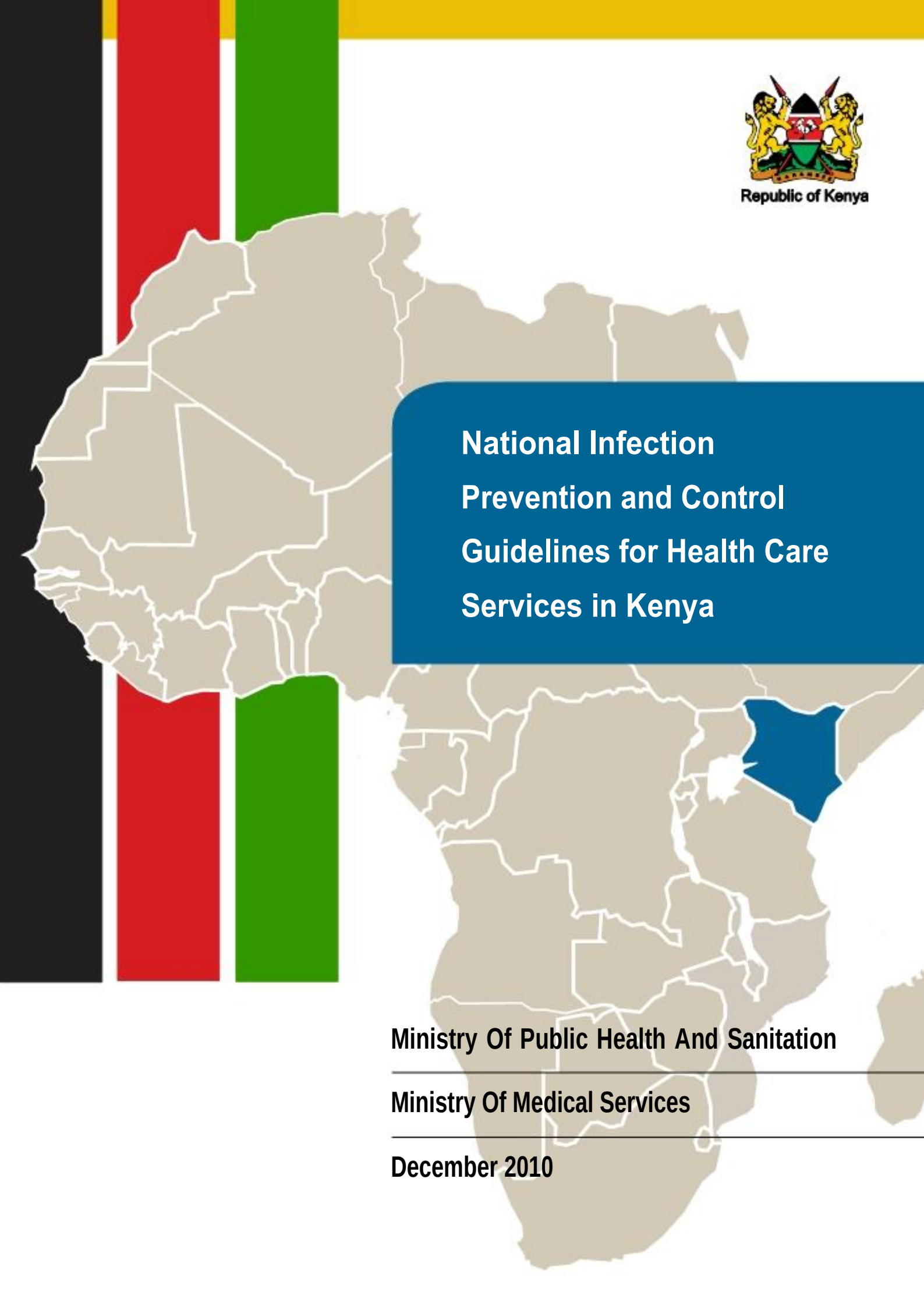


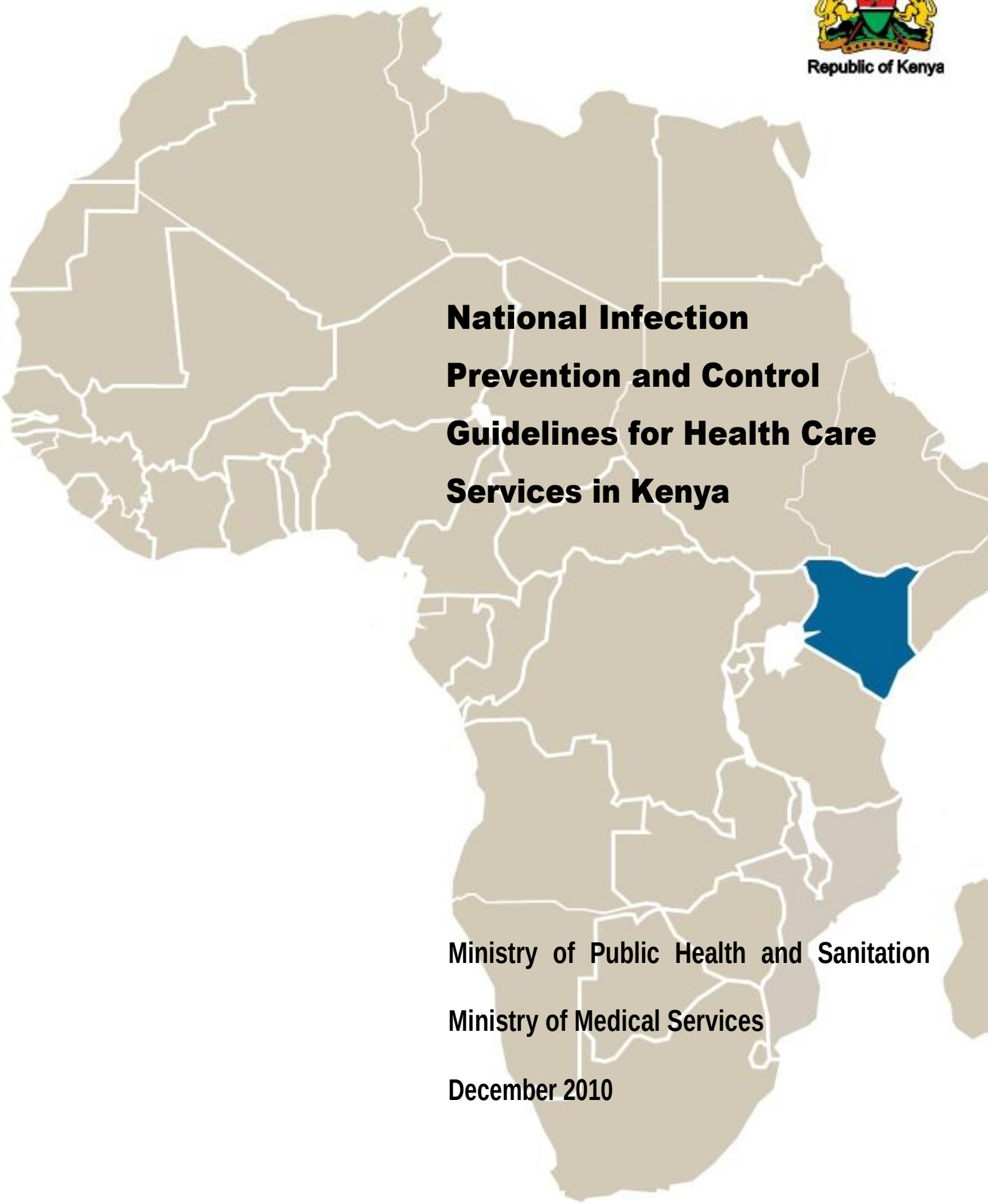
National Infection Prevention and Control Guidelines for Health Care Services in Kenya

Ministry Of Public Health And Sanitation

Ministry Of Medical Services

December 2010

Republic of Kenya



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Enquiries and Feedback

Direct all correspondence to:

Permanent Secretary
Ministry of Public Health and Sanitation
P.O. Box 30016 GPO
Nairobi 00100, Kenya
Email: psph@health.go.ke

Permanent Secretary
Ministry of Medical Services
P. O. Box 30016 GPO
Nairobi 00100, Kenya
Email: ps@health.go.ke

Web site: www.health.go.ke

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- National AIDS and Sexually Transmitted Diseases Control Programme (NASCOP)
- United States Centers for Disease Control and Prevention (CDC)
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FOREWORD

The prevention and control of infections are essential cornerstones of clinical care in all health care settings. The changing pattern of infections and the emergence of bacteria with multiple-antibiotic resistance emphasize the need for all health care workers (HCWs) to understand and practice evidence-based infection prevention and control (IPC) practices that will protect patients, clients, and health care workers from health care-associated infections (HAIs).

Health care-associated infections include urinary tract infections, surgical-site infections, bloodstream infections, and pneumonia. They are a major problem for patient safety—leading to prolonged hospital stays, long-term disabilities, increased resistance of microorganisms to antimicrobials, massive additional financial burdens, high costs for patients and their families, and deaths. As such, the prevention and control of HAIs must be a top priority for settings and institutions that are committed to making health care safer.

For HCWs to provide high-quality health care services and prevent unnecessary HAIs, strict adherence to simple and cost-effective IPC practices such as hand hygiene must be observed.

Even though no institution or country can claim to have solved the problem of HAIs, the burden is much heavier in developing countries such as Kenya, where surveillance is seldom in place. These guidelines should be used in conjunction with other relevant documents such as the *National Policy on Injection Safety and Medical Waste Management* (2007), the *National Standards and Guidelines on Injection Safety and Medical Waste Management* (2007), and *Guidelines for Tuberculosis Infection Prevention in Kenya* (2009). Together they will assist health care providers, health care training institutions, and other IPC stakeholders in designing, implementing, monitoring, and evaluating IPC practices in Kenya. These efforts will contribute to improved IPC practices, help reduce HAIs, and move the country towards achievement of the Millennium Development Goals (MDGs) and Vision 2030.

