration of restricted agents
 - Use of special antimicrobial request forms
 - Antimicrobial cycling
2. Use of back end approach
 - Post-prescription review/Automatic stop order

A back-end approach to antimicrobial management permits empirical use of broad-spectrum antimicrobial agents, followed by post-prescription review and, then, by streamlining (de-escalation) or discontinuing antimicrobial therapy on day 2 or 3, if this decision is supported by culture and susceptibility testing results and by the patient's clinical response.

3. However, it should be noted that reacting to resistance against individual antibiotics by instituting antibiotic restriction may lead to increased use of alternate antibiotics, which, in turn, leads to increased resistance to other antibiotic classes.
4. Feedback mechanism

There are many possible intervention could be proposed to reduce inappropriate or excessive antimicrobial use but deciding which one is the most effective measures in any particular setting can be difficult. It is best that each individual hospitals institute their own programs to improve antimicrobial prescribing practice and to do comparison before and after each programs is initiated. These programs can be conducted as quality improvement activities as a continuous process.

12.6 Antimicrobial policy

Addressing the problem of antimicrobial resistance requires both infection control and regulation of antimicrobial use; addressing either alone is insufficient. Therefore, collaboration with Infectious Disease physicians, clinical microbiologist and infection control nurses is necessary to developed strategies to developed antimicrobial policy to improved antimicrobial control.

Examples from Harbath et al (2001) on correlation between antimicrobial use and resistance

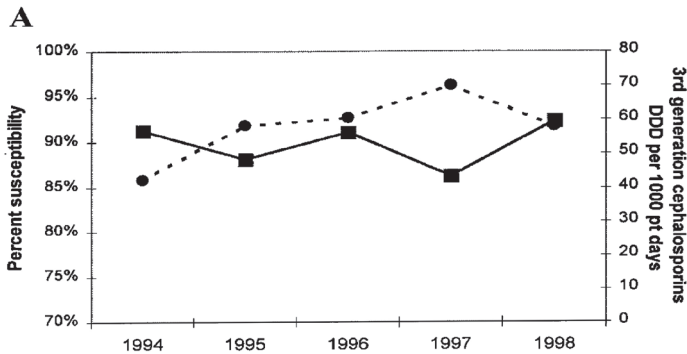
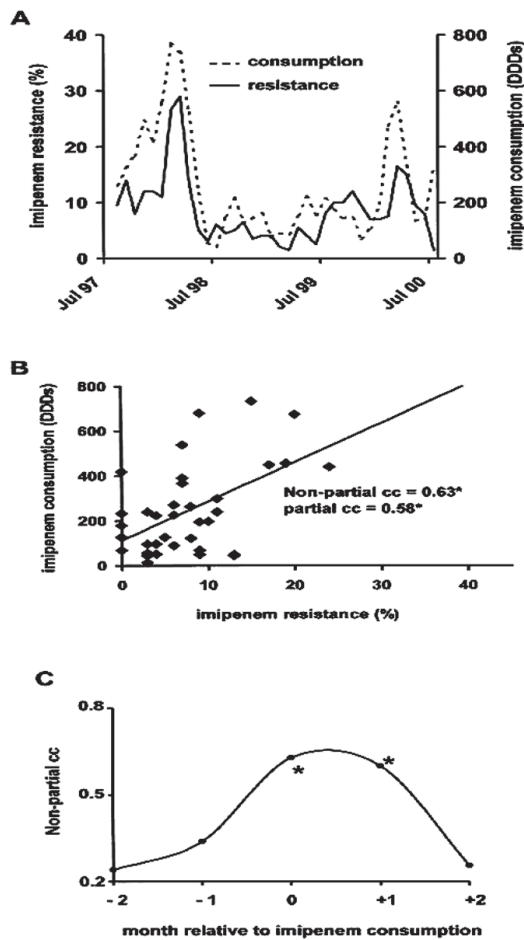


Figure 1. A, Third-generation cephalosporin susceptibility among Enterobacteriaceae (*solid line*) and use in defined daily doses (DDDs; *dotted line*). Examples from Lepper et al, 2002



13. SPECIFIC ORGANISM RELATED INFORMATION

13.1 Multi-Resistant Organism

13.1.1 Introduction

Multi-resistant organisms are bacteria that have developed resistance to more than 2 different groups of any used antibiotics. Development of multi-drug resistance has been associated with inappropriate and over use of antibiotics

Resistant organisms of significance in healthcare settings include *Pseudomonas aeruginosa*, *Acinetobacter* and Extended-spectrum beta lactamase (ESBL)-producing bacteria which are most commonly produced among *Escherichia coli* (*E. coli*), *Klebsiella* and *Proteus*.

13.1.1.1 ESBLs and ESBL Infection

- ESBL are bacterial enzymes that have conferred resistance to second and third generation cephalosporins antibiotics. ESBLs are the cause of multi-drug resistant gram negative bacteria around the world.
- Treatment of choice includes carbapenems and tigecycline

13.1.1.2 *Pseudomonas aeruginosa*

- *Pseudomonas aeruginosa* is a gram-negative bacterium normally found in soil and water. It rarely affects healthy people, but can cause serious illness in immunocompromised people (HIV or cancer patients).
- In healthcare settings it contaminates wet reservoirs e.g. indwelling catheters and can cause serious bloodstream infections.

13.1.1.3 *Acinetobacter*

- *Acinetobacter* is a gram-negative bacterium, normally lives in soil and water and can sometimes be found on the skin, posing no risk to healthy people.
- It can live in the environment for several days. There are several species and a few can cause infections in people who are already unwell.

13.1.2 Transmission

- The transmission of multi-resistant organisms in hospital and community is by person to person spread either directly via staff, patient or visitor unwashed hands that have been contaminated by contact with colonised or infected patient or indirectly from contaminated equipment and surfaces.
- ESBLs can also be transmitted via the faecal oral route.

13.1.3 Prevention of Colonization And Infection With Multi-Resistant Organisms

13.1.3.1 Special units

The Infection Control Team should, in collaboration with the relevant clinical team, be proactive in assessing the risks and routes of transmission of gram-negative organisms. Hospital areas of particular concern include:

- neonatal, pediatric and adult intensive care units
- units caring for neutropaenic patients
- ophthalmology department and ophthalmic surgery
- burns units and hydrotherapy pool

13.1.3.2 Antibiotic policies

1. Excessive use of broad-spectrum antimicrobials will encourage the emergence of multiply-resistant coliforms and non-fermentatives.
2. Antimicrobial prophylaxis for surgery should be as narrow-spectrum as possible, and restricted to a maximum of 24 hours duration

13.1.3.3 Disinfection of equipment and medical instruments

1. Moist respiratory equipment, such as ventilator tubing, nebulizers and humidifiers that come into direct contact with the patient, are easily contaminated with gram-negative organisms and can cause cross-infection.
2. It is therefore important that the correct procedures for decontamination are followed and that the equipment is thoroughly dried before use for other patients.
3. Heat disinfection should be used wherever possible for equipment used on the ward.
4. Disinfectors such as bedpan washers must be maintained and checked regularly to ensure that adequate temperatures are reached (normally 80°C for 1 min), and written records of maintenance must be kept.
5. Disinfection procedures should, where necessary, be checked with the Infection Control Team.
6. All creams, gels and liquids used with such equipment must be stored in such a way as to prevent contamination and patient-to-patient spread of Gram-negative organisms. Single-use disposable sachets are preferred.

