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MINISTRY OF HEALTH**

National Policy and Guidelines for Infection Prevention and Control in Health Care Settings

Ministry of Health, Ghana
2015

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Preface

Infection prevention and control refers to measures aimed at preventing and controlling infections and transmission of infections in health care settings. Such infections may be pre-existing on admission or may be acquired in health care settings (nosocomial infections).

This updated policy and guidelines document on infection prevention and control (IPC) of the Ministry of Health responds to the heightened concerns about inappropriate IPC practices in health care settings in the country.

This document lays down the policies and broad guidelines required for the practice of a nationally acceptable standard of IPC in health care settings.

I am confident that this document will be valuable for improving the quality of services, not only because it was developed after extensive review of relevant literature and consultation with experts, professional groupings, and other stakeholders, but also because its contents are realistic, practical, and designed to meet local needs.

I recommend that it be used as a reference document for the planning and establishment of IPC systems in order to promote good and safe practices.

A handwritten signature in black ink, appearing to be 'K. A. A.', with a long horizontal stroke extending to the right.

The Minister for Health, Ghana

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Acronyms

AIDS	Acquired Immune Deficiency Syndrome
ARDs	Acute Respiratory Diseases
CBOs	Community Based Organisations
CC	Comprehensive Care
CDC	Centres for Disease Control and Prevention
CHOs	Community Health officers
CSSD	Central Sterile Supply Department
EOH	Environmental and Occupational Health
GHS	Ghana Health Service
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HCWs	Health Care Workers
HDV	Hepatitis D Virus
HIV	Human Immunodeficiency Virus
HLD	High Level Disinfection
HPV	Human Papilloma Virus
ICD	Institutional Care Division
ICU	Intensive Care Unit
IPC	Infection Prevention and Control
IPCN	Infection Prevention and Control Nurse
IV	Intravenous
LI	Legislative Instrument
MDR-TB	Multidrug-resistant TB
MOH	Ministry of Health
MRSA	Methicillin-resistant Staphylococcus aureus
NRCD	National Redemption Council Decree
NGOs	Non-Governmental Organisations
NHIA	National Health Insurance Authority
NIPCP	National Infection Prevention and Control Programme
NTC	National Technical Committee
OPD	Outpatients Department
PCR	Polymerase Chain Reaction
PEP	Post-exposure Prophylaxis
PLHIV	People Living with HIV
PPE	Personal Protective Equipment
QA	Quality Assurance
QHP	Quality Health Partners
SARS	Severe Acute Respiratory Syndrome
SSI	Surgical Site Infection
STI	Sexually Transmitted Infection
TB	Tuberculosis
TBP	Transmission Based Precautions
TOTs	Trainer of Trainers
UTI	Urinary Tract Infection
VHF	Viral Haemorrhagic Fever
WHO	World Health Organisation
XDR-TB	Extensively Drug-resistant TB

Definitions

Asepsis	Literally means “without microorganisms.”
Aseptic technique	Practices that help reduce the risk of post-procedure infections in patients/clients by decreasing the chances for microorganisms to enter the body during clinical procedures. It also reduces a service provider’s risk of exposure to potentially infectious blood, blood products, other body fluids, and tissues during clinical procedures.
Decontamination	A process that involves the removal or destruction of most microorganisms to render a surface or object safe to handle.
Disinfection	The use of chemical or physical agents to eliminate virtually all disease-causing microorganisms, but not bacterial spores, on objects and surfaces to a level that is normally harmless.
Detergents	(Liquid or powder) are composed of a hydrophilic (water-seeking) and a lipophilic (fat-seeking) component. There are four types of detergents: anionic, cationic, amphoteric, and non-ionic detergents.
Health care facility	Any of the categories of hospitals, clinics, health centres, CHPS compounds, residential nursing home/care settings, outreaches, emergency services, dental units, and all other health care service delivery points.
High-level disinfection	A procedure that kills all microorganisms except bacterial spores through a process of boiling, steaming, or using acids (e.g., peracetic acids) and halogens (e.g., chlorine).
Intermediate-level disinfection	This level of disinfection kills mycobacteria and most viruses and bacteria through a process of boiling for about 10 minutes, using alcohols (70%), and bleach (0.1%) for about 10 minutes.
Isolation	A process for separating patients with certain communicable diseases (source) from uninfected persons, and for separating immuno-compromised patients from others (preventive).
Low-level disinfection	This level of disinfection kills some viruses and bacteria, but not mycobacteria, through the use of agents such as Cetrimide, Savlon, and soap (liquid or cake), or bleach (0.01%) for about 10 minutes.
Nosocomial infections	These are also called health care-associated infections or hospital-acquired infections. A nosocomial infection is not present or incubating at the time a patient comes to the health care facility
Sterilisation	The destruction of all microorganisms, including bacterial spores. Sterilisation is achieved principally by autoclaving.
Standard precautions	These work practices are required for basic level IPC, and are based on the principle that all blood, body fluids, secretions, excretions, non-intact skin, and mucous membranes may contain transmissible infectious agents

Foreward

The Government of Ghana, through the Ministry of Health, has as one of its goals to improve the quality of health care. The Ministry of Health's review of the 2009 Policy and Guidelines document on infection prevention and control (IPC) is in line with that goal.

Infection prevention and control practices are a multidisciplinary endeavour and require compliance by all categories and levels of staff. Such compliance is obligatory for preventing and controlling health care-associated infections and other infections in health care settings as well as in the community. The Ministry of Health deems it mandatory for all health care personnel to become aware of this document and to diligently implement its policies and guidelines in order to minimize and control the occurrence of infection, thereby improving the overall quality of health care delivery to the population.

The following are strategies to guide the use of the document:

1. The Policy and Guidelines will be disseminated to all health care settings.
2. The Ministry of Health will support the development and implementation of training programmes for all categories and levels of staff, based on the document. Training of Trainers is to be considered a first step in the launch of the training programme.
3. The Institutional Care Division (ICD) of Ghana Health Service (GHS) is responsible for the implementation, monitoring, evaluation, and update of the Policy and Guidelines on behalf of the Ministry of Health.
4. The Head of each health care facility will initiate the dissemination of the Policy and Guidelines and will follow up the required initiatives in the health care facilities.

The Policy and Guidelines are very comprehensive, simple to follow, and appropriate for use by all disciplines.

The Policy

Section 1: Introduction

An effective Infection Prevention and Control (IPC) programme is fundamental to the quality of health care because it carries the potential benefit of reducing the disease burden on patients, health institutions, and the nation as a whole. In the last two decades, health care-associated infections have been recognised as a significant problem in terms of quality of care and cost to patients/clients, health care facilities, and governments. Consequently, many health care organisations are taking steps to improve the prevention and control of these infections.

Over the years, several initiatives have been carried out in the health sector to promote a safe environment and efficient and effective IPC practices in health care settings. These initiatives include the development of procedure manuals, guidelines, and other training materials; and training programmes in various aspects of health care. Despite these efforts, a 2005 baseline assessment document of the Institutional Care Division (ICD) on IPC provided discouraging evidence of compliance with IPC guidelines by health personnel. This was evident in modes of disinfection and sterilisation in health care settings, practices regarding cleaning, health care waste management, and other aseptic procedures. Similarly, knowledge of and skills in IPC are inadequate among health personnel.

The first edition of the national IPC Policy and Guidelines to streamline safety measures was developed in 2003. The document was reviewed in 2009. The major challenges to the implementation of both documents were inadequate dissemination and a lack of concerted effort to support its implementation. The documents also had some deficiencies—for instance, in the area of emerging diseases—hence a review was needed.

The IPC Policy and Guidelines are based on research findings and recommendations from experts, as well as professional judgement. Where necessary, these have been modified to meet local requirements. This document is more comprehensive, addresses emerging issues in IPC, and is directed to all private and public health care settings, clients, and communities in Ghana.

1.1 Policy Statement

The policy and guidelines shall ensure excellence in client-centred care and maximize protection against infections for all categories of health staff, patients/clients, and communities. The Ministry of Health (MOH) shall ensure that comprehensive IPC systems are developed and maintained at all levels within the health care delivery system.

1.2 Purpose of the Policy

The primary purpose of the IPC Policy and Guidelines is to give direction to health care personnel and clients in preventing and controlling infections within health care settings in order to ensure patient safety and the protection of health workers.

1.3 Objectives of the Document

The document's objectives are to:

- Define the policy framework within which IPC measures shall be practised by all health workers in all health care facilities and service delivery points
- Provide acceptable standards for the practice of IPC
- Outline strategies that shall make IPC practices routine in all aspects of health care

1.4 Guiding Principles

The guiding principles of IPC in Ghana shall be:

- Safety
- Client-centred care
- Cost-effectiveness
- Efficiency
- Teamwork
- Standardisation
- Sustainability

1.5 Scope of Application

This policy and guidelines shall be applied in all health care facilities and service delivery points (both curative and preventive) in Ghana.

1.6 Distribution

The Infection Prevention and Control Policy and Guidelines shall be distributed to all health care facilities (public, faith-based, and private), education/training institutions for the educational preparation of all health care workers, and regulatory bodies (Allied Health Professions, Dental, Medicine, Nursing), as well as to identifiable patient groups.

1.7 Regulatory and Policy Framework

Development and implementation of this policy and guidelines have relevance for the following Laws/Acts/Policies and their associated regulations:

- The 1992 Constitution of the Republic of Ghana
- Act 525 (1996)
- Factories, offices and Shops Act, 1970
- HIV/AIDS Workplace Policy, 2004
- Labour Act, 2003
- Medical and Dental Decree, 1972 (NRCD 91)
- National Health Insurance Act 650, 2003
- National Health Policy, 2007
- Occupational Safety and Health Convention, 1981 (No. 155)
- Health professions and regulatory bodies Act, 2013 (Act 857)
- The Ghana Health Service Code of Ethics, 2002
- The Criminal Code, 1960 (Act 29)
- The Ghana Health Service and Teaching Hospitals Act, 1996 (Act 525)
- The National HIV/AIDS and STI Policy, 2004
- The Ghana Health Service Patients' Charter, 2002
- Workmen's Compensation Law, 1987
- All other closely affiliated Acts and Laws

1.8 Non-Compliance

Failure to comply with the IPC policies and guidelines may result in:

- Increased morbidity and mortality
- Litigation against the Ministry of Health, the health care facility, or the individual health worker for damages suffered by patients and/or their families
- Disciplinary action by professional councils or regulatory bodies against individuals in cases where their proven negligence caused harm to patients
- Loss of public confidence in the health institution in question
- Loss of revenue
- Non-accreditation by the National Health Insurance Authority

Section 2: IPC Governance, Organisation, and Management

The Infection Prevention and Control (IPC) programme shall be an integral part of any health service delivery system in Ghana. As much as possible, existing structures within the health sector (formal and informal) shall be used for effective implementation of the IPC programme within the health sector.

2.1 National Level

At the national level, the MOH shall have ultimate responsibility and authority for ensuring the availability and use of infection prevention and control policies and guidelines. There shall be a national IPC programme called the National Infection Prevention and Control Programme (NIPCP), with a management unit and a designated programme manager located in the Institutional Care Division of the Ghana Health Service. A technical committee, the National Infection Prevention and Control Technical Committee, hereafter referred to as the National Technical Committee (NTC), shall support and advise the programme management unit.

The roles and responsibilities of the programme management unit shall be to:

- Formulate policies, strategies, and set standards for IPC
- Provide technical support to IPC teams in their respective regions
- Advise the MOH on issues relating to IPC
- Ensure that standards are adhered to in designing and constructing health facilities
- Liaise with the procurement unit and end users in purchasing equipment and supplies for IPC
- Liaise with the Human Resource Directorate on training programmes for IPC
- Provide information, education, and communication on IPC
- Monitor and evaluate the implementation of IPC activities at all levels of service delivery
- Conduct and coordinate research relevant to IPC
- Ensure that health care facilities budget for IPC in their annual plans
- Play advocacy and resource mobilisation roles for IPC activities
- Perform any other functions related to IPC

Membership of the NTC shall include:

- Medical Microbiologist
- Clinician
- Public Health Specialist
- Senior Nurse with expertise in IPC
- Biomedical Engineer
- Mechanical Engineer/Architect
- Pharmacist
- IPC Programme Manager
- Representative from the Human Resources Directorate
- Representatives from Teaching Hospitals and other MOH agencies
- Other members co-opted as and when required

2.2 Regional and District Health Administration Levels

At the Regional level, the Deputy Director-Clinical Care shall oversee the implementation of the IPC programme and designate a focal person in consultation with the Regional Director of the Health Service. At the District level, the Medical Superintendent of the District Hospital shall be responsible for implementation of IPC and shall designate a focal person in consultation with the District Director of the Health Service. The focal persons shall work with an IPC team at the Regional and District levels in implementing the IPC programme.

Representatives from the Quality Assurance (QA), HIV, and TB management teams and all other relevant groups shall constitute part of the IPC implementation team.

The team shall:

- Ensure the implementation of IPC programmes and policies
- Provide technical support to IPC teams in their respective region and districts
- Collaborate with regional and district training units on IPC training programmes
- Conduct research
- Monitor and evaluate IPC activities at the Regional and District levels
- Disseminate information on IPC programmes
- Advise on procurement of equipment and consumables for IPC
- Encourage health care facilities to budget for IPC in their annual plans
- Play advocacy and resource mobilisation roles for IPC activities
- Perform any other function(s) related to IPC

Membership of the team shall include:

- IPC focal person
- Biomedical Engineer/Equipment Technologist
- Biomedical scientist
- Clinician/Medical officer
- Disease Control officer
- Health Services Administrator
- HIV and TB programme coordinators
- Nurse with expertise in IPC
- Pharmacist
- Public Health Practitioner
- Other members that may be co-opted

2.3 Hospitals

Facility-based infection prevention and control programmes shall be integrated with other relevant programmes such as Quality Assurance, Environmental and Occupational Health, the TB and HIV programmes, Comprehensive Care, and Communicable Disease Control.

The Heads of hospitals shall be responsible for IPC and shall establish committees for IPC. The QA, HIV, and TB coordinators shall be members of the IPC committee, which shall ensure the implementation of IPC policies and strategies in the facility.

The roles and responsibilities of the committee shall be to:

- Ensure the implementation of policies on IPC
- Advise on procurement of equipment and consumables for IPC
- Ensure the maintenance of IPC equipment
- Monitor, supervise, and evaluate IPC activities
- Liaise with in-service training coordinators on training programme(s) in IPC at the facility
- Provide advice on IPC and related matters
- Disseminate information on IPC
- Play roles in advocacy and resource mobilisation for IPC activities
- Encourage the health care facility to budget for IPC in its annual plans
- Perform any other functions related to IPC

Membership of the committee shall include the following:

- Medical Superintendent/Head of hospital or representative
- Health Service Administrator
- Biomedical Scientist
- Representative of Nurses
- Public Health Practitioner/Disease Control Officer
- Infection Prevention and Control Nurse
- Infection Prevention and Control Coordinator
- Pharmacist
- Biomedical Engineer/Equipment Technologist
- Environmental Health Officer
- Head of Catering Services
- Other members that may be co-opted as necessary

NB: The Infection Prevention and Control Coordinator and the Infection Prevention and Control Nurse shall form a team to oversee the day-to-day activities of IPC. The IPC nurse shall be full-time or have dedicated time to carry out IPC activities. The World Health Organization (WHO) recommends that there should be a full-time IPC nurse to oversee every 250 beds in a health facility.

Infection Prevention and Control Team

The IPC coordinator shall be a microbiologist or medically qualified person, or a senior health professional with knowledge and interest in IPC, who can advise on all aspects of infection prevention and control.

A Nurse trained in IPC shall be nominated as the IPC Nurse (IPCN). The nurse shall work closely with the IPC coordinator.

The roles and responsibilities of the team shall be to:

- Ensure the implementation of policies by educating health staff in the facility
- Coordinate IPC activities among clinical and non-clinical staff in the facility
- Advise on all aspects of IPC activities at the hospital
- Educate and ensure the day-to-day implementation of IPC policies on the wards and units

- Provide suggestions on changes in practices and ward procedures on IPC and related matters
- Collect and collate data on surveillance of infections for documentation
- Play an advocacy role for IPC
- Initiate research activities
- Perform any other IPC-related activity

2.4 Polyclinics, Clinics, and Health Centres

The management teams of Polyclinics, Clinics, and Health Centres shall be responsible for IPC and shall establish a team for IPC. The Quality Assurance and the IPC teams shall liaise with the facility management team to oversee the establishment and implementation of IPC programmes.

The roles and responsibilities of the team shall be to:

- Ensure the implementation of policies on IPC
- Advise on procuring equipment and consumables for IPC
- Ensure the maintenance of IPC equipment
- Monitor, supervise, and evaluate IPC activities
- Liaise with district in-service training coordinators on training programme(s) in IPC at the facility
- Provide advice on IPC and related matters
- Disseminate information on IPC
- Perform any other functions related to IPC

Membership of the team shall include the following:

- Head of the facility
- IPC focal person, preferably a nurse or midwife
- Disease control officer

2.5 Community Level

Community representatives – Community Volunteers, Non-Governmental Organisations (NGOs), and Community-Based Organisations (CBOs) – have roles to play in IPC. The Community Health officer (CHO) shall be in charge of IPC activities under supervision of the Sub-district Head.

2.6 Relationship Between IPC and QA Programmes

Infection prevention and control policies and guidelines have a great impact on all aspects of patient care. IPC measures should be in congruence with QA standards. The IPC officer or Nurse should serve as a member on the QA Committee, assisting with the definition of IPC standards. He/she shall conduct and report monitoring/surveillance activities and outcomes related to nosocomial and other infection rates, adherence with IPC practices, and employees' health and safety.

2.7 Purchasing and Introducing IPC Equipment and Logistics

The IPC focal person shall be consulted in the procurement of IPC equipment and consumables. Other equipment and patient care articles for IPC shall be purchased in consultation with experts at the Biomedical Engineering Unit.

2.8 Financial Responsibilities for Managing Nosocomial Infections

If an infection is proven to be a health care-associated infection, the health care facility shall provide support for the care of the patient. Health care facilities shall make arrangements to ensure the availability of funds to provide for such situations.

2.9 Partnerships

The MOH should facilitate the establishment of strong partnerships with government departments and other stakeholders. Public-Private Partnerships with all key stakeholders should be encouraged.

2.10 Research

Periodic studies should be conducted at all levels of health care delivery to determine the status of implementation of practices, skills, and knowledge on IPC and the effectiveness of the monitoring and evaluation systems. The MOH research agenda shall include priority areas on IPC. The outcome of these studies should determine priorities to be addressed by the national, regional, and district IPC structures.

2.11 Monitoring and Evaluation of the Programme

At the national level, the MOH, in collaboration with other relevant stakeholders, shall develop a general framework for monitoring IPC. A national surveillance system for health care-associated infections shall also be developed. At the minimum, the surveillance system shall generate data on health care-associated infections and antibiotic-resistant organisms. Regular audits in health care facilities should include health care-associated infections. The relevant IPC structures in each region and health care facility shall be responsible for monitoring the implementation of the policy.

2.12 Evaluation and Policy Review

2.12a. This policy is subject to review every five years.

2.12b. Despite 2.12a, mid-term evaluation is encouraged.

2.13 Human Resource Development for Infection Prevention and Control

To enable appropriate human resource development for IPC, there shall be continuous education and training on IPC for all categories of health care staff in the health sector. Training shall be designed to meet the needs of the different categories of health staff and shall be done through:

- Pre-service: the MOH shall ensure that health training institutions, the Statutory Bodies, and other agencies regularly develop and/or update their curriculum on IPC.
- In-service training: IPC shall be included in the structured in-service training programme of all facilities.
- Post-basic: the MOH shall liaise with post-basic health training institutions to develop specialty programmes in IPC.
- Health personnel will also be encouraged to specialise in IPC.

In addition, the MOH shall:

- Develop training and learning materials such as flyers, brochures, and posters on IPC for all categories of health workers
- Train a pool of health workers to champion the implementation of IPC at the various levels of service delivery
- Ensure that all new staff and students on attachment undergo orientation on IPC practices when they are recruited into the Service (refer to Appendix 1 for proposed content of orientation programmes)
- Ensure that educational programmes are organised for staff and patients/clients to sensitize and create awareness on IPC issues
- Identify health care facilities and set them up as centres of excellence for IPC

2.14 Staff Dressing or Uniform

To ensure effective infection prevention and control and also protect the community:

- Staff shall change their street clothes or uniform on arrival at the health facility.
- Scrub suits shall be provided for all staff.
- All staff shall wear scrub suits while at work in the health facility.

Section 3: Implementing Infection Prevention Control (IPC)

An IPC programme is a set of coordinated activities that seek to prevent or minimise the risk of infections among health care workers, patients, visitors, and communities in health care settings. The principal activities of Infection Prevention and Control programme include but are not limited to:

- Ensuring the practice of basic IPC measures such as standard and expanded precautions
- Educating and training health care workers
- Educating patients and their relatives on IPC related to their condition
- Protecting health care workers, e.g., medical screening and immunization
- Identifying hazards and minimizing risks
- Routine practices such as aseptic techniques in clinical procedures
- Rational use of antibiotics
- Effective work practices and procedures, such as environmental management practices including management of hospital/clinical waste, support services (e.g., food, linens) and use of therapeutic devices
- Surveillance
- Incident monitoring and investigation
- Outbreak investigation
- Infection prevention and control in specific situations
- Advocacy, communication, social, and resource mobilisation
- Research

In addition to implementing basic measures for IPC, all health care facilities should prioritize their infection prevention and control needs and design their programmes accordingly.

Section 4: Epidemiology

Comprehension of the infectious disease process is necessary for understanding the spread of infections in health care facilities. The spread of infection requires three elements: a source of infecting organisms, a susceptible host, and a means of transmission for the microorganism.

4.1 Source of Infections

The source of the infecting agent may be patients, staff, or visitors. It may include persons with the active disease, those in the incubation period of the disease, or those who are colonized by the infectious agent but have no apparent disease (carriers).

Other sources of infecting microorganisms can be the patient's own endogenous flora (autogenous infection), which may be difficult to control, and inanimate environmental objects that have become contaminated, including equipment and medications.

4.2 Susceptible Host

The susceptible host is the second element in the spread of infection. Persons lacking effective resistance to particular microorganisms are susceptible to those microorganisms.

Patients' resistance to pathogenic microorganisms varies greatly. Some persons may be immune or resistant to colonization by an infectious agent, others exposed to the same agent may establish a commensal relationship with the infecting microorganism and become asymptomatic carriers, and still others may develop clinical disease.

Host features such as age; underlying diseases such as diabetes; certain treatments with antimicrobials, corticosteroids, or other immunosuppressive agents; irradiation; and breaks in the first line of defence mechanisms caused by such factors as surgical operations, anaesthesia, and indwelling catheters may render patients more susceptible to infection.

4.3 Mode of Transmission

Microorganisms are transmitted in health care facilities by several routes, and the same microorganism may be transmitted by more than one route. The five main modes of transmission are:

1. Contact
2. Droplet
3. Airborne
4. Common vehicle
5. Vector-borne

4.3.1 Contact transmission

This is the most important and most frequent mode of transmission of nosocomial infection. It is divided into two sub-groups: direct-contact transmission and indirect-contact transmission.

- a. Direct-contact transmission involves direct contact between body surface and body surface, and physical transfer of microorganisms between a susceptible host and an infected or colonized person. Such contact occurs when a person turns a patient, gives a patient a bath, or performs other patient-care activities that require direct personal contact. Direct transmission can also occur between two patients, with one being the source of the infectious microorganisms and the other a susceptible host.
- b. Indirect-contact transmission involves contact of a susceptible host with a contaminated intermediate object, usually inanimate, such as contaminated instruments, needles, or dressings, or contaminated hands that are not washed and gloves that are not changed between patients.

4.3.2 Droplet transmission

Droplets are generated from the source person primarily during coughing, sneezing, and talking during the performance of certain procedures such as suctioning and bronchoscopy.

Transmission occurs when droplets containing microorganisms generated from the infected person are propelled a short distance through the air and deposited on the host's conjunctivae, nasal mucosa, or mouth. For transmission to occur, the source and the susceptible host need to be within approximately 1 metre (3 feet) of one another.

4.3.3 Airborne transmission

Airborne transmission occurs by dissemination of either airborne droplet nuclei (small particle residue) of evaporated droplets containing microorganisms, which remain suspended in the air for long periods of time, or dust particles containing the infectious agent. Microorganisms carried in this manner can be dispersed widely by air currents and may be inhaled by a susceptible host within the same room or a long distance from the source patient, depending on environmental factors.

Microorganisms transmitted by airborne transmission include *Mycobacterium tuberculosis*, rubella virus, and varicella virus.

Airborne transmission is the most difficult type to control, as it requires control of air flow through special ventilation systems.

4.3.4 Common vehicle transmission

Common vehicle transmission applies to microorganisms transmitted by contaminated items such as:

- Foods—e.g., salmonellosis
- Water—e.g., shigellosis
- Medications/intravenous solutions
- Blood—e.g., hepatitis B, C, HIV
- Equipment and devices

These items can transmit infection to multiple hosts. Such transmission may result in an explosive outbreak.

4.3.5 Vector-borne transmission

Vector borne transmission refers to transmission by insects and vermin, and is prevented by appropriate health care facility construction and maintenance, closed or screened windows, and proper housekeeping.

Vector-borne transmission occurs when vectors such as mosquitoes, flies, rats, and other vermin transmit microorganisms.

Technical Guidelines

Section 5: Standard Precautions and Expanded or Additional Precautions

Standard Precautions are work practices required for basic level IPC, and are based on the principle that all blood, body fluids, secretions, excretions including sweat, non-intact skin and mucous membranes may contain transmissible infectious agents.

5.1 Standard Precautions

Standard Precautions shall be applied during all patient-health care worker interactions that are likely to involve exposure to blood, body fluids, and pathogens. Standard Precautions are recommended for the treatment and care of all patients/clients irrespective of their perceived infectious status. The components of Standard Precautions are:

1. Hand hygiene
2. Appropriate use and removal of personal protective equipment (PPE): gloves, gowns/plastic aprons, masks, goggles, face shields, eye protectors, etc.
3. Proper patient placement, staff allocation, visitors, and transportation
4. Processing of used equipment and other items such as rubber boots
5. Environmental control, cleaning, and disinfection (housekeeping, handling food and drinks, dishes and utensils)
6. Handling and disposal of sharps
7. Health care waste management – solid and liquid
8. Safe injection practices and aseptic techniques
9. Occupational health and safety
10. Handling textiles and laundry
11. Collection, handling, and transporting of clinical specimens
12. Respiratory hygiene/cough etiquette

Details of the components of each of the Standard Precautions are presented in the respective sections.

5.2 Additional/Expanded/Transmission-Based Precautions

Transmission-based precautions are used when the route(s) of transmission is (are) not completely interrupted using Standard Precautions alone. In the case of diseases with multiple routes of transmission (e.g., SARS), more than one transmission-based precaution category, may be used. Whether used singly or in combination, transmission-based precautions must always be deployed in addition to Standard Precautions.

There are 3 categories of transmission-based precautions (TBP):

- Contact precautions
- Droplet precautions
- Air-borne precautions

Details of these precautions are presented in Section 16.

Section 6: Hand Hygiene

Hand hygiene is a general term that applies to routine hand washing, antiseptic hand wash, antiseptic hand rub, or surgical hand antisepsis.

6.1 Introduction

The hand is the most common vehicle for transmitting infections. Hand washing is the single most effective method used in preventing the spread of infections. Proper hand hygiene reduces the number of potentially infection-causing germs on the hands, and decreases the incidence of infection transmission in the health facility. Two categories of germs are found on the hand:

- Resident germs that live on and within the skin and cannot be removed
- Transient germs that are acquired during daily activities and can be removed easily; these are usually the pathogens

The effectiveness of hand hygiene is improved when skin is intact, nails are natural (not acrylic), short, and not varnished; hands and forearms are free of jewellery; and sleeves are above the elbow.

The arms of all health staff shall be bare below the elbow while on duty. Remove all bracelets, wrist watches, and all rings (flat, with stones or ridges), roll up all long sleeves to above the elbow.

Any breached skin (cuts, dermatitis, or abrasion) should be covered with a waterproof film dressing.

6.2 General Indications for Hand Hygiene

Specific occasions for hand hygiene are:

- Before touching a patient
- After touching a patient
- After touching a patient's surroundings
- Before a clean/aseptic procedure
- After risk of body fluid exposure
- Before donning gloves and wearing PPE
- On entry into isolation room/area
- After removal of PPE upon leaving the care area

6.3 Types of Hand Hygiene

There are three major types of hand hygiene. These are:

1. Social/routine hand washing
2. Hygienic hand washing or hand antisepsis
3. Surgical hand wash/scrub

6.3.1 *Social/routine hand washing*

This is hand washing with plain soap and running water for at least 150 seconds (2½ minutes) to remove most transient germs (e.g., *E. coli*) and soil from the hands. Social hand washing shall be done:

- Before and after handling or eating food

- After visiting the toilet
- Before and after attending to patients in situations such as bathing and feeding
- When hands are soiled
- On arrival to work and after

Liquid, bar/cake, leaflet, or powdered forms of plain soap are acceptable. When bar/cake soap is used, cut it into smaller pieces and keep in a rack that facilitates drainage of water. The procedure for social or hygienic hand washing is shown in Table 6.3.1. Recommended agents for hand hygiene are presented in Table 6.3.2.

Note: MAKE SURE you and your colleagues are fully trained in the very best hand washing and drying techniques. It may sound simple, but by following a strict procedure, you will be having a direct impact on minimising cross contamination.

Table 3.6.1 : Procedure for social hand washing

1. Remove jewellery



2. Open tap



3. Wet hands under a stream of running water



4. Dispense soap



5. Evenly spread soap over palms and hands. Rub to make lather.



6. Rub hands together, palm to palm



7. Palm to dorsum 1



8. Palm to dorsum 2



9. Rub the webs of the fingers.



10. Cup them together to massage the back of the fingers
Do that to both hands



11. Rub the fingers in the palm in a circular manner



12. Rub the thumbs



13. Wash the wrists



14. Rinse thoroughly



15. Pick single-use hand-drying material



16. Dry hands



17. Use single-use hand towel or paper to turn off the faucet.



18. Discard single-use paper towel in appropriate receptacle



Table 6.3.2: Recommended agents for hand hygiene

Products	Indications	Special Considerations
<p><i>Plain cake or bar soap, liquid soap</i></p> <p>Clean running water</p>	<ul style="list-style-type: none"> For routine care of patients For washing hands soiled with dirt, blood or other organic material 	<ul style="list-style-type: none"> May contain very low concentrations of antimicrobial agents to prevent microbial contamination and growth in the product Cake or bar soap should be on racks that allow water to drain; Small pieces of cake/bar soap that can be changed frequently are safest
<p><i>Antiseptic/Antimicrobial Agents</i></p> <ul style="list-style-type: none"> Chlorhexidine gluconate scrub strengths: 2% aqueous foam or 4% liquid preparation (hibitane) 0.5% chlorhexidine + povidone-iodine (betadine) Povidone-iodine scrub strengths - 10%, 7.5%, 2%, 0.5% 	<ul style="list-style-type: none"> May be chosen for hand scrubs prior to performing invasive procedures (e.g., placing intravascular lines or devices) When caring for severely immunocompromised patients Critical care areas Based on risk of transmission (e.g., specific microorganisms) Intensive-care nurseries Operating theatre hand scrub When caring for individuals with antimicrobial-resistant organisms 	<ul style="list-style-type: none"> Antiseptic agents may be chosen if it is felt important to reduce the number of resident flora or when the level of microbial contamination is high For use in high-risk areas such as ICU, neonatal units, operating theatre, labour and delivery rooms, isolation areas, laboratory and dialysis units, and for invasive procedures Antiseptic agents should be chosen when persistent antimicrobial activity on the hand is desired. They are usually available in liquid formulations Antiseptic agents differ in activity and characteristics
<p><i>Waterless antiseptic agents</i></p> <ul style="list-style-type: none"> Alcohol rinses Alcohol foams Alcohol wipes Alcohol towelettes Germicidal hand rinse (Hibistat) 	<ul style="list-style-type: none"> Demonstrated alternative to conventional agents. For use where hand-washing facilities are inadequate, impractical, or inaccessible (e.g., ambulances, home care, mass immunization, OPD, antenatal clinic, etc.). For situations in which the water supply is interrupted (e.g. planned disruptions, natural disasters). 	<ul style="list-style-type: none"> Not effective if hands are soiled with dirt or heavily contaminated with blood or other organic material. Follow manufacturer's recommendations for use. Efficacy affected by concentration of alcohol in product. Alcohol is most effective at 70% concentration. Lotions should be readily available to protect skin integrity.

When running water is not available, available alternatives to use include:

- Hand hygiene system (Figure 6.3) or
- Other tap-fitted water storage containers such as “poly-tank.”

Figure 6.3: Hand hygiene system



Note: Germs grow and multiply in standing water.

- Change water every 24 hours
- Clean and disinfect (HLD) daily
- Avoid dipping or washing your hands in a basin that contains standing water, even if an antiseptic solution is added.

Hand washing using plain soap and water removes germs on the hand. It does not kill the germs.

6.3.2 Hygienic hand washing or hand antisepsis

This involves the use of antiseptic detergents to wash hands for about 10-15 seconds, or the use of alcohol-based agents to disinfect hands. Hygienic hand washing or hand antisepsis removes transient microorganisms and soil and kills or inhibits the growth of resident microorganisms.

6.3.2.1 This type of hand hygiene is required:

- Before performing invasive procedures such as setting intravenous lines, lumbar puncture, and catheterisation
- Before and after wearing sterile gloves
- After contact with blood or body secretions, or following situations in which microbial contamination is likely to occur
- Before caring for susceptible (immunocompromised) patients

6.3.2.2 Hand antisepsis with alcohol or non-alcoholic hand rub

Alcohol hand rub is only one kind of antiseptic hand rub. It kills or inhibits the growth of transient and resident germs but does not remove germs or soil. This method can be used when hand washing with antiseptic and running water is not possible or practical—as long as hands are not visibly soiled with dirt, blood, or other organic materials. If hands are dirty, wash with soap and running water.