Dr. S. K. Sharif, Director
Ministry of Public Health and Sanitation

Dr. Francis Kimani
DIRECTOR OF MEDICAL SERVICES

ACRONYMS AND ABBREVIATIONS

AIDS	Acquired immunodeficiency syndrome
AKUH	Aga Khan University Hospital
AMP	Antimicrobial prophylaxis
AOP	Annual operation plan
ARO	Antibiotic-resistant organism
ART	Antiretroviral therapy
ARV	Antiretroviral
AZT	Zidovudine
BBPs	Blood-borne pathogens
BSC	Biosafety cabinet
CDC	United States Centers for Disease Control and Prevention
CQI	Continuous quality improvement
CSSD	Central Sterilization and Supplies Department
DHMT	District health management team
DIPCC	District infection prevention and control coordinator
DLTLD	Division of Leprosy, Tuberculosis, and Lung Disease
DMS	Director of Medical Services
DPHS	Department of Primary Health Services
EFV	Efavirenz
GARP	Global Antibiotic Resistance Partnership
HAI	Health care-associated infection
HAV	Hepatitis A virus
HAZMAT	Hazardous material
HBIG	Hepatitis B immunoglobulin
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HCW	Health care worker
HIV	Human immunodeficiency virus
HLD	High-level disinfection
HMIS	Health management information service
HRH	Human Resource for Health
IEC	Information, education, and communication
IPC	Infection prevention and control
IPCC	Infection prevention and control committee
IPPV	Intermittent positive pressure ventilation
JSI	John Snow, Inc.

KAIS	Kenya AIDS Indicator Survey
KEMRI	Kenya Medical Research Institute
KEPH	Kenya Essential Package for Health
KMTC	Kenya Medical Training College
KNH	Kenyatta National Hospital
KU	Kenyatta University
MDG	Millennium Development Goal
M&E	Monitoring and evaluation
MOMS	Ministry of Medical Services
MOPHS	Ministry of Public Health and Sanitation
MRSA	Methicillin-resistant *Staphylococcus aureus*
MTC	Medical Training College
NaDCC	Sodium dichloroisocyanurate
NASCOP	National AIDS and STI Control Programme
NBTS	National Blood Transfusion Services
NHSSP II	Second National Health Sector Strategic Plan 2005-2010
NIPCC	National Infection Prevention and Control Committee
NVP	Nevirapine
OPIM	Other potentially infectious materials
PEP	Post-exposure prophylaxis
PGH	Provincial General Hospital
PHA	Public Health Act
PHMT	Provincial health management team
PIPCC	Provincial infection prevention and control coordinator
POASB	Peroxygen and organic acid surfactant blend
PPE	Personal protective equipment
PPM	Parts per million
PVI	Povidone-iodine
SARS	Severe acute respiratory syndrome
SSI	Surgical-site infection
TB	Tuberculosis
UON	University of Nairobi
UTI	Urinary tract infection
VRE	Vancomycin-resistant *Enterococcus*
WHO	World Health Organization
WHO/AFRO	WHO, Regional Office for Africa

1 INTRODUCTION

Health care-associated infections (HAIs) are a worldwide problem and have been a problem of health care facilities since their inception as institutions for the healing of the sick. These infections are acquired during (or are associated with) the provision of health care services, in contrast to infections that are already present or incubating at the time of a health care delivery episode. Although medical science has made significant advances in therapeutics, diagnostics, and knowledge of the disease process, the problem of HAIs persists throughout the world. Increased facility-based health care of immunocompromised patients and the extensive use of invasive techniques have exacerbated this problem.

To prevent, identify, monitor, and control the spread of infections in health care facilities, comprehensive infection prevention and control (IPC) practices are required. The consistent use of IPC policies and guidelines ensures that IPC practices are carried out in a standard way across all health care facilities in Kenya. The practices and activities include:

- Using scientifically sound measures for preventing and controlling infections
- Monitoring health care practices
- Surveillance of infection in health care facilities
- Reporting IPC activities
- Providing adequate infrastructure, such as sinks and ventilation, and appropriate supplies and equipment
- Educating and training staff about IPC principles
- Educating patients, families, and members of the community in disease causation, prevention, and control
- Effectively managing IPC programmes
- Periodically evaluating IPC policies and guidelines

1.1 Background

Health care institutions have conducted a number of activities on various aspects of IPC to raise awareness. They have put in place various policies and guidelines that address different aspects and segments of IPC in the country. Some of the existing documents on IPC include the *National Policy on Injection Safety and Medical Waste Management* (2007), the *National Standards and Guidelines on Injection Safety and Medical Waste Management* (2007), and *Guidelines for Tuberculosis Infection Prevention in Kenya* (2009). In addition, some health institutions have developed their own documents. One such document is Kenyatta National Hospital's *Policy Guidelines on Antisepsis, Disinfection, Sterilization and Waste Disposal* (2006). Activities to address IPC of influenza (flu) and other airborne diseases are currently ongoing. But no comprehensive guidelines have been developed to address IPC in Kenya. Across the various regions and levels, many of the differences are attributable to the presence of an infection prevention and control committee (IPCC) and an IPC lead person.

The Ministry of Public Health and Sanitation (MOPHS) and the Ministry of Medical Services (MOMS) (collectively, the ministries of health) have developed the *National Infection Prevention and Control Guidelines for Health Care Services in Kenya*, to be used by all levels of health care facilities to prevent and control HAIs and to safeguard the well-being and safety of patients, clients, and health care workers (HCWs). These guidelines are in keeping with the new shift in the delivery of health care services that promote and emphasize integrated services. The guidelines complement and make reference to existing policies and cover all areas of possible transmission, including injection

and phlebotomy safety and the prevention of tuberculosis (TB) and influenza. The goals of these guidelines are as follows:

- To reduce the incidents of preventable infections in patients and staff and safely care for patients with infections
- To promote good practices through a better understanding of IPC
- To guide the health sector in the development of safe, effective, and appropriate procedures
- To deliver IPC strategies within the strategic framework of the health sector through the annual operating plan (AOP) framework
- To promote a greater awareness of potential infection hazards for HCWs

1.2 Rationale

Infections in health care facilities can occur through the transmission of infective agents from HCW to patient, from patient to HCW, from patient to patient, or from HCW to HCW. Risk of transmitting infections is higher if basic IPC practices are not observed. Effective measures must be developed to identify, prevent, and control infections.

Infections that are associated with health care not only increase morbidity and mortality in patients, but also are responsible for prolonged hospital stays, long-term disabilities, and increased resistance of microorganisms to antimicrobials. This creates an additional financial burden for patients and their families, as well as an extra burden on health care services. Improving the health infrastructure by establishing and adhering to IPC practices is the most cost-effective way to improve health outcomes, prevent morbidity and mortality, decrease health care costs, and avoid possible litigation that could arise from HAIs. At the national level and within the health care facility, IPC is essential for the well-being and safety of patients, families, health care professionals, and the community.

1.3 Situation Analysis

A qualitative rapid assessment of IPC practices in 12 health facilities in five provinces in Kenya revealed significant differences in IPC practices among the health care facilities. Across the various regions and levels of health care facilities, the presence of an IPCC and IPC lead persons that were recognized by the hospital administration was associated with good IPC practices. In these health care facilities, the IPC lead person had support from the hospital administration to acquire various supplies and mechanisms that are necessary for good IPC practices. The management team had integrated IPC into the regular supervision of health care providers, and the IPC lead person was part of the supervision team. In addition, IPC activities were factored into the annual planning and budgetary process, thereby ensuring consistent availability of IPC supplies and equipment.

Health care facilities without active IPC committees performed poorly in IPC practices at both the institutional and individual provider levels. Where the IPC lead person is not part of the hospital management team, IPC activities tend to get relegated to the back and to lose the prominence that is necessary for good practices. (Most IPC lead persons in Kenya are nurses and not all of them are members of the hospital management team.)

Hand hygiene, the most important and basic IPC practice was infrequently practiced in many of the assessed health care facilities. Even though not all health care facilities have piped water, all of them are able to obtain water for use. Where the hospital administration recognizes the importance of good IPC practices, the health care facilities have been able to improvise by adapting buckets or jerry cans

to act as sources of running water in which HCWs can wash their hands. But not all health care facilities that had piped water practiced hand hygiene. In some facilities, the hand-washing basins were nonfunctional or not in use. Adherence to standard precautions, additional precautions, and waste management systems mirrored patterns that were observed in hand hygiene. The presence of sharps containers, waste bins, incinerators, and personal protective equipment (PPE) did not necessarily lead to their correct use in the absence of active IPCCs and IPC lead persons.

The following additional reasons for poor IPC practices were identified:

- Lack of guidelines and job aids for IPC practices during certain procedures
- Inadequate knowledge and skills among HCWs
- Inadequate training in IPC
- Inadequate supplies of equipment and materials such as PPE (gloves, goggles, plastic aprons, boots, etc.)
- Lack of IPCCs and IPC lead persons in health care facilities
- Poorly and inadequately maintained infrastructures, including electrical, water, and drainage systems
- Overcrowded health care facilities with limited physical space
- Inadequate staffing levels
- Negative attitudes towards and lack of awareness of IPC practices among HCWs

1.4 Purpose and Objectives of These Guidelines

The ministries of health have developed these guidelines to provide comprehensive and standardized information regarding the prevention and control of transmissible infections. These guidelines are intended to act as a central reference for all health care facilities and HCWs. The ministries of health place special emphasis on standard and additional (transmission-based) precautions.

These guidelines are intended to provide administrators and HCWs with the necessary information and procedures to implement IPC core activities effectively within their work environment in order to protect themselves and others from the transmission of infections. They provide information on the following topics:

- The infrastructure, equipment, and supplies that are necessary to implement standard and additional (transmission-based) precautions for IPC
- Procedures for cleaning, disinfecting, and reprocessing reusable equipment
- Managing health care waste
- Protecting HCWs from transmissible infections
- IPC practices in special situations

1.5 Use of These Guidelines

The IPC practices described in these guidelines are intended for use in all types of health care facilities in the public, private, and faith-based health sectors. The guidelines are recommended for all of the following:

- Health care workers and trainers in public, faith-based, private-for-profit, not-for-profit, and NGO health care facilities and institutions
- Individuals, groups, and international organizations that are providing health care services
- Policymakers, health managers, programme officers, and health care administrators
- Various health teams, such as provincial, district, and institutional health-management teams

The guidelines are designed to minimize costs and the need for expensive and often fragile equipment, while at the same time assuring a high degree of safety.