13.1.3.4 Hand hygiene

1. All staff who have contact with patients must be trained in hand washing practices, and use disposable gloves and plastic aprons when hand contamination is likely, for example, when emptying bedpans, changing catheter bags, etc.
2. Heavy microbial contamination of hands may not be adequately cleaned by simple washing and, when anticipated, disposable gloves should be used.

13.1.3.5 Ward environment

1. All shared communal services such as lavatories, bathrooms, etc. should be cleaned daily and kept dry.
2. In general, environment disinfectants are not required; detergent and hot water are adequate.
3. Sink traps inevitably harbor organisms, which cannot be removed by disinfectants.
4. The taps and sinks should be designed so that there is minimal splashing from the sink area.

13.2 Methicillin Resistant *Staphylococcus Aureus*

13.2.1 Introduction

Methicillin-Resistant *Staphylococcus Aureus* (MRSA) have been a major cause of health care-associated infections (HCAI) worldwide. Detection of MRSA within hospitals and long term care facilities has increased dramatically and a great deal has been written regarding its management and control.

Concern about MRSA is related to the potential for health care and community transmission and the limited number of antibiotics available to treat infections caused by this organism.

13.2.2 Epidemiology

The current prevalence rate of MRSA in United States hospitals is now believed to exceed 50%. Canada reported a 6% rate, while Japan's rate exceeded 80%. Most European countries had a greater than 6% rate of *S. aureus* strains be MRSA in 1999, but the Netherlands reported less than 1%.

In Malaysia, the rate of MRSA isolate was 0.5% per 100 admissions in 2005 and 0.3% 2007. The epidemiology of MRSA has changed with the apparent emergence of MRSA in the community with clinical, epidemiologic and bacteriologic characteristics distinct from health care-associated MRSA.

13.2.3 Methicillin-Resistant *Staphylococcus Aureus*

- *Staphylococcus aureus* is a facultative anaerobe, non-motile, catalase positive, gram-positive cocci which predominantly arranged in grape-like clusters.
- It is the most important human pathogen among the staphylococci.
- *S. aureus* that is resistant to the synthetic penicillins (methicillin, oxacillin, nafcillin) is referred to as MRSA.
- They colonise the skin, particularly the anterior nares, skin folds, hairline, axillae, perineum and umbilicus. They may also colonise chronic wounds, for example in eczema, varicose and decubitus ulcer.
- MRSA is transmitted primarily through direct person-to-person contact, commonly through the hands of health care workers. However, It can also be transmitted through contact with inanimate objects such as linen, clothing and dust, although these do not represent significant sources for transmission.
- Nasal carriage of MRSA is very common and due to hand to nose transmission.
- A nasal carrier often contaminates his/her own hands by hand to nose contact, then transmits the organism in the course of routine activities.
- Since skin to skin contact is the most significant mode of transmission, hand hygiene is of primary importance in preventing its spread.

- Because of its resistance to antibiotics, management of MRSA infections requires more toxic and expensive treatment.
- MRSA colonization and infections have a significant impact on individual patients and institutions.
- Many patients with MRSA remain colonized indefinitely, and the majority of hospital and nursing homes that have endemic MRSA never eradicates MRSA from the institution.

13.2.4 Clinical Manifestation

- Infections caused by MRSA are wound infections, bacteremia, ventilator-associated pneumonia and less commonly endocarditis and osteomyelitis
- It also produces toxins which can cause necrotising entero-colitis among newborns.

13.2.5 Laboratory Diagnosis

- Screening for MRSA colonization can be detected by culture of the nares or wound swabs
- Clinical infection caused by MRSA can be identified by cultures of blood, broncho-alveolar lavage, sputum, urine or surgically obtained specimens.
- Oxacillin susceptibility testing by the Kirby Bauer technique is the preferred method of identifying MRSA. Resistance to oxacillin also defines resistance to all penicillins, cephalosporins, cephamycins and other classes of antibiotics including aminoglycosides, macrolides and quinolones.
- Methicillin resistance in MRSA is conferred by the *mecA* gene, which encodes an altered penicillin binding protein (PBP2a).

13.2.6 Treatment

Treatment of MRSA falls into two areas, one is the antimicrobial treatment of clinical invasive infection and the other is topical to eradicate skin and nasopharyngeal colonization.

Eradication of colonized patients is recommended as these patients provide a reservoir for subsequent spread of MRSA.

1. Hygiene

- Bath daily and wash hair twice weekly with an antiseptic body wash such as 4% chlorhexidine gluconate scrub or 2% triclosan .
- Use a disinfectant dusting powder (hexachlorophene 0.33%) after bathing and drying. Apply to axilla, groin and any skin folds.

2. Nasal carrier

The usual treatment for nasal carriage is mupirocin, which is an effective topical agent

- Apply mupirocin nasal ointment three times per day for a period of five days. A 'match head' size of ointment should be applied to the inner side of the nostril.
- After the five-day treatment course, cease eradication therapy for two days and repeat the swabs.

- Use an antibacterial (chlorhexidine gluconate 0.2%) mouth wash two times per day.
 - If after two courses of mupirocin treatment the nasal carriage is not eradicated, it is important that mupirocin is stopped because the risk of resistance will develop.
3. Wound treatment
- Colonisation or infection caused by MRSA may delay wound healing. These general principles can be applied:
- Clean wound with sterile water.
 - Use povidone-iodine or silver sulphadiazine preparations where possible.
 - Cover wound with an appropriate dressing.
 - **DO NOT USE TOPICAL ANTIBIOTICS FOR LOCALISED WOUND INFECTION**
4. Systemic infection
- With the emergence of resistance to the penicillinase-resistant penicillins, the glycopeptides agent vancomycin became the treatment of choice for infections cause by MRSA.
 - Vancomycin can have serious side effects, include ototoxicity, nephrotoxicity, 'red man syndrome' and allergic reactions
 - Alternative antibiotics to treat MRSA include linezolid, rifampicin, fucidic acid, tigecycline, quinopristin/dalfopristin and teicoplanin
 - **Avoid using rifampicin or fucidic acid as single agent** because of rapid development of resistance.