To use alcohol hand rub solution:

- Cup dominant hand and dispense 3-5 mls of alcohol hand rub into it without touching the dispenser with your fingers
- Dip and rotate fingers of the second hand in the alcohol rub
- Pour hand rub into second hand, dip and rotate fingers of the dominant hand in the alcohol rub
- Rub to cover all surfaces of the hands and wrist

It is recommended that after 6-10 applications of alcohol rub, a social hand wash must be done (Table 6.3.2.2).

Table 6.3.2.2: Applying alcohol hand rub

1. Scoop hand



2. Dispense alcohol hand rub into hand



3. Insert and rotate fingers in the alcohol hand rub (1)



4. Tip into second palm, insert and rotate fingers in the alcohol hand rub (2)



5. Apply palm to palm with friction



6. Apply palm to dorsum of both hands with friction



7. Apply to both thumbs



8. Apply to both wrists



9. Continue applying till the rub dries. It is most effective when dry.

Note: Alcohol hand rub should be used only when hands are not physically dirty or soiled.

Preparation of alcohol hand rub

- Add 2 mls glycerine to 100 mls of 60-90% alcohol solution

6.3.3 Surgical hand wash/scrub

This involves the use of antiseptic detergents to wash hands for 3-5 minutes. Hands must be washed from the fingers to the elbows. If an alcoholic preparation is used, two applications are recommended. Surgical hand washing should be done before all surgical procedures.

Procedures for surgical hand wash/scrub (Figure 6.3.3)

Step 1. Remove all jewellery on your hands and wrists.

Step 2. Wet your hands and forearms thoroughly.

Step 3. Holding your hands up above the level of your elbow, apply the antiseptic.

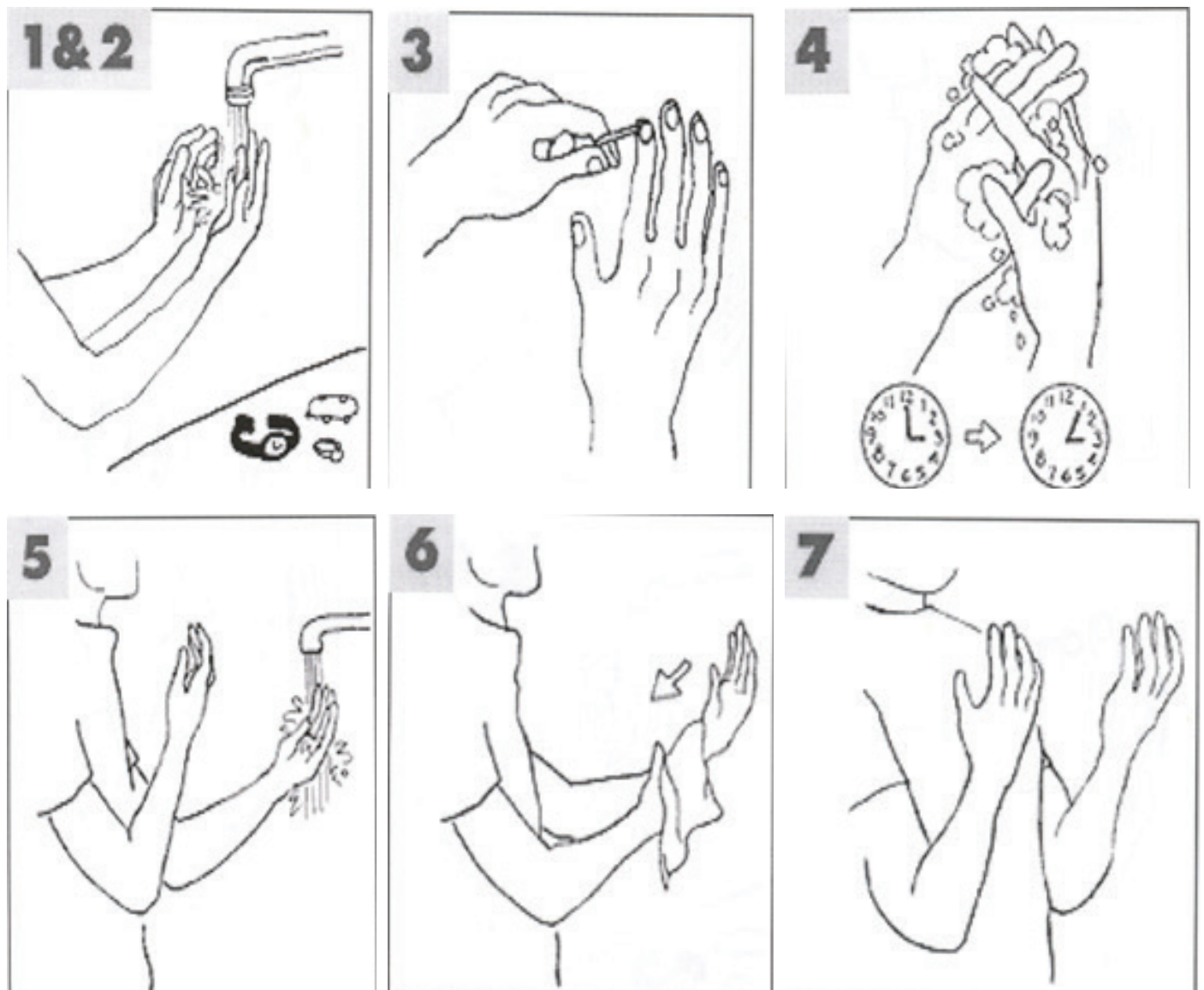
Step 4. Apply the antiseptic. Clean under each fingernail with a nail brush. It is important for all surgical staff to keep their fingernails short. Using a circular motion, begin at the fingertips of one hand and lather and wash between the fingers, continuing from fingertip to elbow. Repeat this for the second hand and arm. Continue washing in this way for 3-5 minutes.

Step 5. Rinse each arm separately, fingertips first, holding your hands above the level of your elbow.

Step 6. Using a sterile towel, dry your arms – from fingertips to elbow – using a different side of the towel on each arm.

Step 7. Keep your hands above the level of your waist and do not touch anything before putting on sterile surgical gloves.

Figure 6.3.3: Procedure for carrying out surgical hand wash



6.4 Hand Drying

After washing, it is important that the hands are dried with any of the following:

- Absorbent paper towels in appropriate dispenser (see Figure 6.4a)
- Single use cotton towels
- Air hand dryers (see Figure 6.4b)

Figure 6.4a demonstrates the procedure for hand drying.

Note: Absorbent paper towels are the best. Avoid using shared towels, as shared towels can become contaminated quickly and must be avoided.

Figure 6.4a: Procedure for hand drying after social/hygienic hand wash

Wipe back of each hand thoroughly with towel, working down from wrist to fingertips.



Rub palm to palm.



Twist towel around each finger and both thumbs, making sure the whole finger from base to tip is dried. Dispose of towel in disposable container



Figure 6.4b: Air hand dryer



6.5 Guidelines on Use of Other Non-Alcohol-Based Hand Rubs

Other non-alcohol-based agents are useful in the prevention of diseases. The active agents used in these disinfectants commonly are PCMX, Triclosan, CHG, and benzalkonium chloride. These agents are in the form of rinses, foams, wipes, and towellettes and are alternatives to conventional agents. Examples are Hibistat, and Steri 7. They are useful where hand-washing facilities are inadequate, impractical, or inaccessible (e.g., ambulances, home care, mass immunization, OPD, antenatal clinic, etc.) and also in situations where water supply is interrupted (e.g., planned disruptions, or natural disasters).

Benefits include:

- Fragrance free
- Non-flammable
- Do not irritate the skin
- Do not damage surfaces
- Break through dirt
- Can be applied to wounds
- Contain organic compounds
- Have moisturizer
- More cost effective
- Leave no residue with use

These agents are not effective if hands are soiled with dirt or heavily contaminated with blood or other organic material. and after 6 applications, the hands should be washed with soap under running water. Use these substances according to the manufacturer's recommendations.

6.6 Other Hand Care and Hand Hygiene Considerations

- Intact skin is a major defence against infection.
- Hand hygiene and gloving can irritate skin.
- Hand hygiene cannot reduce the bacterial counts of personnel with dermatitis.
- Health care providers with dermatitis carry high numbers of microorganisms and may be at increased risk of exposure to blood borne pathogens.
- Workers with chapped or abraded skin must contact their supervisor before initiating work with potentially infectious materials.
- If staff responsible for processing instruments have open sores or cuts on their hands or forearms, they should not clean instruments until the lesions are healed or should apply waterproof adhesive and wear double gloves.
- Lotions can ease the dryness resulting from frequent hand washing. It can also help prevent dermatitis resulting from frequent glove use.

Antiseptic hand cleansers are designed to rapidly wash off the majority of transient flora by their mechanical detergent effect and to exert additional sustained microbiological activity on the resident hand flora. The types of soaps and antiseptic agents for hand hygiene are shown above in Table 6.3.2.

6.7 Improving Compliance with Hand Washing

It has generally been shown that health workers wash their hands only about half as often as they should, but they tend to overestimate how often and how well they wash. Inadequate supplies of water, soap, or antiseptics can play a major role in non-compliance with hand hygiene guidelines. Management's involvement in and commitment to hand washing improves compliance. This involvement and commitment include respected individuals (role models) demonstrating appropriate hand hygiene behaviour and encouraging other staff to do the same.

It is therefore important that:

- Supervisors and managers make water, soap, and antiseptics available at all times
- Supervisors and managers support and model good hand-washing behaviour
- Health care facilities provide educational activities and aids to make sure all staff are aware of the importance of good hand-washing practices
- Management provide posters or signs listing the steps and times for hand washing, to be displayed at vantage points (rest rooms, eating areas, toilets) to help staff become aware of appropriate hand-washing practices.

Section 7: Personal Protective Equipment/Clothing (PPE)

Personal Protective Equipment/clothing (PPE), or barrier-protection items, are used to prevent blood, body fluids, and other potentially infectious materials from coming into direct contact with the clothing and body of health staff, patients and relatives, and the community. There are different types of personal protective equipment/clothing (for example, see Figure 7.1) and the use of each type depends on the task to be performed and the anticipated exposure. The types include:

- Gloves
- Gowns
- Masks, face shields, and goggles
- Headgear
- Helmets
- Leg protections (e.g., boots)
- Rubber aprons and many other items

7.1 Gloves

Gloves protect clients, staff, and the community by acting as a barrier against infectious microorganisms and viruses. Staff must always select the type and size of gloves that are appropriate for the right procedure. The most common types of gloves are:

- **Sterile Surgical gloves:** These are sterile and shall always be used for procedures that involve contact with blood and normally sterile areas of the body. There are some that are up to the elbow level (gynaecological).
- **Single-use examination gloves:** These are non-sterile disposable gloves and shall be used for procedures involving contact with intact mucous membranes (unless otherwise indicated) and also for other patient care procedures that do not require the use of sterile gloves.
- **Utility or Heavy-duty household gloves:** These shall be used when handling contaminated items and when performing non-surgical activities such as housekeeping. Figure 7.1a–7.1d shows the different types of utility gloves.

7.1.1 Guidelines for using all types of gloves

The following are guidelines for using all types of gloves:

- Wear gloves as an additional measure, not as a substitute for hand hygiene.
- Wearing gloves is not required for routine care activities in which contact is limited to a patient's intact skin.
- Wash hands before wearing gloves.
- Wear gloves on both hands before touching all patients' blood and body fluids, mucous membranes, or non-intact skin.
- Do not use gloves if they are peeling, cracked, or discoloured, or if they have punctures, tears, or other forms of deterioration.
- Disinfect and remove gloves and wash hands immediately, if you come into direct contact with a patient's blood or secretions, even if the procedure is not completed. Then, put on a new pair of gloves and continue the procedure. Change and/or disinfect gloves immediately when a patient's blood or secretions come directly into contact with the hand inside the glove, even if the procedure is not completed.
- Change gloves and wash hands in between patients.

- Never reuse disposable gloves.
- Remove gloves before leaving the examination/patient's room, dirty utility areas, or other work areas.
- Decontaminate all utility gloves before taking them off.
- Wash hands after removing any type of glove.

Figure 7.1a: Elbow-length utility gloves



Figure 7.1b: Household utility gloves



Figure 7.1c: Heavy duty utility gloves



Figure 7.1d: Heavy duty utility gloves for better grip



7.1.2 Procedure for wearing gloves

A) Clean technique

- Slip the gloves onto the dominant hand first and then the other hand, making sure they fit securely over the cuffs of the gown, if applicable.
- An extra glove should be handy just in case the original pair tears or becomes soiled.

B) Sterile technique

- Remove all jewellery on the hands, including rings.
- Wash hands thoroughly with an antiseptic and dry them with a sterile material.

Figures 7.1.2a and 7.1.2b: Sterile technique for donning gloves



Open the package containing the sterile gloves (see Figures 7.1.2a and 7.1.2b).

- Carefully open the inner wrapper, maintaining aseptic technique, being careful not to contaminate the gloves by touching them.
- Grasp the folded edges (inside surface) of the dominant glove's cuff with the other hand (see Figure 7.1.2c) and slip the dominant hand inside the glove.
- To avoid contamination, the fingers of the other hand should touch only the inside of the glove. If the glove becomes contaminated, discard it and use a new one.

Figure 7.1.2c

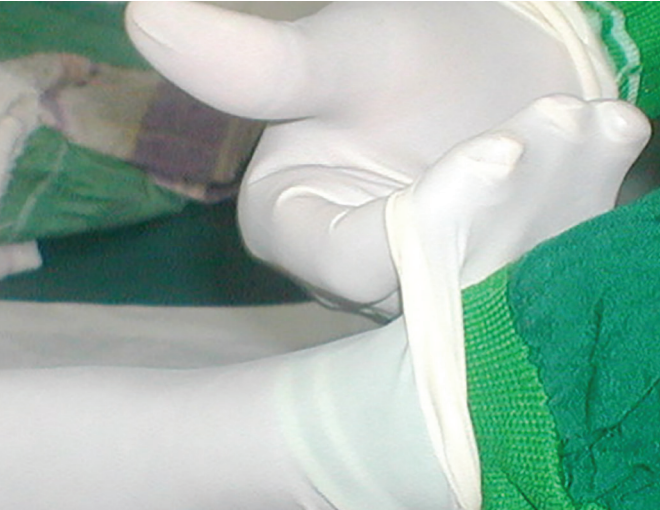


Figure 7.1.2d



- Slip the fingers of your gloved hand under the cuff of the second glove (touching only the outer surfaces of the glove). Insert the other hand into the glove and pull the glove on the dominant hand. Avoid touching your skin with the gloved hand. Keep the thumb up and back.
- Adjust the gloves so they fit properly. Make sure no gaps exist between your fingertips and the ends of the gloves.
- Inspect the gloves for tears before and during the procedure.



Figure 7.1.2e



C) Procedure for removal of surgical gloves

Avoid allowing the outside surface of the gloves to come into contact with your skin, and do not let the gloves snap, as this may cause contaminants to splash into eyes, mouth, skin, or other areas. Remove used gloves before touching anything. There are two schools of thought regarding the removal of gloves. Either of them is acceptable, so long as the principles are followed. Tables 7.1.2a and 7.1.2b demonstrate the two approaches.

Table 7.1.2a: Steps for removing sterile gloves – first approach

	<p>Step 1 Grasp one of the gloves near the cuff and pull it partway off. The glove will turn inside out. It is important to keep the first glove partially on your hand before removing the second glove to protect you from touching the outside surface of either glove with your bare hands.</p> <p>Step 2 Leaving the first glove over your fingers, grasp the second glove near the cuff and pull it part of the way off. The glove will turn inside out. It is important to keep the second glove partially on your hand to protect you from touching the outer surface of the first glove with your bare hand.</p>
	<p>Step 3 Gently pull off the two gloves at the same time, being careful to touch only the inside surfaces of the gloves with your bare hands.</p> <p>Step 4 If the gloves are disposable or are not intact, dispose of them properly. If they are to be processed for reuse, e.g., industrial gloves, place them in a container of decontamination solution. Wash hands immediately after the gloves are removed.</p>

(Courtesy Komfo-Anokye Teaching Hospital)

Table 7.1.2a: Steps for removing sterile gloves—second approach








	<p>Step 1 Pull one glove near your wrist towards your fingertips until the glove folds over.</p>
	<p>Step 2 Carefully grab the fold and pull towards your fingertips. As you pull you are turning the inside of the glove outwards.</p>
	<p>Step 3 Pull the fold until the glove is almost off.</p>
	<p>Step 4 To avoid contamination of your environment, continue to hold the removed glove. Completely remove your hand from the glove.</p>
	<p>Step 5 Slide your finger from your glove-free hand under the remaining glove. Continue to slide your finger towards your fingertips until almost half of your finger is under the glove.</p>
	<p>Step 6 Turn your finger over and pull the glove outwards and towards your fingertips. As you do this, the first glove will be encased in the second glove. The inside of the second glove will also be turned outwards.</p>
	<p>Step 7 Grab the gloves firmly, by the uncontaminated surface (the side that was originally touching your hand). Release your grasp of the first glove you removed. Pull your second hand free from its glove. Dispose of the gloves properly and wash hands immediately.</p>

Table 7.1.2c outlines procedures and the type of gloves to use.

Table 7.1.2c: Gloves requirements – Examples of medical and surgical procedures

Task or Activity	Gloves needed	Examination gloves¹	Sterile gloves	Utility gloves
Measure blood pressure	No	Preferable	No	No
Measure temperature at screen desk	Yes	Yes	No	No
Give an injection	Yes	Yes	No	No
Pelvic examination	Yes	Yes	No	No
Contact with vaginal secretions	Yes	Yes	No	No
IUD insertion	Yes	Yes	No	No
Norplant insertion and removal	Yes	Acceptable	Preferable	No
Surgery: mini-laparotomy, laparoscopy, vasectomy	Yes	Acceptable	Preferable	No
Emergency childbirth	Yes	Acceptable	Preferable	No
Draw blood	Yes	Yes	No	No
Oral/nasal suctioning, manually clean airway	Yes	Yes	No	No
Handle and clean instruments with microbial contamination	Yes	No	No	Yes
Handle contaminated waste	Yes	No	No	Yes
Clean blood or body fluid spills	Yes	No	No	Yes
Dress wounds (extensive wounds)	Yes	Acceptable	Preferable	No
Perform lumbar puncture	Yes	No	Yes	No
Change soiled linen	Yes	No	No	Yes
Change colostomy bag	Yes	Yes	No	No

Note:

- DO NOT wear gloves away from the bedside or laboratory bench; at nursing stations to handle phones, charts; to handle clean linen, clean equipment or patient care supplies; in hallways or elevators.
- Gloves DO NOT replace the need for HAND HYGIENE.
- Gloves DO NOT provide protection from needle sticks or other puncture wounds caused by sharp objects. Use extreme caution when handling needles, scalpels, etc.
- DO NOT wash or decontaminate gloves for reuse(EXCEPT UTILITY GLOVES).

7.2 Gowns

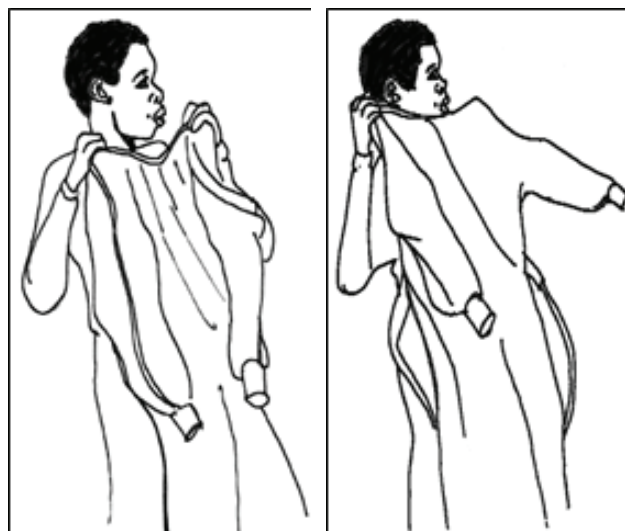
Gowns are recommended to prevent soiling clothing when caring for patients and also to prevent transmission of infection from clothing and body.

- Gowns and aprons shall be worn when splashes of body fluids to the skin or clothing are likely to occur.
- Gowns, including surgical gowns, shall be made of, or lined with, impermeable material to protect all areas of exposed skin.
- The gowns shall be large enough to cover the entire clothing of personnel and to protect all areas of exposed skin.

All management of health care settings shall ensure adequate supply of gowns.

Guidelines for putting on a gown:

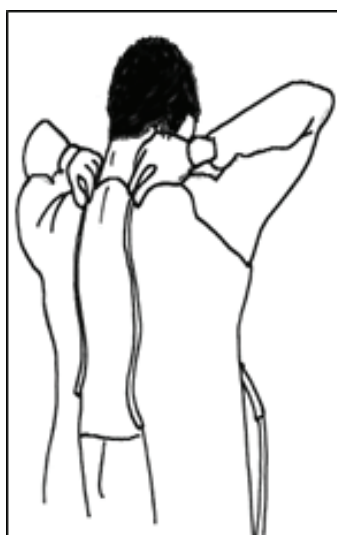
1. Hold the gown so that the back is facing the front of your body.
2. Slip arms one at a time into the sleeves.
3. Next, fasten the neck tab located at the back of the gown to close the top of the gown.
4. Last, extend the ties found at the waist and tie them in the back of the gown, taking care to overlap the edges to protect clothing.
5. Generally, if both a gown and gloves are worn, the gown should be put on first.



Guidelines for removing a gown:

1. Untie the waist ties and then unfasten the neck tab (see Figure a).
2. Next, remove the gown using a peeling motion; gently pull the gown from one shoulder towards the same hand, and then from the other shoulder towards that hand. The gown will turn inside out during the process (see Figure b).
3. Finally, hold the removed gown away from body and roll into a ball in a motion directed away from the body (see Figure c).
4. Discard the gown into an appropriate receptacle.
5. Wash hands after removal of gown and other personal protective barrier equipment.

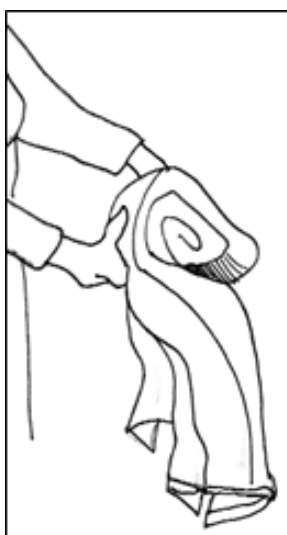
(a)



(b)



(c)



7.3 Plastic Aprons

Aprons prevent contact with infectious body fluids that may soak through cloths. These should be worn over outer garments.

Aprons should:

- Have hooks or ties that fasten around the neck
- Have ties at the waist that reach around and tie at the back
- Be long enough to cover the top of the boots and provide additional protection from spills running inside the boots

Putting on and wearing an apron:

- Wash hands
- Ensure that your sleeves are rolled above the elbows before putting on the apron
- Wear apron over the outer garment and tie around the waist at the back.

Removing an apron:

- Wash hands and dry them
- Remove the apron, touching only the inside of the apron.
- Remove, folding the outside part in.
- Decontaminate or dispose of apron, according to the guidelines of the health facility.
- Wash hands.

7.4 Face and Eye Protection

Face and eye protection must be worn whenever there is a likelihood of splashes, spray, splatter, or droplets of blood or other potentially infectious material getting into the eyes, nose, mouth, or other facial areas. Use safety glasses, or normal glasses with shields, or goggles for eye protection.

Goggles

- Goggles should be made of clear polycarbonate plastic with side and forehead shields.
- Goggles should be optically clear, antifogging and distortion-free.
- Disposable goggles are preferred but reusable ones can be used after proper processing/decontamination and cleaning.

Position goggles over eyes and secure to the head using the ear pieces or headband and adjust to fit (see Figure 7.4a). Eye protection should be worn by securing it over the bridge of the nose and also over the mask.



Figure 7.4a: Procedure for putting on and removing goggles



Face shield

Table 7.4a demonstrates how to put on and remove face shield.

Table 7.4a: Putting on and removing face shield

<p>To put on:</p> <ul style="list-style-type: none">• Position face shield over face and secure on brow with headband• Adjust to fit comfortably	
<p>To remove:</p> <ul style="list-style-type: none">• Grasp strap from behind the head or head pieces with ungloved hands• Lift away from face• Place in designated receptacle for disinfecting or disposal	

Surgical Masks

Surgical masks protect the mucous membranes of the mouth and nose. They generally provide protection against droplets, splashes, and sprays. Masks must cover both the nose and the mouth, and fit the face closely, so that air passes through the mask before being inhaled. Note that face masks have large pores and lack an airtight seal around the edges. Try not to touch the mask once it is secured on your face, as frequent handling may reduce its protection. If you must touch it, wash your hands before and after touching the mask.

Putting on a surgical mask with strings (see Figure 7.4b):

1. Position the mask to cover both nose and mouth.
2. The coloured side of the mask faces outwards, with the metallic strip uppermost.
3. Tie the two (2) top strings first firmly at the back of the head.
4. Tie the two (2) bottom strings at the back of the neck.
5. Mould the flexible metal tab above the bridge of the nose to help secure the mask. The mask should conform to the shape of the face to minimize venting at the sides.

Figure 7.4b: Wearing surgical mask with strings



Steps in removing a surgical mask with strings:

1. First, untie the bottom strings.
2. Next, untie the top strings, being careful not to let go of the mask with both hands.
3. Hold mask by the strings, taking care not to touch the outside of the mask with hands and discard into a waste receptacle for that purpose.
4. Used mask must not be crushed or squeezed before discarding into a waste receptacle.

Putting on a surgical mask with elastic bands (see Figure 7.4c):

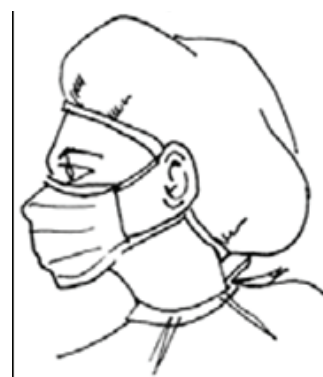
1. When using the mask with elastic bands, position the mask to cover both the nose and mouth with the bands looped behind each ear.
2. Mould the flexible metal tab as described above.
3. Once in position, handling of the mask and talking shall be minimized.

Steps in removing surgical mask with elastic band:

1. Masks with elastic bands should be removed by unlooping the bands from behind each ear, being careful not to drop the mask.

After taking off all masks, fold the mask outwards (i.e., the outside of the mask facing inwards) and put it into rubbish bin with a lid. A surgical mask should be discarded after use, and under no circumstances should it be used for longer than a day. Replace the mask immediately if it is damaged or soiled.

Figure 7.4c: Wearing surgical mask with elastic bands



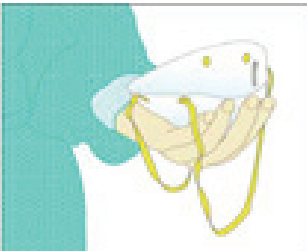




Note: Wash hands before putting on a mask, and after taking one off.

A surgical mask becomes ineffective as a barrier if its integrity is damaged or if it becomes wet (e.g., from perspiration, or if splashed with blood or other potentially infectious material). If this occurs, remove mask and replace with another.

Particulate respirators

Respirators have only tiny pores, which block droplet nuclei and rely on an air tight seal around the entire edge. Respirators can protect health care workers from inhaling microbes such as *Mycobacterium tuberculosis* only if standard IPC work practices and environmental controls are in place. Note that respirators are expensive to purchase and require specialized equipment to determine proper fit. Their use should therefore be restricted to specific high-risk areas in health care facilities, such as rooms where spirometry or bronchoscopy are performed or specialized treatment centers for persons with MDR or XDR TB. Table 7.4b demonstrates the sequence of wearing an N95/FFP2 particulate respirator and doing the seal check.

Table 7.4b: Sequence of wearing a particulate respirator and doing a seal check

	<p>Step 1 Cup the respirator in your hand with the nosepiece at your fingertips allowing the headbands to hang freely.</p>
	<p>Step 2 Position the respirator under your chin with the nosepiece. Pull the top strap over your head, resting it high at the back of your head.</p>
	<p>Step 3 Pull the bottom strap over your head and position it around the neck below the ears.</p>
	<p>Step 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.</p>
	<p>Step 5 Cover the front of the respirator with both hands, being careful not to disturb the position of the respirator.</p> <p><i>To check for positive seal:</i> Exhale sharply. A positive pressure inside the respirator signifies no leakage. If leakage, adjust position and/or tension straps. Retest the seal by repeating the steps until respirator is sealed properly</p> <p><i>To check for negative seal:</i> 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.</p>

7.5 Coats

Coats can be used to protect ordinary street clothing against biological or chemical spills, as well as for body protection.

The specific hazard(s) and the degree of protection required must be assessed before selecting coats.



7.6 Overalls

Overalls protect you and your clothing from dust and other non-hazardous materials.

Overalls should be worn to protect outer garments as and when indicated, especially when spraying, painting, and doing other messy jobs.



7.7 Coveralls











Coveralls are protective clothing used in the management of highly infectious cases. They can also be used in confined areas where hazards have not been fully characterized. They must be worn by trained personnel whenever a potential risk is anticipated. Tables 7.7a and 7.7b outline the procedure for wearing and removing coveralls.





Table 7.7a: Procedure for putting on coveralls



<p>Wear scrub suit, head cover, and gumboots.</p>			
<p>Make sure to gather all PPEs and determine where to place reusable items as well as waste disposal bins.</p>			
<p>Put on the coveralls. Do not cover your head with the hood. <i>Note: If putting on coveralls without shoe cover, pull trouser length of coveralls over the boots.</i></p>			
<p>Put on the plastic apron. The strap of the apron goes under the hood of the coveralls. The assistant may help tie the strap of apron where necessary.</p>			
<p>Perform hand hygiene and put on first pair of gloves. The first pair of gloves should go under the sleeves of coveralls.</p>			

<p>Put on the mask or respirator.</p>			
<p>Put on hood of coveralls and adjust to fit. Create thumb hole and insert thumb through it to secure the sleeves.</p>			
<p>Put on the goggles or face shield. Ensure that it fits well.</p>			
<p>Put on the second pair of gloves over the sleeves of the coveralls.</p> <p>Write name of service provider on the apron at the chest level if using disposable apron otherwise write it on the hood.</p>			
<p>Fully dress staff in coveralls and a disinfection staff with knapsack.</p>			

Table 7.7b: Procedure for removing coveralls

<p>Disinfect the outer pair of gloves with 0.5% hypochlorite (Bleach). Ensure that the bleach covers all parts of the glove and the sleeves of the coverall.</p> <p>Note: The disinfection is done by a trained staff.</p>		<p>Remove outer pair of gloves and disinfect gloved (inner) hands and disinfect the inner pair of gloves.</p>	
<p>Spread arms to disinfect apron from top down, in a horizontal and systematic manner.</p>		<p>Remove goggles from behind, place in appropriate receptacle, and disinfect gloved hands.</p>	
<p>Spread arms to disinfect back of coveralls from top down, in a horizontal and systematic manner. Disinfect the feet of the coveralls as well.</p>		<p>Unzip the coverall taking care not to touch your inner garment.</p>	
<p>Remove apron. First fold from inside out without touching the front side of the apron.</p> <p>Then bend head slightly and remove string of apron from the back, place in an appropriate receptacle, and disinfect outer pair of gloves.</p> <p><i>Note: If wearing a heavy duty apron and a face shield, you will have to remove the shield before removing the apron. However, if you are wearing a disposable apron, you can tear it and discard.</i></p>	 	<p>Remove the hood by grasping and pulling it from the back of the head.</p>	 

<p>Remove coveralls leaving boots, and disinfect gloved hands. Touch only the inner part of the coveralls.</p>	
<p>Remove face mask and disinfect gloved hands.</p>	
<p>Remove last (inner) pair of gloves.</p>	
<p>Disinfect the boots, step over first red line.</p>	

<p>Remove boots and step out over the second red line into clogs in a clean area (take care not to contaminate feet). The officer responsible for disinfection will disinfect all the items, the reusable items will be reprocessed and disposable items will be incinerated. (See healthcare waste management session for more details)</p>	
<p>Wash hands.</p>	

7.8 Headgear

- Disposable caps or scarves should be used where indicated (e.g., in operating theatres, reverse isolation, etc.).
- If disposable ones are not available, well-fitting cotton caps and scarves should be used. These should be laundered at high temperatures (above 60 degrees Celcius) or sterilised.



7.9 Leg Protections like Boots/Shoes/Overshoes

Staff must wear leg protections whenever there is the potential of the legs coming into contact with blood, body fluids, or other contaminated materials: e.g., during surgical operations, delivery, and in the isolation wards (see figures below). Examples of leg protections are as follows.

Boots

- Rubber boots are recommended (see Figure 7.9a and 7.9b below). The sides of the boots should be at least 30 cm high and should have textured soles and be easy to clean. If boots are not available, wear two layers of plastic bags (polythene bags).
- If possible, assign individual pairs of boots to staffs who work in high-risk area such as isolation areas.
- Boots should be stored in covered shelves or in a plastic sack between each use.

Figure 7.9a: Example of gumboots



Figure 7.9b: Example of Wellington boots



Overshoes






Overshoes must be worn over street shoes when infectious waste is on the floor. They must be discarded after a single use (see Figure 7.9c).

Tables 7.9a and 7.9b, present the sequence of putting on and removing personal protective equipment (PPE) in routine isolation practice.