1.6 Content and Organization of This Document

The contents of the *National Infection Prevention and Control Guidelines for Health Care Services in Kenya* are divided into 13 sections:

Section 1. Introduction

Section 2. Management of the IPC Guidelines

Section 3. Epidemiology

Section 4. Standard Precautions

Section 5. Additional (Transmission-Based) Precautions

Section 6. Isolation

Section 7. Environmental Management Practices

Section 8. Traffic Flow and Activity Patterns

Section 9. Reprocessing Instruments and Equipment

Section 10. Clinical Laboratory Safety Practices

Section 11. Laundry and Linen Processing

Section 12. Occupational Safety and Employee Health

Section 13. Preventing Common HAIs

In addition, the following appendices have been included to cover these specific areas of IPC:

1. Key Elements of Standard Precautions
2. Hand-Hygiene Products
3. IPC Practices in the Operating Room
4. IPC in Dentistry
5. IPC for Maternal and Newborn Health
6. Immunobiologics and Schedules for HCWs as Recommended by CDC, 1998
7. Precautions for Handling and Disposing of Dead Bodies and Human Remains
8. Control and Prevention of Antimicrobial Resistance in Health Care Facilities
9. Accidents, Incidents, and Spills Report Form

10. Health Care Facility Cleaning and Disinfection

11. Cleaning and Disinfecting in the Laboratory

1.7 General Policy Statements

The following policy statements are applicable to all IPC practices:

1. Comprehensive IPC practices should be adhered to in all health care facilities and settings in the public, private, and faith-based health sectors:
    - Hospitals
    - Nursing homes
    - Health centres
    - Dispensaries
    - Clinics
    - Special-care facilities
2. Infection prevention and control in the health care facility should be effectively and efficiently supervised and supported by appropriate and adequate resources.
3. Standard precautions should be implemented when contact with any of the following is anticipated:
    - Blood
    - All body fluids, secretions, and excretions (except sweat), regardless of whether or not they contain visible blood
    - Nonintact skin
    - Mucous membranes
4. There should be active IPCCs or teams appropriate for each level of health care. Where appropriate, the team should be multidisciplinary.
5. The appropriate IPC team should be empowered to monitor and ensure compliance with the IPC policies and guidelines in all public, private, and faith-based health care facilities.
6. All HCWs should report the following to the person responsible for IPC:
    - Patients with an order for isolation
    - Situations where the nurse feels that the patient should be isolated, but there is no written order
    - Suspected or confirmed cases of all notifiable diseases
7. The head of the department, ward, or unit shall ensure that all categories of staff, patients, and visitors (where applicable) are aware of and comply with the requirements of standard precautions.
8. The responsibilities of the IPC lead person should include the following:
    - Acting as a resource for information
    - Monitoring the proper use of the standard precautions policy

- Consulting with care givers regarding patient placement and implementing standard precautions
- Educating employees on standard precautions
- Consulting with and advising managers and supervisors on PPE and occupational health and safety protocols

9. All health care facilities should have ongoing, in-service, IPC education programmes to help all categories and cadres of staff understand the basic concepts of IPC and comply with IPC guidelines and practices.
10. The head of the department or unit should ensure that all staff members attend the in-service IPC education programmes.
11. All new employees in all departments or units should be oriented to the *National Infection Prevention and Control Guidelines for Health Care Services in Kenya* by the IPC lead person and the designated supervisor.
12. An occupational health and safety programme at the national and health care facility level, as appropriate, should monitor the health and safety of HCWs and provide the relevant services.
13. The *National Infection Prevention and Control Guidelines for Health Care Services in Kenya* will be reviewed and updated every two years—more frequently if necessary.
14. The *National Infection Prevention and Control Guidelines for Health Care Services in Kenya* should be kept up to date on the results of periodic research conducted on IPC.
15. The *National Infection Prevention and Control Guidelines for Health Care Services in Kenya* should be integrated with the quality assurance programmes for the country and for all health care facilities.
16. Information on IPC should be integrated into pre-service training curricula for all HCWs.
17. There should be a programme of civic education for the community to create awareness of IPC. A multidisciplinary, multi-sectoral approach to programme planning, implementation, and evaluation should be adopted.
18. Improving performance and compliance with recommended policies and guidelines could be significantly enhanced by the following:
    - Consistent support by hospital administrators to improve the quality of services
    - Regular positive feedback and rewards from supervisors that incorporate recommendations for improvement
    - Role modelling by administration and management staff on appropriate IPC practices and behaviours by actively supporting these policies and guidelines
    - Effective logistic management
    - Effective and efficient communication

2 MANAGEMENT OF THE IPC GUIDELINES

The successful implementation of these guidelines depends on effective management and organization at the national, provincial, district, and institutional levels.

2.1 Responsibility and Authority

There are various levels of responsibility and authority for IPC in health care facilities and settings.

National Level

At the national level, MOMS and MOPHS have the ultimate responsibility and authority for ensuring the availability and use of IPC policies and guidelines. The National Infection Prevention and Control Committee (NIPCC) within the two ministries of health shall be responsible for monitoring, reviewing, and updating the IPC guidelines.

Provincial Level

The provincial health management team (PHMT) is responsible for monitoring the facilities under its control for use of and compliance with IPC practices. The PHMT is also responsible for ensuring that adequate and appropriate resources are available for support of IPC practices within these facilities.

District Level

The district health management team (DHMT) is responsible for monitoring the facilities within the district for using and complying with IPC practices. The DHMT is also responsible for ensuring that adequate and appropriate resources are available to support IPC practices within these facilities.

Health Care Facility

At the individual health care facility level, the implementation of IPC is intimately linked to the institution's quality assurance and quality improvement initiatives. The IPCC should monitor, coordinate, and evaluate its implementation.

Health Care Workers

Each HCW at the individual level is responsible and accountable for effective and efficient implementation of the IPC policies and guidelines at all times in her or his duty station.

Training Institutions and Regulatory Bodies

Training institutions and regulatory bodies, such as the Medical and Dental Practitioners Board, the Nursing Council, the Clinical Officers Council, and other Allied Health Professional regulatory bodies, are responsible for ensuring that each respective pre- and in-service curriculum reflects adequate and appropriate content on IPC.

Community and Community Representatives

Individual members of communities have a responsibility for complying with IPC practices at the community level. Community representatives should ensure collaboration with relevant departments to enhance compliance.

2.2 IPC Organizational Structure

Effective IPC practices in a health care facility require that appropriate components be put in place. These components include the following:

- An appropriate IPC infrastructure

- Available supplies and equipment for effective IPC practices
- Policies, guidelines, and standard operating procedures (SOPs) for use within the facility
- Ongoing training and educational programmes for all HCWs in the use of such IPC policies, guidelines, and SOPs
- Effective monitoring and surveillance systems to identify and prevent HAIs
- Effective monitoring systems for the use of disinfectants and the frequency of cleaning the health care facility
- Effective monitoring systems for the use of PPE, waste segregation, and disposal
- Effective monitoring systems for the use of antibiotics

Although the ultimate responsibility for ensuring that these components are put in place and adhered to belongs to the HCW in charge at each health care facility, this person can delegate the responsibility to the IPCC or an IPC lead person.

National Infection Prevention and Control Committee

The NIPCC will have the IPC mandate at the national level and will have the authority to revise or make recommendations for revising the *National Infection Prevention and Control Guidelines for Health Care Services in Kenya*, which should be subjected to a periodic review every two years. The NIPCC should also ensure that health care providers obtain the appropriate IPC training.

Provincial IPC Coordinator

At the provincial level, the IPC coordinator in the ministries of health will be appointed to perform the following duties:

- Monitor adherence to national guidelines
- Evaluate IPC resource needs (assessment and forecasting) for the province
- Compile and communicate an annual report to the relevant departments within the ministries of health
- Review and analyze surveillance data

District Infection Prevention and Control Coordinator

At the district level, the district infection prevention and control coordinator (DIPCC) will be appointed to perform the following duties:

- Provide advisory services to the community, dispensaries, and health centres (KEPH levels 1 to 3 facilities in the district)
- Discuss regional trends and surveillance reports
- Monitor and support institutions to adhere to the IPC guidelines
- Coordinate infectious disease surveillance
- Liaise with district outbreak response structures

Health Care Facility (Institutional)

Each health care facility shall constitute a multidisciplinary IPCC. This institutional IPCC is an integral component of the continuous quality improvement (CQI) programme of the health care facility.

The IPCC reports to the health care facility officer-in-charge and is responsible for establishing and maintaining IPC - its monitoring, surveillance, reporting, research, and education.

The roles and responsibilities of the health care facility (institutional) IPCC are as follows:

- Provide each department and ward or unit with appropriate IPC documents.
- Ensure that the necessary and appropriate equipment and supplies are identified, made available, and used appropriately.
- Advise staff on all aspects of procedures and maintain a safe environment for patients, visitors, and staff.
- Plan and conduct ongoing training programmes in order to ensure that all members of staff are knowledgeable about good IPC practices.
- Encourage all health care facility staff to participate in IPC through orientation, regular meetings, and in-service education.
- Establish a system for identifying infections or suspected sources of infections (for example, making departmental rounds, reviewing clinical reports, and identifying at-risk patients) and taking appropriate actions.
- On a monthly basis, review the levels of HAIs and other infections, identify common sources and routes of entry of infections, and implement recommendations where necessary.
- Verify the effectiveness of the recommendations that have been implemented for IPC practices.
- Monitor the adherence of staff members to appropriate IPC practices such as hand hygiene, decontamination, disinfection, and sterilization.
- Investigate the spread of infection outbreaks in collaboration with medical, nursing, and other staff.
- Liaise with all disciplines and sectors to foster team work in IPC practices.
- Provide relevant information on infection problems to management and others.
- Introduce new techniques and provide general reminders of the importance of maintaining an infection-free environment for the safe delivery of health care services.
- Perform any other duties as and when required (kitchen inspections, pest control, waste disposal, etc.).
- Record and report IPC information to the Provincial IPC Coordinator.

The composition of the health care facility-based IPCC will vary depending on the services offered in the institution. Where they exist, members of this committee should be key personnel who are in decision-making positions from the various departments in the health care facility. These departments should include, but not be limited to, the following:

- Administration
- Central Supply and Sterilization Department
- Clinical Laboratory, Dental, and Dietary
- Epidemiology
- Equipment Technicians
- Housekeeping, Laundry

- Medicine
- Microbiology
- Mortuary
- Nursing
- Operating Theatre
- Obstetrics and Gynaecology
- Paediatrics and Child Health
- Public Health
- Pharmacy
- Quality Assurance
- Surgery
- Transport
- X-ray

The health care facility-based IPCC should include community representation, as well.