13.2.7 Infection Control And Prevention

- The preventive measures of infection control for MRSA follows the contact based precautions which includes hand hygiene, isolation, gloving, linen handling and environmental cleaning.
- Hand hygiene is the single most important factor in preventing the spread of MRSA, therefore the 5 moments shall be adhered to at all times.
- Gloves should be worn for any contact with blood/body fluids, secretions and excretions wounds, invasive site, or mucous membrane of a patient
- Gowns may be worn if splashing or extensive soiling is likely.
- Masks and eye protection are indicated if exposure to aerosols generated by coughing patient is likely or when irrigating wounds.
- Daily routine cleaning of formites must be done with a disinfectant (70% alcohol) and performed in a sanitary manner as is done in all rooms regardless of the presence of MRSA. Terminal cleaning shall be performed upon patient discharge. Equipment should be routinely cleaned, disinfected or sterilized per institution policy.
- The MRSA colonized or infected patient should be isolated in single room if available or cohort with other known MRSA patient.
- Contact based precaution should be strictly adhered to at all times, irrespectively of isolation.

- Ensure OT table be cleaned with 70% alcohol after MRSA case done.
- Visitors shall obtain permission and instruction from the duty nurse before any contact with patients and practice hand hygiene after contact.

Four categories of risk have been identified as related to the potential to develop serious infection as a result of acquiring MRSA as in table below. The risk depend on the local hospital MRSA prevalence and intervention measures shall be decided by the HIACC

Risk categories			
High	Moderate	Low	Minimal
Intensive care	General surgery	Geriatric (acute)	Geriatric (long stay)
Special care baby unit	Urology	General medicine	Psychiatric
Burns unit	Neonatal	Paediatric	Psychogeriatric
Transplant unit	Gynaecology		
Cardiothoracic	Obstetric		
Orthopaedic	Dermatology		
Trauma			
Vascular			

13.2.8 Recommended Practices

13.2.8.1 Risk Category

1. High risk areas of a hospital where MRSA is endemic:
 - Admission screening
 - Discharge screening for MRSA positive patient
 - Use antiseptic for bathing affected patient
 - Screening of contacts
 - Isolate /cohort carriers
 - Screen skin lesions of staff after a single case
 - Screen all staff if additional cases of MRSA occurs
2. Moderate risk areas of a hospital where MRSA is endemic:
 - Screen all patients if there is evidence of transmission (> base line)
 - Isolate/cohort carriers
 - Use antiseptic for bathing affected patient

- Screen staff if there is evidence of further spread
- 3. Low risk areas of a hospital where MRSA is endemic:
 - Admission screen
 - o known to be previously infected / colonized
 - o Frequent readmissions
 - o Transferred from MRSA-affected hospitals
 - o Transferred from hospitals abroad
 - Basic control measures
 - Carry out full MRSA screen on the index patient
 - Screening of contact only if clinical infections are detected
- 4. Minimal risk areas of a hospital where MRSA is endemic :
 - Basic control measures

Environmental screening shall be done only during an outbreak

13.2.8.2 Transfer of colonized / infected patients

- Within the hospital
 - Bathe & wash hair with antiseptic detergent 4% chlorhexidine gluconate scrub or 2% triclosan
 - Clean new clothing
- Out- patients or specialist clinics eg radiology department
 - Keep at the end of working session
 - Make prior arrangements
- Another hospitals
 - ICD to ICD
- Discharge of patients
 - Inform GP / health care staff
- Deceased patients
 - Plastic body bags not necessary

13.2.8.3 Transport of colonized / infected patients

- Lesions should be occluded WITH impermeable dressing.
- Attendants should wear appropriate PPE i.e. gloves if handling patient.
- Trolley / wheelchairs should be cleaned with 70% alcohol.
- Staff should wash hands with antiseptic after the procedure.

13.3 Vancomycin Resistant Enterococci

13.3.1 Introduction

Enterococci are the second most common cause of HCAI in the United States. The emergence of vancomycin-resistant enterococci (VRE) as an important nosocomial pathogen in susceptible populations represents a significant challenge to infection control personnel. In Malaysia, the prevalence rate of VRE is 0.8% in 2007

13.3.2 Enterococcus

Enterococci are gram-positive cocci usually arranged in short chain, which forms part of the normal flora of the gastrointestinal in 95% of individuals. It is a non-pathogenic organism, which may colonise the flora in the female genital tract, oral cavity, perineal area, hepatobiliary tract, and upper respiratory tract.

The two most common species causing human infection are *Enterococcus faecalis*, which causes 80% to 90% of all enterococcal infections, and *Enterococcus faecium*, which causes 5% to 15%. Virtually all VRE are *E. faecium*. Mechanism of resistance in VRE is due to the presence of *van* gene (van A,B,C,D,E,G).

13.3.3 Clinical Manifestation

- Enterococci are relatively poor pathogens, usually causing colonization rather than infection.
- Most enterococcal infections are endogenous, but cross-infection between hospitalized patients does occur mainly on hands contaminated by contact with colonised or infected patients, contaminated surfaces or fomites.
- They can also cause urinary tract infections, bacteraemia, meningitis and wound infections. In most patients, colonisation with VRE precedes infection.
- These organisms were traditionally susceptible to ampicillin, vancomycin, aminoglycosides and quinolones.

13.3.4 Epidemiology of VRE

Populations found to be at increased risk for VRE include:

- Those who have received vancomycin or cephalosporins and/or multi-antimicrobial therapy;
- Those with severe underlying disease or immunosuppression;
- Those who have had intra-abdominal or cardiothoracic surgical procedures;
- Those who have an indwelling urinary catheter or central venous catheter.
- Patients who have undergone sigmoidoscopy or colonoscopy.
- Patients in ICU/renal /oncology/haematology units.
- Patients in long stay institutions

13.3.5 Treatment

- Antibiotics used include linezolid, teicoplanin, carbapenems, quinopristin/dalfopristine and tigecycline.

13.3.6 General Recommendations For The Control Of VRE Transmission

13.3.6.1 Patient Screening

- Faeces is the most useful screening specimen. Where a faeces sample is unobtainable a rectal swab may be taken.
- Screening to identify colonised patients is recommended during outbreaks.
- Other colonised patients may be identified by screening other sites e.g. wounds and vascular catheter sites.

13.3.6.2 Patient Placement

- Place VRE infected or colonised patients in a single room with own toilet facilities or cohort with other affected patients.
- STRICT ADHERENCE TO CONTACT BASED PRECAUTION MUST BE PRACTICE AT ALL TIMES.
- Patients with diarrhoea or incontinence due to or suspected of VRE pose a high risk of transmission to other patients and MUST be isolated.

Isolation may be discontinued when the patient is well and diarrhoea-free and capable of self caring and good hygiene.