Figure 7.9c: Overshoes








Table 7.9a: Suggested sequence of putting on PPE in routine isolation practice

	<p>Step 1</p> <ul style="list-style-type: none"> - Identify hazards & manage risk - Gather the necessary PPE - Plan where to put on & take off PPE. - Do you have an assistant? - Do you know how you will deal with waste?
	<p>Step 2</p> <p>Put on an apron and a gown, or put on a gown with an impermeable lining.</p>
	<p>Step 3</p> <p>Put on recommended mask. Caps are optional: if worn, put on before the mask.</p>
	<p>Step 4</p> <p>Put on eye protection, e.g., face shield/goggles (consider anti-fog drops or fog-resistant goggles).</p>
	<p>Step 5</p> <p>Put on gloves.</p>

Adapted from: "Infection prevention and control of epidemic- and pandemic-prone acute respiratory diseases in health care-WHO Interim Guidelines" available at: <http://www.who.int/csr/resources/publications/WHO>

Table 7.9b: Suggested sequence of removing PPE in routine isolation practice

	<p>The principle is to avoid contamination of self, others, and the environment. To achieve this goal, remove the most heavily contaminated items first.</p> <p>Step 1</p> <ul style="list-style-type: none"> - Remove gloves and perform hand hygiene OR - Remove gloves & gown by peeling off gown & gloves. Roll them inside out and dispose of gloves and gown safely.
	<p>Step 2</p> <p>Perform hand hygiene.</p>
	<p>Step 3</p> <ul style="list-style-type: none"> - Remove goggles from behind and put in a separate container for reprocessing - Remove cap (if worn).
	<p>Step 4</p> <p>Remove mask from behind.</p>
	<p>Step 5</p> <p>Perform hand hygiene.</p>

Adapted from: "Infection prevention and control of epidemic- and pandemic-prone acute respiratory diseases in health care-WHO Interim Guidelines" available at: <http://www.who.int/csr/resources/publications/WHO>

Section 8: Patient Placement and Transportation

8.1 Patient Placement

Patients who pose a risk for transmission of infections to others (e.g., patients with uncontained secretions, excretions, or wound drainage; infants with suspected viral respiratory or gastrointestinal infections) should be placed in a single-patient room when available. If single-patient rooms are unavailable, patients with similar diseases can be placed in the same room. Determine patient placement based on the following considerations:

- Route(s) of transmission of the known or suspected infectious agent
- Risk factors for transmission from the infected patient to others
- Risk factors for adverse outcomes resulting from health-associated infections in other patients in the area or room being considered for patient placement
- Availability of single-patient rooms
- Patient options for room-sharing (e.g., cohorting patients with the same infection).

8.2 Transportation/Translocation of Patients with Infectious Diseases

The following rules shall be observed when transporting patients with infectious diseases:

- Patients infected with virulent or epidemiologically important microorganisms shall leave their room only for essential purposes.
- When transporting the patient, the appropriate precautionary procedures related to their specific infection shall be adhered to: e.g., in infectious respiratory diseases like SARS, Avian influenza, and MDR-TB, surgical masks should be used to cover the mouths and noses of patients.
- Staff transporting the patient in a single chamber ambulance should wear the appropriate PPE.
- The department or institution receiving the patient shall be notified.

Section 9: Patient Care Equipment

The risk of transferring infections from instruments and equipment is dependent on the presence of microorganisms, the number and virulence of the organisms and the type of procedure to be performed (invasive or non-invasive). The classification of the risk of transmission of infection by instruments and equipment is according to the site where the instrument is to be used.

These are:

- Critical
- Semi-critical
- Non-critical

a. Critical items

These are instruments or objects that are introduced directly into the blood stream or into other normally sterile areas of the body. Examples include surgical instruments, IV canulae, implants and lumbar puncture needles.

The reusable items must be sterilised before use.

b. Semi critical items

These refer to instruments or objects that come into contact with intact mucous membranes but do not necessarily penetrate body surfaces, e.g. endotracheal tubes, anaesthetic breathing circuits, vaginal instruments, oral thermometers and endoscopes.

These items should be sterilised before use. Where sterilisation is not possible, high-level disinfection should be used.

c. Non-critical items

These are items that either do not ordinarily touch the patient or touch only intact skin. Examples of these are walls, floors, bedpans, blood pressure cuffs, stethoscopes, and clinical thermometers. Depending on the particular piece of equipment or item, washing or wiping with a detergent or alcohol OR 0.05 % chlorine (low level disinfection) may be sufficient.

Proper processing of instruments and other objects that will be reused in clinical procedure is vital for reducing the transmission of infections. It is important to keep in mind that staff involved in processing instruments and objects are themselves at high risk of infections and must thus take appropriate steps to reduce the risk. Infections in this regard can occur from exposure to blood and blood products, and other body fluids that pass through:

- Open cuts on their hands or forearm, chapped or cracked hands
- Injuries from needle sticks or other sharp instruments
- Splashing of blood and other body fluids onto mucous membranes like the eyes

9.1 Steps in processing used medical devices, including instruments

The steps in processing instruments are decontamination, cleaning, sterilisation or high-level disinfection and proper storage.

9.1.1 Decontamination

This is a process that involves the removal or destruction of most microorganisms to render a surface or object safe to handle. It is the first step in the processing of instruments and objects for reuse. All instruments and other medical devices that come into contact with blood or body fluids must be decontaminated immediately after use. See section 9.2 for details on the process of decontamination. All liquid waste generated should be treated as infectious.

9.1.2 Cleaning

This is the second step in processing instruments and other medical devices. It removes foreign materials, which may contain microorganisms from an instrument. Cleaning greatly reduces the number of microorganisms on items and is therefore a crucial step in processing instruments.

If items are not first cleaned, further processing may not be effective because:

- Germs trapped in organic materials may be protected and survive further processing; and
- Organic materials and dirt can make the chemicals used in some processing techniques less effective.

It is important to use detergent in cleaning because water alone will not remove protein, oils and greases.

9.1.3 Sterilisation

This is the destruction of all microorganisms including bacteria spores. This is achieved principally by autoclaving.

9.1.4 Disinfection

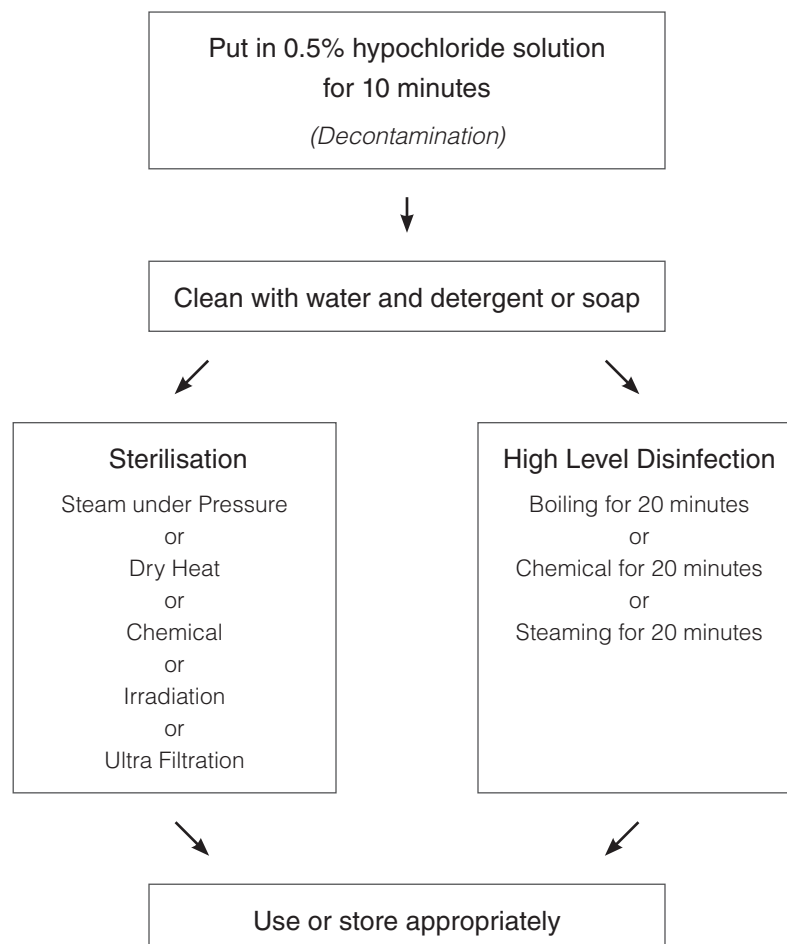
This refers to the use of chemical or physical agents to eliminate virtually all disease causing microorganisms (excluding bacteria spores) on objects and surfaces to a level that is not normally harmful.

9.1.5 Appropriate storage of processed items

This refers to ways of storing clean, disinfected and sterile items in such a way that they do not become contaminated. Proper storage is as important as proper processing.

For proper processing, it is essential to perform the steps in the correct order. Figure 9.1 outlines the steps in processing.

Figure 9.1: Steps on processing used medical devices



9.2 Decontamination of Reusable Instruments

Use chlorine-based disinfectant or any other approved disinfectant for decontamination. Chlorine-based products are cheap and universally available. All instruments or medical items should be fully submerged in 0.5% hypochlorite (bleach) solution for 10 minutes.

A solution that is too weak (less than 0.5% active chlorine) may not adequately kill microorganisms. A solution that is too strong (more than 0.5%) will damage instruments, other items and environmental surfaces, and will also increase the cost of providing services to the health facility.

Chlorine is one of the most widely used disinfectants for preventing infections because it:

- Kills microorganisms
- Is easily available
- Is economical
- Leaves no poisonous residue and is not poisonous to people in the concentration in which it is used
- Is colourless and easy to handle

But it:

- Corrodes items
- Is irritant to skin and mucous membranes

Process of decontamination

1. After completing a procedure and while still wearing gloves, place all instruments and reusable syringes immediately in chlorine solution for 10 minutes then remove instruments from the solution.
2. In case of hollow instruments, syringe the instrument three times with the chlorine solution and then place it in the solution for 10 minutes.
3. Objects like examination or operating tables that come into contact with body fluids must be decontaminated (wiped with 0.5% chlorine solution) before reuse.

Do not leave items soaking for more than 10 minutes or stored in disinfectant solutions.

Preparing 0.5% chlorine solution

Chlorine solution can be made from:

- Liquid chlorine concentrates
- Chlorine-releasing powder or tablet forms.

See Appendix 2 for how to calculate or prepare 0.5% chlorine solution.

Liquid chlorine and chlorine releasing powder or tablets contain a certain percentage of active (available) chlorine. It is the active chlorine in these products that kill microorganisms. The amount of active chlorine is usually described as a percentage and this percentage differs from one product to another. It is important to know the percentage of active chlorine in any chlorine releasing solution, tablet or powder so that the desired percentage can be prepared. Information on the active chlorine must always be noted on the container. If the chlorine solution is not in its container or is in powder or tablet form, check with the stores or the pharmacy to find out the amount of active chlorine in the product.

Always read the label and instructions on disinfectant before use.

Prepared chlorine solution must be discarded after 24 hours whether used or not.

You must also change or prepare a new chlorine solution if the solution becomes heavily contaminated with blood or other body fluids or becomes cloudy.

(Note: when chlorine powder is used, the solution is likely to look cloudy at the start).

It may be useful to set up a bucket of tap water next to the bucket of decontamination solution in which instruments and other items are soaking. The instruments should be removed from the decontamination solution and placed in the water till staff are ready to clean them.

9.2.1 Storage of disinfectants

- Disinfectants should be stored in accordance with the manufacturer's recommendations.
- The storage area should be restricted to authorized persons only.
- Storage containers should be properly stoppered.
- Do not pour back leftover disinfectants and antiseptics into the holding containers.

9.2.2 Preventing contamination of the decontamination solution

Even though disinfectants are effective in killing microorganisms, their abilities are limited and can easily become contaminated. Disinfectants can become contaminated if:

- The water used to dilute the solution is contaminated.
- The containers in which the solution is placed are contaminated.
- Resistant microorganisms from a contaminated item or the service provider's skin come in contact with the solution during use.
- The area in which solutions are prepared or used is not clean.

Solutions may also become more susceptible to contamination, and less effective when exposed to heat and direct light. To prevent contamination, use clean water and container, and pour the solution without touching the rim of the container with your hands, a cotton swab, cloth or gauze.

9.3 Cleaning of instruments

Thorough cleaning should always precede disinfection and sterilisation of instruments and other medical devices. There are two methods of cleaning. These are:

Manual cleaning

This refers to cleaning of devices with the hands. It must be done with extreme caution by adhering to the following steps:

Step 1

- Wear the appropriate utility gloves, plastic apron, face and eye protection when necessary and dismantle all items requiring disinfection or sterilisation before cleaning. Use tap water for the initial washing.
- Using a soft brush, detergent (preferably, the liquid form) and water, firmly brush off all debris, keeping the brush below the surface of the water. Be sure to brush the grooves, teeth and joints of the items where organic materials can collect.

Step 2

- Rinse items finally in clean, warm water to remove all detergent. Any detergent left on the items can reduce the effectiveness of further chemical processing. Allow to air dry or dry them with clean towel before disinfection or sterilisation.

Instruments that will be further processed with chemical solutions must dry completely to avoid diluting the chemicals. Items that will be boiled or steamed do not need to be dried first.

Decontaminate brush after use by soaking, fully submerged in 0.5% chlorine solution, for 10 minutes. Then rinse clean and dry.

Mechanical cleaning

- Washing machines, washer-disinfectants and ultrasonicators could be used if they are available.
- Staff must have adequate training on the use of the machines and must follow manufacturer's instructions strictly in operating them.
- If in doubt, seek advice on how to use the machine.

9.4 Disinfection

Disinfection can be achieved by the use of disinfectants and antiseptics.

- Disinfectant – is a chemical agent used to kill or destroy most disease-causing microorganisms on non-living objects such as instruments and surfaces.
- Antiseptic – is a chemical agent safe enough to be used on the skin and mucous membrane to kill or destroy microorganisms.

Disinfectants and antiseptics shall always be used as specified by the manufacturer's instructions to obtain maximum effect. Suggested areas/items and samples of disinfectants and antiseptics that could be used is outlined in Table 9.4. Examples of commonly used disinfectants and antiseptics in health care facilities are in Appendix 3.

Table 9.4: Areas/items and sample of disinfectants and antiseptics that could be used

Area Or Item	Disinfectant	Antiseptic
Dirty wound (wound dressing)		<ul style="list-style-type: none">• Normal saline, Povidone,• Potassium permanganate
Surgical scrub, skin disinfection		<ul style="list-style-type: none">• Povidone, Chlorhexidine (Hibiscrub), Chlorhexidine + Cetrimide (Savlon)• 70% Alcohol rub (ethyl and isopropyl)
Cleaning blood spillage, utensils, equipment	Hypochlorite (bleach) 0.5%	
Skin		<ul style="list-style-type: none">• Diguanides, 70% Alcohol rub,• Chloroxymenol (detol)• Non-alcohol based preparations e.g. steri -7
Working surfaces	Alcohol, Chlorine + Detergent	
Floors	Phenols	
Chemical sterilisation of endoscopes	Glutaraldehydes, peracetic	
Hand washing		<ul style="list-style-type: none">• Detergents/soap• Antiseptic hand wash e.g. hibiscrub• Quaternary ammonium compounds
Serum, antibiotics preparation, culture media	Ultrafiltration	

9.5 The Role of the Pharmacy Unit in Managing Disinfectants and Antiseptics

The pharmacy unit shall be actively involved in the procuring, storing, distributing, preparing, and quality control programmes for the appropriate use of disinfectants and antiseptics. No further dilution of disinfectants or antiseptics shall occur at the point of use. Where this is not applicable, appropriate instructions on how to dilute the disinfectant shall be provided on the disinfectant container.

The following guidelines shall also be applied:

- Officials of the pharmacy shall label all disinfectants and antiseptics appropriately, specifying type, preparation, and expiry dates and concentration.
- Precautionary signs and measures shall be prominent on all containers.
- Precautions regarding expiry dates of disinfectants and antiseptics shall be strictly adhered to.
- Officials of the pharmacy shall ensure that disinfectants are poured into labelled containers that are clean and dry.

9.6 Disinfection of Instruments

There are 3 levels of disinfection: the High, Intermediate, and Low levels.

- High-level disinfection: This kills all microorganisms except bacterial spores. High-level disinfection can be done by boiling, steaming, and using acids (e.g., peracetic acid) and halogens (e.g., chlorine). See Appendix 3 for examples of disinfectants; Table 9.4 lists areas/items and type of agent to use.
- Intermediate level disinfection: This kills mycobacteria, most viruses, bacteria, and fungi. Intermediate disinfection can be done by boiling for about 10 minutes, using alcohols (70%), and chlorine bleach (0.05% for skin and 0.5% for surfaces).
- Low-level disinfection: This kills some viruses and bacteria, but it does not kill mycobacteria. Examples of agents for low-level disinfection are Cetrimide, Savlon, and soap (liquid or cake), or chlorine (0.05%). An example is hand washing with soap and water. Always follow the manufacturer's instructions.

9.6.1 High-level disinfection of instruments

When sterilisation is not available or feasible, high-level disinfection (HLD) could be done. HLD is also the third step in the processing of instruments. The effectiveness of HLD depends on:

- The amount and type of microorganisms, organic material (blood, other body fluids, tissue), and other matter present on the instrument or other medical items
- The extent of protection the item gives the microorganism (such as whether the item has grooves or other areas in which microorganisms can hide)

It is therefore very necessary to decontaminate and thoroughly clean instruments and other medical devices before HLD.

9.6.2 Methods of High-Level Disinfection of instruments

There are three methods of HLD: boiling, chemical, and steaming. All facilities must have more than one method of sterilisation or HLD available to use as a backup when equipment breaks down, supplies run out, or electricity is not available.

High-level disinfection by boiling

Boiling is a simple method of disinfection that can be performed in any location that has access to clean water and a source of heat. Boiling is HLD, not sterilisation. The following steps should be followed in high-level disinfection by boiling:

Step 1

- Decontaminate and clean all instruments and other medical devices to be boiled.
- Open all hinged instruments and disassemble those with sliding or multiple parts.
- Place bowls and containers upright, not upside down, and fill with water.
- Completely submerge all instruments and other items in the water in the pot or boiler. This is because water must touch all surfaces for HLD to be achieved.
- Cover the pot or boiler and bring the water to a gentle, rolling boil.

Step 2

- When the water comes to a rolling boil, start timing for 20 minutes. Use a timer or make sure to record the time that boiling begins. From this point on, do not add any water or item to, or remove any water or item from, the pot or boiler.

Step 3

- Lower the heat to keep the water at a gentle, rolling boil. If you boil the water too vigorously, the water will evaporate and the items may become damaged if they bounce around the container and hit the sidewalls and other items being boiled. Lowering the heat also saves fuel or electricity.

Step 4

- After 20 minutes, remove the items using dry high-level disinfected pickups (e.g., lifters, Cheattle's forceps).
- Place the instruments or medical devices on a high-level disinfected tray or in a high-level disinfected container that is in a low-traffic area away from insects and dust.

Note: A high-level disinfected tray or container can be prepared by boiling it for 20 minutes or by filling it with a 0.5% chlorine solution and letting it soak for 20 minutes, then draining the chlorine solution and rinsing thoroughly with boiled water.

Step 5

- Allow items to air dry before use or storage. Use items immediately or keep them in a covered, sterile, or HLD container for up to one week.

Note: Never leave boiled items in water that has stopped boiling; they can become contaminated as the water cools down. A white scaly deposit may be left on items that have been boiled frequently and on the pot or boiler. These are lime deposits caused by lime salts in the water.

To minimise lime deposits:

- Add some vinegar to the water to remove deposits on the inside of the boiler.
- Boil the water for 10 minutes to precipitate the lime (to make it come out of the water and settle on the bottom or sides of the boiler instead of on the instruments or other items) before the items are added.
- Use the same water throughout the day, adding only enough to keep the items below the surface.
- Drain and clean out the boiler at the end of each day.

High-level disinfection using chemicals

This method is used for heat-sensitive items when a heat source is not available. In most health care settings, the only chemicals appropriate for HLD are chlorine and glutaraldehyde gluconate with Cetrimide.

Step 1

- Decontaminate, clean, and thoroughly dry all instruments and other medical devices to be processed.

Note: Water from wet items will dilute the chemical solution, thereby reducing its effectiveness. It is therefore very important to dry all items that will be high-level disinfected using the chemical method.

Step 2a – When using a glutaraldehyde solution (preferably only for endoscopes):

- Prepare the solution according to the manufacturer's instructions; normally the strength is 2% for 20 minutes. Ideally, an indicator strip should be checked each time the solution is used to determine if the solution is still effective.
- After preparing the solution, put it in a clean container with a lid.
- Mark the container with the date the solution was prepared and the date it will expire.

OR

Step 2b – When using a chlorine solution:

- Prepare the 0.5% chlorine solution as described for decontamination.
- Fresh solution should be made each day, or more often if the solution becomes cloudy.
- Put the solution in an HLD container with a lid.

Step 3

- Open all hinged instruments and medical devices and disassemble those with sliding or multiple parts.
- The solution must come into contact with all surfaces in order for HLD to be achieved.
- Completely submerge all items in the solution.
- Place the bowls and containers upright, not upside-down, and fill with the solution.
- Cover the container and allow the items to soak for 20 minutes. Do not add or remove any instrument or other items once timing has begun.

Step 4

- Remove the items from the solution using dry HLD pickups (lifters, Cheatle's forceps).
- Rinse thoroughly with cold sterile water or water that has been boiled for 20 minutes to remove the residue that chemicals leave on items. This residue is toxic to skin and tissues.
- Place the items on a HLD tray or container and allow to air-dry before use or storage. Use items immediately, or keep in a covered dry HLD container and use within one week.

9.7 Processing Other Medical Devices

Special considerations must be taken when decontaminating reusable storage containers, laparoscopes, and other instruments used in suction and similar procedures.

Storage containers (e.g., waste bins and buckets):

- Fill containers (especially those for infectious materials) with 0.5% chlorine solution and soak for 10 minutes.
- Pour out the chlorine solution from the container.
- Rinse, clean, and allow to air-dry.

Endoscopes (Laparoscopes):

- Do not soak in chlorine solution, since chlorine can damage them.
- Do not also use alcohols on them as it can fog the lens or dissolve the cement holding the lens in place.

The preferred chemical for disinfecting/sterilising endoscopes is either glutaraldehyde (2%) or peracetic acid. The procedure for disinfecting/sterilising endoscopes using glutaraldehyde is described in Table 9.7.

Table 9.7: Procedure for disinfecting/sterilising endoscopes using glutaraldehyde

Step 1	Immediately after use, gently wipe the laparoscope and fibre optic light source, cables, and plastic tubing with Luer lock with a cloth soaked in 60%-90% ethyl or isopropyl alcohol to remove all blood and organic material.
Step 2	Completely disassemble the laparoscopic equipment.
Step 3	Place disassembled parts in clean water and mild non-abrasive detergent (e.g., liquid soap).
Step 4	Wash all outer surfaces using a soft cotton cloth.
Step 5	Clean inner channels with a cleaning brush supplied with the kit. Use a rotating motion to remove particles (organic material) in the narrow channels. Be careful not to forcibly push the brush against the closed end of the inner tube as this may damage it.
Step 6	Rinse all parts thoroughly with clean water (running water or from a basin). Use the brush to remove detergent and particles from the inner channels.
Step 7	Dry equipment with a clean soft cotton cloth or air-dry.
Step 8	Clean lens at least weekly, and more often as needed. Do not touch the lens with your fingers.
Step 9	High-level disinfect (for 20 minutes, or sterilise overnight) or if not needed immediately, carefully clean, dry and store in instrument container for next use.

9.8 Sterilisation

Sterilisation protects patients/clients by eliminating all microorganisms (bacteria, viruses, fungi, and parasites), including bacterial endospores, from instruments and other items. Sterilisation is recommended for instruments and other items that will come into contact with the bloodstream or tissues under the skin, as well as on drapes and some surgical attire.

Sterilisation can be performed using:

- High pressure steam (autoclaving)
- Dry heat (oven)
- Soaking in chemicals (cold sterilisation)

Heat (autoclaving/steam and dry heat) is the most effective method of sterilisation and reliable if monitored carefully. It is also cheaper than chemical methods. It should be considered first for all medical equipment that can withstand heat.

Chemical, e.g., ethylene oxide and 0.55% ortho-phthalaldehyde, is the alternative in situations where heat cannot be used.

9.8.1 Sterilisation by Heat

Dry Heat:

Time/Temperature: 1 hour at 170 degrees C (340 degrees F)

2 hours at 160 degrees C (320 degrees F)

2½ hours at 150 degrees C (300 degrees F)

3 hours at 140 degrees C (285 degrees F)

Steam Heat:

Time: 20 minutes (or 30 minutes if wrapped)

Temperature: 121 degrees C (250 degrees F)

Pressure: 106 KPA (15 lbs/sq inch)

Note: The units of pressure marked on an autoclave's pressure gauge may vary from one autoclave to another.

9.8.2 Sterilization by Chemicals

The chemical sterilisation method is used for instruments and other items that are heat-sensitive or when heat sterilisation is not available.

- Decontaminate, clean, and thoroughly dry all instruments and other items to be sterilised. Water from wet instruments and other items dilutes the chemical solution, thereby reducing its effectiveness.
- Prepare the chemical solution by following the manufacturer's instructions, or use a solution that was prepared previously, as long as it is clear (not cloudy) and has not expired. After preparing the solution, put it in a clean container with a lid. Always mark the container with the date the solution was prepared and the date it expires.
- Open all hinged instruments and other items and disassemble those with sliding or multiple parts; the solution must contact all surfaces in order for sterilisation to be achieved. Completely submerge all instruments and other items in the solution; all parts of the instruments and other items should be under the surface of the solution. Place any bowls and containers upright, not upside-down, and fill with the solution.
- Follow the manufacturer's instructions regarding the time necessary for sterilisation to be achieved. In general, if the solution contains 0.55% ortho-phthalaldehyde, cover the container, and allow the instruments and other items to soak for 8 to 10 hours. Do not add or remove any instruments or other items once time has begun.
- Remove the instruments and other items from the solution using large, sterile pickups (lifters, Cheatle's forceps).
- Rinse thoroughly with sterile water to remove the residue that chemical sterilants leave on instruments and other items. This residue is toxic to skin and tissues.

Note: Boiled water is not sterile, because boiling does not guarantee that bacterial endospores have been killed. Therefore, rinsing with boiled water can contaminate sterilised instruments and other items.

- Storage: Place the instruments and other items on a sterile tray or in a sterile container and allow to air-dry before use or storage. Use the instruments and other items immediately or keep in a covered, dry, sterile container and use within one week.

See Appendix 4 for a summary of methods of processing instruments and equipment.

9.9 Sterilisation Quality Control

Quality control procedures with appropriate supporting documentation should be in place to ensure that only sterilised items are used for treating patients. All sterilisation quality control systems should include:

- Automatic and continual display of the chamber temperature, pressure, and time for each sterilised load
- A system for differentiating between sterilised and unsterilised items
- Appropriate indicators for monitoring the procedure

The operator must check and record thermometer readings during each complete cycle. This is to ensure the attainment of a minimum temperature to achieve sterilisation of the entire load, depending on the quantity and the compaction of the load.

Heat-sensitive tape or biological indicator monitoring: Operators must use heat-sensitive tapes or other devices for each load that is processed, to indicate that the load has undergone the steam sterilisation process. Remember that the tape only indicates that the proper temperature has been reached; it does not indicate that the load was heated for the proper length of time.

Biological indicator monitoring: At least once a month, operators must monitor the biological indicator placed at the centre of a load processed under standard operating conditions so as to confirm that adequate monitoring has been met. Follow the manufacturer's instructions for using indicators. Keep a log of the results – date performed, test results, initials of the person doing the test.

9.10 Care of All Instruments

- Avoid oils that may protect bacteria during autoclaving; water-soluble lubricant is recommended.
- Never use steel wool or abrasive powders on stainless steel instruments. Their use may seriously damage the corrosion-resistant film of the instrument.
- Never label surgical instruments by impact marking. Striking any hardened instruments can cause stress, and severe damage may result at a later date.
- Staining and spotting can be caused by condensation of water droplets on the surface, leaving slight mineral deposits.
- General dullness of the surface finish may arise from water softening systems.
- When instruments do stain in spite of all good care taken, they can be cleaned by using a commercially available rust and stain remover.

9.11 New Instruments

- All new instruments are supplied without lubrication. It is recommended that all be carefully washed and dried and any moving parts lubricated.
- When instruments are no longer new, avoid as far as possible contact between stainless steel instruments and any of the following substances: barium chloride, aluminium chloride, bromide, and iodine-containing compounds.

9.12 Storage of Processed Patient Care Items

After processing, items should be used immediately or stored in such a way that they do not become contaminated. Proper storage is as important as proper processing. Sterile items that are not to be used immediately should be packaged and stored in designated places. The shelf-life of sterile wrapped items depends on whether or not a contaminating event occurs.

Shelf-life is affected by:

- Type of packaging material used
- Number of times the pack is handled
- Number of people who handle the pack
- Cleanliness and humidity in the storage area
- Temperature of the storage area

- Storage of the packs in open or in closed shelves
- Use, or non-use, of dust covers

Storage areas should be:

- Restricted to authorized persons only
- Kept clean and dry
- Designed such that items stored on shelves are 20-25 cm (8-10 inches) above floor level and 45-50 cm (18-20 inches) from the ceiling.

When in doubt about the sterility of a pack, the pack should be considered contaminated and the items resterilised.

Unwrapped items should be used immediately or kept in a covered sterile container for up to one week.

Section 10: Environmental Management and Controls

Environmental controls are practices that are performed to render the health care facility environment safe from infections or reduce infections to the barest minimum. It includes cleaning and disinfection of surfaces and other items in the health care facility, as well as the appropriate design of health facilities. Section 10 deals with cleaning and disinfection of surfaces. Section 24 will address issues regarding facility design.

Environmental cleaning is the process that physically removes foreign materials that may contain germs from an object or surface.

10.1 General Cleaning Guidelines

Although certain areas of the facility require special cleaning, the following guidelines apply to all parts of a health care facility.

Health care facilities shall provide a clean environment by following these procedures and using approved agents for cleaning:

- Cleaning can be manual or mechanical.
- Clean and disinfect surfaces that are likely to be contaminated with pathogens: those that are touched frequently such as bed rails, bed tables, door knobs, light switches.
- All housekeeping staff shall have a structured in-service training once a year.
- Ward/Unit Supervisors and Housekeeping supervisors shall draw up cleaning schedules for the different areas of the ward/unit. These schedules shall be posted at vantage points where all staff responsible for housekeeping can see and closely follow them.
- Housekeeping staff shall wear gloves (heavy-duty/domestic utility gloves), plastic aprons, masks (where applicable), and protective shoes when cleaning.
- Use of a damp or wet mop or cloth for walls, floors, and surfaces, instead of dry dusting or sweeping, will reduce the spread of dust and germs.
- Scrubbing should be applied in areas such as bathrooms, toilets, floors, and gutters. Scrubbing is the most effective way to remove dirt and germs.
- Wash surfaces from top to bottom, so that debris falls to the floor and is cleaned up last. Clean the highest fixtures first and work downwards. For example, clean ceiling lamps, then shelves, then tables, and then the floor.
- Change disinfectant cleaning solutions whenever they appear dirty. A solution is less likely to kill infectious germs if it is heavily contaminated.
- Use separate cleaning items (brushes, mops, and duster) for high-risk areas, which are likely to be contaminated: for example, toilets.



Note: Thorough cleaning and drying will remove most organisms from a surface. Cleaning is normally accomplished by the use of water, mechanical action, and detergent. It may be manual or mechanical (e.g., a vacuum cleaner).

10.2 Cleaning Patient Care Areas

Patient care areas include operating theatres, procedure rooms, laboratories, wards, and Outpatients Department (OPD) areas such as injection rooms, emergency rooms, toilets, and sluice rooms. In these areas, there is a greater potential for clients, staff, and visitors to become contaminated with infectious materials. Such areas must be cleaned with special care, using a disinfectant cleaning solution.

In addition to the general cleaning guidelines, above, the following should be applied:

- Wear appropriate protective clothing if spraying is to be done or if splattering is likely to occur.
- Sweep all patient care areas with a sweeping brush.
- Mop floors thoroughly and clean with disinfectant solution daily and as required.
- Damp-wipe countertops, tables, drip-stands, beds, and trolleys with water and detergent at the beginning of each work day, to remove dust that has accumulated.
- In-between clients, clean operating and procedure rooms, examination tables, trolleys, countertops, and any other potentially contaminated surface using a cloth dampened with a disinfectant cleaning solution.
- Clean spills of blood or other body fluids immediately.



Toilets and sluice rooms: These areas are usually heavily contaminated and should be cleaned as often as possible with a disinfectant cleaning solution and in accordance with a cleaning schedule. Use a separate set of cleaning items to clean these areas.

10.3 Cleaning Spills of Blood and Body Fluids on Surfaces

- Clean up spills of potentially infectious materials immediately. Besides preventing the spread of infections, prompt removal also prevents accidents.
- Staff who are cleaning up spills must wear appropriate protective clothing.
- Standard cleaning equipment, including a mop and cleaning bucket plus cleaning agents, should be readily available for spills and should be stored and sign-posted in an area known to all staff.
- Procedure for spill management will depend on the following:
 - Nature of the spill, e.g. blood, urine, and faeces
 - Possible pathogens that may be involved
 - Size of the spill, e.g., spot, splash, puddle, large spill
 - Type of surface involved, e.g., linoleum, carpet, wood, laminated, etc.
 - Area involved, e.g., preparatory laboratory, teaching areas, common access areas, etc.
 - Likelihood of bare skin contact with the soiled area

Small spills:

- For a small spill, disinfect using a disinfectant cleaning solution and clean.

Large spills:

- First remove the visible organic matter with absorbent material, e.g., disposable towel or paper, and discard into an appropriate leak-proof bin. Disinfect with 1%-5% sodium hypochlorite disinfectant. Mop and clean the area and allow to air-dry.

Large spills of cultures:

- If the spill is a large spill of cultures or concentrated infectious materials, flood with (0.5% chlorine) solution or available stock strength of chlorine, clean, and then disinfect it again with fresh disinfectant, clean, and allow to air-dry. A suggested technique when flooding the spill with germicide is to lay absorbent material down on the spill and apply sufficient germicide to thoroughly wet both the spill and the absorbent material.
- Do not place a rag over the spill for cleaning up later, someone could easily slip and fall on it.
- Items used for cleaning must be cleaned. Items such as mops, buckets, and dusters should be decontaminated with a disinfectant (0.5% chlorine) solution, cleaned with detergent and water, rinsed in clean water, and dried before reuse.
- Hands shall be thoroughly washed and dried after gloves are removed.