The chairperson reports to the health care facility officer-in-charge on all matters related to IPC. The incumbent should be a senior member of the institution staff with knowledge of IPC. Responsibilities of the post include the following:

- Chairing the IPCC meetings
- Acting as a link between the medical staff and the IPCC
- Promoting IPC practices
- Ensuring that IPC guidelines are implemented
- Coordinating IPC activities:
  - Surveillance activities for collecting, processing, analyzing, and reporting HAIs and other infections, and taking appropriate control measures
  - Supporting-staff orientation and in-service training in IPC
  - Communication and consultation processes between the IPCC and internal and external sources
- Reviewing and consolidating departmental IPC reports into a facility-wide report for dissemination

Each department in the health care facility will form a subcommittee that will include all cadres of health care personnel working in that department. The roles and responsibilities of IPC subcommittees will be similar to those of the health care facility IPCC, but will address IPC issues at departmental levels.

IPC Focal Person

In health care facilities at levels 2 and 3, an IPC focal person should be appointed to ensure implementation of IPC practices. This person's roles and responsibilities should include the following:

- Ensuring that adequate supplies of IPC equipment and commodities are requested, recorded, and reported
- Ensuring on-the-job training of other HCWs in the health care facility
- Monitoring IPC practices
- Reporting IPC activities to the DIPCC

2.3 The Guidelines

Control

The IPCC, under the direction of its chairperson, has the overall responsibility for the IPC policies and guidelines within the health care facility.

Distribution

These guidelines should be distributed to everyone in the following:

- Health care facilities in the public, private, and faith-based sectors
- Pre-service and in-service training institutions for HCWs
- Health care regulatory bodies
- Health care-related, nongovernmental, and community-based organizations

Review Cycle

The guidelines should be reviewed and updated every two years or more often if warranted.

The risk of acquiring an HAI is universal and pervades every health care facility and system around the world. Because of the difficulty of gathering reliable diagnostic data, however, the exact global burden is unknown. The incidence, type, and magnitude of HAIs vary from one health care institution to another, but these infections are estimated to account for approximately 10 percent of hospital admissions. In resource-restricted countries, the rates are estimated at between 15 and 31 percent.

Epidemiological data on HAIs in Kenya is currently lacking, but the risk for HAIs is high. Data from the Kenya AIDS Indicator Survey (KAIS) 2007, demonstrated that approximately 6.6 million people (33.1 percent) received at least one injection, a predisposing factor for HAI, in the year preceding the survey. The percentages for women were significantly higher than for men.

3.1 The Infectious Disease Process (the Epidemiological Triangle)

It is necessary to understand the infectious-disease process in order to comprehend the spread of infections in health care facilities. The spread of infection requires three (3) elements: a source of infecting organisms, a susceptible host, and a means of transmitting the microorganism.

Source

The source of the infecting agent might be a patient, a staff member, or a visitor. It could be a person with an active disease, a person in the incubation period of the disease, or someone who is colonized by the infectious agent, but has no apparent disease (asymptomatic carrier).

Other sources of infecting microorganisms can be the patient's own endogenous flora (autogeneous infection), which might be difficult to control; or inanimate environmental objects, such as equipment and medications, that have become contaminated.

Host

The susceptible host is the second element in the spread of infection. Persons lacking effective resistance to a particular microorganism are susceptible to infection by that microorganism. Resistance to pathogenic microorganisms varies greatly among individuals. When exposed to an infectious agent, the following responses might be exhibited:

- Complete immunity to the microorganism and ability to resist colonization
- A commensal relationship with the microorganism (the exposed person becoming an asymptomatic carrier)
- Development of clinical disease

Certain factors can render individuals more susceptible to infection:

- Extremes of age
- Presence of an underlying disease, such as diabetes mellitus, or human immunodeficiency virus (HIV) infection
- Use of certain medications, such as antimicrobials, corticosteroids, chemotherapeutic agents, or other immunosuppressive drugs
- Irradiation
- Breaks in the first line of defense mechanisms caused by invasive procedures such as surgical operations, anaesthesia, indwelling catheters, and other procedures

Transmission

Microorganisms are transmitted in health care facilities by several routes. The five (5) main modes of transmission—contact, droplet, air, common vehicle, and vector—are discussed in this section.

Contact Transmission

This is the most important and most frequent mode of HAI transmission. It is divided into two subgroups: direct-contact transmission and indirect-contact transmission.

Direct-contact transmission involves a direct body-surface-to-body-surface contact and physical transfer of microorganisms between a susceptible host and an infected or colonized person. It can occur when a HCW turns a patient, gives a patient a bath, or performs other activities that involve direct personal contact. Direct-contact transmission can also occur between two patients, with one serving as the source of the infectious microorganisms and the other as a susceptible host.

Indirect-contact transmission involves contact between a susceptible host and a contaminated intermediate object, usually inanimate, such as contaminated instruments, needles, dressings, contaminated and unwashed hands, or gloves that are not changed between patients.

Droplet Transmission

Droplet transmissions occur when droplets are propelled a short distance through the air and deposited on the host's conjunctivae, nasal mucosa, or mouth. The droplets are generated from the source person primarily through coughing, sneezing, and talking and during certain procedures such as suctioning and bronchoscopy. For transmission to occur, the source and the susceptible host must be within one meter (approximately three feet) of one another.

Airborne Transmission

Airborne transmission occurs by dissemination of either airborne droplet nuclei (small-particle residue) of evaporated droplets that contain microorganisms and remain suspended in the air for long periods of time, or dust particles that contain the infectious agent. Airborne microorganisms can be dispersed widely by air currents and can be inhaled by a susceptible host within the same room or some distance from the source patient, depending on environmental factors. Microorganisms transmitted by airborne transmission include *Mycobacterium tuberculosis*, rubella, and varicella viruses.

Control of airborne transmission is the most difficult, because it requires control of airflow through special ventilation systems.

Common-Vehicle Transmission

Common-vehicle transmission refers to the transmission of infection to multiple hosts by contaminated items (vehicles). This mode can result in explosive outbreaks. Vehicles for transmission include the following:

- Foods, which can transmit salmonellosis, for example
- Water, which can transmit shigellosis, for example
- Medications and intravenous solutions
- Blood, which can transmit hepatitis B (HBV) and hepatitis C (HCV) and HIV, for example
- Equipment and devices

Vector-Borne Transmission

Vector-borne transmission refers to the transmission of microorganisms through vectors such as mosquitoes, flies, fleas, rats, and other vermin. This mode can be prevented by appropriate health care facility construction and maintenance, closed or screened windows, and proper housekeeping.

3.2 Surveillance of HAIs

Surveillance is the systemic collection of data pertaining to the occurrence of specific diseases, the analysis and interpretation of these data, and the dissemination of consolidated and processed information to those who need it. The monitoring component of HAI surveillance should be integrated into the supervisory activities of the facility. As part of comprehensive IPC practices, health care facilities need to design effective surveillance and outbreak detection systems and report occurrences to the NIPCC.

An effective surveillance system is important in determining the baseline HAI rate, evaluating IPC measures, monitoring good patient-care practices, meeting the safety and quality standards as set out by the ministries of health, and detecting outbreaks and exposures. Accordingly, the ministries will set up sentinel sites through which to conduct ongoing surveillance of HAIs.

4 STANDARD PRECAUTIONS

Preventing and controlling infection in health care facilities involves two levels of approach: standard precautions and additional (transmission-based) precautions. Standard precautions are taken to reduce the risk of transmitting blood-borne microorganisms and other pathogens from both recognized and unrecognized sources. These precautions should be used, as a minimum, in the care of all patients in health care facilities and settings, regardless of their diagnoses or presumed infection status. Patients may also be assigned an additional category of isolation precaution, depending on their clinical situation. Implementing standard precautions is the primary strategy for successful HAI control.

4.1 Hand Hygiene

Hand hygiene is the single most important IPC precaution and one of the most effective means to prevent transmission of pathogens associated with health care services. Appropriate hand hygiene must be carried out upon arriving at and before leaving the health care facility, as well as in the following circumstances:

- Before and after performing any procedure between patients or on the same patient
- Before and after examining (coming in direct contact with) a client or patient
- Before putting on gloves
- After removing gloves
- After any situation in which hands might become contaminated, such as:
  - Handling contaminated objects, including used instruments
  - Diapering or toileting children
  - Using the toilet, wiping or blowing one's nose, or performing other personal functions
  - Touching mucous membranes, blood, body fluids, secretions, or excretions
  - Coming in contact with a source of microorganisms
- Before preparing medication
- Before preparing, handling, serving, or eating food
- Before feeding a patient

Note: Frequent hand washing and wearing gloves can irritate skin. Lotions can ease dryness from frequent hand washing and also help prevent dermatitis from frequent glove use.

There are four types of hand hygiene:

- Routine hand washing
- Hand washing with an antiseptic
- Alcohol handrub
- Surgical hand scrub

Routine Hand Washing

The purpose of hand washing is to remove soil, blood and other organic material, and transient microorganisms from the skin. The three elements that are essential for effective hand washing are soap, clean running water,[1] and friction.

Follow these steps in hand washing:

1. Remove all jewelry.
2. Thoroughly wet hands with running water. Do not dip hands into a basin that contains standing water, even with the addition of an antiseptic agent, because microorganisms can survive and multiply in these solutions. Use a comfortable water temperature. Washing your hands in hot water increases the risk of skin irritation and does not remove more microorganisms.
3. Apply a hand-washing agent (plain soap or detergent). Washing hands with plain water without soap is not effective.
4. Rub all areas of hands and fingers vigorously for 10 to 15 seconds, paying close attention to fingernails and areas between the fingers. Don't forget the wrists. Repeat each action five times. (See Figure 1.)
5. Remove debris from under the fingernails.
6. Rinse hands thoroughly with clean running water from a tap for 10 to 15 seconds.
7. Use a paper towel when turning off the water if the tap is hand-operated.
8. Dry hands with paper towels or air them dry. Avoid using common or shared towels, which might harbor microorganisms and contaminate hands even after proper hand washing or hand rubbing. To avoid sharing towels, use disposable paper, or single- use hand towels. Do not dry hands on personal clothes or on wet and soiled towels. Blow dryers are not recommended.

Patients and family members should be instructed on proper hand washing. Patients should wash their hands before eating, after toileting, and when hands are soiled, under running water with a soap approved by the health care facility.

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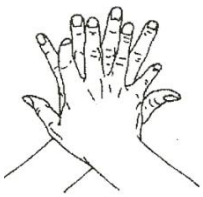
[1] Clean water refers to natural or chemically treated and filtered water that is safe to drink and use for other purposes (washing hands and cleaning medical instruments). Clean water has zero level of microorganisms, including bacteria, viruses, and parasites; has low turbidity; and has a minimum level of disinfectants, disinfectant by-products, and organic materials. If running water is not available, a bucket with a tap or a bucket with a pitcher can be used.