13.3.6.3 Treatment

- As colonisation with VRE is more frequent than infection patients must be assessed before commencing treatment.
- Attempts at clearance by oral therapy are usually unsuccessful and not recommended.

13.3.6.4 Hand Hygiene

- Thorough hand washing by staff before and after patient contact, after handling incontinence material or faeces.
- Wash hands after glove removal.
- Alcoholic hand rub are effective if hands are physically clean.
- Patients with VRE should be educated to wash their hands after using the toilet.

13.3.6.5 Gloves/Aprons

- When carrying out-patient procedures wear disposable gloves. Wash hands after removal.

- Wear an apron when entering the room of a patient infected or colonised with VRE:
 - ❖ If substantial contact with patient or with environmental surfaces in the patient's room is anticipated.
 - ❖ If the patient is incontinent.
 - ❖ If the patient has had an ileostomy or colostomy, has diarrhoea, or has a wound drainage not contained by a dressing.
 - ❖ Remove gloves and apron BEFORE leaving the patient's room and immediately wash hands or use alcohol hand gel.
 - ❖ Dedicated thermometers, blood pressure cuffs, stethoscopes, should be kept in the patient's room. After discharge they should be cleaned and disinfected appropriately.

13.3.6.6 Transfer Of Infected Or Colonized Patients

- Patients that are colonised with VRE must not be transferred without prior knowledge of the receiving hospital or department.
- VRE positive patients may attend other hospital departments such as radiology, with prior arrangement with the receiving department.

13.3.6.7 Waste Disposal

- Dispose of aprons/ gloves and incontinence wear in clinical waste bin.

13.3.6.8 Linen

- Soiled linen must be placed in an alginate bag prior to placement in outer bag. Other linen treat as normal.

13.3.6.9 Cleaning Policy

- Separate equipment must be kept for isolation areas.
- Thorough cleaning of all surfaces including bed rails, call bells, bedside tables, commodes, bathroom and toilets must be done on at least a daily basis.
- On the advice of the Infection Control Nurse, hypochlorite 1: 1000 may be recommended after cleaning.
- On discharge of the patient all areas/surfaces of the room or ward must be thoroughly cleaned with hypochlorite.

13.4 HIV

13.4.1 Introduction

In the health-care setting, the major risks for HIV infection are blood contact due to percutaneous injuries and, to a lesser extent, mucous membrane and skin contact. There are no known instances of transmission of a bloodborne pathogen by aerosol in a clinical setting.

In studies conducted in dental operatories and hemodialysis centers, hepatitis B surface antigen could not be detected in the air during the treatment of hepatitis B carriers, including during procedures known to generate aerosols. This suggests that detection of HIV in aerosols would also be uncommon, since the concentration of HIV in blood is generally lower than that of HBV. HIV in an aerosol would not necessarily mean that HIV is readily transmissible by this route.

13.4.2 HIV Related Infection Control Procedures

1. Standard chemical germicides at concentrations much lower than commonly used in practice can rapidly inactivate HIV.
2. In general, reusable instruments or devices that enter sterile tissue, including the vascular system of any patient, and devices through which blood flows should be sterilized before reuse.
3. Reusable devices or items that contact intact mucous membranes should be sterilized or receive high-level disinfection before reuse.
4. Medical devices that require sterilization or disinfection should be thoroughly cleaned to reduce bioburden before being exposed to the germicide, and the germicide and device manufacturers' instructions should be closely followed.
5. Extraordinary attempts to disinfect walls, floors, or other environmental surfaces are not necessary. However, cleaning and removal of soil should be done routinely. Germicide effective against HIV is a solution of sodium hypochlorite (1 part household bleach to 99 parts water or 1/4 cup bleach to 1 gallon of water) prepared daily. Bleach, however, is corrosive to metals (especially aluminum) and should not be used to decontaminate medical instruments with metallic parts.
6. Chemical germicides that are approved for use as "hospital disinfectants" and that are tuberculocidal/virucidal when used at recommended dilutions and contact times can be used to decontaminate spills of blood or other body fluids.
7. In patient-care areas, visibly soiled areas should first be cleaned and then chemically decontaminated. For disinfection, the pre-cleaned areas should be moistened with the appropriate germicide and allowed to air dry.
8. In the laboratory, large spills of cultured or concentrated infectious agents should be flooded with a liquid germicide before cleaning, then decontaminated with fresh germicidal chemical after organic material has been removed. It is not necessary to flood spills of blood or other body fluids with germicide before cleaning.
9. Gloves should always be worn during cleaning and decontaminating procedures
10. Aerosols should not be confused with droplets and splashes. CDC recommends barrier precautions (face shields, masks, gowns, etc.) to prevent contact with droplets and splashes.

13.5 Dengue

13.5.1 Introduction

Dengue (DF) and dengue hemorrhagic fever (DHF) are caused by one of four closely related virus serotypes of the genus *Flavivirus*, maintained in a cycle that involves humans and the *Aedes* mosquito.

Aedes aegypti, a domestic, day-biting mosquito that prefers to feed on humans, is the most common *Aedes* species. It is highly susceptible to dengue virus, is a daytime feeder, has an almost imperceptible bite, and is capable of biting several people in a short period for one blood meal.

The mosquito is well adapted to life in urban settings and typically breeds in clean, stagnant water in containers that collect rainwater, such as tyres, tin cans, pots, and buckets.

13.5.2 Patient's Isolation

Dengue patient need not be nursed in isolation room. However, an air-conditioned or a natural-ventilated room is preferred.

If a natural-ventilated room is used, it is suggested to put mosquito nets to all the windows in the room.

If both facilities are not available, then the patients can be nursed in the general ward. Specific measures to avoid mosquito bites should be considered.

13.5.3 Prevention of vector transmission

1. Source elimination/reduction for Dengue fever

Source elimination or reduction is the method of choice for mosquito control when the mosquito species targeted are concentrated in a small number of discrete habitats.

Among the suggested measures to make sure that there will be no breeding grounds for mosquito in the area are:

- The larval habitats may be destroyed by filling depressions that collect water, by draining swamps, or by ditching marshy areas to remove standing water.
- Container-breeding mosquitoes need to be identified and removed.
- Water in cans, cups, and rain barrels around hospitals should be covered.
- Chemical insecticides can be applied directly to the larval habitats.

Other methods, which are less disruptive to the environment, are usually preferred:

- Oil may be applied to the water surface, suffocating the larvae and pupae. Most oil in use today are rapidly biodegraded.