10.4 Cleaning Surgical Settings

Surgical settings include operating theatres, ambulatory surgical units, physicians' offices where invasive procedures are done, intravascular catheterization laboratories, endoscopy rooms, and all other areas where invasive procedures may be performed.

- Cleaning procedures shall be completed on a scheduled basis, usually daily.
- Areas outside the sterile field contaminated by organic debris shall be cleaned as spills or splashes occur.
- Surgical lights and horizontal surfaces, equipment, furniture, and patient transport vehicles shall be cleaned between patients/clients with a clean duster and a low-level disinfectant.
- Floors shall be cleaned with a low-level disinfectant/detergent, preferably using a wet vacuum system between patients/clients or, depending on type of procedures carried out, at the end of the day.
- Countertops and surfaces that have been contaminated with blood or body fluids capable of transmitting infection shall be cleaned with disposable towels, using an appropriate cleaning agent and water as necessary (e.g., after each procedure, end of the day, etc.). The surfaces shall then be disinfected with a low-level chemical disinfectant or sodium hypochlorite. Loose or cracked work surfaces should be replaced.
- All other areas and equipment in the surgical practice setting (e.g., air conditioning grills and/or filters, cabinets, shelves, walls, ceilings, lounges, and locker rooms) shall be cleaned according to an established routine.
- Before any piece of portable equipment enters or leaves the operating theatre, it shall be wiped with the approved disinfectant.

IMPORTANT POINTS TO REMEMBER!

Always use frictional cleaning/scrubbing, the most important way to remove dirt and microbes, for all environmental cleaning procedures. In order to avoid soiling clean areas in the process of cleaning dirty ones, always:

- Treat the cleaning material as per recommendations (see Appendix 5 on environmental cleaning).
- Change cleaning disinfectant solution after 24 hours OR as per manufacturer's directions, whichever is the sooner OR when obviously dirty.
- Use separate equipment for cleaning contaminated areas, e.g., toilets, isolation rooms.
- Wash walls from top to bottom.
- Change the cleaning solution and wash the equipment between areas or cubicles or when dirty.
- Dilute the disinfectant to the correct, prescribed concentration.
- Prepare and display simple clear routine housekeeping schedules for all personnel

10.5 Disinfecting Patient Clothing and Bedding

To disinfect patient clothing and bedding, follow these guidelines:

- Any solid excrement, e.g., faeces or vomitus on soiled sheets, should be removed using a flat firm object and flushed down a toilet or in the sluice. Soiled linen should then be placed immediately into plastic bags.
- Used linen should be handled carefully to prevent contamination of surrounding surfaces or infecting people.
- Soak soiled clothing on 0.05% chlorine for at least 30 minutes on the ward.
- Remove and place in a leak-proof bag and send to laundry for immediate washing.
- If safe cleaning and disinfection of heavily soiled linen is not possible or reliable, burn the linen to avoid unnecessary risk to staff.

10.6 Cleaning Non-Patient Care Areas

In areas of the facility where clinical services are not provided and processing of instruments and other items does not occur – such as the kitchen and administrative spaces – the risk of infections is generally minimal. Routine domestic cleaning is usually satisfactory. These areas shall be cleaned with a duster or mop dampened with detergent and water daily, or when visibly dirty. Avoid the use of carpets in these areas. Routine users of these areas should adhere to strict guidelines to prevent contamination of these areas. Should contamination occur, appropriate cleaning practices shall be done as for patient/client care areas.

10.7 Terminal Cleaning/Cleaning After Discharge

Terminal cleaning

Upon discharge of a patient, the room, cubicle, or bed-space, bed, bedside equipment, and environmental surfaces shall be thoroughly cleaned before another patient is admitted.

- Terminal cleaning shall primarily be directed toward those items that have been in direct contact with the patient or in contact with the patient's excretions, secretions, blood, or body fluids.
- Housekeeping personnel shall use the same precautions to protect themselves during terminal cleaning that they would use for routine cleaning. Masks are not needed unless the room was occupied by a patient for whom there were airborne precautions and insufficient time has elapsed to allow clearing the air of potential airborne organisms.
- All disposable items shall be discarded immediately in the appropriate receptacle (see Section 9 on Patient care equipment).
- Reusable items that have been in direct contact with the patient or with the patient's excretions, secretions, blood, or body fluids shall be reprocessed as appropriate to the item (see Section 9).
- Bedside tables, bed rails, commodes, mattress covers, and all horizontal surfaces in the room shall be cleaned (see Appendix 5).
- Routine washing of walls, blinds, and curtains is not indicated. These shall be cleaned if visibly soiled (see Appendix 5).
- Cubicle/wards curtains should be changed when visibly dirty or when there is contamination.
- Disinfectant fogging is not a satisfactory method of decontaminating air and surfaces and shall not be used.
- If VHD is suspected, disinfect and burn all materials used in patient care.

In general, no special cleaning techniques are required for rooms that have housed patients for whom additional precautions were in place. However:

- Special terminal cleaning procedures may be indicated for certain organisms, e.g., *Clostridium difficile* or diarrhoeal outbreaks. In such cases, thorough cleaning and disinfection should be performed with a disinfectant known to be effective against the microorganism in question. Attention should be paid to surfaces such as door knobs, call bell pulls, taps, and wall surfaces, which have been frequently touched by the patient.

Terminal disinfection

- Walls: Clean with disinfectant cleaning solution.
- Beds, lockers and tables and other items in the room: Disinfect using low-level disinfectant.
- Utensils: Clean and wash in soapy water, rinse and dry.
- Linen: Change all linen, place in appropriate bag. If soiled, rinse to remove soiled material and place in appropriate linen bag.
- Plastic covering of pillows and mattresses: Disinfect and air-dry for at least an hour before the next admission.
- Equipment:
 - Sterilise contaminated, reusable critical items or patient care equipment.
 - Semi-critical patient care equipment shall be sterilised or disinfected after use to reduce the risk of transmission of microorganisms to other patients. The article and its intended use, the manufacturer's recommendations, the health care facility policy, and any applicable guidelines and regulations will determine the type of disinfection.
 - Non-critical equipment contaminated with blood, body fluids, secretions or excretions shall be decontaminated, cleaned and disinfected after using a low-level disinfectant.
 - Contaminated disposable (single-use) patient care equipment shall be handled and transported in a manner that reduces the risk of transmission of microorganisms and environmental contamination in the health care facility. The equipment shall be disposed of according to the institutions' policy and applicable regulations.

10.8 Pest Control

Cockroaches, flies and maggots, ants, mosquitoes, spiders, mites, and mice are among the typical arthropod and vertebrate pest populations found in health care facilities. Insects can serve as agents for the mechanical transmission of microorganisms, or as active participants in disease transmission by serving as a vector. Although insects carry a wide variety of pathogenic microorganisms on their surfaces and in their gut, the direct association of insects with disease transmission (apart from vector transmission) is limited.

- Eradicate arthropod and vertebrate pests from all indoor environments, including health care facilities.
- Eliminate food sources, indoor habitats, and other conditions that attract pests.
- Apply pesticides as needed.
- Seal windows in health care facilities to help minimize insect intrusion. When windows need to be opened for ventilation, ensure that screens are in good repair and close doors to the outside to help with pest control.
- A pest-control specialist with appropriate credentials can provide a regular insect-control program that is tailored to the needs of the facility and uses approved chemicals and/or physical methods.

10.9 Disinfection: Vehicles and Patient Transportation

Vehicles that transport patients to and from health care settings are possible sources of infection, because they may become contaminated during transportation of patients. The following measures should be used to disinfect these vehicles after transporting patients:

- Person cleaning the vehicle should use the appropriate PPE.
- Disinfectant cleaning solution should be used and rinsed off with clean water.
- Vehicle should be air-dried after cleaning.

10.10 Types of Cleaning Solutions

Three kinds of cleaning solutions are normally used during housekeeping in health care facilities. It is essential that housekeeping staff know and understand the different types of solutions and how each should be used.

Detergent or plain soap and water

This is used for low-risk areas (non-patient care areas) and general cleaning tasks. Detergent removes dirt and organic material and dissolves or suspends grease, oils, and other matter so it can easily be removed by scrubbing.

Disinfectant solution (0.5% hypochlorite solution)

Disinfectants rapidly kill or inactivate infectious germs during the cleaning process. Disinfectants are also used to decontaminate an area (flooding) so that it is safer to clean with a disinfectant cleaning solution. In most settings, a 0.5% hypochlorite solution made from locally available bleach is the cheapest disinfectant, but alternatives include commercial disinfectants containing 5% carbolic acid (e.g., Phenol or Lysol) or quaternary ammonium compounds.

Disinfectant cleaning solution

This solution contains a disinfectant, detergent, and water. It is used for cleaning areas that may be contaminated with infectious materials such as operating theatres, procedure rooms, bathrooms, toilets, and sluice rooms. The disinfectant rapidly kills or inactivates infectious germs during the cleaning process; the detergent removes dirt and organic materials, which cannot be done by water or disinfectant alone. Instructions on how to make a disinfectant cleaning solution are provided below.

How to make a disinfectant cleaning solution

Step 1: Prepare a 0.5% chlorine solution or obtain any disinfectant that contains 5% carbolic acid.

Step 2: Add some liquid or powdered detergent or soap, and mix. Continue adding detergent until the solution becomes mildly foamy or bubbly.

Note: Chlorine solution should never be mixed with cleaning products containing ammonia, ammonium chloride, or phosphoric acid. Combining these chemicals will result in the release of a chlorine gas which can cause nausea, eye irritation, tearing, headache, and shortness of breath. These symptoms may last for several hours.

See Appendix 5 for further details on environmental cleaning and disinfection.

Section 11: Handling Linen

Processing linen consists of all the steps required to collect, transport, sort, launder (wash, dry and fold or pack), store, and deliver clean linen for client care. Health care facilities may launder their soiled or dirty linen in house or contract it out to companies that have specialized in this work. Regardless of where the soiled/dirty linen is processed, the following infection prevention and control recommendations must be applied.

Updated guidelines for handling, transporting, and processing exposed linen should be considered in a manner that prevents skin and mucous membrane exposures and contamination of clothing and avoids transferring pathogens to other people and the environment.

11.1 Principles of Linen Handling

The principles of linen handling and storage are based on “clean management” as opposed to sterile. In handling linen, the following must be observed:

- All laundry units must have:
 - Separate area provided in the laundry unit for sorting dirty/soiled linen, folding, and storing clean linen
 - Adequate ventilation (6 - 10 air changes per hour) and physical barriers (walls) between the clean and soiled linen areas
 - Sufficient tubs, preferably stainless steel, for the separation and soaking of used and soiled linen.
- Laundry staff must be trained and should follow manufacturer’s recommendation with regard to the use of equipment and products.
- All laundry staff should be trained on guidelines for handling linen and how to use laundry equipment and logistics.
- Health care facility managers and supervisors should ensure that there are adequate supplies of linen for use in the different sections. Remember that all used linen is potentially infectious and must be handled with care.
- Standard precautions should be observed when handling all laundry. Always wear utility gloves and appropriate protective clothing (minimum heavy-duty utility/household gloves, goggles, apron, and boots) when handling used linen.
- Linen should be handled as little as possible and with minimum shaking, to prevent the spread of microorganisms in the environment.
- All health care facilities should develop procedures for laundering client’s personal clothing.
- All units/wards should have separate linen bags for “used” and “soiled” linen for laundry.
- The bags should be appropriately labelled (see Figure 11.1).

Figure 11.1: Examples of Linen Bags



11.2 Laundry Procedures

Collecting and sorting linen

- Place soiled linen in impervious (leak-proof) bags immediately on the unit/ward and transport to the laundry unit on an appropriate laundry cart.

Note: The storage time for soiled linen before washing is related to practical issues, such as available storage space and aesthetics and not necessarily to infection prevention and control concerns.

- Soiled linen in a linen bag, or containers with lids, or covered carts, should be marked “soiled” and be well secured. Soiled linen should be transported using an appropriate laundry cart and should not come into contact with the carrier’s body during transportation.
- Sorting of soiled linen must be done at the laundry unit, and not on the ward or patient care areas, with personnel wearing all appropriate protective clothing.
- Soiled linen should not come into contact with health worker’s clothes, even if they are wearing plastic aprons.

Colour Coding System for linen bags:

- Yellow - for soiled linen
- White - for clean linen from the laundry
- Blue - for used dirty linen from wards and departments
- Green - for linen from special departments such as operating theatre, labour and delivery ward, to be transported to the laundry
- Red - for linen contaminated with highly infectious organisms or materials.

Laundering (washing) linen

The laundering process is designed to remove organic soil and render the linen incapable of causing disease. No microbiology standards exist to define “safe” levels of bacteria in textiles because of the variability in microbial survival, degree of soiling, specific laundering techniques, fabric content, and ability of various organisms to adhere to certain fabrics. Guidelines for the different methods of washing linen are provided in Table 11.2 (below).

Hand washing of all hospital linen is discouraged. Where this has to be done, specific guidelines shall be followed.

NOTE:

Decontamination of linen, as in decontamination of medical devices (e.g., instruments) is impractical and often ineffective and so must be avoided because:

- The 0.5% chlorine is too strong for most fabrics.
- Repeated soaking of linen in chlorine, even if diluted, will cause the fabric to deteriorate more quickly.

If required, heavily soiled linen could be pre-soaked in soap, water, and 0.05% chlorine solution before hand washing. The best protection for health workers responsible for hand washing linen is the use of the appropriate PPE.

Table 11.2: Guidelines for washing linen

Machine Washing	Hand Washing
<p>Step 1</p> <p>Wash heavily soiled linen separately from non-soiled linen.</p>	<p>Step 1</p> <p>Wash soiled linen separately from dirty linen.</p>
<p>Step 2</p> <ul style="list-style-type: none"> • Adjust the temperature and time cycle of the machine according to manufacturer's instructions and the type of soap or other washing product being used. • Both cold and hot water washing cycles that include bleach reduce bacterial counts in the linen. 	<p>Step 2</p> <ul style="list-style-type: none"> • Wash the entire linen in water with liquid/cake/powdered soap to remove soiled materials. • Use warm water if available. • Add bleach (e.g., 30–60 ml, about 2–3 tablespoons, of a 0.05% chlorine solution) to washing solution to aid in cleaning and bactericidal action.
<p>Step 3</p> <ul style="list-style-type: none"> • When the wash cycle is complete, check the linen for cleanliness. • Rewash if it is dirty or stained. (Heavily soiled linen may require two wash cycles.) 	<p>Step 3</p> <p>Check the item for cleanliness. Rewash if it is dirty or stained.</p>
	<p>Step 4</p> <p>Rinse the item with clean water.</p>

Drying, checking, folding, storage, and transportation of linen

The procedure is the same for both hand- and machine-washed linens:

- Completely air or machine dry before further processing.
- Air-dry in direct sunlight, if possible, keeping the fabric off the ground, away from dust and moisture.
- After linen is totally dry, check for holes and threadbare areas. If these are present, the item must be discarded or repaired before reuse or storage.
- Clean and dry linen should be ironed as needed and folded. If sterile linen is required, prepare and sterilise wrapped packs.
- Once processing is complete, the clean linen should be handled as little as possible, wrapped with wrapping paper or cloth to prevent contamination, and stored in a covered area.
- Clean linen should be transported in carts that are used for clean linen only and should be covered in a manner which will prevent contamination.
- Wrapped linen that has been opened should be placed on the front of the shelf and used first. Wrapped linen that has been opened should be sterilised before putting back on the shelf.
- Linen which has been stored for long periods should be inspected and, when found to be dirty, must be reprocessed before using.

Section 12: Handling Food and Drinks

Food and drinks shall be handled in a manner that will prevent contamination and infections. Storage of food and drinks should conform to standards set by the Catering Unit of the Ghana Health Service and the Ministry of Health.

- All food service staff should comply with guidelines on Standard Precautions.
- Food service staff should all follow established dress codes and use appropriate barriers when preparing, transporting, and serving food.
- Hand washing is mandatory before and after handling food and equipment.
- No eating, drinking, or smoking is permitted in the food preparation area.
- Staff with communicable diseases – skin infections, respiratory infections, and/or gastrointestinal infections – should not work in food handling units until they are cleared by a physician to resume work.
- Food-borne or suspected food-related illness in employees or clients should be reported to the IPC nurse/coordinator so it can be investigated.
- Cleaning, dishwashing, and disinfection procedures should be strictly followed and monitored.
- Public eating areas should be maintained in a sanitary condition.
- Vending companies should clean their machines and ensure the safety of food products. These machines must be monitored for cleanliness and reports of compliance provided to the appropriate authority.
- Commercially prepared foods should be inspected for expiry dates and for other signs of deterioration and, if found to be unwholesome, should be discarded.
- Health care facility managers must ensure that all food vendors (sellers) in and around the health care facility comply with the District Assemblies' guidelines on food handling.
- Ensure routine medical check-ups for food service staff.

Refrigeration

- Keep separate refrigerators for food, specimens, and medicines. Each refrigerator must be labelled to indicate the purpose for which it must be used.
- A log should be maintained to monitor daily temperatures, cleaning schedule, and routine inspection of contents.

Under no circumstance should food and medicines be stored in the same refrigerator.

Section 13: Injection Safety and Handling of Sharps

The health and safety of providers, clients, and the community as a whole are very critical when infections are to be brought to the barest minimum. Appropriate handling and disposal of sharps should be of utmost concern to managers of health facilities. Caution must therefore be exercised when handling used needles, syringes, and other sharps like scalpels, blades, scissors, lancets, broken glass, etc.

13.1 General Guidelines for Handling Used Syringes and Needles

The following guidelines shall apply when handling sharps:

Table 13.1: Handling used syringes and needles

- Do not recap, bend, break, or remove used needles from syringes. Where it is absolutely necessary to recap, use the “one hand technique” or use toothed dissecting or artery forceps.
(see techniques below for sharps disposal).
- Dispose of used needles and syringes into the appropriate sharps container after use (Figure 13.1).
- Sharps containers must be:
 - Rigid and puncture-resistant
 - Sealed on all sides, and must have a one-way lid opening system
 - Tamper proof.
- Label all sharps containers appropriately with the international biohazard symbol.
- Do not recycle disposable needles and syringes.
- Sharps must be segregated at the source of generation.

Figure 13.1: Safety box



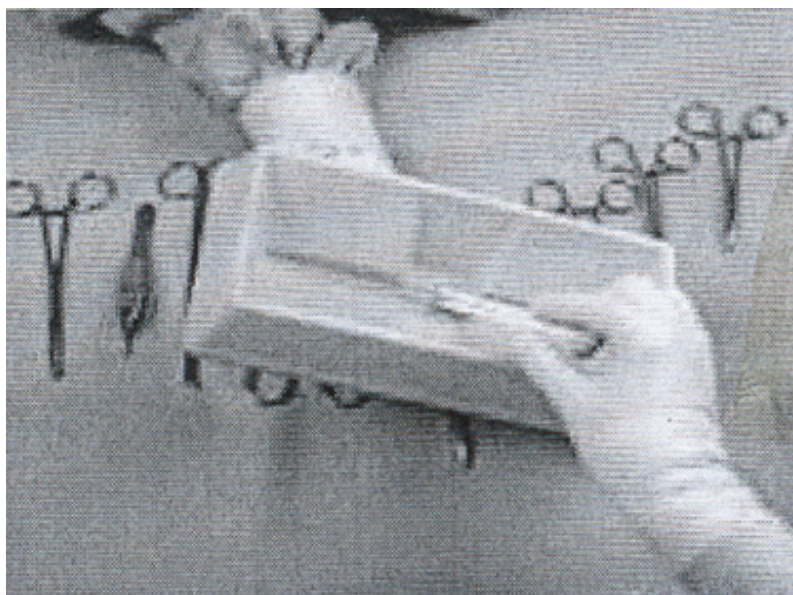
Note: All waste management practices shall comply with GHS Policy and Guidelines on Health Care waste management.

13.2 Passing Sharps

When passing sharps, uncapped or otherwise, unprotected sharps should never be passed directly from one person to another. In the operating theatre or procedure room, pass sharp instruments in such a way that the surgeon and assistant are never touching the item at the same time. This way of passing sharps is known as the “hands-free” technique:

1. The assistant places the instrument in a sterile kidney basin or in a designated “safe zone” in the sterile field (see Figure 13.2).
2. The assistant tells the service provider that the instrument is in the kidney basin or safe zone.
3. The service provider picks up the instrument, uses it, and returns it to the basin or safe zone.

Figure 13.2: Hands-free technique





When giving injections:

- Unexpected client motion at the time of injection can lead to accidental needle sticks. Many needle sticks occur when children or adults move unexpectedly.
- Always prompt clients when you are about to give them an injection.
- Restrain children gently and securely in the lap of an adult, with arms and legs held.
- Assess the mental condition of bed-ridden patients and ask a coworker to help restrain adult patients who may be confused.

13.3 Recapping: The “One-Hand” Technique

Recapping is a dangerous practice. Sharps injuries are responsible for about 2.5% of HIV among health care workers and contribute 30% of new cases of HBV among health care workers annually. Many accidental needle sticks occur when health workers are recapping needles using both hands (See Table 13.3).

Table 13.3: One-hand technique of recapping needles

“One-hand” technique of recapping needles. THE RIGHT WAY TO RECAP	Recapping with both hands. NOTE: THIS IS DANGEROUS
	

If at all possible, dispose of needles immediately without recapping them. If it does become necessary for you to recap a needle (for example, to avoid carrying an unprotected sharp when immediate disposal is not possible), do not bend or break the needle and do not remove a hypodermic needle from the syringe by hand. To safely recap needles, use the “one-hand” technique.

Step 1: Place the cap on a flat surface, then remove your hand from the cap.

Step 2: With one hand, hold the syringe and use the needle to “scoop up” the cap.

Step 3: When the cap covers the needle completely, use the other hand to secure the cap on the needle hub. Be careful to handle the cap at the bottom only (near the hub).

Section 14: Safe Injection Practices

The following injection safety guidelines describe practices which, when complied with, render injections safe.

14.1 Medication

- Perform hand hygiene prior to handling all parenteral material.
- Follow manufacturer's guidelines for expiration date, storage, use, and disposal of pharmaceuticals.
- Use aseptic technique to avoid contamination of sterile injection equipment.
- DO NOT administer medications from a syringe to multiple patients, even if the needle or cannula on the syringe is changed.
- Inspect the syringe and needle package for breaks. Discard syringe and needle if the package has been punctured, torn, damaged by exposure to moisture, or if it has expired.
- Check the vial to be sure there are no leaks or cracks.
- Check the solution to be sure it is not cloudy and that there are no particles in it.
- Wipe the top of the vial with a fresh cotton swab soaked with 60%-70% alcohol, and allow it to dry.
- Use a sterile, single-use, disposable syringe and needle for each injection, and discard while intact in an appropriate sharps container immediately after use.
- Use aseptic technique to avoid contamination of sterile injection equipment and medications.
- Prepare each injection in a designated clean area where blood and body fluid contamination is unlikely.
- Discard syringe and needle in a puncture-resistant leak-proof container, if contaminated during the medication preparation.
- Use single-dose medication vials, prefilled syringes, and ampoules when possible.
- DO NOT administer medications from single-dose vials to multiple patients or combine leftover contents for later use.
- Never leave one needle inserted in the vial cap or infusion bag for multiple uses, as this increases the risk of contamination of the fluid between each use.
- Most medicines, especially antibiotics, are unstable when constituted and should not be stored for long. It is therefore recommended that staff consult the production literature or with the Pharmacist of the institution about storage after constitution.
- Needles, cannulae, and syringes are sterile single-use items; they should not be reused for another patient or to withdraw a medication or solution that might be used for a subsequent patient.
- Use fluid infusion and administration sets (giving sets), e.g., intravenous bags, tubing and connectors, for one patient only and dispose of them appropriately after use.
- Consider a syringe or needle/cannula contaminated once it has been used to enter or connect to a patient's intravenous infusion bag or administration set.
- Use single-dose vials for parenteral medications whenever possible.
- If using an ampoule that requires a metal file to open, protect fingers with a clean barrier (e.g., small gauze pad) when opening the ampoule.
- Only one vial of a multi-dose medication should be opened at a time in each patient care area.
- NEVER re-enter a vial or infusion bag with a needle or syringe used on a patient, even if for the same patient.
- As much as possible, DO NOT use bags or bottles of intravenous solution as a common source of supply for multiple patients.

- Use sterile syringe and needle, and sterile diluent to reconstitute medication.
- For medications requiring reconstitution, add a label, which must include:
 - Date and time of preparation
 - Type and volume of diluent (if applicable)
 - Final concentration
 - Expiry date and time
 - Name and signature of the person reconstituting the drug
- For medications that DO NOT require reconstitution, add a label, which must include:
 - Date and time of first piercing the vial
 - Name and signature of the person first piercing the vial
- Discard multi-dose vials:
 - If sterility or content is compromised
 - At expiry date/time
 - Without antimicrobial preservatives within 24 hours of opening
 - With antimicrobial preservatives according to the manufacturer's recommended expiration date on the vial
 - All undated, improperly stored, multi-dose vials inadvertently contaminated are perceived as contaminated immediately upon discovery, regardless of expiration date

14.2 Multi-Dose Ampoules

Use of multi-dose ampoules poses a serious risk of infection. As much as possible, use single-dose ampoules or, where practicable, discard multi-dose ampoules after a single use.

When giving injections:

- Unexpected client motion at the time of injection can lead to accidental needle sticks. Therefore, always prompt patients/clients when you are about to give them an injection.
- To protect patients/clients, always use proper client preparation when giving an injection.
- Use appropriate PPEs for insertion of catheters or injection of material into spinal or epidural spaces via lumbar puncture procedures: e.g., myelogram, spinal or epidural anaesthesia.

Section 15: Health Care Waste Management

Clinical and related waste is defined as waste generated in health care institutions, e.g., waste generated during investigation or treatment of patients or in research studies. Health care waste includes all solid and liquid waste (both hazardous and non-hazardous). Management of clinical and related waste shall conform to the health care waste management policy of the Ministry of Health.

All staffs have a responsibility to manage waste in a manner that poses minimal hazard to patients/clients, visitors, staff, the individuals, and families in the community. Proper handling of waste minimizes the spread of infections and reduces the risk of accidental injuries. It helps to provide an aesthetically pleasing atmosphere and reduces unpleasant odour. It also prevents the attraction of insects and other animals to the facility and reduces the likelihood of contamination of the soil or ground water with chemicals or microorganisms.

Health care waste carries a higher risk of infection and injury than any other type of waste. The greater part of waste generated by health institutions (75%-90% of all waste) is not hazardous and can be managed like household waste. The remaining 10%-25% is hazardous and requires special arrangements by the management of the facility.

15.1 Classification of Health Care Waste

Health care waste can be classified as follows.

15.1.1 General or normal waste

This is similar to domestic waste. It is not harmful. Examples are waste from the hospital kitchen/canteen and sweepings from offices, i.e., paper, cardboard, plastics, etc.

15.1.2 Infectious waste

Infectious Waste: Waste generated by inpatient and outpatient activities that are likely to contain harmful organisms. Examples of infectious waste are blood and body fluids, and laboratory waste. Other highly infectious waste are blood and body fluids from patients with viral haemorrhagic fevers (Ebola, Lassa Fever, Marburg).

Sharps: These are sharp-edged waste with puncturing and/or cutting properties. Examples are needles, syringes, blades, and broken vials. They may be infectious when contaminated with blood or body fluids. They are also likely to cause injuries.

Pathological Waste: This type of waste includes body parts, placenta, tissues from surgery, birth, etc. They are potentially infectious.

15.1.3 Toxic waste

Pharmaceutical waste: These are chemical wastes that are normally generated in the provision of pharmaceutical services. Examples are expired drugs, vaccines and leftover drugs.

Electronic Waste: e.g., X-ray machines, films, computers, ultrasound scanners, etc.

Radioactive Waste: e.g., Radionuclides, medium, etc.

15.2 Principles of Health Care Waste Management

The principles are:

- The “Polluter Pays” principle: This implies that all generators of waste are legally and financially responsible for the safe and environmentally sound disposal of the waste they produce.
- The “Precautionary” principle: This is concerned with the adaptation of measures to protect health and safety when the magnitude of the particular risk posed by the waste is uncertain.
- The “Proximity” principle: This principle demands that waste be disposed of at the closest possible location to its source, in order to minimize the risks involved in its transportation.
- The “Duty of Care” principle: This stipulates that any person handling or managing hazardous substances or related equipment is ethically responsible for applying the utmost care.
- The “Prior Informed Consent” principle (cradle-to-grave-control): All parties in health care settings involved in the generation, storage, transportation, treatment, and disposal of hazardous waste should be licensed or registered to do so. Only licensed organisations and sites must be allowed to receive and handle these wastes.

The ultimate responsibility for ensuring that waste is disposed of lies with the person or institution that generates the waste. Health care institutions are therefore responsible for the waste that is generated by their activities and are required to take practical steps to ensure its separation, storage, treatment and safe disposal.

15.3 Components of Health Care Waste Management

A health care waste management system comprises the following:

- Collection and segregation
- Storage
- Transportation
- Treatment
- Final disposal

Health care waste management is discussed below under these headings.

15.3.1 Collection and Segregation

Different types of waste require different methods of disposal. It is therefore important that health care waste is segregated into various categories for effective disposal. Segregation should occur at the source of generation. For example, each type of waste must be placed immediately into its appropriate colour-coded container.

General requirements for waste containers

Containers for collecting waste should have the following characteristics:

- They should be non-transparent
- They should be impervious.
- They should be leak proof.
- They should have close-fitted lids.
- They should have sufficient strength to prevent easy damage during handling or use.

Table 15.3.1 and Figure 15.3.1 below show the approved colour-codes for the different types of waste containers.

Table 15.3.1: Colour-coding of health care waste containers

Category	Container and Colour code
General waste	Black plastic bags and bins
Sharps	Yellow puncture-resistant containers
Other infectious waste	Yellow plastic bags and bins
Pharmaceutical and chemical containers	Brown plastic bags and bins
Highly infectious waste	Red biohazard plastic bags and bins

Figure 15.3.1: Colour-coded bins



15.3.2 Storage

Storage takes place from the time waste is generated until its collection for final disposal. There are two types of waste storage: internal and external.

Internal waste storage

This is the temporary placement of waste at the point of generation (e.g., consulting room or injection room) before being sent to external storage sites.

The following shall apply to internal waste storage:

- Do not store health care waste at the temporary sites for more than 24 hours.
- Empty waste bins/containers daily or when two-thirds full (whichever comes first), but discard sharps containers.
- Every unit or ward in the health care facility should be provided with adequate numbers of appropriate waste bins.
- Once you drop waste in the container, do not put your hands in to remove anything from the container.
- Waste bins should be covered and placed in areas protected from rain, pests, etc.
- Waste containers used should be cleaned and disinfected after emptying.

External waste storage

This refers to the site where waste is stored after removal from an internal storage area, until it is collected for final disposal.

Guidelines for external waste storage are as follows:

- External storage areas for health care waste should be sited away from the reach of the general public.
- The storage site should be enclosed, provided with a gate, and locked.
- The floor should be smooth, impervious, and easy to clean.
- Do not allow access to the storage sites by unauthorized human beings and animals.
- Waste bins should be washed and disinfected after each collection and more frequently if required.

15.3.3 Transportation

Health care waste must be transported directly to the disposal or treatment site within the shortest possible time.

Vehicles (e.g., wheelbarrow) used for transportation (internally or externally) should be such as will prevent scattering of waste, odour, and be leak proof.

15.3.4 Treatment

The recommended treatment options for health care waste are:

- Incineration
- Sterilisation by Autoclave or Dry Heat
- Chemical Disinfection

15.3.5 Final disposal

Disposal of solid waste

Proper treatment and disposal of health care waste is necessary to ensure that its impact on health workers, waste collectors, the public, and the environment is minimized or eliminated. The best disposal methods for treated health care waste are controlled disposal at proper sanitary landfill and burial. General waste should be treated as domestic waste and disposed of at landfill sites. Sharps, pharmaceutical, as well as pathological waste must be incinerated.

Note:

- **Ideally, final disposal must be by incineration.**
- **Final disposal could also be by burning or burying in well-fenced pits, in facilities where incinerators are not available.**

Disposal of liquid waste

Disposal of liquid waste should be handled with utmost care to avoid splashing the waste on oneself, others, or on the floor and other surfaces. The following should serve as a guide:

- Carefully pour liquid waste down a sink dedicated for the purpose, a drain, water closet, or latrine. If this is not possible, bury it in a pit along with solid waste.
- Rinse the sink, drain, or toilet thoroughly with water to remove residual waste, still avoiding splashing.
- Clean these areas with a disinfectant cleaning solution at the end of each day, or more frequently if heavily used or soiled.
- Decontaminate the container that held the liquid waste by filling it with, or soaking it for 10 minutes in, a 0.5% chlorine solution before washing.
- Wash your hands after handling liquid waste, and decontaminate and wash gloves.

Other waste

- Placenta or body parts should be incinerated or buried in a safe area.
- Chemical wastes should be treated as for liquid waste.
- Genotoxics should be disposed of in consultation with experts.

Health workers who handle waste should be provided with protective clothing.

This includes:

- Elbow-length heavy duty gloves
- Overalls
- Eye protection (goggles)
- Face masks (N95 for highly infectious)
- Helmets/headgear (if applicable)
- Wellington boots

Housekeepers and cleaners should have as thorough an understanding of issues relating to health care waste management as other health care professionals, since they all perform some aspects of waste management.

Supervisors and administrators who make decisions about waste management practices and procurement of related items should also be familiar with this section.