Figure 1: Hand-washing technique

1. *Wet hands with running water, apply soap agent, and rub palms together.*

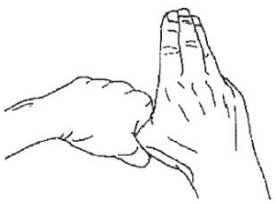
2. *Rub right palm over dorsum of left hand and left palm over dorsum of right palm.*



3. *Rub palm to palm with fingers interlaced.*

4. *Interlock fingers with backs of fingers to opposing palms.*

5. *Clasp each thumb and rub rotationally with the opposite hand.*

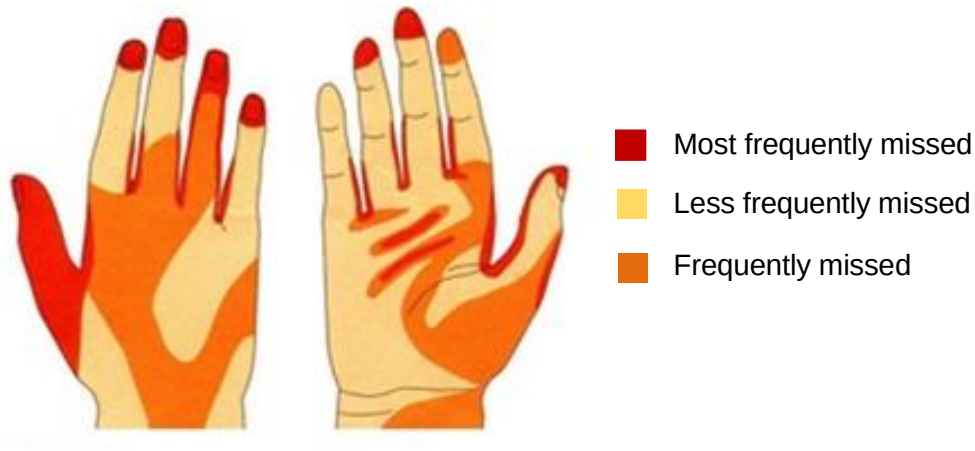


6. *Rub each palm rotationally with fingers of the opposite hand.*

Hand-washing products should be handled according to these guidelines:

- For bar soaps, provide soap racks to allow the bar to stay dry, because microorganisms grow and multiply in standing water.
- Store liquid hand-washing products in closed, disposable containers. If reusable containers are used, clean thoroughly and dry them before refilling. Follow routine maintenance schedules and document them. Do not top off liquid-soap containers.
- Rotate the antimicrobial soaps that are used in order to prevent the development of resistant organisms.
- If a liquid hand-washing product requires dilution, have the pharmacy do it.

Figure 2: Areas that are frequently missed while hand washing



Hand Washing with an Antiseptic and Running Water

The purpose of hand antisepsis is to remove soil and debris and to reduce both transient and resident flora on the hands. It removes transient microorganisms and kills or inhibits the growth of resident microorganisms. It may reduce infections in high-risk situations, such as the following:

- When there is heavy microbial contamination
- Before performing invasive procedures such as the placement and care of intravascular devices and indwelling urinary catheters
- Before contact with highly susceptible patients, such as premature infants; elderly patients; and individuals with immune defects such as AIDS, damage to the integumentary system (e.g., burns or wounds), and percutaneous implanted devices
- Before and after direct contact with patients on contact precautions for hepatitis A or E, or who have infections with antimicrobial-resistant microorganisms, such as methicillin-resistant *Staphylococcus aureus* (MRSA)

The technique for hand antisepsis is similar to that of hand washing, but it involves the use of a soap containing an antimicrobial agent instead of plain soap.

Alcohol Handrub without Water

The purpose of an antiseptic handrub is to inhibit or kill transient and resident flora. Use of a waterless, alcohol-based handrub product is more effective in killing transient and resident flora than antimicrobial hand-washing agents or plain soap and water. An antiseptic handrub is quicker and easier to perform and gives a greater initial reduction in hand flora. Handrub products also contain a small amount of an emollient such as glycerin, propylene glycol, or sorbitol that protects and softens skin. When the hands are visibly soiled or contaminated with blood or body fluids, do not use a handrub—wash hands with soap and water instead.

Use an adequate amount (5 milliliters) of antiseptic handrub solution and follow these instructions for an appropriate and effective handrub:

1. Apply enough alcohol-based handrub to cover the entire surface of your hands and fingers.
2. Rub the solution vigorously into your hands, especially between the fingers and under the nails until dry.
3. Do not rinse the hands after applying the handrub.

Notes: Alcohol-based handrubs are appropriate for rapid hand decontamination between patient contacts. They are not a substitute for hand washing if hands are soiled.

To reduce the build up of emollients on hands after repeated use of alcohol-based handrubs, wash hands with soap and water after every five handrubs.

A nonirritating, antiseptic handrub can be made by adding glycerine, propylene glycol, or sorbitol to alcohol (2 milliliters in 100 milliliters of 60-90 percent ethyl or isopropyl alcohol solution).

Surgical Hand Scrub

Prior to performing any surgical procedure, all surgical personnel, including surgeons, anaesthesiologists, and nurses, must perform a surgical hand scrub to remove debris and transient microorganisms and to reduce resident flora on their hands. The warm moist conditions inside surgical gloves provide an ideal environment for the growth of microorganisms. Hand washing with antiseptics before the surgical procedure helps prevent this growth of microorganisms and reduces the risk of transmitting infections to the patient if the surgeon's gloves develop holes, tears, or nicks during the procedure. Use the steps listed and illustrated in Figure 3.

Alternatively, hand washing with plain soap and water followed by a waterless, alcohol-based handrub containing chlorhexidine has been shown to yield significantly greater reduction in microbial counts on hands, improve skin health, and reduce time and save resources. Waterless alcohol handrubs have more immediate activity and they lower the quantity of skin flora to such an extent that it takes several hours to grow back. Perform this surgical hand-scrub technique as follows:

1. Remove rings, watches, and bracelets.
2. Thoroughly wash hands and forearms to the elbows with soap and water.
3. Clean nails with a nail cleaner (toothpick or any other pointed instrument).
4. Rinse with clean running water and dry thoroughly with a clean, dry towel or air dry.
5. Apply 5 milliliters of a waterless, alcohol-based handrub to hands, fingers, and forearms and rub until dry; repeat applications and rubbing two more times for a total of at least 2 minutes, using a total of about 15 milliliters of the handrub.
6. Keep hands up and away from the body; do not touch any surface or article prior to putting sterile or high-level disinfected surgical gloves on both hands.

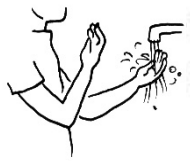
Figure 3: Steps for surgical hand scrub

1. *Remove all jewelry on hands and wrists.*
2. *Adjust water to a warm temperature and thoroughly wash hands and forearms to 5 centimeters above the elbows with soap and water to remove dirt and transient flora.*

3. *Clean under each fingernail and around the nail bed with a nail cleaner prior to performing the first surgical scrub of the day. Keep nails short and do not wear artificial nails or fingernail polish.*

4. *Holding hands up above the level of the elbow, apply antiseptic agent (e.g., 2 percent to 4 percent chlorhexidine or povidone iodine) to hands and forearms up to the elbows. Using a circular motion, begin at the fingertips of one hand and lather and wash between the fingers, continuing from fingertip to 5 centimeters above the elbow. Repeat this process for the other hand and forearm. Continue rubbing for 3-5 minutes.*

5. *Rinse each hand and forearm separately, fingertips first, holding hands above the level of the elbow and away from your body.*



6. *Using a sterile towel, dry the fingertips to 5 centimeters above the elbow. Use one side of the towel to dry the first hand and the other side of the towel to dry the second hand.*

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

Washing Hands without Piped Water

Remember that even where there is no piped water, hand washing is possible and required. If piped water is not available, you can use one of the following methods:

- A bucket with a tap (See hand-operated example in Figure 4.)
- A pitcher or a jug to pour water over hands with the help of an assistant or a foot-operated device (example in Figure 4.)
- A waterless alcohol-based solution

Figure 4: Hand-washing stations that can be used when there is no running water

Foot-operated

Hand-operated

Other Considerations

Health care workers should be aware of the following considerations:

- Health care workers should follow the guidelines for using gloves with hand hygiene. (See Figure 5.)
- To minimize and treat contact dermatitis related to frequent hand washing (more than 30 times per shift), the use of harsh detergents, and frequent exposures to antiseptic agents, HCWs may use hand lotions, creams, and moisturizing skin care products. Such products should be water-based and without fragrance.
- Cuts and abrasions on cuticles, hands, and forearms should be covered with waterproof dressings. If covering them in this way is not possible, surgical staff with skin lesions should not operate until the lesions heal.
- Health care workers who have open sores or cuts on their hands or forearms should not process instruments until the lesions are healed.
- Long fingernails serve as possible reservoirs for gram-negative bacilli, yeast, and other pathogens; and tend to puncture gloves more easily.
- Hand washing cannot reduce the bacterial counts of HCWs with dermatitis. Health care workers with dermatitis carry high numbers of microorganisms and may be at increased risk of exposure to blood-borne pathogens. Intact skin is a major defense from infection.

Improving Hand Hygiene Compliance

For more than 150 years, hand washing and hygiene have been known to reduce the transmission of microorganisms and to prevent infection, but compliance remains a challenge in every health care facility. The following steps might increase compliance:

- Widely disseminate current guidelines for hand hygiene and the evidence supporting its effectiveness in preventing diseases and the need for HCWs to adhere to IPC guidelines and practices.
- Involve hospital administrators in promoting and enforcing the guidelines by convincing them of the cost benefits of hand-hygiene practices.

- Use successful educational methods, including role modeling, mentoring, monitoring, and providing positive feedback.
- Use performance improvement approaches targeted to all health care staff, not just doctors and nurses.
- Consider the needs of staff for convenient and effective options for hand hygiene and provide appropriate resources.
- Make alternative options, such as waterless alcohol-based handrubs, available.

Table 1: Strategies to improve hand-washing techniques and compliance

Obstacle	Strategy
Lack of knowledge	Provide education with supportive literature, videotaped instructions, and hand-washing demonstrations. Provide personnel with education and feedback on infection rates.
Lack of motivation	Provide direct observation and feedback on a regular basis. Use mentors and role models. Involve staff in studies. Apply new technologies. Provide programmes on hand hygiene for patients and families. Ensure that hand-washing facilities are conveniently located throughout the health care facility.
Unavailability of hand-washing facilities	Make running water available. Make hand-washing facilities available in rooms where health care procedures are performed. Make soap and disposable towels available in adequate and continuous supply. Make waterless antiseptic agents available in wall-mounted dispensers or in small containers for mobile care and emergency response.
Nonacceptance of hand-washing products	Provide hand-washing products that have a high level of acceptability to staff. Take into consideration appropriateness, cost, and supply of such products.
Dermatitis	Ensure constant supply of lotions in small, nonrefillable containers to prevent skin dryness. Lotions should be approved by the IPCC to ensure compatibility with antiseptic products.