- Biological control agents include toxins from the bacterium *Bacillus thuringiensis* var. *israelensis* (Bti). These products can be applied in the same way as chemical insecticides. They are very specific, affecting only mosquitoes, black flies, and midges.
- Insect growth regulators such as methoprene. Methoprene is specific to mosquitoes and can be applied in the same way as chemical insecticides.
- Mosquito fish (*Gambusia affinis*) are effective in controlling mosquitoes in larger bodies of water.
- Other potential biological control agents, such as fungi (e.g., *Laegenidium giganteum*) or mermithid nematodes (e.g., *Romanomermis culicivorax*), are less efficient for mosquito control and are not widely used.

2. Avoidance from mosquito bite

Specific measures on the avoidance from mosquito bite should be followed.

Measures that have been described to avoid mosquito bites are:

- **insect repellents** containing N,N-diethyl-3-methylbenzamide (DEET), Adult-dose 95% DEET lasts as long as 10-12 hours, and 35% DEET lasts 4-6 hours. For children, use concentrations of less than 35% DEET. Use sparingly and only on exposed skin. Remove DEET when no longer exposed. (Please refer to PROPER APPLICATION OF REPELLANT).
- **protective clothing** (the most effective is permethrin-impregnated). Avoid mosquitoes by limiting exposure during times of typical blood meals. Wearing long-sleeved clothing may also prevent infection.
- **insecticide-treated bed nets** The usefulness of insecticide-treated bed nets at night is limited since *Aedes* mosquitoes bite during the day.
- **insecticides**- “knockdown resistance” may occur in some locations.
- **Untreated bed nets** form a protective barrier around persons using them. However, mosquitoes can feed on people through the nets, and nets with even a few small holes provide little, if any, protection.
- *Aedes* mosquitoes bite during the day; hence, these measures must be taken during the day, particularly in **the morning and late afternoon**.
- **Fogging or area spraying** is primarily reserved for emergency situations: halting epidemics or rapidly reducing adult mosquito populations when they have become severe pests. Fogging and area sprays must be properly timed to coincide with the time of peak adult activity, because resting mosquitoes are often found in areas that are difficult for the insecticide to reach.

13.6 Malaria

13.6.1 Introduction

Humans are infected with *Plasmodium* protozoa when bitten by an infective female *Anopheles* mosquito vector.

The mosquito larvae develop within a few days, escaping their aquatic environment before it dries out. It is difficult, if not impossible, to predict when and where the breeding sites will form, and to find and treat them before the adults emerge.

13.6.2 Patient's Isolation

Malaria patient need not be nursed in isolation room. However, an air-conditioned or a naturally-ventilated room is preferred.

If a naturally-ventilated room is used, it is suggested to put mosquito nets to all the windows in the room.

If both facilities are not available, then the patients can be nursed in the general ward. Specific measures to avoid mosquito bites should be considered (see under *Prevention of vector transmission*).

13.6.3 Prevention of vector transmission

1. Source elimination/reduction for Malaria fever

Source elimination or reduction is the method of choice for mosquito control (refer to *Source elimination/reduction for Malaria fever*).

2. Avoidance from mosquito bite

Specific measures on the avoidance from mosquito bite should be followed.

Measures that have been described to avoid mosquito bites are:

- **insect repellents** containing N,N-diethyl-3-methylbenzamide (DEET), Adult-dose 95% DEET lasts as long as 10-12 hours, and 35% DEET lasts 4-6 hours. For children, use concentrations of less than 35% DEET. Use sparingly and only on exposed skin. Remove DEET when no longer exposed. (Please refer to PROPER APPLICATION OF REPELLANT).
- **protective clothing** (the most effective is permethrin-impregnated). Avoid mosquitoes by limiting exposure during times of typical blood meals. Wearing long-sleeved clothing may also prevent infection.
- **insecticide-treated bed nets** The use of insecticide-treated bed nets at night is useful as *Anopheles* mosquitoes bite during dawn and dusk.
- **insecticides**- "knockdown resistance" may occur in some locations.

- **Untreated bed nets** form a protective barrier around persons using them. However, mosquitoes can feed on people through the nets, and nets with even a few small holes provide little, if any, protection.

Anopheles mosquitoes bite during the **dusk** and **dawn**; hence, these measures must be taken during the late evening and throughout the night.

- **Fogging or area spraying** is primarily reserved for emergency situations: halting epidemics or rapidly reducing adult mosquito populations when they have become severe pests. Fogging and area sprays must be properly timed to coincide with the time of peak adult activity, because resting mosquitoes are often found in areas that are difficult for the insecticide to reach.

Insecticide-treated bed net

Insecticide-treated bed nets (ITNs) are a form of personal protection that has repeatedly been shown to be useful in preventing Malaria and/or Dengue transmission. ITNs have been shown to reduce all-cause mortality by about 20%.

There are several types of nets available. Nets may vary by size, material, and/or treatment. Most nets are made of polyester but nets are also available in cotton, polyethylene, or polypropylene.

Currently, only **pyrethroid** insecticides are approved for use on ITNs. These insecticides have very low mammalian toxicity but are highly toxic to insects and have a rapid knock-down effect, even at very low doses. Pyrethroids have a high residual effect. They do not rapidly break down unless washed or exposed to sunlight.

To maintain the efficacy of ITNs, the nets must be retreated at intervals of 6-12 months, more frequently if the nets are washed. Retreatment is done by simply dipping nets in a mixture of water and insecticide and allowing the nets to dry in a shady place.

13.6.4 Proper Application Of Repellent

The environmental protection agency has issued guidelines regarding proper repellent application in order to maximize effectiveness and minimize side effects, which are particularly important when using DEET-based repellents:

- Use just enough repellent to lightly cover but not saturate the skin.
- Repellents should be applied to exposed skin, clothing, or both, but not under clothing.
- A thin layer can be applied to the face by dispensing repellent into the palms, rubbing hands together, and then applying to the face.
- Repellent should be removed from the palms after application to prevent contact with the eyes, mouth, and genitals.
- Do not use repellents over cuts, wounds, inflamed, irritated, or eczematous skin.
- Do not inhale aerosols or get them into the eyes.
- Frequent reapplication of repellent is unnecessary.
- The areas treated with repellent should be washed with soap and water once the repellent is no longer needed.

13.7 Fungal Infections

13.7.1 Introduction

- The incidence of fungal infections has increase in recent years as the immunocompromised population increases.
- *Candida* infections are currently the fourth most common cause of bloodstream infections in ICUs and have led to the highest crude mortality rates for patients with bloodstream infections.
- Data from Europe showed that 17% of microbiologically documented infections in ICUs were due to fungi, representing the fourth most common cause of nosocomial bloodstream infections.
- The rate of candidemia in ICU patients has been estimated at 1/1000 patient days, less than half of such infections were caused by *Candida albicans*, and slightly more than half were due to non-*albicans Candida* species.
- Hospital construction and renovation have been associated with an increased risk for nosocomial fungal infection, particularly aspergillosis, among severy immune-compromised patient.
- The nonpathogenic fungi such as *Trichosporon*, *Paeilomyces*, *acromium* species, *Mucormycosis* agents and *Dematiaceous* are increasingly being identified as nosocomial pathogens.