Section 16: Occupational Health and Safety

It is the responsibility of the Ministry of Health to ensure the safety of all staff while at work. Individual staff also have the responsibility to take reasonable care for the health and safety of themselves and other people who may be affected by their acts or omissions at work. Team Leaders/Supervisors, by acting as role models, will be able to influence the practice of others. Health care workers should be protected against acquiring infections in the workplace. Several infections can be acquired in the health care setting: Examples are infections such as tuberculosis (TB), HIV/AIDS, Hepatitis B, C, and D, Human Papilloma Virus (HPV), Methicillin Resistant Staphylococcus Aureus (MRSA), and Viral Haemorrhagic Fevers (VHF). The following recommendations are to ensure the health and safety of health care workers.

16.1 Risk Assessment and Management

Infection prevention and control risk assessments should be carried out in each health facility.

- The various District Infection Prevention and Control Committees should receive and discuss institutional risk assessment, risk management, and plans.
- District Infection Prevention and Control Committees should submit their risk assessment and management plans to Regional Infection Prevention and Control Committees.
- The Regional Infection Prevention and Control Committee will discuss and submit their regional risk profiles and management plans to the national IPC programme management unit.
- The Regional Infection Prevention and Control Committee should monitor the implementation of the risk management plans at the lower levels of service delivery.
- The National IPC programme management unit shall analyse the national economic impact of health care-associated infections on the health care system.

In assessing risk, the following shall be done:

1. Identify the hazard (e.g., infection) and its likely mode(s) of contact.
2. Determine the likelihood (probability) of its occurrence.
3. Ascertain the likely severity of its effect.
4. Determine level of priority.
5. Recommend level of action or control measures to be taken.

In instituting control measures, apply the hierarchy of controls in the following order:

- Engineering and environmental controls – e.g., provision of appropriate physical structures, adequate ventilation, proper environmental cleaning
- Administrative controls – e.g., provision of adequate staff and supplies, education of health workers, patients, and visitors
- Personal protective measures

16.2 Staff Management Strategies

There shall be health assessment during the pre-employment period and an exit assessment.

- All health workers shall have at least a yearly medical examination.
- All health staff shall be immunized against immunizable diseases on recruitment into service, and booster doses shall be given as appropriate.
- All health staff that are accidentally exposed to an infected person shall be thoroughly investigated and treated (see Appendix 6 for accidents/injuries reporting format).
- A logbook shall be kept within units for recording injuries and infections (both potential and real).
- Another logbook shall be kept at the Occupational Health Unit to record results of all investigations done and treatments provided to the staff.
- Information obtained about health workers shall be confidential and shall be disclosed only with the consent of the health worker, except when disclosure is in the public interest or required by law.
- All health care workers should have attire specifically for work.

For staff in special units, the frequency of the laboratory examinations should be determined and applied.

Section 17: Laboratory Biosafety

The primary goal of this section is to provide basic information on laboratory biosafety. More in-depth information can be found in standard operating procedures (SOPs) for laboratory services.

17.1 General Laboratory Guidelines

- All laboratory personnel, and others whose work requires them to enter the laboratory, shall be knowledgeable about the chemical and biological hazards with which they will come into contact through their normal work in the laboratory, and shall be trained in appropriate safety precautions and procedures.
- Access to the laboratory shall be severely restricted to only authorized persons.
- The laboratory shall be kept neat, orderly, and clean, and with minimal storage of materials not pertinent to the work.
- Protective laboratory clothing (e.g., uniforms, coats, gowns) shall be made available and worn properly by all personnel including visitors, trainees, and others entering or working in the laboratory.
- Protective laboratory clothing shall not be worn in non-laboratory areas.
- Suitable footwear with closed toes and heels, and preferably with non-slip soles, shall be worn in all laboratory areas.
- Safety face and eye wear (e.g., glasses, goggles, face shields, or other protective devices) shall be worn when necessary to protect the face and eyes from splashes, impacting objects, harmful substances, UV light, or other rays.
- Eating, drinking, smoking, storing food or utensils, and applying cosmetics shall not be permitted in any laboratory work area.
- Long hair shall be tied back or restrained.
- Oral (MOUTH) pipetting is prohibited in any laboratory.
- Ideally, vacutainers should be used. Where this is not possible, hypodermic needles and syringes shall be used. These must be disposed of appropriately.
- Extreme caution shall be used when handling needles and syringes, to avoid auto-inoculation and the generation of aerosols during use and disposal. Needles shall not be bent or recapped and shall be promptly placed in a puncture-resistant container for disposal.
- Gloves shall be worn for all procedures that might involve direct skin contact with toxins, blood, or infectious materials.
- Gloves should be changed between patients/clients.
- Reusable utility gloves shall be appropriately decontaminated.
- Hands shall be washed before leaving the laboratory and at any time after handling materials known or suspected to be contaminated, and after removal of gloves.
- Work surfaces shall be disinfected before and after procedures are completed, and at the end of each working day, with an effective all-purpose disinfectant such as hypochlorite solution with a concentration of 0.5% available chlorine.
- Loose or cracked work surfaces should be replaced by management as soon as possible.
- All technical procedures shall be performed in a manner that minimises the creation of aerosols.
- All contaminated or infectious liquid or solid materials shall be treated before disposal.
- Contaminated materials to be autoclaved or incinerated at a site away from the laboratory shall have the outside

disinfected chemically, or shall be double-bagged and then transported to the autoclave or incinerator in durable leak-proof containers which are closed and wiped on the outside with disinfectant before removal from the laboratory.

- Hazard warning signs with the relevant information shall be posted outside the entrances of laboratories where the infectious agent(s) used in the laboratory requires special provisions for entry.
- All laboratories shall have clear written procedures for dealing with spillages or other accidental contamination.
- All spills, accidents/incidents, and overt or potential exposures shall be reported in writing to the supervisor.
- The Accident/Incident Spill Report Form and Post-Exposure Form shall be completed (see Appendix 6 for samples of reporting forms) and appropriate medical evaluation, surveillance, and treatment shall be provided as required.
- Laboratory personnel should work on infectious specimens in the right environment, e.g., inside biological safety cabinets where necessary.
- Laboratory personnel shall be protected against relevant infection by immunization where possible and shall be tested for immunity.

Note: Refer to Laboratory Safety Guidelines

17.2 Handling Clinical Specimens

Clinical specimens include: excreta, secretions, blood and its components, body fluids, tissue and tissue fluid of human and animal origin. The proper handling (selection, collection, storage, and transportation) of clinical specimens is an essential component of IPC and the quality assurance system of the microbiological laboratory.

17.2.1 Rationale for proper handling of specimens

Proper handling of specimens ensures:

- Their Integrity
- Their Timely Receipt In The Laboratory
- Reduction of Wastage of Resources
- Reduction In Incorrect Diagnosis
- Reduction In The Risk of Infections To the client and health staff

17.2.2 Types of clinical specimens

There are several types of clinical specimens. Some of these are:

- Stool and urine
- Blood and body fluids
- Body tissues
- Sputum

The correct type of specimen to collect depends on the type of infection and symptoms. For example, if one suspects septicaemia, a blood specimen is required; if it is a urinary tract infection, a urine sample is required; and for respiratory tract infections, sputum and not saliva is required.

17.3 General Principles for the Collection of Specimens

17.3.1 Time of collection

The time of collection for most specimens depends on the condition of the patient, the type of disease being investigated, and times agreed on by the clinician, nursing, and laboratory staff for the delivery of a specimen to the laboratory. For example, sputum and urine are best collected in the morning soon after the patient awakes, when the organisms have had the opportunity to multiply over several hours. In cases of septicaemia, blood is best collected at the peak of the patient's temperature. Specimens must be collected before antimicrobial treatment is started. If antimicrobial treatment has started, indicate on the form the time and type of antimicrobial administered.

17.3.2 Precautions for the collection of microbiological specimens

- Laboratories should provide wards and outpatient clinics with appropriate specimen containers and instructions to ensure that specimens are safely kept and transported. Under no circumstance should patients be allowed to use their own specimen containers.
- Use aseptic techniques to prevent contamination of the specimen, especially during collection from sites that are normally sterile: e.g., blood, cerebrospinal fluid, or effusions. This ensures that the specimen contains microorganisms only from the site where it was actually collected.
- Swabs used to collect discharges and wound materials must be sterile and free from antibacterial agents. Avoid contaminating discharges and wounds with skin commensals (normal flora). Collect specimens in sterile, leak-proof, dry containers, free from traces of disinfectants.
- The containers must be autoclavable plastic to avoid breakages.
- Sterile containers are not necessarily required for collection of faeces and sputum. Containers must, however, be clean.
- Instruct patients on how to aseptically collect a specimen to avoid contaminating the outside of the containers. If contamination occurs before the specimen is sent to the laboratory, wipe the outside of the container with a paper tissue or cloth soaked in disinfectant.
- Specimens should be collected in the appropriate place to avoid transmission of infections. For example, all facilities should be encouraged to provide separate toilets for collection of urine and faecal specimens and properly ventilated areas for collection of sputum.
- Upon receipt, the specimen must be evaluated for abnormal features such as cloudiness, abnormal coloration, or presence of pus, blood, mucus, or parasites.
- As a routine, the appearance of urine, pus, vaginal discharge, faeces, effusion, and cerebrospinal fluid should be evaluated and reported.

Note: Ensure that the appropriate container is used for the collection of a specimen.

17.3.3 The Request form and labelling of specimens

The clinician or health provider must label the specimen container correctly and fill out the request form appropriately. Incorrect patient identification or incorrect labelling of either specimen or request form may lead to incorrect diagnosis, hence inappropriate treatment. Each specimen must be accompanied by a request form which gives the following information:

- Patient's name
- Name of facility
- Ward/unit/department
- Identification number or insurance number
- Date of birth or age
- Sex
- Specimen type and source
- Date and time of collection
- Main clinical signs and symptoms and most likely diagnosis
- Physician to whom results are to be sent
- Any antimicrobial agent the patient is receiving or has received
- Clinician requesting for laboratory investigation
- Clinician's signature
- Clinician's telephone number
- Test requested

The specimen container must be properly labelled with the following information:

- Patient's name
- Age and sex
- Ward/unit/department
- Identification number
- Source of specimen
- Date and time of collection

17.3.4 Transportation of specimens

To ensure that pathogens survive during transportation to the laboratory, specimens should be delivered to the laboratory as soon as possible after collection. When delay is unavoidable, suitable preservatives or transport media must be used to prevent the organisms from dying due to enzyme action, change of pH, or lack of essential nutrients. Anaerobes usually require transport medium.

17.3.5 Mailing/dispatch of clinical specimens

Special precautions must be taken when transporting or mailing specimens, as carrying infectious specimens over long distances – whether by hand, motor transport, by inland mail, or by external mail – is more hazardous if the organisms are in Risk Group 3 or 4 (see Table 17.5) (e.g., sputum for acid-fast bacilli and blood for *Brucella*).

Regulations governing the carriage of such materials by mail should be applied. Guidelines may be obtained from the Post office and health authorities. For carrying specimens by air across international boundaries, obtain the regulations from the health and aviation or airline authorities. Specimens for dispatch must be packed well and safely. All specimens should be considered potentially hazardous and must bear Biohazard labels as shown in Figure 17.3.5.

Figure 17.3.5: Biohazard symbol



17.3.6 Storage of microbiological specimens

The following guidelines should be applied for storage of specimens:

- Refrigeration at 4°-10° C can help to preserve and reduce the multiplication (overgrowth) of normal flora in unpreserved specimens. However, specimens for the isolation of *Haemophilus influenzae*, *S. pneumoniae*, or *Neisseria gonorrhoeae* must be sent immediately after they are taken to the laboratory. They must never be refrigerated because these pathogens die under cold conditions.
- Infectious materials and agents that require low temperatures should be stored in deep-freeze cabinets or on dry ice. The outer surfaces of ampoules stored in these ways should be disinfected when the ampoules are removed from storage.

17.4 Standard Precautions and Dangers Involved in Handling Specimens

All specimens are to be treated with Standard Precautions at all times, because it is often impossible to know which specimen might be infectious. The primary dangers are contamination of hands, parenteral exposure through accidental needle sticks, cuts from contaminated equipment, exposure of mucous membranes (e.g., eye, nose) to aerosolized droplets, and exposure of broken skin, wounds, and scratches to contaminated specimens.

The handling, transfer, and shipment of improperly packed specimens also carry a risk of infection to all people directly engaged in or in contact with any part of the process. They also endanger personnel who are indirectly involved, e.g., the administrators, secretarial staff, and other support personnel. They also pose a risk to the public and to personnel of the transport and postal services.

It is always important that infectious specimens should be worked on in the right environment by laboratory personnel: e.g., inside biological safety cabinets where necessary. Always practice Standard Precautions with all specimens at all times.

17.5 Classification of Biological Agents*

The inherent risks of a pathogen are judged according to:

- Severity of the disease it causes
- Routes of infection
- Its virulence and infectivity
- Existence of effective therapies
- Immunization
- Presence or absence of vectors

Biological agents are classified into four (4) risk groups, which primarily reflect the judgements made concerning their inherent risk. There are four (4) corresponding levels of containment. Table 17.5 summarizes the risk groups and levels of containment.

Table 17.5: Summary of risk groups and levels of containment

Risk Group		Containment Level
1	Agents most unlikely to cause human disease.	<ul style="list-style-type: none">• Good microbiological practice recommended for all work with microorganisms. This should minimise risks for inadvertently culturing pathogenic organisms or non-pathogenic organisms proving harmful.
2	Agents that may cause human disease and may be a hazard to laboratory workers but are unlikely to spread to community. Laboratory exposure rarely produces infection. Effective prophylaxis or treatments are usually available.	<ul style="list-style-type: none">• Good microbiological practice mandatory.• Most work can take place on the open bench, but safety cabinets are required for operations generating significant aerosols.
3	Agents that may cause serious human disease and may be a hazard to laboratory workers may be of high risk of spreading to community. Effective prophylaxis is usually available.	<ul style="list-style-type: none">• Risks of airborne contamination reduced by working in safety cabinets (usually open fronted).
4	Agents that cause severe human disease and are a serious hazard to laboratory workers may be of high risk of spreading to the community. Usually no effective prophylaxis or treatment available.	<ul style="list-style-type: none">• Work performed in closed cabinets in maximum containment laboratories.

Source: * <http://www.soton.ac.uk/~safety/GuidelinesforHandlingMicroorganisms.html>

17.6 Biohazard Spills

Biological spills outside biological safety cabinets will generate aerosols that can be dispersed in the air throughout the laboratory. These spills can be very serious if they involve microorganisms that require Level 3 Containment, since most of these agents have the potential for transmitting disease by infectious aerosols. To reduce the risk of inhalation exposure in such an accident, occupants should leave the laboratory immediately. The laboratory should not be re-entered to decontaminate or clean up the spill for at least 30 minutes. During this time, the aerosol may be removed from the laboratory via the exhaust ventilation systems, such as biological safety cabinets or chemical fume hoods, if present.

17.6.1 Spills on the Body

- Remove contaminated clothing.
- Wash exposed area vigorously with soap and running water for one minute.
- Obtain medical attention (if necessary).
- Report the incident to the laboratory supervisor.

17.6.2 Biosafety Level 1 Organism Spill

- Wear disposable gloves.
- Soak paper towels in disinfectant and place over spill.
- Place towels in a plastic bag for disposal.
- Clean up spill area with fresh towels soaked in disinfectant.

17.6.3 Biosafety Level 2 Organism Spill

- Alert people in immediate area of spill.
- Put on personal protective equipment. This may include a laboratory coat with long sleeves, back-fastening gown or jumpsuit, disposable gloves, disposable shoe covers, safety goggles, mask, or full-face shield.
- Cover spill with paper towels or other absorbent materials. Pour a freshly prepared 0.5% (1:10) dilution of household bleach around the edges of the spill and then into the spill. Avoid splashing (see Section 10: Housekeeping).
- Allow a 20-minute contact period. After the spill has been absorbed, clean up the spill area with fresh towels soaked in disinfectant.
- Place towels in a plastic bag and incinerate or burn.

17.6.4 Biosafety Level 3 and 4 Organism Spills

- Attend to injured or contaminated persons and remove them from exposure.
- Alert people in the laboratory to evacuate. Close doors to affected area.
- Call appropriate emergency number for emergency response.
- Have a person knowledgeable of the incident/accident and laboratory assist emergency personnel on arrival.
- In special situations, with spills of microorganisms such as anthrax and Ebola, the Ministry of Health shall develop specific guidelines to deal with these.

17.7 Cytotoxic/Antineoplastic Spills

17.7.1 General Procedures

- Follow appropriate guidelines established by the laboratory.
- Immediately clean up spills and breakages of cytotoxic/antineoplastic drugs.
- Remove broken glass carefully.
- Identify spill with a warning sign, so that other persons in the area will not be contaminated.

17.7.2 Personnel Contamination

- Remove the gloves or gown immediately.
- Wash the affected skin area immediately with soap (not germicidal cleanser) and running water. For eye exposure, immediately flood the affected eye with water or normal saline designated for the purpose for at least five minutes.

- Obtain medical attention immediately.

17.7.3 Clean-up of Small Spills

- Immediately clean up spills of less than 5 ml or 5 gm outside a hood.
- Wear gowns, double surgical latex gloves, and eye protection for procedure.
- Wipe up liquid with absorbent gauze pads. Wipe solids with wet absorbent gauze. Then clean the spill areas (three times) using a detergent solution followed by clean water.
- Place broken glass fragments in a small cardboard or plastic container, then into a disposal bag along with the used absorbent pads and any non-cleanable contaminated items.
- Place reusable glassware or other contaminated items in a plastic bag, to be washed in a sink with detergent by a trained employee wearing double surgical latex gloves.

17.7.4 Clean-up of Large Spills

For spills of amounts larger than 5 ml or 5 gm, the spread should be limited by gently covering with absorbent sheets of spills-control pads or pillows or, if a powder is involved, with damp cloths or towels. Be sure not to generate aerosols.

- Access to the spill areas should be restricted.
- Wear personal protective equipment (PPE) with the addition of a respirator when there is any danger of airborne powder or an aerosol being generated. The dispersal of particles into surrounding air and the possibility of inhalation are serious matters and should be treated as such.
- Chemical inactivators (with the exception of sodium thiosulfate, which can be used safely to inactivate nitrogen mustard) may produce hazardous by-products and should not be applied to the spilled drug.
- Clean all contaminated surfaces with detergent solution, and then wipe with clean water. All contaminated absorbents and other materials should be disposed of in the disposal bag.

17.7.5 Spills in Hoods

If the spill occurred in a glove box, clean bench, or biological safety cabinet, the filter contained in the cabinet is more than likely contaminated. Label the unit “Do Not Use – Contaminated with (name of substance)”. The filter and filter cabinet must be decontaminated and the filter changed and properly disposed of. This procedure may require the services of an outside contractor trained in the use of specialised personal protective equipment.

17.7.6 Waste Disposal

See Section 15 on health care waste management.

17.7.7 Blood Spills

See Section 10 on housekeeping.

Section 18: Additional Precautions

Additional precautions are also called expanded precautions or transmission-based precautions. These are additional measures to complement Standard Precautions and are designed to prevent transmission of microorganisms that are transmitted through airborne, droplet, and contact modes. These precautions apply mainly in hospitalized patients. In practicing additional precautions, isolation is mandatory. Additional precautions include:

- Contact precautions
- Droplet precautions
- Airborne precautions

Note: When additional precautions are indicated, appropriate education and counselling must be given to patients and relations to counteract possible adverse effects on patients (e.g., anxiety, depression, perception of stigma, reduced contact with clinical staff) in order to improve compliance by patients.

18.1 Contact Precautions

Contact precautions are intended to prevent transmission of infectious agents which are spread by direct or indirect contact with the patient or the patient's environment. Excessive wound drainage, faecal incontinence, and other discharges from the body all lead to extensive environmental contamination.

In addition to Standard Precautions:

- Nurse patients in a single room if available. If unavailable, share room with another patient who has an active infection with the same organism.
- Ensure that patients are physically separated from each other. Distance of separation should be at least one metre with droplets infections.
- Health care personnel caring for patients on contact precautions shall wear a gown, gloves, goggles (face shield), rubber aprons, footwear, and headgear for all interactions that may involve contact with the patient or the patient's contaminated environment.
- Always disinfect the outer gloves between contacts with patients in the same room. Do not take off the attire while in the room (kindly review).
- After completing procedures, remove gloves before leaving the patient's room and perform hand hygiene.
- Ensure that the hands of personnel do not touch potentially contaminated environmental surfaces after gloves are removed.
- Limit patient movement to that which is absolutely necessary. Take care during transport to minimize contact with other patients or environmental surfaces.
- When transport is necessary, ensure that infected or colonised areas of the patient's body are contained and covered.
- Remove, decontaminate, and dispose of non-reusable PPE and perform hand hygiene prior to transporting patients.
- Wear clean PPE to handle the patient at the transport destination.
- Use non-critical patient care equipment (e.g., thermometers, rubber aprons, etc.) only for a single patient.
- If sharing of common equipment is absolutely necessary, adequately clean and disinfect the equipment before using it for another patient.

18.2 Droplet Precautions

Droplets are usually generated from coughing, sneezing, talking, as well as during procedures such as bronchoscopy or suctioning. Droplet precautions are intended to prevent transmission of pathogens spread through close respiratory or mucous membrane contact with respiratory secretions. Examples of organisms in this category include influenza and mumps viruses, *Mycoplasma*, *Streptococcus pneumoniae*, and *Bordetella pertussis*.

In addition to Standard Precautions, the following shall be observed:

- Patients shall be placed in a single room or, if not available, they may be cared for in isolation or in a corner of the ward.
- A sign indicating precautions to be taken shall be placed on the door of the patient's room and on the patient's chart.
- The appropriate mask shall be worn when working within 1 metre of the patient.
- Patient movement shall be limited to that which is absolutely necessary.
- Relatives shall wear appropriate PPEs.
- Patients shall be encouraged to use face masks at all times.
- Instruct patients to follow Respiratory hygiene/cough etiquette (see Section 18.4).
- With regards to patient transport, instruct patient to wear mask and follow respiratory hygiene.
- No mask is required for a person transporting patients in open spaces.

18.3 Airborne Precautions

Airborne precautions are designed for infections that are transmitted by airborne droplets that can remain suspended in the air. Airborne precautions prevent transmission of infectious agents that remain infectious over long distances and periods when suspended in the air. Examples include tuberculosis, rubella (German measles), varicella (chickenpox), and possibly SARS.

In addition to Standard Precautions, the following shall be observed in airborne precautions:

- Patients shall be isolated (refer to Category "A" isolation) or in an airborne infection isolation room. An airborne infection isolation room is a single patient room that is equipped with special air handling and ventilation capacity (6 to 12 air exchanges per hour).
- A respiratory protection programme that includes education about use of respirators, fit testing, and user seal checks is required in any facility for airborne precautions.
- Patients must practice respiratory hygiene/cough etiquette.
- In settings where airborne precautions cannot be implemented, masking the patient, placing the patient in a single room with the door closed, and providing N95 or FFP2 or higher-level respirators for health care personnel will reduce airborne transmission. Masks should only be used in such a situation if respirators are unavailable.
- A sign indicating precautions to be taken shall be placed on the door of the client's room and on the client's chart.
- All relatives must wear the appropriate protective clothing before entering the room.
- Patients' movement shall be limited to that which is absolutely necessary.
- Patients shall wear masks when being transported outside the room.

Precautions for aerosol-generating procedures when airborne precaution is indicated:

The performance of procedures that can generate aerosols, such as bronchoscopy, endotracheal intubation, and open suctioning of the respiratory tract has been associated with transmission of infections such as tuberculosis, SARS, and meningitis to health care personnel.

Protection of the eyes, nose, and mouth, in addition to gown and gloves, is recommended during performance of these procedures in accordance with Standard Precautions. A respirator is recommended during procedures likely to contain TB, SARS, Avian or Pandemic Influenza viruses.

18.4 Respiratory Hygiene/Cough Etiquette

Respiratory hygiene is a practice encouraged to reduce the spread of microbes (droplets) from coughing, sneezing, and nose blowing through the use of a barrier such as handkerchief/tissue paper to contain the microbes.

Health care personnel should be educated about the importance of source control measures to contain respiratory secretions to prevent droplet and fomite transmission of respiratory pathogens, especially during seasonal outbreaks of viral respiratory tract infections from organisms (e.g., influenza virus, adenovirus, para-influenza virus) in communities.

18.4.1 Measures for individuals with signs and symptoms of respiratory infection

The following measures to contain respiratory secretions are recommended for all individuals with signs and symptoms of a respiratory infection:

- Cover the mouth and nose with a handkerchief or tissue when coughing or sneezing. In the absence of that, use inner part of the forearm to cover your mouth.
- Use a disposable tissue to contain respiratory secretions, and dispose of it in the nearest waste receptacle after use.
- After having contact with respiratory secretions or contaminated objects/articles, perform hand hygiene/hand washing with soap and water, alcohol-based hand rub, or antiseptic hand wash.
- Health care facilities should do the following to ensure the availability of materials for adhering to respiratory hygiene in waiting areas for patients and visitors:
 - Provide tissues and non-touch receptacles for used tissue disposal
 - Provide conveniently located dispensers of alcohol-based hand rub
 - Put notices in the facility to facilitate cough etiquette, including not spitting on the floor
 - Ensure availability of hand-washing supplies (i.e., water, soap, disposable towels).

18.4.2 Measures directed toward patients and accompanying symptomatic individuals

In order to contain respiratory secretions in patients and in accompanying individuals who have signs and symptoms of a respiratory infection, measures should:

- Begin at the point of initial encounter in a health care setting (e.g., triage, reception and waiting areas in emergency departments, outpatient clinics, and physician offices).
- Include posting signs at entrances and in strategic places (e.g., corridors, lift (elevator), canteens) within OPD and inpatient settings with instructions to patients and other persons with symptoms of a respiratory infection to: cover their mouths/noses when coughing or sneezing, use and dispose of tissues, and perform hand hygiene after hands have been in contact with respiratory secretions.
- Continue during periods of increased prevalence of respiratory infections in the community (e.g., as indicated by increased number of patients seeking care for a respiratory infection). For example:
 - Offer appropriate masks to coughing patients and other symptomatic persons (e.g., persons who accompany ill patients) upon entry into the facility or medical office.
 - Encourage them to maintain spatial separation, ideally a distance of at least 1 metre, from others in common waiting areas.

Section 19: Isolation

Isolation is the process of separating patients with certain communicable diseases from uninfected persons and separating immunocompromised patients from others.

Note: All persons accessing the isolation area shall observe the Standard Precautions guidelines.

19.1 Categories of Isolation

There are three main categories of isolation: These are categories A, B, and C.

- Category A: This applies to infections spread by direct contact with contaminated equipment, faeces, body fluids, and airborne infections.
- Category B: This applies to patients that require Strict Isolation. They are in specialized units for patients with highly contagious diseases like rabies, anthrax, diphtheria, and haemorrhagic fevers.
- Category C: This is also referred to as Protective (reverse) Isolation. It applies to immunocompromised patients who must be protected from other patients and attending staff, e.g., patients on cancer treatment.

19.1.1 Category “A” isolation

Examples of diseases in this category are cholera, enteric fever, and severe pulmonary tuberculosis.

The requirements for category “A” isolation are:

- Cubicle
- Protective clothing – gloves and aprons are essential (masks shall be used if indicated).

In addition to Standard Precautions, the following measures shall be adhered to:

- All health staff and visitors shall abide by IPC protocols and wear protective clothing as indicated.
- Protective clothing shall be disposed of immediately after use.
- Patients in this category shall be attended to last, i.e., after dealing with all non-infected patients.
- All health staff that are inadvertently exposed to an infected person(s) shall be thoroughly investigated.
- Body fluids and faeces shall be disposed of immediately.
- Where separate equipment is not available for different patients, reliable decontamination methods shall be used before reusing the equipment on other patients.
- Airborne Precautions shall be applied when indicated.

19.1.2 Category “B” isolation (Strict isolation)

These specialized units apply to patients with highly contagious diseases like rabies, anthrax, diphtheria, haemorrhagic fevers, etc.

The requirements for category “B” isolation shall include:

- Cubicle
- Protective clothing such as plastic aprons, masks, gloves, eye goggles, gowns
- Disposable plates, cups, and cutlery

In addition to Standard Precautions, the following measures shall apply:

- Use disposable non-clinical items and do not recycle items like plates, cups, and cutlery.
- Keep airborne contamination and patient handling to a minimum.
- Educate health care facility staff and visitors on the risks involved when looking after such patients.
- There shall be restricted access to the patient.
- All waste produced in this unit shall be handled as highly infectious.

Note: Airborne precautions and other precautions to be taken by visitors also apply. Dead bodies from category “B” diseases should be put in body bags before removal from the wards.

19.1.3 Category “C” isolation (Protective isolation)

This shall apply to patients who must be protected from other patients and attending staff, such as immunosuppressed patients (e.g., patients on cancer treatment).

The requirements for category “C” isolation shall be:

- Cubicle
- Protective clothing, plastic aprons, masks, gloves, eye goggles, and gowns

In addition to Standard Precautions, the following measures shall be observed:

- Patients in this category must be attended to first, before attending to all other patients.
- Hygienic hand wash, sterile aprons, gloves, and head gear/cap, mask, etc. must be worn.
- All protective clothing shall be discarded after attending to patients.

19.2 General Isolation Guidelines

- Health care providers shall collaborate in effecting the timely and appropriate application of isolation.
- All isolation wards shall be clearly labelled.
- Procedure and need for isolation shall be explained to the patient and family.
- Prepare a well-ventilated room/area for isolation with all necessary equipment.
- Display a “NO VISITORS” sign clearly in the patient’s isolation area.
- The physician or Nurse-In-Charge, using the appropriate form, shall report all infectious cases suspected or confirmed to the appropriate authority.
- The patient’s charts and records shall be kept outside the patient’s room.
- Contact tracing should be done and investigations must be carried out, especially for all visitors and relations when indicated.

19.2.1 Preparation of isolation ward/room

- All isolation wards/rooms shall have an anteroom and a separate exit.
- Ensure that appropriate hand washing facilities are available within the ward/room.
- Ensure adequate room ventilation.
- Post an isolation sign on the door.
- Remove all non-essential furniture; the remaining furniture should be easy to clean, and should not conceal or retain dirt or moisture.

- Appropriate colour-coded waste bins and dirty linen bins should be kept in the isolation ward/room.
- Place a puncture-proof container for sharps disposal inside the isolation room.
- Keep adequate and separate equipment for cleaning or disinfecting the isolation room, and ensure daily cleaning of the isolation room.
- Stock PPE supplies and linen outside the isolation room.
- Provide well-designated places for decontamination and disinfection.

19.2.2 Transporting infected patients

- Patients shall leave the isolation area only for essential purposes.
- When patient transportation is necessary, it is important that:
 - Appropriate barriers (e.g., masks, barrier-proof dressings) are worn or used by the patient to reduce the transmission of pertinent microorganisms to other patients, staff, and visitors, and to reduce contamination of the environment
 - Personnel, in the area to which the patient is to be taken, are notified of the impending arrival of the patient and of the precautions to be taken
 - Patients are informed of how they can assist in preventing the transmission of their infectious microorganisms to others.
- The vehicle used for transporting the patient shall be decontaminated/disinfected and cleaned.

19.2.3 Visitors

Visitors shall:

- Be restricted to two persons at a time during visiting hours.
- Observe the “NO VISITORS” sign and report to the Nurse-In-Charge prior to entering the isolation ward/room.
- Be requested not to bring items which may harbour potentially harmful microorganisms.
- Be educated on the necessary precautions to be taken to prevent the spread of infection to the family, friends, and community.
- Wear personal protective equipment (e.g., gloves, masks, gowns) if required.
- Practice hand hygiene before and after visiting the isolation ward.

19.2.4 Patients’ personal effects

- Patients in isolation shall not share items which may serve as vehicles for transmission of microorganisms.
- Stuffed toys for children shall be discouraged. Soft plastic toys shall be suggested as an alternative. These plastic toys shall be disinfected before a patient is discharged.
- No special precautions are required for utensils. Follow standard procedures for the handling and care of utensils, i.e., washing with soap and hot water or 0.5% (1:10) sodium hypochlorite solution. Soak utensils in solution for 10 minutes, then rinse.

19.2.5 Patient care equipment and articles

- Contaminated, reusable, critical medical devices or patient care equipment shall be sterilised.
- Semi-critical medical devices or patient care equipment shall be sterilised or disinfected after use, to reduce the risk of transmission of microorganisms to other patients. The article and its intended use, the manufacturer’s recommendations, the health care facility policy, and any applicable guidelines and regulations determine the type of disinfection.
- Non-critical equipment contaminated with blood, body fluids, secretions, or excretions shall be decontaminated/disinfected and cleaned after use, according to the health care facility policy.

- Contaminated, disposable (single-use), patient care equipment shall be handled and transported in a manner that reduces the risk of transmission of microorganisms and environmental contamination in the health care facility.
- The equipment shall be disposed of according to the institution's policy and applicable regulations.

19.2.6 Linen and laundry

- Soiled linen shall be handled, transported, and laundered in a manner that avoids transfer of microorganisms to patients, personnel, and the environment.

19.2.7 Routine and terminal cleaning of the isolation ward/unit

- Standard routine cleaning procedures shall be strictly adhered to.
- Terminal decontamination, cleaning, and disinfection shall be done when the patient no longer occupies the room.
- The room, or area and bedside equipment, of patients on Expanded Precautions shall be cleaned using the same procedures used for patients on Standard Precautions, unless the infecting microorganism(s) and the amount of environmental contamination indicates special cleaning.
- In addition to thorough cleaning, adequate disinfection of bedside equipment and environmental surfaces (e.g., bedrails, bedside tables, carts, doorknobs, faucet handles, light switch, etc.) is indicated for certain pathogens, especially Enterococci, which can survive in the inanimate environment for prolonged periods of time.
- All waste shall be decontaminated and disinfected before disposal.
- The room should be aired for at least 24 hours before the next admission.

Section 20: Asepsis and Aseptic Technique in Clinical Procedures

Asepsis literally means without germs, and aseptic technique refers to practices that help reduce the risk of post-procedure infections in patients/clients by decreasing the likelihood of germs entering the body during clinical procedures. Aseptic technique also reduces the service provider's risk of exposure to potentially infectious blood and blood products, other body fluids, and tissues during clinical procedures.