4.2 Personal Protective Equipment

Protective barriers and clothing are referred to as personal protective equipment, or PPE, and have been used for many years to protect clients from microorganisms present on HCWs in the health care setting. With the emergence of HIV/AIDS and HBV/HCV and the resurgence of TB, PPE has now become important for protecting HCWs as well as clients. PPE provides a physical barrier between microorganisms and the wearer, thereby preventing microorganisms from contaminating hands, eyes, clothing, hair, and shoes. PPE also prevents microorganisms from being transmitted to other patients and staff.

PPE reduces, but does not completely eliminate, the risk of acquiring an infection. PPE must be used effectively, correctly, and whenever there is a risk of contact with blood and body fluids. Making PPE available and training HCWs to use it properly are essential.

Note: Use of PPE does not replace the need to follow basic IPC measures such as hand hygiene.

Principles for Using PPE

Health care workers should follow these guidelines for using PPE:

- Assess the risk of exposure to blood, body fluids, excretions, or secretions and choose items of PPE accordingly.
- Use the right PPE for the right purpose.
- Avoid any contact between contaminated (used) PPE and surfaces, clothing, or people outside the patient care area.
- Discard used PPE appropriately in designated disposal bags.
- Do not share PPE.
- Change PPE completely and thoroughly your wash hands each time you leave a patient to attend to another patient or another duty.

The following individuals should use PPE:

- Health care workers who provide direct care to patients and who work in situations in which they might have contact with blood, body fluids, excretions, or secretions
- Support staff, including waste handlers, cleaners, and laundry staff, in situations in which they might have contact with blood, body fluids, excretions, or secretions
- Laboratory staff who handle patient specimens
- Family members who provide care to patients and could come in contact with blood, body fluids, excretions, or secretions

Table 2 describes the types of PPE and their recommended uses.

Gloves

Gloves should be worn in addition to, not as a substitute for, hand washing. Hand hygiene coupled with the use of protective gloves is a key component in minimizing the spread of disease and maintaining an infection-free environment. Understanding when gloves are required and, equally important, *when they are not required*, can reduce costs and maintain safety for both patients and staff.

Table 2: Types and recommended uses of PPE

Type of PPE	Recommended Use	Primarily Protects
Gloves	When there is a reasonable chance of hands coming in contact with blood or other body fluids, mucous membranes, or nonintact skin Before performing invasive medical procedures, for example, when inserting vascular devices such as peripheral venous lines Before handling contaminated waste items or touching contaminated surfaces	Service providers
Caps, gowns, scrub suits, or aprons	When performing invasive procedures during which tissue beneath the skin is exposed When handling immunocompromised patients or clients When handling patients with infectious disease When handling contaminated waste	Service providers and patients
Masks	When performing invasive procedures When handling patients with airborne or droplet infections When handling medical waste	Service providers, patients, incinerator operators, and visitors
Goggles or glasses	Situations in which splashing of blood, body fluids, secretions, or excretions are likely	Service providers
Mackintoshes, plastic or rubber aprons	Situations in which splashing or spillage of blood, body fluids, secretions, or excretions are likely Contaminated waste	Service providers
Closed boots or shoes	Situations in which sharp instruments or in which spillage or infectious agents are likely When handling immunocompromised patients In the nursery	Service providers and patients
Sterile drapes	Major or minor surgical procedures	Patients

Gloves are expensive irrespective of who is paying for them. They should not be worn when it is not necessary to do so. Gloves are not required if there is no anticipated contact with mucous membranes, blood, body fluids, secretions, or excretions (for example, for routine care activities in which contact is limited to a patient's intact skin, such as checking blood pressure, checking temperature, or giving IM injections). The appropriate type of gloves should be used for the appropriate reason (for example, use sterile gloves only for the necessary purpose).

The following types of gloves are available in Kenya:

- Sterile surgical gloves
- Disposable (single-use) examination gloves
- Utility or heavy-duty gloves (for use in cleaning instruments, equipment, contaminated surfaces, and while handling or disposing of contaminated waste)

When performing surgical procedures, always use sterile surgical gloves. Clean, nonsterile, disposable gloves (that is, nonsurgical gloves) are adequate in the following situations:

- When providing routine care for patients who have highly transmissible infections
- When there is a reasonable chance of hands coming in contact with blood or other body fluids, mucous membranes, or nonintact skin (when performing medical examinations and procedures, such as pelvic examinations)
- For contact with blood, body fluids, secretions, excretions, mucous membranes, draining wounds, or nonintact skin (open skin lesions or exudative lesions)
- When handling items that are visibly soiled with blood, body fluids, secretions, or excretions
- When the HCW has nonintact skin on his or her hands
- Before performing invasive medical procedures, for example, inserting vascular devices such as peripheral venous lines
- Before handling contaminated waste items or touching contaminated surfaces

The general principles for using gloves are provided here:

- When indicated, put gloves on directly before contact with the patient or just before the task or procedure that requires the gloves.
- To prevent cross-contamination of body sites, change gloves between care activities and procedures with the same patient after contact with materials that may contain high concentrations of microorganisms (after handling an indwelling urinary catheter or suctioning an endotracheal tube, for example).
- Remove gloves before moving to another patient.
- Wear gloves while handling laboratory specimens.
- Remove gloves immediately after completing care or a specified task, at the point of use, and before touching clean environmental surfaces.
- Wash and dry hands immediately after removing gloves.
- Do not wash, decontaminate, and reuse single-use disposable gloves. They do not provide adequate protection after reprocessing.
- Do not wear gloves while walking in corridors and riding in elevators.
- All staff should wear appropriate gloves prior to contact with blood, body fluids, secretions, or excretions from any client or patient.
- Use a separate pair of gloves for each client to avoid cross-contamination.
- Use elbow-length gloves in the following circumstances:

- During vaginal deliveries and Caesarean sections, when the chance of coming in contact with blood is 25 percent and 35 percent, respectively
- While performing procedures such as the manual removal of placenta and any other procedure where there is a contact with a large volume of blood or body fluids

The following dos and don'ts apply to the use of surgical gloves:

- Do wear the correct size gloves, particularly surgical gloves. Poorly fitting gloves can limit your ability to perform the task and they can get damaged easily.
- Do change surgical gloves periodically (every 45 minutes) during long cases, because the protective effect of latex gloves decreases with time and unapparent tears can occur.
- Do keep fingernails trimmed moderately short (less than 3 mm beyond the finger tip) to reduce the risk of tears.
- Do pull gloves up over cuffs of gown (if worn) to protect the wrists.
- Do use water-soluble hand lotions and moisturizers often to prevent hands from drying and cracking due to frequent hand washing and gloving.
- Do *not* use oil-based hand lotions or creams, because they will damage latex rubber surgical and examination gloves.
- Do *not* use latex gloves if you have an allergy to latex.
- Do *not* store gloves in areas where there are extremes of temperature (direct sunlight, near a heater, air conditioner, ultraviolet light, X-ray machine, etc.). These conditions can damage the gloves and reduce their effectiveness as a barrier.
- Do *not* reprocess surgical gloves for reuse.

See Figure 5 for the correct procedure for putting on surgical gloves and Figure 6 for the correct procedure for removing surgical gloves.

Caps

Use caps to keep the hair and scalp covered during surgery in order to prevent flakes of skin and hair from shedding into a patient's wound and to prevent your hair from coming into contact with patient's blood, body fluids, secretions, or excretions. Caps should be large enough to cover all hair. Do not reuse disposable caps.

Footwear

Wear closed shoes to protect your feet from injury by sharps or heavy items or from contact with blood or body fluids. Wear rubber boots in areas where indicated, for example, in operating theatres and mortuaries. Clean and disinfect reusable boots.

Surgical Masks

Surgical masks protect the mucous membranes of the nose and mouth during procedures and patient care activities. A surgical mask should be worn in circumstances where splashes of blood, body fluids, secretions, and excretions are likely, or when the patient has a communicable disease that is spread via the droplet route. A mask should be large enough to cover the HCW's nose, lower face, jaw, and all facial hair.

Figure 5: Steps for putting on surgical gloves

1. *Prepare a large, clean, and dry area for opening the package of gloves. Perform surgical antisepsis and ask someone (a circulating nurse, for example) to open the package of gloves.*

2. *Open the inner glove wrapper, exposing the cuffed gloves with the palms up.*

3. *Pick up the first glove by the cuff, touching only the inside portion of the cuff. (The inside is the side that will be touching your skin when the glove is on.)*

4. *While holding the cuff in one hand, slip your other hand into the glove. (Pointing the fingers of the glove toward the floor will keep the fingers open.) Be careful not to touch anything, and hold the gloves above your waist level.*

5. *Pick up the second glove by sliding the fingers of the gloved hand under the cuff of the second glove. Be careful not to contaminate the gloved hand with the ungloved hand.*

6. *Put the second glove on the ungloved hand by maintaining a steady pull through the cuff. Adjust the glove fingers and cuffs until the gloves fit comfortably.*

Figure 6: Steps for removing surgical gloves

1. *Grasp one glove near the cuff and pull it partway off. The glove will turn inside out. Keep the first glove partially on before removing the second one to protect you from touching the outside of a glove with your bare hand.*

2. *Leaving the first glove over your fingers, grasp the second glove near the cuff and pull it partway off. Keep the second glove partially on.*

3. *Pull off the two gloves at the same time, being careful to touch only the inside surface of the gloves with your bare hand and being careful not to allow any splashes in the environment. Dispose of gloves immediately.*

4. *Wash your hands immediately with soap and running water.*

The purpose of the mask is to protect the patient from moisture droplets that are expelled as HCWs speak, cough, or sneeze; and to protect the HCW by preventing accidental splashes of patient's blood or other contaminated body fluids from entering the HCW's nose or mouth. Unless the mask is made of fluid-resistant materials, it is not effective in preventing either of these.

There are two types of surgical masks:

- *The tie-back mask*, which has four ties to fasten the mask around the mouth and nose. The flexible metal tab is placed above the bridge of the nose to help secure the mask and minimize air escape from the sides (venting).
- *The ear-loop mask* is similar to the tie-back mask except that it has two elastic bands used for hooking behind the ears.