13.7.2 Candida Infection

- Risk factors for systemic fungal infections, particularly *Candida* infections, in ICU patients include neutropenia, long-term central venous catheter access, colonization by *Candida*, exposure to broad-spectrum antibiotics, all forms of vascular catheterization, mechanical ventilation, blood transfusions, hemodialysis, diabetes mellitus, steroid use, immunosuppression, parenteral feeding, and presence of urinary catheters.
- Independent risk factors for *Candida* nosocomial infection in ICU patients include length of previous broad spectrum antibiotic treatment, severity of underlying illness (as measured by APACHE II score), and intensity of *Candida* colonization (as measured by the number of body sites colonized).
- *Candida* infections including candidemia can be transmitted via the hands of healthcare workers, the evidence for cross infections particularly in the ICU's has increased in the literature.
- There is a strong relationship between candida infections and hyperalimentation using intravascular devices.
- Candiduria is especially common in patients receiving prolonged urinary catheterization and broad spectrum antimicrobial agents.

- Isolation of *Candida* from any sterile site should be considered a significant finding in an ICU patient. Heavy colonization places patients at risk for infection and should be used in the decision to treat
- Precise mycologic diagnosis to the species level is helpful in treating patients. Susceptibility testing of candidal isolates may be helpful, although specific drug levels are not usually needed (with the exception, perhaps, of flucytosine).

13.7.3 Aspergillous infection

- *Aspergillus* spp. are ubiquitous, commonly occurring in soil, water and decaying vegetation and can be cultured from the hospital environment (unfiltered air, ventilation systems, dust dislodged during hospital construction, carpeting, food and ornamental plants).
- In healthcare settings it contaminates wet reservoirs e.g. indwelling catheters and can cause serious bloodstream infections.
- Route of acquisition includes inhalation of fungal conidia, ingestion of contaminated food, contamination of adhesive tape or gauze used with intravascular catheters and contamination of patient care items.
- *Aspergillus* species has become a common cause of nosocomial infection in highly immunocompromised patients such as those with hematologic malignancy undergoing bone marrow or solid organ transplantation or corticosteroid therapy.

Outbreaks of nosocomial aspergillosis occur mainly among neutropenic patients (< 500granulocytes per mm³).

- Contaminated air or ventilation systems have been associated with outbreaks of nosocomial aspergillosis.

13.7.4 Infection Control General Precautions

- Proper use of antibiotics and strict protocol for invasive procedures.
- Standard and expanded precautions i.e hand hygiene before and after patient contact. Gown, gloves, and mask are indicated for suspected or proven infections for which Transmission-Based Precautions are recommended.
- Antifungal therapy must be based on yeast identification.
- Remove existing intravascular catheter in patient with candidemia or acute hematogenously disseminated candidiasis. All infected devices should be removed. (refer to catheter related sepsis)
- Tunneled CVCs or implantable devices should be removed as soon as possible in the presence of documented catheter – related fungemia.
- Bone marrow recipients should received anti fungal prophylaxis

13.7.5 Infection Control and Ventilation Requirements for Patients undergoing allogeneic hematopoietic stem cell transplant

- Patients undergoing allogeneic hematopoietic stem cell transplant should remain in a Protective Environment room except for required procedures that cannot be performed in the room, and they should use respiratory protection such as an N95 respirator when leaving the PE
- Protective Environment room must be equipped with ventilation system to maintain ≥ 12 ACH and positive room air pressure (≥ 2.5 Pa [0.01-inch water gauge]) in relation to the corridor
- Maintain airflow patterns and monitor these on a daily basis by using permanently installed visual means of detecting airflow in new or renovated construction, or by using other visual methods (e.g., flutter strips or smoke tubes) in existing PE units. Document the monitoring results
- Minimize exposures of severely immunocompromised patients (e.g., solid-organ transplant patients or allogeneic neutropenic patients) to activities that might cause aerosolization of fungal spores. Avoid carpeting in patient rooms or hallways, upholstered furniture and furnishings, and fresh or dried flowers or potted plants in PE rooms or areas. When vacuum cleaning is needed, the vacuum should be equipped with HEPA filters
- Horizontal surfaces should be wet-dusted daily with cloths moistened with MOH approved hospital disinfectant and detergent. Methods that stir up dust should be avoided.
- Engineering features should include central or point-of-use high-efficiency particulate air (HEPA; 99.97% efficiency) filters that can remove particles $0.3 \mu\text{m}$ in diameter for supply (incoming) air; well-sealed rooms; properly constructed windows, doors, and intake and exhaust ports; smooth ceilings free of fissures, open joints, and crevices; walls sealed above and below the ceiling

13.7.6 Investigation for source of nosocomial fungal infections outbreaks

- If no epidemiologic evidence exists of ongoing transmission of fungal disease, conduct an environmental assessment to find and eliminate the source
- Collect environmental samples from potential sources of airborne fungal spores, preferably by using a high-volume air sampler rather than settle plates
- If either an environmental source of airborne fungi or an engineering problem with filtration or pressure differentials is identified, promptly perform corrective measures to eliminate the source and route of entry
- If an environmental source of airborne fungi is not identified, review infection-control measures, including engineering controls, to identify potential areas for correction or improvement
- If possible, perform molecular sub-typing of *Aspergillus* spp. isolated from patients and the environment to compare their strain identities.

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CASE DEFINITIONS

DEFINITIONS OF NOSOCOMIAL INFECTIONS FIRST EDITION 2002

This document has been adapted from the **CDC Definition of Nosocomial Infections** (Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections. In: Olmsted RN, ed: APIC Infection Control and Applied Epidemiology: Principles and Practice. St. Louis: Mosby; 1996: pp. A-1 to A-20).

Most bacterial nosocomial infections becomes evident 48 hours (i.e., the typical incubation period) or more after admission. However, because the incubation period varies with the type of pathogen, nature of infection and the patient's underlying conditions, each patient must be assessed individually for evidence that links it to the hospitalization.

The diagnosis of a nosocomial infection is based on **a combination of clinical and laboratory findings**.

There are two special situations in which an infection is considered nosocomial:

1. Infection that is acquired in the hospital but does not become evident until after hospital discharge.
2. Infection in a neonate that results from passage through the birth canal.

There are two special situations in which an infection is not considered nosocomial:

1. Infection that is associated with a complication or extension of infection already present on admission, unless a change in pathogen or symptoms strongly suggests the acquisition of a new infection.
2. In an infant an infection that is known or proved to have been acquired transplacentally (e.g., toxoplasmosis, rubella, cytomegalovirus, or syphilis) and becomes evident at or before 48 hours after birth.