Components of aseptic technique include:

- Hand hygiene
- Use of personal protective equipment (PPE)
- Skin and mucous membrane preparation for clinical procedures
- Maintaining a sterile field during sterile procedures
- Maintaining a clinically safe environment in the surgical/procedure area

Guidelines on hand hygiene and use of protective clothing are in Sections 6 and 7 respectively.

20.1 Skin and Mucous Membrane Preparation for Clinical Procedures

Although skin cannot be sterilised, applying an antiseptic solution minimises the number of germs around the site that may contaminate and cause infection. In addition, for surgical incisions:

- Avoid shaving the hair around an operative site; if necessary, remove hair with clippers.
- If the area is heavily soiled, wash with soap and water and dry before applying antiseptic.
- Ask patients about allergic reactions, so as to inform the selection of antiseptics.
- Apply antiseptic to the operating site before incision.

20.2 Maintaining Asepsis in Specific Clinical Procedures

20.2.1 Intravascular device insertion

Intravenous procedures are the most common invasive procedures performed in clinical settings and are administered either by the peripheral or central routes. Infections associated with device use are common and, in some countries, tend to be the commonest source of nosocomial infections.

Principles for the prevention of intravascular infection

In ensuring prevention of intravascular infection, the following measures should be taken:

- Ensure that infusion fluid is free from contamination – no cloudiness, no sediments, and not expired.
- Thoroughly disinfect the insertion site with alcohol.
- Use sterile equipment for all invasive procedures, e.g., cannula, needle, etc.
- Use aseptic technique during insertion of catheters (hand disinfection, non-touch technique, and use of sterile gloves).
- Cover site with sterile dressing as soon as possible.
- Change dressing only when soiled, loosened, or wet/damp, using aseptic technique.
- Change infusion sets after 72 hours, and consider re-siting the cannula after the same period.
- Keep site dry, free from contamination, and secure.

- Inspect site daily and remove device immediately if signs of infection are noticed.
- Close injection ports that are not needed with sterile stopcocks.
- Change a blood and blood products giving set within 24 hours.
- Dispose of IV line and any remaining fluid when infusion is replaced or discontinued.
- Needle and catheter should be disposed of in a manner similar to sharps.

20.2.2 Urinary tract catheterization

The majority of urinary tract infections (UTIs) in hospitalized patients are associated with the use of urinary drainage devices such as bladder catheters. Normal urethral flora which migrate to the bladder are flushed out during urination. When a catheter is inserted, this flushing mechanism is altered and thus facilitates the passing of both urethral and perineal flora into the bladder, causing infections. Urinary catheters should therefore be inserted only when there are clear medical indications. These indications include, but are not limited to:

- Relief of urinary tract obstructions
- Urinary drainage in patients with neurogenic bladder dysfunction and urinary retention
- Urologic surgery or other surgeries on contiguous structures
- Accurate measurement of output in critically ill patients
- Radiological investigations

Principles for infection prevention in urinary catheterisation

These principles include the following:

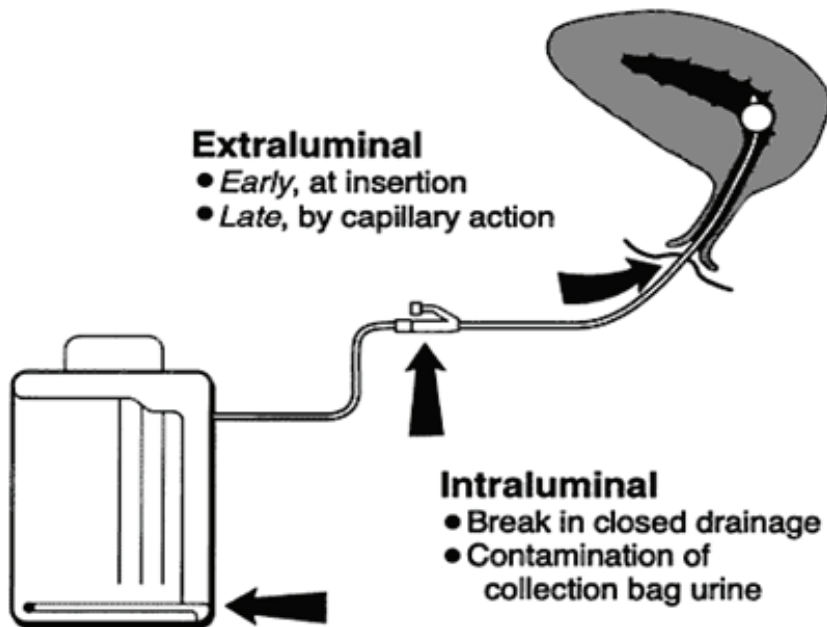
- Use sterile disposable catheters.
- Hands should be washed and sterile gloves worn.
- Peri-urethral area should be cleaned, preferably with antiseptic such as Chlorhexidine (Hibitane) or Cetrimide-Chlorhexidine (Savlon).
- Catheter should be secured to avoid movement in the urethra (see picture below).



- If a urine sample is required, collect with sterile syringe and needle from sampling area of the tubing after cleaning the area with alcohol.
- If irrigation is required to remove clots, aseptic technique must be used.
- Drainage bag must be emptied into a receptacle used for that patient only.
- The bag should not be allowed to stand on the floor or rise above waist height.
- Avoid changing catheters routinely, to reduce risk of infection and trauma.
- Hand hygiene must be practiced before and after emptying drainage bags.
- Maintain a closed drainage system as much as possible.

- All procedures involving the catheter and drainage system should be documented in the medical or nursing notes. At the minimum, these should include:
 - Date of catheter insertion and removal
 - Type of catheter
 - Size of catheter
 - Volume of water in the balloon

Figure 20.2.2: Possible sites of contamination in using urinary catheters



Copied from: Dennis G. Maki and Paul A. Tambyah. Engineering Out the Risk of Infection with Urinary Catheters. Emerg Infect Dis, Vol. 7, No. 2, March-April 2001.

20.3 Maintaining a Safer Environment in the Surgical/Procedure Area

20.3.1 Principles for prevention of infections in post-operative wounds

Post-operative wound infections or surgical site infections delay recovery, increase length of stay and cost of services, and are also associated with increased morbidity and mortality.

The risk factors that increase vulnerability include:

- Patient conditions such as age (e.g., elderly and neonates), diseases (e.g., diabetes), and nutritional status (e.g., obesity)
- Surgical categories, as in contaminated or dirty surgical procedures and transplants or implants
- Surgical operations of long duration, haemorrhage and haematomas, degree of tissue trauma, and location and types of drains used
- Inappropriate antibiotic prophylaxis, inadequate skin preparation and care, unsuitable theatre environment, and excessive movement of staff
- Inadequate sterilisation and reuse of processed invasive devices
- Prolonged post-operative stay in the surgical ward and the use of inappropriate dressing techniques

20.3.2 Perioperative care

Patient care during the perioperative period also determines, to a large extent, the risk of infection. Thus, the following measures should be observed:

- If antibiotic prophylaxis is required, it should conform to the antibiotic policy of the facility.
- Concurrent diseases should be attended to or stabilized before operations.
- Adequate surgical training and experience is required to prevent surgical site infections (SSI).
- Closed system of wound drainage is preferable to open wound drains, which increase SSI.
- Excessive number and movement of staff in the operating room should be controlled, since they contribute to an increase in airborne infections.
- Staff should change into clean theatre clothing prior to an operation, to avoid transfer of pathogens into the operating rooms. Clothes intended for work in the suite should not be worn in patient care areas or outside the suite.
- Surgical hand hygiene should be maintained.
- Before a new patient is brought into the operating theatre, all surfaces that may have been contaminated during the last procedure (e.g., surgery tables, trolleys) should be cleaned and disinfected.

20.3.3 Operating theatre ventilation

The following shall apply in operating room ventilation:

- Operating theatre air should, ideally, be filtered to reduce the concentration of airborne pathogens generated by staff. If windows have to be left open, they should be covered with fly or insect-proof netting.
- Air conditioning systems should ensure that a minimum of 12 air changes per hour of filtered air is delivered.
- Routine bacteriological testing of operating room air is unnecessary. Testing should be performed when commissioning a new theatre and may be useful when investigating an outbreak.
- Regular planned preventive maintenance of the air-conditioning system.

20.3.4 Surgical ward

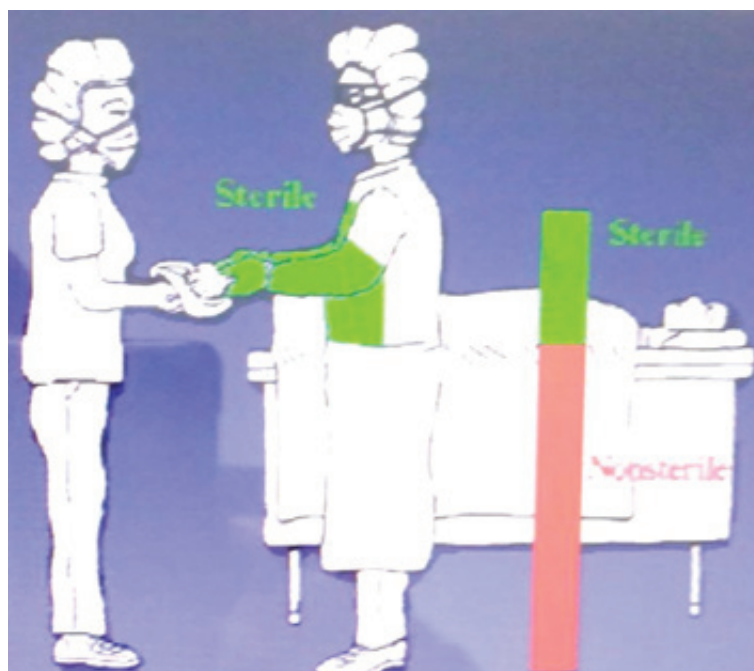
The following guidelines shall be observed in surgical wards:

- Avoid prolonged pre-operative stay on the ward.
- Ensure proper prophylactic antibiotic use.
- Ensure sterilisation or high level disinfection of instruments before use.
- Maintain surgical hand disinfection.
- Use sterile gloves.
- Ensure a clean environment and adequate ventilation.

20.3.5 Creating a sterile field

A sterile field is an area created by placing sterile towels or surgical drapes around the procedure site. It can also be created on a stand that will hold sterile instruments and other items needed during the procedure. It is enhanced when a service provider is properly dressed in sterile surgical attire. Items below the level of the draped patient are outside the field and are not sterile. The sterile area of a properly gowned and gloved provider extends from the chest to the level of the sterile field. Sleeves are sterile from 5 cm above the elbow to the cuff (See Figure 20.3.5).

Figure 20.3.5: Sterile and contaminated areas when gowned



GREEN = STERILE

RED = CONTAMINATED

20.3.6 Maintaining the sterile field

Once a sterile object comes in contact with a non-sterile object or person, or with dust or other airborne particles, the object is no longer sterile. Maintaining the sterile field is therefore imperative. The following measures should be practiced:

- Do not place sterile items near open windows or doors.
- Place only sterile items within the sterile field.
- Do not contaminate sterile items when opening, dispensing, or transferring them.
- Do not allow sterile personnel to reach across the unsterile areas or touch unsterile items.
- Recognise and maintain the provider's sterile area.
- Recognise that the edges of a package containing sterile items are considered unsterile.
- Be conscious of where your body is at all times, and move within or around the sterile or HLD field in a way that maintains sterility or HLD status.

Section 21: Dentistry

Dental patients and health care workers may be exposed to a variety of microorganisms via blood, oral, or respiratory secretions. These microorganisms may include cytomegalovirus, Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Herpes Simplex Virus Types 1 and 2, Human Immunodeficiency Virus (HIV), Mycobacterium tuberculosis, Staphylococci, Streptococci, and other viruses and bacteria, especially those that infect the upper respiratory tract. Infections may be transmitted through the following routes:

- Direct contact with blood, oral fluids or other secretions
- Indirect contact with contaminated instruments, clinic equipment, or environmental surfaces
- Airborne contaminants present in either droplet, spatter, or aerosols of oral and respiratory fluids

21.1 Limiting Contamination

Four principal means of limiting contamination by droplets, spatter, and aerosols are:

- The use of high-velocity air evacuation
- Proper patient positioning
- Appropriate use of rubber dams
- Avoiding contact with objects such as charts, telephones, etc. During patient treatment

21.2 General Guidelines

1. Observe Standard Precautions in the dental unit and laboratory.
2. For routine dental procedures such as examinations and non-surgical procedures, hand washing with antibacterial liquid soap is recommended.
3. For surgical procedures, an antimicrobial surgical hand scrub is recommended.
4. Non-sterile gloves are appropriate for examinations and non-surgical procedures.
5. Gloves designed for single use shall not to be washed, decontaminated, and reused.
6. Fluid-impervious or surgical masks shall be worn anytime the dentist and staff are working in close proximity to a patient who is coughing.
7. Protective eyewear/face shield shall be worn when preparing a tooth with high-speed hand pieces and when polishing a crown.
8. Face shields should be changed when necessary.
9. Protective clothing – gowns, aprons, laboratory coats, clinic jackets – shall be worn when soiling of clothing with blood or other body fluids is anticipated.
10. Reusable protective clothing shall be washed, using a normal laundry cycle.
11. Protective garments and devices (including gloves, masks, eye and face protections) shall be removed before personnel exit the areas of the dental office used for laboratory or patient care activities.

Needles and Sharp Instruments

12. Between injections on the same patient, the multi-use needle/syringe unit shall be re-capped using the standard single-hand “scooped” method or with a mechanical device such as a forceps stabilizing the needle sheath to prevent needle-stick injury.
13. When a multi-use needle syringe unit is used, the unsheathed needle shall be placed in a location where it will not become contaminated or cause unintentional needle sticks.

Control of Environmental Contamination

14. Environmental surfaces which are difficult to decontaminate/clean (e.g., light handles, hand-operated controls, X-ray unit head) shall be covered with a disposable fluid-impervious sleeve/drape.
15. Coverings shall be changed after each patient.
16. Rubber dams shall be used as appropriate.

Linen

17. Disposable drapes (if not contaminated with blood and body fluids) shall be discarded in the appropriate trash container.

Waste disposal

18. Sharp items such as needles and scalpel blades shall be placed in puncture-resistant containers marked with the biohazard label for disposal.
19. Human tissue may be handled in the same manner as sharp items. However, it shall not be placed in the same container but shall be autoclaved/incinerated/burned.
 - Solid waste contaminated with blood or other body fluids shall be placed in sealed, strong, impervious bags to prevent leakage of the contained items.
 - Blood, suctioned fluids, or other liquid waste shall be poured carefully into a drain connected to a sanitary sewer system. Caution shall be taken in emptying the containers to avoid splashes or spilling of potentially infectious material.

21.3 Decontamination, Cleaning, and Sterilisation of Dental Instruments and Equipment

21.3.1 Classification of dental instruments and items

Dental instruments and items may be classified as critical, semi-critical, or non-critical.

- Critical: Surgical and other instruments (forceps, scalpels, burs, etc.) used to penetrate soft tissues or bone. These should be heat sterilised after each use.
- Semi-critical: Instruments such as mirrors and amalgam condensers, and high-speed and slow-speed hand piece attachments that do not penetrate soft tissues or bone but contact oral tissues, shall be sterilised after each use. If sterilisation is not possible, high-level disinfection shall be done. Agents for high-level disinfectant of those items which cannot be heat sterilised include ortho-phthalaldehydes and hydrogen peroxide. Use according to manufacturer's instructions.
- Non-critical: Instruments or medical devices such as external components of X-ray heads that come into contact only with intact skin shall be reprocessed between patients with intermediate-level or low-level disinfection or with detergent and water washing, depending on the nature of the surface and the degree and nature of the contamination.

21.3.2 Principles of instrument reprocessing

- Decontaminate all instruments. If instruments cannot be immediately decontaminated, they shall be placed in a rigid, leak-proof receptacle containing a holding solution (such as an enzyme cleaner) to prevent hardening of bio-burden until ready for processing.

- The decontamination process shall be physically separated from dental treatment areas and other instrument-processing functions.
- Cleaning shall be done according to IPC policy.
- Following decontamination, all reusable critical and semi-critical dental instruments that are heat stable must be sterilised routinely between uses by autoclaving, dry heat, or high-level disinfection. Manufacturers' instructions should be followed.
- All sterile supplies, including reusable dental items, shall be stored in a manner that will preserve their sterility until used.

21.3.3 Specific procedures for the dental unit

Equipment and environmental surfaces that are contacted by health care workers during patient treatment shall be barrier protected or cleaned and disinfected between patients and at the end of the day, using a 0.5% sodium hypochlorite solution. Plastic wrap or other impervious-backed paper may be used to protect surfaces against contamination by blood and/or body fluids and to cover areas that are difficult to disinfect, such as:

- Handles for the overhead dental lamp
- Patient's head rest
- High-speed evacuation
- Low-speed evacuation
- Metal instrument tray beside dentist
- Air/water syringes on both sides of chair
- Assistant's instrument tray
- X-ray head
- Exposure button for X-ray unit

Air/water syringes

If not disposable, air/water syringes shall be:

- Autoclaved after each patient
- Covered with a disposable wrap

Single-use disposable instruments

These items shall be used for one patient only and discarded appropriately. Blood-contaminated disposables shall be placed in colour-coded autoclavable trash bags for incineration. Single-use disposable instruments include:

- High-speed evacuator tips
- Low-speed evacuator tips
- Saliva ejectors
- Air/water syringes
- Prophylaxis angles
- Prophylaxis cups and brushes
- All cotton supplies

Post-procedure decontamination and sterilisation of instruments

- High-speed dental hand pieces and low-speed hand pieces components used intra-orally, reusable prophylaxis angles, and oral surgery instruments are decontaminated, cleaned, and autoclaved between patients. Sterilisation with liquid chemical agents or dry heat is not recommended for dental hand pieces and prophylaxis angles.

- Other reusable intra-oral instruments attached to, but removable from, the dental unit air or water lines – such as ultrasonic scaler tips and component parts and air/water syringe tips – shall be reprocessed as described previously.
- Instruments shall be dried for 20 minutes to prevent rusting, then wrapped for autoclaving.
- Heavy-duty gloves shall be used for instrument manipulation.

Additional disinfection/sterilisation issues

- Intra-oral X-ray films are disinfected using low-level disinfectant prior to being transported to the developer.
- Laboratory materials and other items used in the mouth, such as impressions, bite registrations, fixed and removable prostheses, and orthodontic appliances, shall be decontaminated, cleaned, and disinfected prior to being manipulated or transported.
- These items shall also be decontaminated, cleaned, and disinfected before placement in the patient's mouth.
- Steam sterilisation cycles shall run full cycle, based on the manufacturer's instructions.
- Biological monitoring (spore testing) shall be conducted daily.

Maintenance of air and water lines

- Anti-retraction valves shall be installed and maintained to reduce the risk of possible aspiration of patient material into the hand pieces and the water lines.
- High-speed hand pieces shall be run to discharge water and air for at least 20-30 seconds after use on each patient.
- At the beginning of each day, the water shall be allowed to run for several minutes to flush the water lines that connect to the dental instruments.
- Sterile water or sterile saline shall be used during procedures involving the cutting of bone.
- Devices that do not penetrate the skin or come into contact with sterile areas of the body, such as several types of endoscopes, shall be decontaminated, cleaned, and disinfected by immersion in a 0.55% ortho-phthalaldehyde solution for 5 minutes, or other approved alternative solution.

Biopsy Specimens

(See Section 5: Standard Precautions)

21.4 Dental Laboratory

Transmission of infection in the dental laboratory can occur through:

- Pumice – during polishing
- Acrylic dust – from working on acrylic dentures
- Impressions – blood, saliva, mucus from a patient's mouth
- Dental prostheses – doing repairs, making obturators, realigning dentures

21.4.1 Polishing

- Pumice used in the polishing unit should be mixed with water. A detergent may be added to the water.
- Change pumice in the polishing trough after polishing an old denture, so that any infection from the old denture will not be transmitted to the new denture during its subsequent polish.

21.4.2 Acrylic dust

- The operator, while working on acrylic dentures, can inhale acrylic dust. Such dust can cause respiratory problems if inhaled in large quantities. Use of an appropriate face mask during these procedures will reduce or eliminate inhalation of the infectious acrylic dust.

21.4.3 Impressions

- Impressions are taken of the patient's mouth and taken to the laboratory for the manufacture of the appropriate prosthesis. These impressions contain oral fluids such as saliva, blood, and mucus. Blood may also be found in the impression, and this can carry infections to the operator. It is therefore important that these fluids are removed from the impressions in order to reduce the transmission of infections. Mucus, saliva, and blood can be washed away under running water; and the impressions can be dipped in Betadine or other disinfectants useful for this purpose. The dental technician shall take precautionary measures and undertake these cleaning and disinfection procedures while wearing gloves and goggles.
- The impressions shall be immersed in an appropriate high-level disinfectant for the recommended contact time. The solution is discarded after use.
- Reusable impression trays shall be decontaminated, cleaned, and heat sterilised between patients.

21.4.4 Treatment of dental prostheses within the laboratory

A combination of factors, including time considerations and the lack of heat stability of many items, makes heat sterilisation of all prostheses entering the laboratory impractical. For most prostheses, cleaning and chemical disinfection will remain the principal mechanisms for reducing contamination. The following sequence of general procedures is recommended:

1. Initially scrub all prosthetic devices with a brush and antimicrobial soap to remove gross debris and contamination.
2. Heat-sterilise brushes or store them in a container filled with an approved disinfectant.
3. Immerse prostheses in a solution of 0.5% sodium hypochlorite or other intermediate- to high-level disinfectant for the recommended contact time.
4. After disinfection, rinse the prostheses under running tap water, dry, and complete the required work.

21.5 Practices for the Dental Laboratory

Receiving area

A receiving area should be established separate from the production area. Countertops and work surfaces shall be cleaned and then disinfected daily with an appropriate surface disinfectant, used according to the manufacturer's directions.

Incoming prosthesis and appliances

All incoming prosthesis and appliances shall be disinfected as they are received. Containers shall be sterilised or disinfected after each use. Packing materials shall be discarded to avoid cross contamination.

Disposal of waste materials

Solid waste that is soaked or saturated with blood or body fluids shall be placed in sealed, sturdy, impervious bags. The bags shall be incinerated/autoclaved/burned.

Production area

Persons working in the production area shall wear a clean uniform or laboratory coat, a face mask, protective eyewear, and disposable gloves. Work surfaces and equipment shall be kept free of debris and disinfected daily. Any instruments, attachments, and materials to be used with new prostheses or appliances shall be maintained separately from those to be used with prostheses or appliances that have already been inserted in the mouth. Brushes and other equipment shall be disinfected at least daily.

Outgoing prosthesis and appliances

Each outgoing prosthesis or appliance shall be disinfected before it is returned to the dental clinic. Dentists shall be informed about infection control procedures that are used in the dental laboratory.

21.6 Education

All dental staff shall have training on infection prevention and control. In-service education updates shall be held at least annually, and more often as the need arises.

Section 22: Infection Prevention and Control: Selected Situations

The following infectious diseases present special challenges to IPC practice in health care settings, hence the guidelines below must be adhered to.

22.1 Human Immunodeficiency Virus (HIV)

22.1.1 Introduction

The HIV prevalence rate for Ghana is currently estimated at 1.3% , with an estimated 224,488 people living with HIV. Though sexual transmission accounts for the majority of infections (80%), a few cases of occupational transmission (1%) have been documented. Occupational transmission could be prevented by the use of post-exposure prophylaxis (PEP), and it is recommended that every health care facility put in place a programme to provide PEP to all health workers exposed to the virus in the line of duty, rather than through their lifestyle and behaviours.

22.1.2 HIV post-exposure prophylaxis

The risk of exposure to blood and blood-borne pathogens is slightly greater for health care personnel than for people who do not work around blood. Workplace accidents or injuries may occur that expose the health worker to a patient's body fluids.

The transmission of HIV in the workplace may occur through accidental or non-accidental exposure to blood and other body fluids as a result of injury with a needle or any other sharp instruments, or via mucous membranes (eye, mouth), or contact via damaged skin (eczema, wounds). Preventing transmission of HIV in the workplace, therefore, means:

- Complying with Standard Precautions
- Providing post-exposure prophylaxis after high-risk exposure to HIV

In the event of exposure to HIV, the following steps should be taken immediately:

- The wound site must be cleaned with soap and water or, in case of mucous membranes, flushed with water.
- If therapy is necessary, it should be initiated promptly, preferably, 1-2 hours after exposure.
- The incident should be reported immediately to the supervisor.

Post-exposure prophylaxis reduces the likelihood of HIV infection after high-risk exposure. PEP may either prevent the establishment of infection or prevent new infection while allowing clearance of already infected cells. PEP is particularly effective within 1-2 hours of exposure and not more than 72 hours after exposure.

Assessment of exposure to risk

Exposure to HIV can be classified into three levels:

- Very low-risk exposure – splash of body fluid on intact skin
- Low-risk exposure – exposure to small volume of blood or body fluid from asymptomatic HIV-positive patient with low viral load
 - An injury with a soiled needle (e.g., non-hollow, suturing needles)
 - Any superficial injury or muco-cutaneous exposure

- High-risk exposure –
 - Exposure to large volume of blood or potentially infectious fluid
 - Exposure to blood or blood-contaminated fluid from a patient with a high viral titre (i.e., in AIDS phase or early seroconversion phase of HIV)
 - Injury with soiled hollow-bore needle
 - Deep and extensive injury
 - Resistance to ART in source patient

Actions to be taken in the event of possible exposure to HIV

In the event of possible exposure to HIV, the following actions should be taken:

- Very low-risk exposure
 - Wash exposed/wound area immediately with soap and water.
 - In the case of mucous membranes, exposed area should be flushed with water.
 - Eyes should be flushed with water or saline.
- Low-risk exposure (in addition to the measures for very low risk)
 - Lamivudine 150 mg 12 hourly x 28 days, and
 - Zidovudine 200 mg 8 hourly x 28 days
- High-risk exposure (in addition to the measures for very low risk)
 - Lamivudine 150 mg 12 hourly x 28 days, and
 - Zidovudine 200 mg 8 hourly x 28 days, and
 - Nelfinavir 750 mg tid or 1250 mg bd x 28 days
 or
 - Lopinavir 400 mg/100 mg 12 hourly x 28 days

Table 22.1.3: Recommended laboratory investigations after HIV exposure

Baseline tests	<ul style="list-style-type: none"> • Full blood count. • Liver and renal function tests. • HIV serology & Polymerase Chain Reaction (PCR)
Two weeks	<ul style="list-style-type: none"> • Full blood count • Liver and renal function tests
Six weeks	HIV serology
Three months	HIV serology
Six months	HIV serology

Note: All exposed persons should receive counselling from trained counsellors throughout the period and thereafter if necessary.

(For more details, refer to Guidelines for Antiretroviral Therapy in Ghana, June 2008.)

22.2 Tuberculosis

22.2.1 Introduction

Recent increases in tuberculosis (TB) notification among health care workers (HCWs), as well as hospital-based outbreaks of multidrug-resistant TB (MDR-TB) among HIV-infected patients, and extremely drug-resistant TB (XDR-TB) among HIV-infected persons, have led to greater concern about the risk of *Mycobacterium tuberculosis* (*M. tuberculosis*) transmission in health care settings (nosocomial transmission). The Ministry of Health thus sees the issue of TB-IPC as very important. It is recommended that any facility providing care for TB suspects shall have a complete IPC programme in place comprising administrative and environmental controls and personal respiratory protection.

22.2.2 TB-specific administrative controls

The first and most important IPC level is to prevent generation of droplet nuclei and thus reduce exposure of HCWs and patients to *M. tuberculosis*. Important administrative measures include:

- Early diagnosis of potentially infectious TB patients
- Prompt separation of infectious TB patients
- Prompt initiation of appropriate anti-tuberculosis treatment

The following administrative controls are specific to TB:

- All health care facilities should have a specific set of administrative measures for early identification of TB patients.
- Patients presenting in OPDs shall be triaged to quickly identify those with symptoms of TB. The method of triaging shall:
 - Screen all patients with a cough attending OPD to look for symptoms of TB.
 - Educate the patients on cough etiquette.
 - Separate the patients from others to limit spread of infection.
 - Rapidly provide services for them.
 - Investigate for TB and treat or refer.
- All diagnosed TB patients should be notified.
- All PLWHIV should be screened for TB using the symptom-screening questionnaire (see questionnaire in Appendix 7).

22.2.3 TB-specific environmental controls

These environmental controls aim at reducing the concentration of droplet nuclei in the air by maximising natural ventilation and controlling the direction of airflow. Environmental controls for reducing TB transmission are the following:

- Patient areas should have all windows and doors fully open to ensure adequate ventilation (i.e., 6 to 12 air changes per hour).
- Where natural ventilation would not be enough, use ceiling fans or extraction fans.
- Regular checks and maintenance schedules should be in place for mechanical ventilation systems.
- Where possible, MDR TB cases shall be isolated in negative-pressure rooms.
- Patients should be managed in well-lit areas with easy access and exit for persons and equipment.
- Safety cabinets should be used in laboratories where sputum culture for TB is done.
- Ensure that there is adequate ventilation in OPDs.
- Ensure a minimum of 1 metre between beds on TB Wards.
- Ensure that all admitted patients have beds.

22.2.4 Personal protective measures for TB care

Personal protective measures include surgical masks (cloth, paper) and respirators. Respirators (N95 or FFP2) are better than surgical masks but expensive; therefore, their use must be limited only to high-risk areas such as in the care of MDR TB patients or when performing high-risk aerosol-generating procedures. HCWs must be fit-tested before using respirators and should be adequately trained in their use.

22.3 Viral Hepatitis

22.3.1 Hepatitis B and C

Transmission of Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) in the workplace occurs in the following ways:

- Accidental exposure to blood – any contact with blood or body fluids as a result of injury with a needle or any other sharp instruments, or via mucous membrane (eye, mouth), or contact via damaged skin (eczema, wounds)
- Percutaneous exposure – exposure to blood or body fluids through broken skin
- Needle stick or sharps injury – puncture with a needle or sharp instrument that is contaminated or potentially contaminated with blood or body fluids
- Blood splash – skin visibly contaminated with blood or body fluids
- Exposure of intact normal skin to a large volume of blood
- Human bites

Preventing transmission of HBV in the workplace, therefore, means:

- Preventing the occurrence of exposure
- Complying with Standard Precautions

22.3.2 Procedure for post-hepatitis B exposure prophylaxis

Health personnel exposed to blood or body fluids by needle stick, cuts, or bites should do the following:

- Wash the area thoroughly with soap and water immediately.
- Worker should be tested for Hepatitis B surface antigen and Hepatitis B antibody.
- If the antibody titre level is low or negative, start immunisation or give booster dose of Hepatitis B immunisation.
- Repeat tests after 1 month and then 6 months after the first test.
- If the titre is still low, repeat the Hepatitis B immunisation.
- Those who do not respond to Hepatitis B immunisation after a 3rd dose should not be assigned to high-risk areas (e.g., areas where blood specimens are handled, fevers units, obstetric and gynaecological units, etc.).

22.3.3 Treatment for HBV

HBV treatment is available and several methods exist. A few are listed here for easy reference:

- Tab. Lamivudine 150 mg twice daily or 300mg daily
- Tab. Tenofovir 300 mg daily
- Interferon alpha 5 MU daily or 10 MU 3 times a week

Note: Not all people infected with HBV will require treatment; any treatment for Hepatitis must therefore be initiated by a Physician Specialist and must be monitored by laboratory investigations.

22.4 Viral Haemorrhagic Fever

Viral Haemorrhagic Fever (VHF) may be caused by different viruses; e.g., Lassa, Marburg, Ebola, Crimean-Congo. VHF:

- Is associated with high mortality
- Has limited or no treatment options
- Has potential for person-to-person and specimen-to-person spread

VHF is not endemic in Ghana but should be suspected in:

- Persons who have been in an endemic area within 21 days of the onset of their febrile illness
- Persons who have had unprotected contact with blood, other body fluids, secretions, or excretions of a person or animal with VHF
- Persons with possible exposure when working in a laboratory that handles haemorrhagic fever viruses

Note: Persons who have come into contact with unconfirmed suspected cases of VHF that have died must be isolated and observed/monitored for VHF for at least 21 days.

22.4.1 Infection Prevention and Control Precautions for VHF

The following precautions are recommended when VHF has been diagnosed:

- Patients should be cared for in a category B isolation room.
- All workers should practice Standard Precautions.
- Caretakers should use barrier precautions to prevent skin or mucous membrane exposure.
- All persons entering the patient's room should wear appropriate PPE.
- Prior to leaving the room of a patient with suspected VHF, safely remove and dispose of all protective gear, and clean and disinfect shoes that are soiled with body fluids.
- Access to the room should be restricted to only authorised persons.
- Maintain a log of all people (both clinical and non-clinical) who enter the room.
- The importance of Standard Precautions in the management of blood, other body fluids, secretions or excretions, and handling of soiled linen and wastes cannot be overemphasised.

22.4.2 Other special consideration in VHF

Laboratory specimens

Laboratory investigations should be reduced to the barest minimum that allows for patient care and essential diagnostic evaluation. This is because of the potential risks associated with handling infectious material.

Wastes Management

Highly infectious wastes (e.g., personal clothing from patients with VHF, used gloves, and gauze from such patients) should be put into a biohazard bag, the bag containing the waste sprayed with 0.5% chlorine, reinserted into another biohazard bag, re-sprayed with 0.5% chlorine, and made ready for treatment (hydroclaving or incineration) and final disposal.

Note: Highly infectious wastes should not have external transit but should be sent directly for treatment (incineration or hydroclaving) and the final disposal site.

Deaths

When patients die, handling of the body should be minimized. Bodies should be wrapped in a leak-proof material and promptly buried.

Exposure management for VHF

The following shall apply in exposure to VHF:

- Persons with percutaneous or muco-cutaneous exposures to blood, body fluids, secretions, or excretions from a patient with suspected VHF should immediately wash the affected skin surfaces with soap and water.
- Mucous membranes (e.g., conjunctiva) should be irrigated with copious amounts of water or eyewash solution.
- Exposed persons should receive medical evaluation and follow-up care, including fever monitoring twice daily for 21 days after exposure.
- Consultation with an infectious diseases expert is recommended for exposed persons who develop fever within 21 days of exposure.