Surgical masks with attached face shields that provide a protective barrier against splashes and spatters of blood or other potentially infectious material are also available. These masks are fluid-resistant, lightweight, and adequate for most procedures and isolation precautions in which the use of a mask is indicated. The correct procedures for putting on and removing surgical masks are described in Figure 7 and Figure 8 on the following pages.

Protective Eyewear (Goggles, Visors, and Face Shields)

Protective eyewear includes clear plastic goggles, safety goggles, and face shields. Health care workers should wear protective eyewear to protect the mucous membranes of their eyes during procedures and patient care activities that could generate splashes or sprays of blood, body fluids, secretions, and excretions. The following guidelines apply:

- Use protective eyewear that is appropriate for the particular procedure.
- Discard disposable eyewear appropriately.
- If they are reusable, decontaminate them according to the manufacturers' instructions.
- Masks and eyewear should be worn when performing any task where an accidental splash into the face is likely to occur. If face shields are not available, goggles or glasses and a mask can be used together.

Figure 7: Steps for putting on a surgical mask

1. Position the mask to cover both the nose and the mouth.

2. Tie the two top ties first firmly at the back of the head.

3. Tie the two bottom ties at the back of the neck.

4. Bend 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.

5. When using the mask with elastic bands, position the mask to cover both the nose and mouth and loop the bands behind each ear. Adjust the flexible metal tab as described in step 4 above.

6. Do not handle the mask once it is in position, and do not talk any more than is necessary.

A surgical mask becomes ineffective as a barrier if the integrity is damaged or if it becomes wet (for example, from perspiration or splashes of blood or other potentially infectious material). If this occurs, remove the mask and replace it with another mask.

Figure 8: Steps for removing a surgical mask

1. *Untie the bottom ties.*

2. *Untie the top ties with both hands, being careful not to let go of the mask.*

3. *If the mask has elastic bands, remove it by unlooping the bands from behind each ear, being careful not to drop the mask.*

4. *Do not crush or squeeze a used mask before discarding it.*

5. *Discard used masks in the appropriate waste bin.*

Respirator Masks

An N95 mask protects HCWs from inhaling respiratory pathogens that are transmitted via the airborne route. This helps prevent the spread of infectious diseases such as TB. All of the following individuals should wear a respirator mask:

- Health care workers attending to a patient who has a communicable disease that is spread via the airborne or droplet route
- Visitors to a patient who has a communicable disease that is spread via the airborne or droplet route
- Patients who have communicable diseases that are spread via the airborne or droplet route and are being transferred to other departments or hospitals

These masks are for single use only and should be discarded after four to six hours of use. They should not be stored in bags and reused, shared, or hung around neck. If a mask is splashed wet, it should be changed using clean gloves and strict hand washing.

Table 3. Examples of different types of respirator masks

Type of mask	When it should be worn	Comments
N95 or P2	In the presence of open or active pulmonary TB, pneumonic plague, or any other infectious droplets or airborne disease, such as H1N1	These are ideally recommended, but single-use, cost, and continuous availability might restrict the use. In such situations, standard surgical masks can be used by both patients and HCW
N100 or P3	During invasive procedures that involve collecting respiratory secretions or working in a laboratory or other environment where organisms in concentrated form could be encountered	These are ideally recommended, but filters need to be kept continuously available and can be used only once, which could mean that cost considerations restrict their use. In such situations, standard surgical masks can be used.
Masks	When performing invasive procedures When handling patients with airborne or droplet infections When handling medical waste	Service providers, clients, incinerator operators, and visitors should use these.
Standard surgical splash-proof masks (not gauze masks)	During invasive procedures	Change a mask when it becomes wet, soiled, or contaminated. Do not reuse. Discard according to these guidelines.

Note: When a HCW is attending to a patient with an infectious airborne or droplet infection, both patient and HCW should wear a mask.

Gowns

Wear gowns to protect uncovered skin and to prevent soiling of clothing during procedures and patient care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions. Impermeable gowns are preferable.

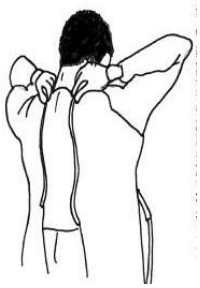
Gowns should not be worn outside the area for which they are intended, and soiled or wet gowns should be removed as soon as possible. Generally, if both a gown and gloves are worn, the gown should be put on first. See Figures 9 and 10 for the correct procedures for putting on and removing a surgical gown.

Figure 9: Steps in putting on the gown

1. *Hold the gown so that the back is facing the front of the body.*

2. *Slip arms into the sleeves one at a time.*

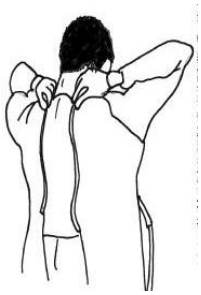
3. *Fasten the neck tab at the back of the gown to close the top of the gown.*



4. *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.*

Figure 10: Steps in removing the gown

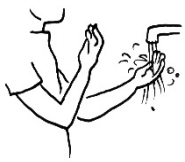
1. *Untie the waist ties, and then unfasten the neck tab.*



2. *Remove the gown using a peeling motion—gently pulling it from one shoulder towards the same hand, and then from the other shoulder towards that hand. The gown will turn inside out.*

3. *Hold the removed gown away from body and roll it into a ball in a motion directed away from the body, and discard the gown in an appropriate receptacle*

4. *Wash your hands after removing the gown and other PPE.*



Plastic Aprons

Mackintoshes or plastic aprons are used to protect clothing or surfaces from contamination. Plastic aprons are recommended for procedures during which splashes or spillage of blood, body fluids, secretions, or excretions are likely, for example, when delivering babies.

An apron could be worn beneath the gown. Aprons made of rubber or plastic provide a waterproof barrier along the front of the HCW's body and provide protection from exposure to blood, body fluids, secretions, and excretions.

Launder gowns and aprons appropriately if they are reusable. Do not reuse disposable gowns and aprons.

4.3 Policies for Patient-Care Equipment

Patient care involves the use of many kinds of equipment. Some equipment is used for surgical procedures and is either disposed of or sterilized. Some equipment is used for noninvasive procedures, but it is sanitized as a precautionary method. Heat sterilization is used on metal equipment.

Patient-care equipment should be handled according to the following orders:

- Clean and reprocess reusable equipment and linen that have been in contact with a patient before using them in the care of another patient.
- Decontaminate and clean patient-care equipment that has been soiled with blood or body fluids to prevent transferring microorganisms to other individuals and the environment.
- Clean items that are routinely shared between patients.
- Establish and monitor a routine cleaning schedule for items that are in contact with intact skin only if cleaning between patients is not feasible.
- Establish procedures for assigning responsibility and accountability for the routine cleaning of all patient-care equipment.
- Clean any equipment that is being sent for repair or service with an approved disinfectant.
- Decontaminate and disinfect bedpans and urinals between patient uses.
- Clean toilets and commodes regularly and when soiled.
- Handle soiled patient-care equipment in a manner that prevents exposing skin and mucous membranes and contaminating clothing and the environment.
- Do not reuse disposable patient-care equipment.
- Do not share patient-care supplies, such as soap, lotion, and creams, between patients.
- Discard or decontaminate, as appropriate, clothing, books, board games, arts and crafts and magazines that are visibly soiled with blood, body fluids, or other potentially infectious material.
- Disinfect toys in playrooms and clinic areas that are made of nonporous, impervious, smooth-surface materials. Toys that cannot be washed should not be allowed.

- Continuously monitor toys during the time of use. Toys that are broken, malfunctioning, contaminated with blood, body substances, or other potentially infectious material should be removed promptly and either discarded or decontaminated, cleaned, disinfected, and dried.

4.4 Safe Handling of Sharps

Sharps (needles, scalpels, etc.) must be handled with extreme caution to avoid injuries during use or disposal.

General Policies for Sharps

All health care providers should handle sharps according to the following orders:

- Do not pick up a handful of sharp instruments simultaneously.
- Position the sharp end of instruments away from self and others.
- Exercise caution when rotating instruments are in use.
- Wear heavy-duty or strong utility gloves while decontaminating, cleaning, and disinfecting instruments.
- Dispose of used sharps immediately in designated puncture- and leak-proof containers labelled with a biohazard symbol.
- Prevent access to used needles and syringes, and other sharps while awaiting transport for final disposal.
- If injured by sharps, contact the supervisor immediately.

Safe and Appropriate Injections and Use of Needles and Syringes

A safe injection is an injection that does not harm the recipient, does not expose the provider to any avoidable risk, and does not result in any waste that is dangerous for other people.

WHO estimates that at least 50 percent of all injections are unsafe. This poses serious health risks to recipients, HCWs, and the public. In many developing countries, injection overuse and unsafe practices account for a substantial proportion of new infections with HBV, HCV, and HIV. For example, for the year 2000, WHO estimated that injections with contaminated needles or syringes accounted for 30 percent of new HBV infections, 41 percent of new HCV infections, and 5 percent of new HIV infections (21 million new HBV infections, 2 million new HCV infections, and 260,000 new HIV infections).

In a national cross-sectional survey on injection-safety practices in Kenya in 2003, over-prescription of injections, and improper disposal of injection-related waste were identified as some of the most prominent factors for unsafe injection practices in the country.
Injections should be administered safely and only when they are medically indicated. Eliminating unnecessary injections is the best way to prevent injection-associated infections.

These best practices have been determined through scientific evidences or expert consensus to most effectively protect patients, providers, and communities.

Use Sterile Injection Equipment

Use a sterile, single-use syringe and needle for each injection.

- Auto-disable syringes are mandatory for all immunization injections.
- For curative and other types of injections, syringes with reuse-prevention devices and syringes with safety features are recommended. Where these are not available (for example, 20-milliliter and 50-milliliter insulin syringes), standard disposable syringes can be used.
- Ensure that the syringe and needle are sealed and inspect the packaging for breaches in barrier integrity.
- Reconstitute each unit of medication aseptically and separately using a single-use syringe and needle.