The standardize definitions are only for the most common nosocomial infections i.e. urinary tract infection, pneumonia, surgical site infections, blood stream infections and clinical sepsis. For other nosocomial infections record them as OTHERS and briefly describe the nature of the infection as best you can.

More definitions will be included in this document in due course. The following pages contain the criteria to be used for diagnosing the common nosocomial infections. If you are in doubt **PLEASE CONSULT THE ATTENDING DOCTOR OR MICROBIOLOGIST**

INFECTION SITE: Symptomatic urinary tract infection

CODE: UTI

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

Criterion 1:

Patient has at least one of following signs or symptoms with no other recognized cause: fever ($<38^{\circ}\text{C}$), urgency, frequency, dysuria, or suprapubic tenderness and patient has a positive urine culture, that is 10^5 microorganisms per cm^3 or urine with no more than two species of microorganisms.

Criterion 2:

Patient $<$ or $=$ 1 year of age has at least one of the following signs or symptoms with no other recognized cause: fever ($>38^{\circ}\text{C}$) hypothermia ($<37^{\circ}\text{C}$), apnea, bradycardia, dysuria, lethargy or vomiting 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.

COMMENTS:

- A positive culture of a urinary catheter tip is not an acceptable laboratory test to diagnose a urinary tract infection.
- 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 confirmed by a specimen aseptically obtained by catheterization or suprapubic aspiration.

INFECTION SITE: Asymptomatic bacteriuria

CODE: 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 or urine with no more than two species of microorganisms and patient has **no** fever, 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, that is, 10^5 microorganisms per cm^3 of urine microorganisms and no more than two species of microorganisms and patient has no fever, 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)

DEFINITION: A superficial SSI must meet the following criterion:

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 draining 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.
- d. Diagnosis of superficial incisional SSI by the surgeon or attending physician

COMMENTS

- 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.
- 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.

INFECTION SITE: Surgical site infection (Deep incisional)

CODE: SSI-(Soft Tissue)

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

Infection occurs within 30 days after the operative procedure if no implant is left in place or within one 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
- b. A deep incision spontaneously dehisces or is deliberately opened by surgeon when the patient has at least one of the following signs or symptoms: fever ($> 38^{\circ}\text{C}$), or localized pain or tenderness
- c. An abscess or other evidence of infection involving the deep incision is found on direct examination, during re-operation, or by histopathologic or radiologic examination
- d. Diagnosis of a deep incisional SSI by a surgeon or attending physician

INFECTION SITE: Surgical site infection (organ/space)

CODE: SSI-(Specify site of organ/space)

DEFINITION: An organ/space SSI involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure.

Specific sites are assigned to organ/space SSI to further identify the location of the infection.

Listed below are the specific sites that must be used to differentiate organ/space SSI. An example is appendectomy with subsequent subdiaphragmatic abscess, which would be reported as an organ/space SSI at the intra-abdominal specific site (SSI-Intra-abdominal).

Appendix A

An organ/space SSI must meet the following criterion:

Infection occurs within 30 days after the operative procedure If no implant is left in place or within one year if implant is in place and the infection appears to be related to the operative procedure and infection involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure and patient has at least one of the following:

- a. Purulent drainage from a drain that is placed through a stab wound into the organ/space
- b. Organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space.
- c. An abscess or other evidence of infection involving the organ/space that is found on direct examination, during re-operation, or by histopathologic or radiologic examination
- d. Diagnosis of an organ/space SSI by a surgeon or attending physician

COMMENTS

- Occasionally an organ/space infection drains through the incision. Such infection generally does not involve re-operative and is considered a complication of the incision. Therefore, it is classified as a deep incisional SSI.

The following are specific sites of an organ/space SSI:

Osteomyelitis
Breast abscess or mastitis
Myocarditis or pericarditis
Disc space
Ear, mastoid
Endometritis
Endocarditis
Eye, other than conjunctivitis
Intraabdominal
Intracranial, brain abscess or dura
Joint or bursa
Mediastinitis
Meningitis or ventriculitis
Oral cavity (mouth, tongue, or gums)
Other male or female re-productive
Other infections of the urinary tract
Spinal abscess without meningitis
Sinusitis
Upper respiratory tract, pharyngitis
Arterial or venous infection
Vaginal cuff

INFECTION SITE: Pneumonia

CODE: PNEU

DEFINITION: Pneumonia must meet at least one of the following criteria:

Criterion 1:

Patient has rales or dullness to percussion on physical examination of the chest and at least one of the following:

- a. New onset of purulent sputum or change in character of sputum
- b. Organisms cultured from blood
- c. Isolation of an etiologic agent from a specimen obtained by tracheal aspirate, bronchial, brushing, bronchoscopy specimen or biopsy.

Criterion 2:

Patient has a chest radiographic examination that shows new or progressive infiltrate, consolidation, cavitation or pleural effusion and at least one of the following:

- a. New onset of purulent sputum or change in character of sputum
- b. Organisms cultured from blood
- c. Isolation of an etiologic agent from a specimen obtained by tracheal aspirate, bronchial brushing, bronchoscopy specimens or biopsy.

Criterion 3:

Patient < or = 1 year of age has at least two of the following signs or symptoms: apnea, tachypnea, bradycardia, wheezing, rhonchi or cough and at least one of the following:

- a. Increased production of respiratory secretions
- b. New onset of purulent sputum or change in character of sputum
- c. Organisms cultured from blood
- d. Isolation of an etiologic agent from a specimen obtained by tracheal aspirate, bronchial brushing, bronchoscopy specimen or biopsy.

COMMENTS:

- Expecterated **sputum cultured are not useful in the diagnosis of pneumonia** but may help identify the etiologic agent and provide useful antimicrobial susceptibility data.
- Findings from serial chest x-rays may be more helpful than a single x-ray.

INFECTION SITE: Laboratory-confirmed bloodstream infection

CODE: BSI

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, chills, or hypotension and at least one of the following:

- a. Common skin contaminant (e.g., diphtheroids, *Bacillus* sp., *Propionibacterium* sp., coagulase-negative staphylococci, or micrococci) is cultured from two or more blood cultures drawn on separate occasions.
- b. Common skin contaminant (e.g., diphtheroids, *Bacillus* sp., *Propionibacterium* sp., coagulase-negative staphylococci, or micrococci) is cultured from at least one blood culture from a **peripheral specimen** of a patient with an intravascular line, and the physician institutes appropriate antimicrobial therapy and signs and symptoms and positive laboratory results are not related to an infection at another site.