Table 22.4.2: Isolation Precautions

Wash hands as needed



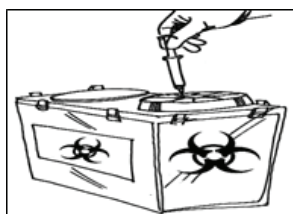
Isolate the patient



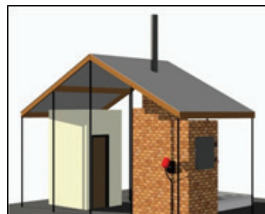
Wear protective clothing



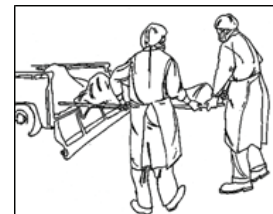
Dispose of needles and syringes safely



Dispose of waste safely



Use safe burial practices



22.4.3 Recommended safety precautions for contact tracing teams

Since Ebola Virus Disease (EVD) cases are more likely to be discovered during contact follow-up, contact tracing teams should take precautionary measures to protect themselves during home visits.

The teams should abide by the following:

- Avoid direct physical contact like shaking hands or hugging.
- Maintain a comfortable distance (more than 1 metre) from the person.
- Avoid entering the residence.
- Avoid sitting on chairs offered to you.
- Avoid touching or leaning against potentially contaminated objects.
- Always have a good breakfast before home visits to resist the temptation to eat or drink while visiting contacts.
- Do not conduct home visits wearing personal protective equipment like masks, gloves, or gowns.

- If you must take the contact's temperature:
 - Put on disposable gloves.
 - Avoid touching the patient and step back about 1 metre.
 - Use the infrared thermometer to take their temperature.
 - If using the mercury thermometer, take temperature from the back of the patient.
- If the contact is visibly ill, do not attempt to take their temperature but notify your supervisor.
- As part of the overall safety of the response team, all members of the contact tracing team should monitor their own temperature every morning.

22.5 Acute Respiratory Diseases (ARD)

Acute respiratory diseases (ARD) are upper or lower respiratory tract illnesses, usually infectious in aetiology, which can result in a spectrum of illnesses ranging from asymptomatic or mild infection to severe and fatal disease, depending on the causative pathogen, environmental factors, and host factors. Examples of pathogens causing ARDs are Rhinovirus, Respiratory syncytial virus, Para-influenza virus, Severe Acute Respiratory syndrome-associated coronavirus (SARS-CoV) and Influenza virus. Only the guidelines on Avian Influenza virus and SARS-CoV are provided in this policy and guidelines document.

22.5.1 Avian influenza

Avian influenza (Bird Flu) is a disease caused by an influenza virus that occurs naturally among birds but can cause disease in humans. In humans, the virus can be transmitted via large respiratory droplets. Given the uncertainty about the exact modes by which avian influenza may be transmitted between humans, additional precautions may be prudent for health care workers involved in the care of patients with documented or suspected avian influenza.

The following IPC measures are recommended for Avian Influenza:

- All patients who present to a health care setting with fever and respiratory symptoms should be managed in accordance with the avian influenza clinical management guidelines of the Ministry of Health.
- All categories (i.e., suspected, probable, or confirmed) of avian influenza cases that report to the health care facility must be admitted straight into isolation wards/rooms/area.
- The admitting clinician must notify the IPC focal person or the emergency response team of the facility immediately.

See Appendix 8 for criteria for categorising human cases of avian influenza.

In addition to Standard Precautions, the following shall apply:

- Contact precautions
- Airborne precautions
- Respiratory hygiene

Details of the above precautions are in Section 16. These precautions should be continued for 14 days after onset of symptoms, or until deemed otherwise by the attending clinician.

Surveillance and monitoring of health care workers:

- Health care workers exposed to avian influenza virus should carry out self-monitoring for the development of fever, respiratory symptoms, and/or conjunctivitis (i.e., eye infections) for 1 week after last exposure.
- Health care workers who become ill should seek medical care and, prior to arrival at the health facility; notify their health care provider that they may have been exposed to avian influenza.
- All symptomatic HCWs shall be given treatment within 24 hours of reporting to the health facility.
- In addition, employees should notify occupational health and infection control personnel at their facility.

Vaccination of health care workers against human influenza

Health care workers involved in the care of patients with confirmed or suspected avian influenza may be offered a vaccine against the most recent seasonal human influenza. In addition to providing protection against the predominant circulating seasonal influenza strain, this measure is intended to reduce the likelihood of a health care worker being co-infected with human and avian strains.

22.5.2 Severe Acute Respiratory Syndrome (SARS)

Severe Acute Respiratory Syndrome is a disease caused by the SARS coronavirus. Transmission of SARS coronavirus (SARS-CoV) occurs predominantly through close interactions with infected persons, although faecal/oral transmission may occur in some settings. SARS-CoV may also be transmitted through close contact with respiratory droplets expelled when a patient coughs or sneezes. The aim of IPC in this instance is to ensure early recognition of patients at risk and to prevent transmission of SARS-CoV to health care workers by implementing appropriate infection prevention and control precautions.

The following precautions are recommended:

- Posters and audiovisuals (in appropriate languages) shall be posted at the entrance to outpatient facilities instructing patients and visitors to practice respiratory hygiene/cough etiquette.
- During periods of increased respiratory infection in the community, surgical masks (or respirators) shall be offered to persons who are coughing.
- Coughing persons should sit 1 metre from others in common waiting areas.
- Ensure appropriate triage and management of patients with possible SARS-CoV disease.

In addition to Standard Precautions, health care workers should practice droplet precautions when examining a patient with symptoms of a respiratory infection. Droplet precautions should be maintained until it is determined that they are no longer needed.

Patient placement

The following shall apply in the placement of patients with SARS:

- Admit patients to isolation in a well-ventilated room.
- Designate “clean” and “dirty” areas for isolation materials.
- Limit the amount of patient-care equipment brought into the room to that which is medically necessary. Provide each patient with patient-dedicated equipment (e.g., thermometer, blood pressure cuff, and stethoscope).
- Limit staff to the number sufficient to meet patient-care needs, using staff who have been specially trained to care for patients with SARS.
- Apply precautions regarding transportation and visitation of patients in isolation with airborne infections.
- Follow visitors who have been in contact with the patient before and during hospitalization.
- Take appropriate precautions when performing aerosol-generating procedures.
- Contain all specimens appropriately (bag them, if necessary), and have a completed laboratory requisition slip attached. Information on the requisition slip should indicate that the patient is or could be infected with SARS-CoV.
- Alert laboratory personnel to the possibility of SARS-CoV to ensure safe handling procedures.
- Manage exposed persons according to the standard management protocol for SARS.

Section 23: IPC Considerations in Use of Antibiotics and Antivirals

Rational use of antibiotics and antiviral agents is important for preventing and controlling the development of resistant strains of microorganisms and the spread of infections. The following shall be followed in the use of antibiotics:

- Antibiotics and antivirals shall be prescribed rationally.
- Prescribers must follow national guidelines on the use and choice of antibiotics and antivirals for treatment and prophylaxis (refer to the Ghana National Drug Policy and the current editions of the Essential Drug List and Standard Treatment Guidelines of the Ministry of Health).
- Medicine and Therapeutic Committees, in conjunction with IPC teams, shall develop operational policies on antibiotics and antivirals use and shall monitor the rational use of antibiotics in all health facilities. This policy shall contain information on use of antibiotics and antivirals for prophylaxis and the choice of these for empirical and targeted therapy of major infections.
- Data on antibiotic use shall be routinely collected for surveillance at all levels of health delivery.
- Operational policies on the use of antibiotics and antivirals at the facility level shall be based on the national policy on the use of antibiotics and antivirals.

Antibiotic resistance

Antibiotic (antimicrobial) resistance may principally be due to irrational use of antibiotics (e.g., excessive, non-compliance, or under-usage) and the use of fake antibiotics. To ensure that information on bacterial resistance is obtained and used to improve services, the following shall be done:

- All microbiological methods shall be standardised to ensure uniformity and comparability of results in all health care facilities.
- All specimen requests to microbiological laboratories shall state clearly whether the specimen is from a client with a suspected nosocomial infection or not.
- Data on antibiotic sensitivity and resistance shall be collected routinely in all nosocomial infections and these shall be reviewed, analysed, and disseminated regularly.

Section 24: IPC Environmental and Engineering Considerations

The layout of physical structures and the installation of equipment have an influence on the implementation of infection prevention and control guidelines in health facilities. There is, therefore, the need to ensure compliance with IPC requirements in the design of health facilities. The layout of physical structures and installation of equipment shall conform to standards set by the Estate Management Department. This section deals with some specific areas of design and construction of health care facilities that have an effect on IPC practices. They include the following:

- Work areas
- Ventilation
- Surfaces
- Traffic pattern in the facility
- Positioning/siting of sink
- Storage facilities for supplies and equipment
- Storage facilities for food and drinks
- Water supply system
- Changing rooms
- Hazards associated with renovation and maintenance
- Waste management systems (refer to Section 15)

24.1 Work Areas

Work areas shall conform to the standards set by the Estate Management Department and shall:

- Have adequate lighting
- Have easy access and space for equipment and persons
- Be designed to allow thorough cleaning and disinfection of all surfaces
- Be of adequate size to accommodate the workload
- Have designated facilities for storing outer garments and personal items and for eating and drinking
- Have adequate and easily accessible hand hygiene facilities

24.2 Ventilation

Airborne organisms may present a hazard in health care facilities particularly in high-risk areas such as isolation wards, operating rooms, and emergency rooms. Adequate ventilation seeks to reduce the concentration of microorganisms in the air. For these reasons:

- Ventilation should be appropriate for each working area.
- Where required, ventilation equipment should maintain the inflow of fresh air, temperature, humidity, and purity of the air within prescribed limits.
- For areas where unsafe concentrations of airborne contaminants are generated (e.g., incinerators, kitchen, steam and gas sterilisers), or where risk group microorganisms are being handled (e.g., isolation rooms and laboratories), fume extraction facilities and biological safety cabinets should be installed and used.

24.3 Surfaces

Surfaces should be such that they can easily be cleaned with disinfectant cleaning solution. Surfaces should therefore be:

- Level and smooth, as well as having minimum joints where bacteria can accumulate
- Unaffected by spilt liquids
- Durable enough to withstand repeated cleaning with disinfectant solution

All surfaces, including the surfaces of furniture and equipment, should be made of materials that will facilitate effective cleaning and disinfection.

With regard to woollen carpets for floors, there are usually problems with staining and odours. Woollen carpets are therefore not advisable in any patient care and other areas where spillage or soiling is likely to occur (e.g., kitchens).

24.4 Traffic Pattern in the Facility

To prevent cross-infection, the design of the facility will need to consider the following:

- Patient movement should cause minimal exposure of patients to each other and to visitors.
- Visitors' traffic routes should minimize contact with patients (e.g., elevator for visitors should be separated from that of the patients).
- Staff who are required to wear protective clothing should have ready access to locker space without entering protected areas.
- Movement of all supplies and equipment whether clean, sterile, or contaminated, should be done in closed containers that will not let supplies fall from the container to the floor.
- The design should put special areas like operating room, labour and delivery, waste storage, nursery, and clinical laboratories out of the major traffic routes.
- The design should provide an area for emptying bedpans without leaving a patient's room.

24.5 Positioning/Siting of Sinks for Hand Washing

IPC policy states that hand washing should be done before and after each patient contact. To support this, attention should be paid to the following:

- Sinks should be placed in areas that are convenient and easily accessible, such that they can easily be used for hand washing before and after patient contact.
- An adequate number of sinks should be provided for use by health workers, patients, and their relations.
- Adequate space should be provided around the sinks for hand dryers, soap dispensers, and garbage bins.
- Sinks should be large enough (hygienic hand wash sinks) to prevent splashing.
- Sinks should be operated by hand, elbow, foot, or knee. Elbow-, foot-, and knee-controlled sinks are preferred in areas where there is increased risk of touch-contamination (e.g., isolation rooms).

24.6 Supplies and Equipment

Storage areas for medical supplies and equipment should be:

- Rodent free
- Away from sinks and drains to avoid splashing and high humidity
- Able to have adequate space, including aisles between equipment, to facilitate cleaning of equipment and staff movement, as well as to eliminate pests' hiding places
- Well ventilated and lighted

In addition to the above, special attention should be paid to the following:

- Contaminated equipment and supplies should be kept away from clean/sterile equipment and supplies.
- Contaminated equipment and supplies should not be stored for long periods.
- Dust covers or other protective coverings should be used to prevent contamination by dust and moisture.

24.7 Storage of Food and Drinks

As indicated in the Management Standards and Guidelines manual for hospital catering services, adequate storerooms should be provided in the kitchen premises for storage of food and drinks. In addition, attention should be paid to the following:

- The storerooms should be well lit, ventilated, dry, and have a stable temperature.
- Walls and floors should be tiled. Floors could be either granolithic or terrazzo, in order that they can be cleaned easily.
- Stores should be outfitted with shelves. These could be wooden shelving, slate, or marble-topped benching, or easily movable and adjustable metal racks with stainless steel-topped tables, which could be fitted with castors so they can move easily.
- Cold storage facilities should be provided and should include a refrigerator, a deep freezer, and cold room walk-ins and chill room walk-ins.
- There should be separate fridges for the storage of food and drinks.

Food and drinks must never be stored in the same refrigerator as medicines, vaccines, and patient specimens. Also, note that under no circumstances should food be kept on the floor. Food should be stored away from cleaning items and poisons. Finally, food preparation/production areas should always occur away from the mortuary and incinerators.

24.8 Water Supply System

To prevent the spread of infection, wholesome and potable water should be easily available for drinking, food preparation, hand washing, patient bathing and cleaning, decontamination, and sterilisation. Water tanks installed for storage should have tight covers to prevent dust, animal droppings, and sunlight from entering, as these accelerate the growth of algae and other microorganisms. Routine emptying and cleaning of tanks is recommended.

24.9 Changing Rooms

An appropriate changing-room facility shall be provided for all health staff to promote the wearing of scrubs within the health facility.

Section 25: Surveillance and Monitoring

Surveillance and monitoring are key IPC activities and are used to evaluate the effectiveness of IPC measures. These activities aim at reducing health care-associated infections and their cost. Surveillance and monitoring in IPC are organized methods of systematically identifying, collecting, analysing, reporting, disseminating, and using information related to IPC activities and health care-associated infections.

The specific objectives are to:

- Increase health care workers' awareness of health care-associated acquired infections and antimicrobial resistance, so they appreciate the need for preventive actions
- Monitor trends: incidence and distribution of health care-associated infections and their prevalence
- Identify possible areas for improvement in patient care and for further epidemiological studies
- Identify the need for strengthening infection prevention and control activities, and also evaluate the impact of preventive measures
- Disseminate to stakeholders the information gathered

25.1 IPC Surveillance and Monitoring Responsibility at National Level

The Ministry of Health/IPC programme management unit, in collaboration with the relevant key stakeholders, shall develop a national surveillance system for health care-associated infections. This system will generate quality data on health care-acquired infections and antibiotic-resistant organisms. The Ministry of Health/IPC programme management unit, in consultation with the relevant partners, shall determine microorganisms to be placed under surveillance.

The surveillance system will enable reporting of infection outbreaks in health care facilities so that appropriate interventions and support by national, regional, and district structures can be provided when necessary. A national standardised reporting system shall be developed to enable the regional and district IPC structures to extract data on health care-associated infections and antimicrobial resistance for their local use.

In addition, the Ministry of Health/IPC programme management unit shall develop a set of indicators to monitor specific IPC practices (e.g., hand hygiene, reprocessing of used instruments, and use of protective clothing) at all the levels of services delivery.

Feedback and good practices shall be shared nationally through the following:

- An infection control bulletin (quarterly or biannual publication)
- A national infection prevention and control web page, toll free text messages, other social media such as Whatsapp, and Facebook
- An annual conference

25.2 IPC Surveillance and Monitoring Responsibility at Facility Level

At facility level, regular reports of comparative data on the levels of health care-associated infections, antimicrobial resistance, and other IPC practices within the facility should be made available to clinicians. This will make them aware of their local resistance profiles, enabling them to make better empirical treatment choices and to assess implications of their treatment choices and infection prevention and control practices.

Reports on IPC should be prepared and regularly discussed with the relevant infection prevention and control officers, committees, and/or health departments/units.

25.3 General Guidelines on Collection, Analysis, and Dissemination of Surveillance and Monitoring Information

25.3.1 Data collection, analysis and dissemination

There must be routine collection of data on infections and IPC practices by the IPC Team. These should be reviewed and analysed weekly, and disseminated to all stakeholders. (e.g., Hospital Management, Heads of Hospital Units, etc.).

Infection rate and isolates should be monitored by:

- Daily report from the microbiology laboratories
- Prevalence studies on infections in the hospital
- Notification of infections to and from the district, regional, and national surveillance centres

25.3.2 Outbreak

An outbreak is defined as an unusual or unexpected increase in cases of a known nosocomial infection or the emergence of cases of a new infection.

An outbreak must be suspected when:

- Laboratory report of a specimen yields an organism of public health interest and/or a notifiable disease (refer to weekly notifiable disease reporting form, Appendix 9).
- Two or more patients are found to have an infection attributable to a pathogen not previously reported, particularly when it happens after a surgical procedure.
- Several people report infections caused by the same organism.
- Clinicians or ward staff report multiple infections of a similar nature.

25.3.3 Guidelines on investigation and response to surveillance reports on infections

Single case of nosocomial infection

- When a single case of nosocomial infection is observed, the Infection Prevention and Control Team shall investigate and establish whether the cause has been a breakdown of procedures or whether it is a new admission. When the cause has been established the Infection Prevention and Control Team shall review the steps in the process with the unit staff to ensure that the policy is understood and properly implemented. See Appendix 10 for classification of nosocomial infections.
- The Infection Prevention and Control Team shall contact the clinical care team to discuss and advise on the possible implication of the outbreak. The patient shall be managed according to established infection prevention and control policy.

Two or more cases of nosocomial infections

In case of two or more cases of nosocomial infections (potential or actual outbreak), full investigation shall be conducted. If an outbreak is confirmed, it shall be communicated to all staff and specific actions to be taken should be stated.

- A unit may have to be closed down to prevent further spread or to allow the outbreak to be investigated fully and/or to establish the source of the outbreak. If closure of unit(s) is necessary the staff shall be made fully aware of the consequences and the unit(s) shall be re-opened as soon as possible.
- The Infection Prevention and Control Committee shall critically review all aspects of investigations in order to identify problems so that future errors can be prevented. On conclusion of the investigations, a formal written report shall be distributed to all departments.

25.3.4 Procedure for Investigating Outbreaks in health facilities

An increase in the isolation of an infectious organism or any clustering of clinical cases shall form the basis for investigating outbreaks in the hospital. The aim of investigation shall be to:

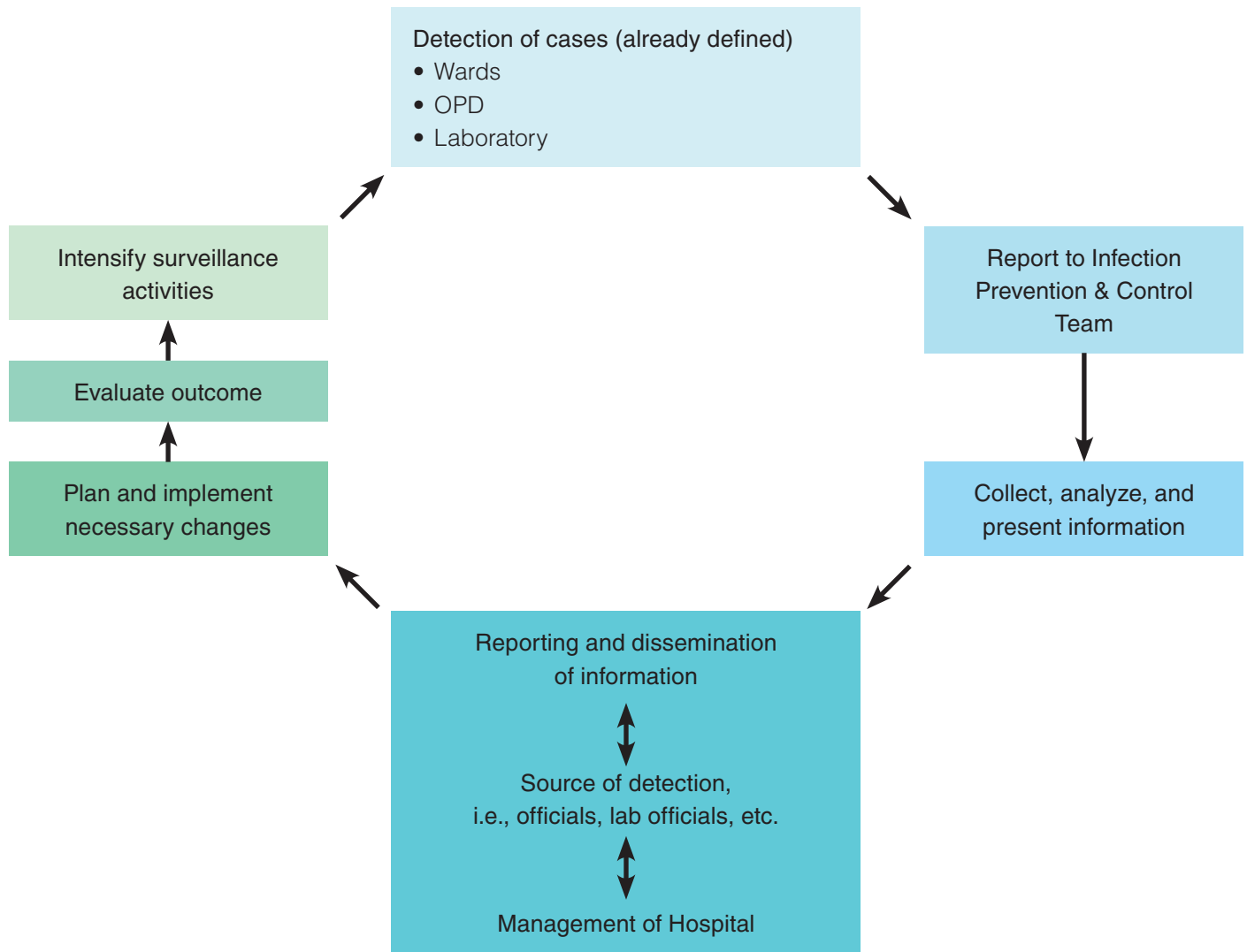
- Determine how the outbreak occurred.
- Treat the infected patients/persons.
- Prevent spread of infection with minimum disruption to activities of patients and staff.
- Recommend appropriate measures to prevent future occurrences.
- Conduct contact tracing if the source is proven to be external to the health facility.

Steps in investigating outbreaks

The steps may vary depending on the nature of the problem. However, Steps 1 and 2 must be done before proceeding:

- Step 1. Establish or verify that an outbreak exists. Do the following:
 - Verify diagnosis and/or causative agent of reported case(s).
 - Characterize the nature of the disease, e.g., signs and symptoms, laboratory findings. Obtain the appropriate laboratory specimens to identify the specific disease agent.
- Step 2. Confirm the existence of an outbreak:
 - Define or estimate the extent and magnitude of the problem, keeping within the range of a specific time period appropriate to the nature of the infection.
 - Compare current rates with the usual or baseline rate for the time frame.
 - Determine the need for outside assistance/consultation.
 - Institute early and appropriate prevention or control measures.
 - Obtain and preserve cultures.
- Step 3. Continue surveillance for additional cases.
- Step 4. Characterize cases by person, place, and time to determine if the outbreak is from a common or a propagated source.
- Step 5. Institute and evaluate other control measures. Update and educate the staff as to findings, etc.
- Step 6. Provide and disseminate reports as required and maintain pertinent records. Suggested route of dissemination of information is shown in Figure 25.3.

Figure 25.3: Suggested route for collecting/disseminating surveillance information



(adapted from the Manual of Epidemiology for District Health Management. 1989 WHO)

Section 26: Care of the Deceased

The transmission of deadly infectious diseases resulting from mortuary care sometimes occurs among health care workers. In handling dead bodies, all health care workers shall adhere to Standard Precautions at all times and appropriate PPE shall be used. Training shall be organized for all people, including mortuary staff and undertakers, who handle dead bodies.

26.1 Recommended PPE for Health Care Workers (HCWs) Handling Dead Bodies

The recommended PPE for handling dead bodies are:

- Reusable, long-sleeved, cuffed gown
- Waterproof apron
- Non-sterile gloves/utility gloves (elbow length)
- Wellington boots
- Mask
- Goggles
- Headgear

Note: Perform hand hygiene after removing all PPE. Appropriately disinfect reusable PPE.

26.2 Packing and Transport of Dead Body to Mortuary, Crematorium, and Burial

Apply the following instructions when packing and transporting dead bodies:

- Use the appropriate PPE when performing the last offices.
- The body should be fully sealed in an impermeable body bag before removal from the room/ward and before transfer to the Pathology Department or the mortuary, to avoid leakage of body fluid.
- Transfer to the mortuary should occur as soon as possible after death.
- If an autopsy is being considered, the body may be held under refrigeration in the mortuary and shall be conducted only when a safe environment can be provided for the autopsy.
- Family members of the deceased should be educated on Standard Precautions to take, if they wish to view or touch the body.

26.3 Mortuary Care

Mortuary staff and the burial team should apply Standard Precautions. Embalming must be conducted according to local regulation or legislation. Hygienic preparation of the deceased such as cleaning the body, tidying of hair, trimming of nails, shall be conducted with the application of Standard Precautions.

26.4 Postmortem Examination

Postmortem examinations and collection of samples are essential to ascertain the cause of death. These procedures are associated with risk of transmitting infections and should be performed only when necessary and if safety measures are in place. The following are some general safety precautions:

- A minimum number of staff should be involved in the procedure.
- A well-ventilated room should be available for the procedure.
- Appropriate PPE should be used.

Recommended PPE that shall be used when performing autopsy are:

- Scrub suit: tops and trousers or equivalent garments
- Impermeable long-sleeved gowns
- Surgical masks, but if small particle aerosols might be generated during autopsy procedures, a particulate respirator or its equivalent should be used
- Face shield or goggles
- Autopsy gloves or double-gloving of 2 pairs of non-sterile gloves
- Knee-high boots

Health care workers shall put on PPE in the dressing room before proceeding to the autopsy room where the body is located.

When removing PPE:

- Exit the autopsy room to the dress out room.
- Remove PPE in designated dress out room.
- Dispose of PPE in accordance with recommendations, and perform hand hygiene.

26.5 Suggested Methods to Reduce Aerosol Generation During Autopsy

To reduce aerosol generation during autopsy:

- Containment devices should be used whenever possible, e.g., biosafety cabinets for the handling and examination of smaller specimens.
- Vacuum shrouds should be used for oscillating saws.
- High-pressure water sprays should not be used.
- Do not open intestines under water.

In instances where death is due to a highly infectious organism, the corpses may not be released to the family for burial.

Resources

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Appendices

Appendix 1: Contents of Training Programmes on IPC

Education and training in IPC shall be designed to meet the needs of the different categories of health staff. Training programmes shall include such topics as:

- Basic microbiology and modes of disease transmission
- Infection prevention and control principles
- Support supervision, monitoring, and evaluation of IPC.
- Importance of good hygiene and hand washing
- Standard and specialised disinfection and sterilisation equipment
- Sterilisation processes and practices
- Decontamination, cleaning, and disinfection of work areas
- Use of protective clothing and equipment
- Dealing with spills
- Handling and disposal of waste
- Management of exposures and accidents
- Risk identification, assessment and control
- Handling of specimens
- Health and safety issues
- Antibiotic policy and practice
- Legal and ethical issues
- Information management and research

Appendix 2: How To Prepare 0.5% Chlorine Solution

Formulas for Calculations

Using chlorine-releasing solution (bleach)

$$\left[\frac{\% \text{ Chlorine in liquid bleach}}{\% \text{ Chlorine desired}} \right] - 1 = \text{Total parts of water for each part of bleach}$$

Example: To make 0.5% chlorine solution from 3.5% bleach

$$\left[\frac{3.5}{0.5} \right] - 1 = 7 - 1 = 6 \text{ parts water for each part of bleach}$$

Thus, to make 0.5% chlorine solution, add 1 part bleach to 6 parts water.

Using chlorine-releasing powder

$$\left[\frac{\% \text{ Chlorine desired}}{\% \text{ Chlorine in chlorine-releasing powder}} \right] \times 1,000 = \text{Number of grams of powder for each litre of water}$$

Example: To make 0.5% chlorine solution from chlorine-releasing powder containing 35% active chlorine

$$\left[\frac{0.5\%}{35\%} \right] \times 1,000 = 0.0143 \times 1,000 = 14.3$$

Thus, to make 0.5% bleach solution, you dissolve 14.3 grams of bleach powder in each litre of water.

Using chlorine-releasing tablets

Follow the manufacturer's instructions, since the percentage of active chlorine in these products varies.

Appendix 3: Examples of Commonly Used Disinfectants and Antiseptics

Type of Chemical	Disinfectants	Antiseptics
Halogens	Hypochlorite (Bleach) 5% Tincture of Iodine 1-3%	Iodophors (Povidone- iodine)
Aldehydes	2% Glutaraldehyde (Cidex)	
Acids	Peracetic acid	
Oxidizing agents	Potassium permanganate	Hydrogen peroxide Potassium permanganate
Alcohols – 70% (spirits)	Ethanol Isopropyl alcohols	Ethanol Isopropyl alcohols
Phenolics	Phenol (Carbolic acid) Hexachlorophene (PhisoHex)	Hexachlorophene
Quaternary ammonium compounds	Cetrimide Cetrimide + chlorhexidine (Savlon)	Cetrimide Cetrimide + chlorhexidine (Savlon)
Diguanides	Chlorhexidine 4% Chlorhexidine 4% + detergent Chlorhexidine 4% + glycerin	Chlorhexidine 4% + detergent (Hibiscrub) Chlorhexidine 4% + glycerin (Hibisol)

Appendix 4: Summary of Methods for Processing Instruments and Equipment

Equipment/Items	Agent(s) and Preferred Methods	Alternative Methods/ Other Recommendations
Airways and endotracheal tubes	<ul style="list-style-type: none"> Single use, disposal, or heat sterilised in CSSD 	<ul style="list-style-type: none"> Single use for known infection, e.g., TB, AIDS
Ampoules (outside)	<ul style="list-style-type: none"> Wipe neck of ampoule with 70% alcohol Allow to dry before opening 	<ul style="list-style-type: none"> If sterile exterior is required, this should be processed by CSSD (agreed by Medical and Pharmacy staff).
Anaesthetic equipment Ventilator tubings Face masks Laryngeal mask (LMA) Endotracheal tubes	<p>Where possible:</p> <ul style="list-style-type: none"> Steam sterilise or use Ethylene oxide. Check manufacturer's instructions for each instrument. <p>Chemical disinfection between patients:</p> <ul style="list-style-type: none"> Sodium hypochlorite 0.5%. <p>After use with TB patients and at end of the day use:</p> <ul style="list-style-type: none"> 0.55% ortho-phthalaldehyde. [OPA] 	<p>General Procedure</p> <ul style="list-style-type: none"> After each patient, wash thoroughly with liquid detergent. Rinse with water. Disinfect. Rinse thoroughly with distilled water. Dry. <p>Disinfection Procedure</p> <p>Between patients:</p> <ul style="list-style-type: none"> Soak in hypochlorite solution or for 10 minutes. <p>After TB patients:</p> <ul style="list-style-type: none"> Soak in 0.55% ortho-phthalaldehyde for 5 minutes. <p>At the end of the day</p> <ul style="list-style-type: none"> Soak in 0.55% ortho-phthalaldehyde for 10 hours (chemisterilant). Use disposable circuits if financially possible.
Nebulisers	<ul style="list-style-type: none"> Container and mask: Clean and dry after each use (wipe with paper). Store dry, and cover to protect from dust. 	<ul style="list-style-type: none"> Replace mask on weekly basis or sooner if visibly soiled.
Babies' feeding bottles and teats	<ul style="list-style-type: none"> Pre-sterilised. If non-disposable, wash thoroughly with brush, detergent, and water. Rinse and immerse in fresh sodium hypochlorite 0.0125% (125 ppm) solution for 30 minutes or use other sterilisation methods. 	<ul style="list-style-type: none"> Chemical disinfectant should be used only when methods are unavailable <p>OR</p> <ul style="list-style-type: none"> Use cups and spoons.
Oral airways Oxygen masks	<ul style="list-style-type: none"> Sodium hypochlorite 0.5%. <p><i>Do not heat sterilise, but ethylene oxide can be used if available.</i></p>	<ul style="list-style-type: none"> Wash in warm soapy water. Soak in sodium hypochlorite for 20 minutes. <p>OR</p> <ul style="list-style-type: none"> Rinse with sterile water and dry.
Cheate's forceps	<ul style="list-style-type: none"> Autoclave daily 	
Flexible and fixed: <ul style="list-style-type: none"> Endoscopes Laparoscopes Arthroscopes Cystoscopes, etc. 	<p><i>Most rigid endoscopes which are now on the market can be heat sterilised.</i></p> <ul style="list-style-type: none"> Check suppliers' instruction as to whether heat sterilisation is possible or chemical sterilisation is necessary. Chemical disinfectant with Ortho-phthalaldehyde [OPA] 	<ul style="list-style-type: none"> Pre-clean brush with detergent solution. Immerse in 0.55% Ortho-phthalaldehyde [OPA] solution for 5 minutes. At least 20 minutes if contaminated with <i>Mycobacterium tuberculosis</i>. Rinse in sterile water and dry. Rinse water should be sent for culture at least once during a session to check process. If an organism is isolated, check the effectiveness of the disinfection process. If an infection is isolated, check for procedural problems, e.g., inadequate cleaning or air bubbles in tubing. If organism still persists, it is probably resistant, so change disinfectant. Use of an enzymatic cleaner should help.

Equipment/Items	Agent(s) and Preferred Methods	Alternative Methods/ Other Recommendations
Glass chest drainage bottles	<ul style="list-style-type: none"> • Steam sterilise OR <ul style="list-style-type: none"> • Sodium hypochlorite 0.5%. 	<ul style="list-style-type: none"> • Pack in paper packet or towels then steam sterilise. OR <ul style="list-style-type: none"> • Soak in disinfectant for 10 minutes. • Rinse in sterile water and dry.
Humidifiers	<ul style="list-style-type: none"> • As for suction bottles. • Heat disinfect in CSSD OR <ul style="list-style-type: none"> • Wash with hot water and detergent, rinse and store dry. 	<ul style="list-style-type: none"> • As for suction bottles. • When reusing, fill with sterile water and connect in-line. • Water must be changed every 24 hours, or sooner if necessary.
Infant incubators	<p><i>Read manufacturer's instructions. Follow cleaning/disinfection procedure.</i></p> <ul style="list-style-type: none"> • Generally wipe with 70%- 95% methylated spirit. 	<p><i>Do not use alcohol (methylated spirit) on Perspex plastic parts, as it will discolour.</i></p> <ul style="list-style-type: none"> • Wash-wipe with warm soapy water. • Wipe with alcohol. • Rinse with clean water and dry.
Laryngoscope blades (to be checked)	<ul style="list-style-type: none"> • 0.55% Ortho-phthalaldehyde 	<ul style="list-style-type: none"> • Wash in warm soapy water. • Rinse and dry. • Soak in 0.55% Ortho-phthalaldehyde for 5 minutes. • Rinse in sterile water.
Oroscope pieces	<ul style="list-style-type: none"> • 0.55% Ortho-phthalaldehyde 	<ul style="list-style-type: none"> • Repeat above procedures.
Instruments: <ul style="list-style-type: none"> • General • Surgical • Dental Ophthalmic	<ul style="list-style-type: none"> • Heat sterilisation. OR Chemical disinfection with 0.55% Ortho-phthalaldehyde solution only for those instruments that cannot be heat sterilised. • Return to CSSD in a closed container. • 0.55% Ortho-phthalaldehyde. <p><i>Do not heat sterilise.</i></p> <ul style="list-style-type: none"> • In some cases, use ethylene oxide if available. Check manufacturer's instructions. 	<ul style="list-style-type: none"> • Decontaminate, brush with detergent solution, rinse. • Then soak in 0.55% Ortho-phthalaldehyde for 5 minutes. • Rinse in sterile water and dry. • Contaminated instruments to be cleaned by trained staff in CSSD. • Decontaminate. • Clean with detergent, rinse thoroughly, and dry. • Soak in 0.55% Ortho-phthalaldehyde for 5 minutes. • Rinse in sterile water and dry.
Nailbrush (surgeons' and nurses' use)	<ul style="list-style-type: none"> • Use is discontinued. 	<ul style="list-style-type: none"> • The practice of scrubbing hands and arms in the operating theatre with nailbrush is discontinued.
Oxygen tent	<ul style="list-style-type: none"> • Wash with hot water and detergent, rinse well, and dry thoroughly. 	<ul style="list-style-type: none"> • Store covered with clean plastic sheeting in a clean area.
Razors <ul style="list-style-type: none"> • Safety • Open • Electric 	<ul style="list-style-type: none"> • Ideally, individual shaving equipment is disposable. • Detach head, clean thoroughly, and immerse in 70% alcohol for 10 minutes. • Allow to dry between each patient. 	<ul style="list-style-type: none"> • Discard disposables after each use in puncture-resistant containers.
Renal dialysis machines	<ul style="list-style-type: none"> • Methylated spirit. • Formaldehyde. • Sterile distilled water. • Sodium hypochlorite 0.5%. <p><i>Do not heat sterilise.</i></p> <ul style="list-style-type: none"> • In some cases, ethylene oxide sterilisation might be the correct treatment. Check manufacturer's instructions. 	<ul style="list-style-type: none"> • Damp dust exterior of equipment with methylated spirit. • Flush lines thoroughly with sterile distilled water. • Distilled water should be used in 0.5% sodium hypochlorite. • Flush lines with formaldehyde. • Rinse thoroughly with sterile distilled water. • Check for residual formaldehyde with Clin-Test tablets.

Equipment/Items	Agent(s) and Preferred Methods	Alternative Methods/ Other Recommendations
Suction bottles, chest drainage bottles	<ul style="list-style-type: none"> Detergent and water. <p>Pre-disinfect to render safe:</p> <ul style="list-style-type: none"> Use NaDCC powder <p>OR</p> <ul style="list-style-type: none"> Sodium hypochlorite 0.25% (2500 ppm) <p>Disinfect with:</p> <ul style="list-style-type: none"> Sodium hypochlorite. <p>Pour bottled contents carefully into sluice, then flush.</p> <p>Rinse jar, then wash with hot water and detergent.</p>	<p>Regardless of patient's status of infection:</p> <ul style="list-style-type: none"> Empty suction bottle, wash with soapy water. Add disinfectant power (NaDCC) OR 0.25% sodium hypochlorite solution into bottle, mix, leave for 5 minutes, empty. Fill with prepared disinfectant solution, leave for 20 minutes. Rinse with clean water and dry.
Thermometers <ul style="list-style-type: none"> Armpit Oral Rectal (generally discouraged) 	<ul style="list-style-type: none"> 70%-95 % Methylated spirit. 	<ul style="list-style-type: none"> Each ward should have enough thermometers available to serve individual patients. <p>Before and after use:</p> <ul style="list-style-type: none"> Wash with cold soapy water. Wipe with cotton wool soaked in methylated spirit. Store thermometers dry.
Disposables: <ul style="list-style-type: none"> Endotracheal tubes Foley catheters Feeding tubes Suction tubes Stomach tubes Laboratory waste Syringes Scalpel blades Dressings, etc. Gloves Masks 	<ul style="list-style-type: none"> Discard. <p><i>Only in the case that disposables expire before use, repeat sterilisation with ethylene oxide, if available, can be considered.</i></p>	<ul style="list-style-type: none"> The very nature of disposables is that they are to be disposed of after use. Handle with care! All sharps should go in the sharps containers. Other materials collect in the refuse bag recommended. Full sharps puncture-resistant containers and plastic bags should be incinerated (see Section 4: Standard Precautions).

Appendix 5: Health Care Facility Environmental Cleaning and Disinfection Policies

Item/task and location	Frequency of cleaning/ disinfection	Agent, equipment, and supplies needed	Procedure/Remarks
Cleaning Equipment			
Cleaning cloths	Daily after use	<ul style="list-style-type: none"> Liquid detergent and water Clean water and bucket 	<ul style="list-style-type: none"> Wash with detergent, rinse, and dry Store dry Incinerate if heavily contaminated
Mops, brooms, brushes	Clean and disinfect after use	<ul style="list-style-type: none"> Liquid detergent and water Sodium hypochlorite 05% 	<ul style="list-style-type: none"> Decontaminate, wash thoroughly with detergent, rinse in water, and dry Always comply with colour-code and confine use of each mop to its designated room, eg, kitchen, toilet, ward, etc DO NOT MIX MOPS Mops should be stored dry and upright with head up
Plastic buckets for use during cleaning	Daily after use or as required	<ul style="list-style-type: none"> Liquid detergent and water Isolation areas: <ul style="list-style-type: none"> Sodium hypochlorite 05% 	<ul style="list-style-type: none"> Each area to have own bucket Isolation areas: <ul style="list-style-type: none"> Decontaminate, clean, and dry
Ablution Facilities			
Ablution blocks: <ul style="list-style-type: none"> Toilets Toilet seats Toilet cistern Urinal 	<ul style="list-style-type: none"> Thorough daily cleaning or as per cleaning schedule 	<ul style="list-style-type: none"> Liquid detergent and water Sodium hypochlorite 05% Deodoriser 	<ul style="list-style-type: none"> Use a low-level disinfectant Use deodorizer if necessary as per manufacturer's instructions Soak in sodium hypochlorite (decontaminate if possible) clean and dry
Jugs (for measuring urine, emptying catheter bags)	<ul style="list-style-type: none"> Between use and daily 	<ul style="list-style-type: none"> Sodium hypochlorite 05% Store dry and inverted 	<ul style="list-style-type: none"> Decontaminate, clean, and dry

Item/task and location	Frequency of cleaning/disinfection	Agent, equipment, and supplies needed	Procedure/Remarks
Bedpans/urinals Sputum mugs	<ul style="list-style-type: none"> Scrub with vim, soap, and water daily 	<ul style="list-style-type: none"> Detergent and water In case of diarrhoeal disease: <ul style="list-style-type: none"> Sodium hypochlorite 05% 	Regardless of patient's status of infection: <ul style="list-style-type: none"> Empty bedpan/urinal/ washing bowl down sewer Decontaminate, clean, and dry Use bed pan washer if available Extra bedpans/urinals/sputum mugs not in use should be stored in cupboards Sputum mugs must be decontaminated and cleaned before dispatching to patients Used toilet brushes: Soak in decontaminant, wash in warm soapy water, rinse, and hang to dry
Disposable sputum mugs	Discard after use		
Floors Walls	<ul style="list-style-type: none"> Scrub with disinfectant cleaning solution, rinse, and allow to air-dry Clean spills as per policy Clean walls once a week or as necessary 	<ul style="list-style-type: none"> Liquid detergent and warm water Spills: <ul style="list-style-type: none"> Sodium hypochlorite 05% 	Comply with cleaning schedule
Sluice rooms	<ul style="list-style-type: none"> Once a day and as required Disinfect after contamination 	<ul style="list-style-type: none"> Liquid detergent and warm water Sodium hypochlorite 05% 	<ul style="list-style-type: none"> Avoid splashing and spills on walls and surrounding area Pour contents of urinals and bedpans GENTLY down the sluice Disinfect surfaces after use and as necessary
Bathrooms			
Enamel baths and basins (bathtubs and sinks)	<ul style="list-style-type: none"> Clean once a day as required Clean spills as per policy 	<ul style="list-style-type: none"> Liquid detergent and warm water Sodium hypochlorite 05% 	<ul style="list-style-type: none"> Scrub floors and walls to remove any residues Clean and dry drainage hole Clean walls from top to bottom <i>Do not</i> use ammonia detergent and chlorine-based compound together because of the release of toxic compounds Rinse thoroughly to remove disinfectant <i>Do not</i> use abrasive material to clean bath and sink, as it will damage their surface
Washing bowls	<ul style="list-style-type: none"> Clean and disinfect between patients 	Disinfect with: <ul style="list-style-type: none"> Sodium hypochlorite 05% 	
Pedal bin and container			
Without liner	<ul style="list-style-type: none"> Empty daily or when 2/3 full Decontaminate, wash daily and as required 	<ul style="list-style-type: none"> Liquid detergent and water Sodium hypochlorite 05% 	<ul style="list-style-type: none"> Decontaminate and clean thoroughly daily and anytime it is dirty
With liner	<ul style="list-style-type: none"> Discard 		<ul style="list-style-type: none"> Dispose of liner when $\frac{3}{4}$ full, and clean once per week

Item/task and location	Frequency of cleaning/ disinfection	Agent, equipment, and supplies needed	Procedure/Remarks
Furniture, Fittings and Equipment			
Drains	<ul style="list-style-type: none"> Once per week and as necessary 	<ul style="list-style-type: none"> Liquid detergent and water Drain cleaner for unblocking 	<ul style="list-style-type: none"> Pour hot soapy water down the drain. If blocked, use plunger (colour-coded) Use drain cleaner only if necessary
Beds (including frames)	<ul style="list-style-type: none"> Daily damp cleaning Disinfect on discharge or for spills 	<ul style="list-style-type: none"> Liquid detergent and water Spills and terminal disinfection with 0.5% sodium hypochlorite/disinfectant cleaning solution 	<ul style="list-style-type: none"> Clean the bed with detergent and water Disinfect mattress and the pillow(s) and air-dry for at least 1 hour in-between patients <p>Never admit a patient into a bed that has not been disinfected</p>
Bedside lockers (General Ward)	<ul style="list-style-type: none"> Daily damp cleaning Thorough cleaning once per week and on discharge of patient 	<ul style="list-style-type: none"> Liquid detergent and water 0.5% sodium hypochlorite/disinfectant cleaning solution 	<ul style="list-style-type: none"> Check lockers for pest control requirements If splashed with blood and body fluids, wipe with 0.5% sodium hypochlorite/disinfectant cleaning solution and wash with water
Bowls (dressing, surgical, vomit, kidney)	<ul style="list-style-type: none"> After each use 	<ul style="list-style-type: none"> Clean with detergent Autoclave at CSSD Store dry and inverted Individual bowl for each patient preferred For communal use, after thorough cleaning 	<p>For infected patients use individual bowls:</p> <ul style="list-style-type: none"> Clean with phenolics for bacterial and hypochlorite for viral infections On discharge, autoclave or disinfect <p>For non-infected patients, treat as for washing bowls:</p> <ul style="list-style-type: none"> Decontaminate, wash with detergent and water Rinse and dry
Couches	<ul style="list-style-type: none"> Wipe daily or as necessary 	<ul style="list-style-type: none"> Liquid detergent and warm water 	
Carpets	<ul style="list-style-type: none"> Vacuum daily Wash quarterly 	<ul style="list-style-type: none"> Carpet shampoo or warm soapy water 	<ul style="list-style-type: none"> Vacuum clean routinely and wash thoroughly quarterly Not recommended for patient areas
Bed curtains Window curtains	<ul style="list-style-type: none"> Every 6 months or after infectious cases 	<ul style="list-style-type: none"> Laundry detergent and water 	<ul style="list-style-type: none"> For infectious cases, avoid use of curtains 1% hypochlorite is used for laundering after disinfection, if necessary
Electronic equipment	<ul style="list-style-type: none"> Follow manufacturer's instruction and/or disinfect surfaces between patients 	<ul style="list-style-type: none"> 70%–95 % Methylated spirit 	
Fans	<ul style="list-style-type: none"> Routinely and on discharge of patient 	<ul style="list-style-type: none"> Liquid detergent and soapy warm water 	<ul style="list-style-type: none"> Damp wipe with clean cloth Dismantle the fan for terminal cleaning and when visibly dirty

Item/task and location	Frequency of cleaning/disinfection	Agent, equipment, and supplies needed	Procedure/Remarks
Hydrotherapy pool	<ul style="list-style-type: none"> Clean after each use 	Water: <ul style="list-style-type: none"> Chlorine-based compound Chlorine level in pool 14 to 20 ppm Tiled areas and floor area surrounding pool: <ul style="list-style-type: none"> Sodium hypochlorite 05% 	<ul style="list-style-type: none"> Check chlorine levels and pH of pool daily Bacteriological investigations of pool water to ensure level of disinfection is sufficient to cope with level of use
Linen	<ul style="list-style-type: none"> Collect as per health care facility policy 	<ul style="list-style-type: none"> Laundry detergent and water 	<ul style="list-style-type: none"> If not soiled, put into laundry bin and send to laundry If soiled, remove solid soil and discard into sluice for flushing; wring, rinse, put into colour-coded container, and send to laundry
Mattress Pillows With plastic covering	<ul style="list-style-type: none"> Wipe and disinfect when necessary and after each patient 	<ul style="list-style-type: none"> Laundry detergent and water Sodium hypochlorite 05%/disinfectant cleaning solution if contaminated 	<ul style="list-style-type: none"> All mattresses should be covered with soft impervious plastic
Mackintosh	<ul style="list-style-type: none"> Wash mackintosh with liquid detergent and disinfect after each patient 	<ul style="list-style-type: none"> Detergent and water 	
Stands for: <ul style="list-style-type: none"> IV sets Gas tanks Bed screen 	<ul style="list-style-type: none"> Damp clean daily and as necessary 	<ul style="list-style-type: none"> Detergent and water Disinfect spills Wipe with methylated spirit 	<ul style="list-style-type: none"> Use disinfectant cleaning solution and wash with water
Sinks (kitchen, other)	<ul style="list-style-type: none"> Daily or as necessary 	<ul style="list-style-type: none"> Detergent and warm water 	
Safety cabinet (Pharmacy)	<ul style="list-style-type: none"> Wipe at end of each procedure 	<ul style="list-style-type: none"> Sodium hypochlorite 05%/disinfectant cleaning solution Treat spills as per policy 	<ul style="list-style-type: none"> Clean airflow and change filters as per manufacturer's instructions
Trolleys and Trays			
Procedures	<ul style="list-style-type: none"> Daily damp cleaning and as required Disinfect before and after every use 	<ul style="list-style-type: none"> Liquid detergent and water Disinfectants: <ul style="list-style-type: none"> Methylated spirit – 70% 05% chlorhexidine in alcohol Sodium hypochlorite 05% 	<ul style="list-style-type: none"> Wipe with methylated spirit or chlorhexidine before and after every use
Food			<ul style="list-style-type: none"> Wipe daily with sodium hypochlorite
Glassware and other equipment (Pharmacy)	<ul style="list-style-type: none"> As per requirements of Pharmacy 	<ul style="list-style-type: none"> Liquid detergent and warm water 	
Image Intensifier	<ul style="list-style-type: none"> Daily and after each use 	<ul style="list-style-type: none"> Liquid detergent and warm water OR <ul style="list-style-type: none"> 70%–95 % Methylated spirit 	<ul style="list-style-type: none"> Routinely damp dust Wipe with alcohol
X-ray equipment	<ul style="list-style-type: none"> Daily and after each use 	<ul style="list-style-type: none"> Liquid detergent and warm water 	<ul style="list-style-type: none"> Routinely damp dust Allow to dry before use

Item/task and location	Frequency of cleaning/disinfection	Agent, equipment, and supplies needed	Procedure/Remarks
Tooth mugs	<ul style="list-style-type: none"> Wash daily or use disposable 	<ul style="list-style-type: none"> Detergent and hot water if reusable 	<ul style="list-style-type: none"> For infected patients, use individual mugs or disposables Disinfect with sodium hypochlorite 05%
Toys	<ul style="list-style-type: none"> After discharge or as required 	<ul style="list-style-type: none"> Wash, rinse, and dry thoroughly <i>Do not</i> soak in disinfectant if contaminated; heat disinfect OR Wipe surface with 05% sodium hypochlorite or 70% methylated spirit 	<ul style="list-style-type: none"> For patients with infections, do not use communal toys which cannot be easily disinfected Heavily contaminated toys should be destroyed
Floors, Walls, and Windows, Etc.			
Floors <ul style="list-style-type: none"> General wards/ areas Laundry Pharmacy Occupational, Physiotherapy, Radiotherapy, and Dental Departments 	<ul style="list-style-type: none"> Thorough damp cleaning daily Cleaning when soiled Cleaning between patients and after discharge (if single room accommodation) Damp mop Clean spills as per policy 	<ul style="list-style-type: none"> Liquid detergent and warm water Spills: <ul style="list-style-type: none"> Sodium hypochlorite 05% Liquid detergent and warm water 	<ul style="list-style-type: none"> See section on floor mops, brooms, for care Use colour-coded mops to prevent cross-contamination between areas Switch off fans while cleaning
Special Procedures and Surfaces			
Ambulance			
Delicate equipment, eg, radios, cardiac monitors	<ul style="list-style-type: none"> After each patient and daily 	<ul style="list-style-type: none"> Liquid detergent and water Disinfectant: <ul style="list-style-type: none"> Sodium hypochlorite 05% Liquid detergent and water 	<ul style="list-style-type: none"> Wipe with soap and water Wipe with disinfectant if contaminated Wash in warm water with detergent Rinse and dry
Oxygen masks, nebulizers		Disinfectant: <ul style="list-style-type: none"> Sodium hypochlorite 05% For any suspect TB patients: <ul style="list-style-type: none"> 055% ortho-phthalaldehyde 	<ul style="list-style-type: none"> Decontaminate, clean, and high-level disinfect Soak in OPA for 5 minutes
Inside Ambulance (Walls, windows, floors, slats)	<ul style="list-style-type: none"> Weekly or after spills Wash daily and as necessary 	<ul style="list-style-type: none"> Liquid detergent and water Treat spills as per policy 	<ul style="list-style-type: none"> Wash daily and as necessary See Section on floors and walls
Mortuary			
Trays	<ul style="list-style-type: none"> Disinfect trays after every removal of body 	Routine disinfection: <ul style="list-style-type: none"> Sodium hypochlorite 05% OR <ul style="list-style-type: none"> Liquid detergent and water Deodorizer 	<ul style="list-style-type: none"> Wipe trays thoroughly and mop floor If there are excessive smells, use deodorizer
Floors	<ul style="list-style-type: none"> Wash floors daily and as required 		<ul style="list-style-type: none"> Sweep first, then mop with detergent soap solution Wipe and deodorize

Appendix 6: Reporting Formats for Workplace Exposures/Injuries

Instructions:

Fill out this form and have the appropriate test done within 48 hours after injury. Send the report to the Regional Director of Health Services through your immediate supervisor and the head of the facility. Follow up on the blood test results and forward it to the Regional Director through the same means.

Name and ID of employee _____

Category/Rank _____

Name of institution _____

Age _____

Sex Male () Female ()

Date and time of injury, accident and assault _____

Diagnosis of patient _____

Place of injury/accident/assault _____

Details on the type of injury, accident, assault and exposure (including amount of fluid or blood taken in the body)

Type of blood test done (e.g. Hepatitis B, HIV) _____

Date and time of test _____

Results obtained _____

Date on which results were obtained _____

Person notified immediately after the injury or accident occurred _____

Time of exposure/injury/accident/assault

Was action taken within 48 hours? Yes No

Explanation _____

Was action taken after 48 hours? Yes No

Explanation _____

Signature of employee _____

Signature of receiver of the form _____

Appendix 7: TB Screening Questionnaire

Name and ID of employee

Age

Sex

Date

Symptom Screen

Do you have any of the following symptoms? (please circle grade for response)

	No	Yes
Cough for more than 2 weeks	0	2
Coughing up blood	0	2
Sputum production	0	2
Loss of weight in last 3 months	0	1
Loss of appetite recently	0	1
Fever for more than 1 week	0	1
Chest pain	0	1

Total Score: (max 10)

Past Medical History

Have you been exposed to a TB patient recently? Yes No

Have you been treated for TB in the past 5 years? Yes No

When _____ (Year)

Duration _____ (Months)

<i>If patient has</i>	<i>Interpretation</i>
Cough for > 2 weeks	Suspect
Score of 7 or more on symptom screen	Suspect
Previous TB treatment in last 5 years	Suspect

Conclusion (circle)

Suspect

Non Suspect

Request Sputum Smear Microscopy For All Suspects

Results (circle final diagnosis)

Sputum 1	Date _____	POS	NEG	REF	NPC	DEA	ILL
Sputum 2	Date _____	POS	NEG	REF	NPC	DEA	ILL
Sputum 3	Date _____	POS	NEG	REF	NPC	DEA	ILL

KEY

POS: positive smear result

NEG: negative smear result

REF: refused to provide a sputum

NPC: non-productive cough

DEA: died before sputum collection

ILL: too ill to provide sputum

Appendix 8: Categorisation of Human Cases of Avian Influenza (H5N1)

The schema shall be used to categorise clinical cases of human cases of avian influenza:

a. Suspected avian influenza (H5N1) case

Any individual presenting with fever (temperature $\geq 38^{\circ}\text{C}$);

and

i. one or more of the following symptoms:

Cough

Shortness of breath

Sore throat

OR

ii. death from an unexplained acute respiratory illness

and

at least one of the following exposures within 7 days prior to onset of symptoms:

i. Resides in or visits an area where H5N1 is suspected or confirmed in birds or fowls and has been in close contact with any sick or dead wild birds or domestic fowl.

ii. Works in a laboratory with potential exposure to influenza H5N1.

iii. Close contact with a confirmed case.

b. Probable influenza (H5N1) case

As suspected cases:

and

Limited laboratory evidence for influenza H5N1 (not conclusive, e.g., % H5N1 specific antibodies detected in a single serum specimen).

c. Confirmed influenza (H5N1) case

An individual for whom laboratory testing demonstrates one or more of the following:

i. Positive viral culture for influenza H5N1.

ii. Positive PCR for influenza H5N1.

iii. Immunofluorescence antibody (IFA) test positive using H5N1 monoclonal antibodies.

iv. 4-fold rise in influenza H5N1 specific antibody titre in paired serum samples.

WEEKLY NOTIFIABLE DISEASES REPORTING FORM

Sub-district

Region

Week

Week Ending Saturday / /

N.B Report zero (0) when no cases of diseases are seen in reporting period

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Analysis, Interpretation and Response

CHOLERA	MENINGITIS	MEASLES	AVIAN INFLUENZA	AFP CASES	GUINEA WORM
Comments on Lab:					
Total Samples sent to lab: _____ Type of Pathogens isolated: _____ _____	Total No. of CSF samples sent to lab: _____ Type(s) of Pathogens isolated: _____ _____	Total No. of samples sent to lab: _____	Total No. of samples sent to lab: _____	Total No. of samples sent to lab: _____	
Comments on trends: Compare number of cases with at least those of two previous weeks (State whether cases are increasing, decreasing or there is no change)					
Comments on Mortality: Compare case fatality rate (CFR) (State whether CFR is increasing, decreasing or there is no change)					
Conclusion: (State the current disease situation)					
Sub-district/District Meningitis Alert Threshold crossed <input type="checkbox"/> Yes <input type="checkbox"/> No Name(s) of Sub-district/District crossing Alert Threshold: _____ Sub-district/District Meningitis Epidemic Threshold crossed? <input type="checkbox"/> Yes <input type="checkbox"/> No Name(s) of Sub-district/District crossing Epidemic Threshold: _____					
Actions taken:					
Recommendations:					

Name of Person Reporting: _____

Telephone No.: _____

Signature _____

Date of Report: ____/____/____

Appendix 10: Classification of Nosocomial Infections

There are several classifications of nosocomial infections. In the Ministry of Health the classification shall depend on:

1. Source of infection
2. Type of infection

1. Source of infection:

These include:

- a. Self-infection
- b. Cross infection – person-to-person
- c. Environmental – from environment to person
- d. Iatrogenic

2. Type of infection:

The four most frequent types of hospital-acquired infections are:

- a. Urinary Tract Infections (UTIs)
- b. Wound infections
- c. Lower respiratory tract infection
- d. Skin sepsis such as pressure sores, varicose ulcers

Type	Main Organisms	Usual Sources	Means of Spread
1. Urinary tract infections (can occur in catheterized patients or those undergoing cystoscopy, prostatic biopsy, or urological surgery)			
	Gram-negative bacilli e.g.: <i>E. coli</i> <i>Klebsiella</i> <i>Proteus</i> <i>Pseudomonas</i> <i>Serratia</i>	1. Patient's own faecal flora 2. Contaminated equipment, e.g., urinary catheters or endoscopes	1. Hands of staff contaminated by infected urine, while handling patient, or infected urinary equipment 2. Inadequately sterilised urinary equipment
2. Post-operative wound sepsis			
in 'Clean' surgery	1. <i>Staph. aureus</i> 2. <i>Strep. pyogenes</i> (much less common than Staph.)	1. Patient's own skin or nasal flora 2. Staph./Strep. from septic lesions of other patients or hospital staff 3. 'Dry' environment/air, bedclothes, dust, etc	1. Hands or clothing of patient/staff contaminated by an infected patient 2. Carriage by staff or patients of an epidemic strain 3. Dispersal of Staph./Strep. from infected lesion or carriage site into air or dust

Type	Main Organisms	Usual Sources	Means of Spread
Abdominal and gynaecological surgery (also frequently complicated by intra-abdominal or pelvic abscesses due to similar organisms)	<ol style="list-style-type: none"> 1. Gram-negative bacilli e.g. <i>E. coli</i> 2. Non-sporing anaerobes e.g. <i>Bacteriodes fragilis</i> 3. <i>Staph. aureus</i> 	1. Patient's own faecal flora	<ol style="list-style-type: none"> 1. Usually 'self'-infections. 2. Staph. (see 'Clean' surgery above)
Orthopaedic surgery	<ol style="list-style-type: none"> 1. <i>Staph. aureus</i> 2. Haemolytic 3. <i>Streptococci</i> 4. <i>Clostridium perfringens</i> 5. <i>Staph. epidermidis</i> 6. Gram-negative bacilli and 7. Non-sporing anaerobes 	<p>Same as 'Clean' surgery above</p> <p>Patient's faecal flora:</p> <ul style="list-style-type: none"> • Spores on skin may germinate unless adequate prophylaxis is given, especially for cases of ischaemic arterial disease and lower limb amputations. • Skin of patient or surgeon when hip joint replacement operation involved • Patient's faecal flora when extensive lower limb surgery involved 	Usually not applicable: 'self'-infection
3. Respiratory tract infections			
Pneumonia in post-operative and debilitated cases	<ol style="list-style-type: none"> 1. <i>Strep. pneumonia</i> 2. <i>Staph. aureus</i> 	<ol style="list-style-type: none"> 1. Patient's own upper respiratory flora 2. Patient's nasal flora or from hospital 'dry' environment 	<p>Usually not applicable</p> <p>Air and dust</p>
Pneumonias in aspiration cases	<ol style="list-style-type: none"> 1. <i>Strep. pneumonia</i> 2. <i>Staph. aureus</i> 3. <i>Haemophilus influenzae</i> 4. Non-sporing anaerobes 5. Gram-negative bacilli 	<p>As above</p> <p>Patient's own upper respiratory flora</p> <p>From hospital 'moist' environment</p>	<p>As above</p> <p>Not applicable</p> <p>Hands of staff and 'moist' environment</p>
Pneumonias in intensive care cases	Similar to aspiration pneumonia	As for aspiration pneumonia	As for aspiration pneumonia
Immunosuppressed cases	Similar to aspiration pneumonia + Cytomegalovirus, <i>Nocardia</i> , <i>Legionella pneumophila</i> , <i>Pneumocystis</i> , fungi, <i>Mycobacterium tuberculosis</i>		
Tuberculosis	<i>Mycobacterium tuberculosis</i>	Respiratory droplets and sputum from open TB cases	Air and dust
Influenza	Influenza viruses	Respiratory droplets from infected patients or staff	Air
Upper respiratory tract in childhood	<ol style="list-style-type: none"> 1. <i>Strep. pyogenes</i> 2. Rhinoviruses 3. Respiratory syncytial virus 4. Measles virus 5. Varicella-zoster virus and other 'respiratory' viruses 6. <i>Herpes simplex</i> 	<p>Respiratory droplets from infected patients or staff</p> <p>Patient's latent mouth flora</p>	Air

Type	Main Organisms	Usual Sources	Means of Spread
4. Alimentary tract infections			
Gastroenteritis	1. <i>Salmonella</i> species 2. <i>Clostridium perfringens</i> 3. <i>Campylobacter jejuni</i> 4. <i>Staph. aureus</i> 5. Enteropathogenic <i>E. coli</i> (infants) 6. Rotavirus (infants)	1. Infected food from hospital kitchen or contaminated infant milk feeds 2. Infected patient faeces or asymptomatic carrier faeces	1. Hands of kitchen, nursing, or other staff, or 2. Direct spread in maternity or paediatric units 3. Contaminated 'moist' sites, e.g., infected bedpans (NB: <i>Clostridium perfringens</i> food poisoning does not spread from patient to patient)
Bacillary dysentery	1. <i>Shigella sonnei</i> 2. <i>Shigella flexneri</i> 3. Other <i>Shigellae</i>	Faeces of infected patients	1. Direct spread in mental, paediatric, and geriatric wards. 2. Hands of staff and patients 3. Moist sites in toilets, bedpans
Enteric fever	<i>Salmonella typhi</i>	Infected or carrier patient-faeces, urine, exudates	1. Contaminated hands of staff 2. Contaminated moist sites, e.g., endoscopes
5. Hepatitis and human immunodeficiency virus (HIV) infections			
	1. Hepatitis B virus Hepatitis C virus HIV 2. Hepatitis A virus	Infected or carrier patient-blood, serum, exudate, tissues, etc. Faeces of infected patient (before start or less than 1 week of jaundice)	1. Contamination of hands, mucous membranes, or eyes of ward, theatre, or laboratory staff. 2. Contaminated machines, 'sharps,' bed pans, and other environmental items
6. Maternity/neonatal infections			
Breast abscess in mother (develops later outside hospital) Neonatal skin/eye/umbilical cord sepsis Ritter's disease	<i>Staph. aureus</i> (penicillin resistant)	Skin or nasal flora of hospital staff or infected patient	1. Hands of hospital staff 2. Air and dust in nursery – especially if neonates are close to each other
Puerperal sepsis, septic abortion, intra-uterine sepsis	Haemolytic Streptococci, Lancefield groups A, B, C, or G Non-sporing anaerobes, e.g., <i>Bacteroides</i> species <i>Clostridium perfringens</i> <i>E. coli</i> and other coliforms <i>Staph. aureus</i>	1. Vaginal or respiratory flora of patient. 2. Upper respiratory flora of hospital Faecal or lower vaginal flora of patient (as for <i>Staph. aureus</i> above)	1. Hands of hospital staff (although most group B Strep. 'self'-infection) 2. Not applicable: 'self'-infection
Neonatal septicaemia or meningitis (often following soft tissue or umbilical cord sepsis)	Group B haemolytic <i>Streptococcus</i> <i>E. coli</i> and other coliforms <i>Pseudomonas aeruginosa</i>	Maternal faecal or lower vaginal flora Maternal flora or contaminated antiseptics, water, baby incubator, or resuscitation equipment	Usually not applicable: occasionally hands of hospital staff
7. Skin sepsis			
Infected eczema, burns, pressure sores, and varicose ulcers	<i>Staph aureus</i> <i>Strep. pyogenes</i> and other haemolytic Streptococci 'coliforms,' <i>Pseudomonas</i> and <i>Bacteroides</i>	Pus and skin scales of infected patients Also <i>Staph. aureus</i> self-infection from patient's own carrier sites, see as above, and Patient's own faecal flora	1. Hands of hospital staff 2. Air and dust 3. Contaminated moist environment



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