Criterion 3:

Patient < or = 1 year of age has at least one of the following signs or symptoms: fever (>38°C), hypothermia (<37°C), apnea or bradycardia and at least one of the following:

- a. Common skin contaminant (e.g., diphtheroids, *Bacillus* sp., *Propionibacterium* sp., coagulase-negative staphylococci, or micrococci) is cultured from two or more blood cultures drawn on separate occasions

Appendix A

- b. Common skin contaminant (e.g., diphtheroids, *Bacillus* sp., *Propionibacterium* sp., coagulase-negative staphylococci, or micrococci) is cultured from at least one blood culture from a **peripheral specimen** of a patient with an intravascular line, and physician institutes appropriate antimicrobial therapy and signs and symptoms and positive laboratory results are not related to an infection at another site.

INFECTION SITE: Clinical sepsis

CODE: 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, hypotension (systolic pressure <90mm), or oliguria (<20 cm³/hr) and blood culture not done or no organisms detected in blood and no apparent infection at another site and physician institutes treatment for sepsis.

Criterion 2:

Patient < or = 1 year of age has at least one of the following clinical signs or symptoms with no other recognized cause: fever (>38°C), hypothermia (<37°C) apnea or bradycardia and blood culture not done or no organisms detected in blood and no apparent infection at another site and physician institutes treatment for sepsis

INFECTION SITE: Others

CODE: OTHERS (Describe the best you can the nature of the infection. Consult the doctor or microbiologist if in doubt)

KKM/NI/2007/1

CASE INFORMATION FORMAT

(Please complete separate form for each nosocomial infection case detected. Note that one patient may have more than one nosocomial infection)

(Tick (√) in the appropriate boxes)

Hospital:..... Ward: Dept/Unit:..... R/N:.....

Patient Name: I/C New):.....

Age Sex:..... Race:..... Date of Admission:

Clinical Diagnosis on Admission:.....

Date of Nosocomial Infection Detected:.....

Antibiotic Treatment: 1.....

2.....

3.....

4.....

A. TYPES OF NOSOCOMIAL INFECTIONS:

(refer to specific"case definitions")

1. Urinary tract infection ☐

2. Pneumonia ☐

3. Surgical Wound Infection (For surgical wound infections, tick one of the boxes)

Superficial surgical site infection (SSI) ☐

Deep incisional wound SSI ☐

Organ / space SSI ☐

4. Bacterimia ☐

5. Clinical Sepsis ☐

6. Others (Specify :.....) ☐

Appendix B

B. MICROBIOLOGY REPORT (Include only the positive cultures relevant to NI)

No	Date Specimen Sent	Date of Lab Result Received	Type of Specimen	Organism(s) Isolated

C. DEVICES USED BEFORE THE ONSET OF NOSOCOMIAL INFECTION

		Date inserted
1. Indwelling urinary catheter	☐	
2. Mechanical ventilator	☐	
3. Tracheostomy	☐	
4. Central venous catheter	☐	
5. Arterial Lines	☐	
6. Peripheral venous line	☐	
7. Other drainage catheters	☐	
e.g EVD, Chest tube, etc (Please Specify)		

D. GENERAL PREDISPOSING RISK FACTORS

1. Underlying disease	☐	(Specify :)
2. Immunosuppressive therapy	☐	(Specify :)
3. Prolonged hospitalization > 2/52	☐	
4. Prematurity / Low Birth Weight	☐	
5. Others	☐	(Specify :)

Name of person completing the form:_____

Date:_____

Signature:_____

Appendix B

[illegible]

	NO	RN no.	Microbiologic Report		Possible contributing factors										
			Date of specimen send	Date of Lab Report Received	Type of specimen				Organism Isolated	Underlying disease	Immunosupp. therapy	Prolong hospitalisation	Invasive procedures	Prematurity/ LBW	
					Blood										
					sputum										
					urine										
					pus/discharge										
					local swabs										
					CSF										
					Others										
											</				

Measures To Control Nosocomial Infection Outbreak In NICU

In the event of an outbreak of MRSA or Multiresistant organism infection (MRO) in the NICU, the following measures will be enforced:

1. NICU will be closed for outborn referral until the outbreak is under control.
2. Nurses taking care of patient with MRSA / MRO infection, should not be taking care of patients who are not infected at the same time.
3. Where it is not possible to place the patient(s) in isolation, patients with multiresistant infections should be cohorted to the same cubicle as far as possible to prevent cross transmission.
4. Patients without infection but in close proximity to infected infants to be kept in a separate cohort from new admissions, if space permits.
5. Antibiotic policy to be reviewed if necessary according to the sensitivities of the organisms involved.
6. Microbiology department to be alerted to help determine source of outbreak and to provide timely information of cultures sent from the ward.
7. Infection control policies to be reinforced to all staff.
 - a. Hand washing with antimicrobial liquid soap before and after handling patients is to be strictly reinforced. Wash hands immediately after handling the patients, before touching the patient records or X –ray. All staff will be reminded about the proper technique of handwashing.
 - b. Hibitane 70% alcohol hand rub will be made available at every patient's bedside and can be used as an alternative.
 - c. Masks and plastic aprons and are to be used whenever handling patients with multiresistant organism especially whenever there is risk of exposure to body secretions. These should be discarded after use with each patient.
 - d. Stethoscopes are not to be shared between patients and should be wiped with alcohol swab after each use. They should be hung up immediately after use, away from TPN bags or enteral bags and not be left on patients' bed or on writing table.
8. Bed linens are to be change at least twice daily or more frequently when soiled with body secretions.
9. Environment service staff is to look into the cleaning and housekeeping procedures, especially about the leaks from the air-conditioner.
10. Relatives are to be taught how to wash their hand before and after touching the patient.
11. Screening: While screening for MRSA is not done routinely, during an MRSA outbreak every NICU patient and staff should be screened for MRSA colonisation.

12. Transfer out of MRSA / MRO patients to other wards :

- a. The ward staff should be informed about the multi-resistant organism infection so that preparation can be made for isolation.
- b. Infection control nurse should be informed.

13. Terminal cleaning of segregation area.

- a. When segregation area becomes vacant, thorough cleaning of surfaces, floors and walls should be carried out using a detergent (eg. Savonna) by environment service staff.
- b. After use by an infected patient, incubator/ cot and ventilator are taken to the general cleaning area. Equipment used by infected patients should be cleaned last. Bacterial filters from incubator and ventilators are to be changed. Terminal cleaning to be done before use of equipment by another patient.

Table 1: Methods for cleaning and disinfection in the NICU

Item	Method of cleaning and disinfection				
	Detergent and water followed by drying	Alcohol	Hypochlorite	Hot machine wash	CSSD
General ward areas	Yes				
Sinks and dispenser	Yes				
Cotside equipment		Yes			
Mobile equipment		Yes			
Incubator (Change weekly)		Yes			
Scanner Heads	Use disinfection as recommended by the manufacturer				
Baby clothes				Yes	
Suctions jars					Yes
Body fluid spillage			Yes		
Terminal disinfection			Yes		

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