Prevent Contamination of Injection Equipment and Medication

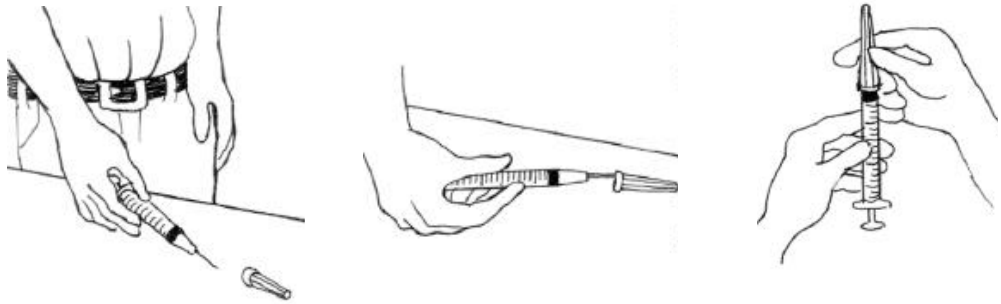
- Prepare each injection in a clean designated area where blood or body fluid contamination is unlikely.
- Use single-dose vials instead of multi-dose vials.
- If multi-dose vials must be used, always pierce the septum with a sterile needle.
- Do not leave the needle in place in the stopper of the vial.
- Select pop-open ampoules instead of ampoules that require a metal file to open.
- Protect fingers with a clean barrier, such as a small gauze pad, when opening ampoules.
- Inspect for and discard medications with visible contamination or breaches of integrity, such as cracks or leaks in the container.
- Follow product-specific recommendations for using, storing, and handling equipment and medication.
- Swabbing new vial tops or ampoules with an antiseptic or disinfectant is unnecessary.
- Prepare patient's skin before injection:
  - Wash skin that is visibly soiled or dirty with soap and water.
  - If swabbing with an antiseptic, use a clean, single-use swab and maintain the contact time that is specified for the product.
  - Do not use cotton balls that have been stored wet in a multi-use container.
  - Avoid giving injections on skin that has compromised integrity.
- Discard a needle that has touched any nonsterile surface.

Prevent Injuries to HCWs

Before administering an injection or any skin-piercing procedure, ensure that the following precautions are observed, depending on the types of procedure:

- Anticipate and take measures to prevent sudden patient movement during and after the injection.
- Avoid recapping and otherwise manipulating needles by hand. When recapping is unavoidable, such as when using dental needles, the single-hand-scoop method should be used. (See Figure 11.)
- Discard all used syringes and needles or any other sharps as a unit at the point of use in an enclosed sharps container that is puncture- and leak-proof, placed within arm's reach, and less than three-quarters full.
- Use disposable gloves only if excessive bleeding is anticipated.

Figure 11: Single-hand-scoop method for recapping dental needles



Standards for Administering Injections

Follow these policies when administering injections:

- Counsel each patient before administering the injection as to the type of drug, side effects, possible adverse effects and events following the injection, and the total number of doses to be given by injection.
- Inform self-injecting patients such as diabetic patients about their medications and how to give themselves safe injections. If a patient needs to take the injection equipment home, he or she should be counseled on the storage, disposal, and sterility of their drugs and equipment.
- Prepare a well-laid-up tray, including emergency drugs for managing possible drug reactions.
- Wash hands with soap and water.
- Drip dry or use single-use hand towels.
- Check the vial or ampoule for expiry dates, breaches, leaks, particles, or any contamination.
- Make sure that the correct drug, dose, and route are used for the right patient or client.
- Reconstitute medications (powder forms) according to the manufacturers' instructions, using the correct diluents.
- Draw the right dose as prescribed, including expelling the air.
- Clean the correct injection site appropriately.
- Administer the drug.
- Without recapping, dispose of the used syringes and needles immediately into the sharps container.
- Do not give used syringes and needles to patients or clients to carry home even if they came with the equipment. Instead, discard them into the sharps container after use.
- Keep a patient for at least five minutes after the injection has been given and observe for any possible adverse effects or events.
- Thank the patient or the client.
- Record the date and time of the injection.

Managing Sharps and Sharps Containers Safely

Prevent access to used needles and syringes and other sharps by disposing of them immediately after use in a designated puncture- and leak-proof container. Make sure that sharps containers are appropriately placed and easy to see, recognize, and use:

- Put sharps containers as close to the point of use as possible and practical, at a convenient height, and ideally within arm's reach.
- Attach containers to the walls or other surfaces if at all possible.
- Label sharps containers clearly with a biohazard symbol so that people will not unknowingly use them as a garbage or trash container.
- Keep sharps containers in the area where sharps are being used.
- Do *not* place containers in high-traffic areas, such as corridors outside patient rooms or procedure rooms, where people could bump into them or be stuck by someone carrying sharps to be disposed of.
- Do *not* place containers on the floor or anywhere they could be knocked over or easily reached by a child.
- Do *not* place containers near light switches, overhead fans, or thermostat controls where people might accidentally put their hands on them.

Mark a fill line on the sharps container at three-quarters full.

- Do *not* fill the sharps containers above the three-quarters-full mark.
- Do *not* shake a container to settle its contents and make room for more sharps.
- Seal the container when it is three-quarters full and do not reopen it. *Never reopen, empty, or reuse a sharps container after closing and sealing it.*

After it has been sealed, store the used sharps containers in a secure area, of out reach of patients and other unauthorized persons, while it awaits transport for final disposal. Dispose of sharps waste in an efficient, safe, and environment-friendly way to protect people from exposure to used sharps.

5 ADDITIONAL (TRANSMISSION-BASED) PRECAUTIONS

Additional or transmission-based precautions are used for patients who are known or suspected to be infected or colonized with highly transmissible or epidemiologically important pathogens. Transmission-based precautions are based on the modes of transmission, such as air, droplet, and contact, and are designed to reduce the spread of related infections in health care facilities. In all situations, the additional, transmission-based precautions must be used in conjunction with the standard precautions.

5.1 Airborne Precautions

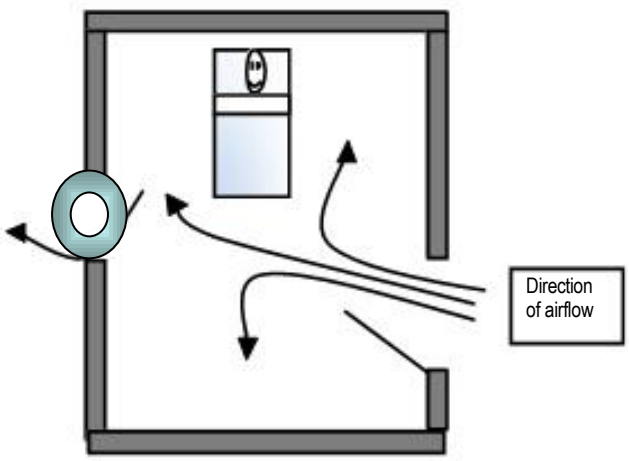
In addition to standard precautions, use airborne precautions for patients known or suspected to have serious illnesses that are transmitted by airborne particles 5 micromiters or less in size and that can remain in the air for several hours and be widely dispersed. These precautions are effective in preventing many infections, including TB, measles, and varicella (including disseminated zoster). The components of airborne precautions are described in the following subsections.

Patient Placement and Transport

Patients that are known or suspected to have serious illnesses that are transmitted by air should be cared for in a private room, with the door kept closed. The room air should be exhausted to the outside (negative air pressure) using fans or another filtration system. (See Figure 12.) If a private room is not available, place the patient in a room with other patients that are actively infected with the same disease, but have no other infection (cohorting). The staff on duty should check all visitors for susceptibility before allowing them to visit. Children should not be allowed to visit such patients.

Limit the transport of these patients to essential purposes only. When transport is required, the patient must wear a surgical mask. Notify the area receiving the patient.

Figure 12: Negative-pressure ventilation room



Respiratory Protection for HCWs

Health care workers should wear appropriate masks when caring for patients who have illnesses that are transmitted by air. For TB, HCWs should wear respirator masks (N-95 masks) and patients should wear surgical masks. (See Figure 13.) Health care workers should remove their respirator masks after leaving the room and hang them in a well-aerated place for reuse. Surgical masks should not be reused.

In cases of chickenpox or measles, immune persons do not need a mask. Susceptible persons should not enter the room.

Figure 13: N-95 masks

5.2 Droplet Precautions

In addition to standard precautions, use droplet precautions for patients who are known or suspected to have serious illnesses that are transmitted by large particle droplets. These precautions reduce the risks for transmitting pathogens that are spread wholly or partially by droplets larger than 5 micrometers in size. Droplet precautions are simpler than airborne precautions, because particles remain in the air for a short time and travel only a few feet. These precautions are effective in preventing infections such as the ones listed below:

- Invasive *Haemophilus influenzae*-type diseases, including meningitis, pneumonia, and epiglottitis
- Invasive *Neisseria meningitidis* diseases, including meningitis, pneumonia, and sepsis.
- Other serious bacterial respiratory infections that are spread by droplet transmission, such as:
  - Diphtheria (pharyngeal)
  - Mycoplasma pneumonia
  - Pertussis
  - Streptococcal (group A) pharyngitis, pneumonia, or scarlet fever in infants and young children
- Serious viral infections that are spread by droplet transmission, such as:
  - Adenovirus (might require more than one type of precaution)
  - Influenza
  - Mumps

- Parvovirus B19
- Rubella

Patient Placement and Transport

Patients that are known or suspected to have serious illnesses that are transmitted by droplets should be cared for in a private room, but the door can be left open. If a private room is not available, place the patient in a room with other patients who are actively infected with the same disease, but with no other infection (cohorting). If neither option is available, maintain a separation of at least 1 meter between patients.

Limit the transport of these patients to essential purposes only. When transport is required, the patient must wear a surgical mask. Notify the area receiving the patient.

Respiratory Protection for HCWs

Wear a mask if within 1 meter of the patient.

5.3 Contact Precautions

In addition to standard precautions, use contact precautions for patients who are known or suspected to have serious illnesses that are easily transmitted by direct patient contact or by contact with items in the patients' environment and patient-care equipment. Contact precautions are effective in preventing infection from patients with wet or draining infections that might be contagious, such as draining abscesses, herpes zoster, impetigo, conjunctivitis, scabies, lice, and wound infections; and other illnesses such as those listed below:

- Gastrointestinal, respiratory, skin, or wound infections or colonization with multi-drug-resistant bacteria of clinical and epidemiological significance.
- Enteric infections with a low infectious dose or prolonged environmental survival, such as these:
  - Clostridium difficile
  - Entero-haemorrhagic *Escherichia coli* 0157:H7, Shigella, hepatitis A, or rotavirus for patients with fecal incontinence
  - Respiratory syncytial virus, para-influenza virus, or enteroviral infections in infants and young children
- Skin infections that are highly contagious or that could occur on dry skin, such as the conditions listed below:
  - Cutaneous diphtheria
  - Herpes simplex virus (neonatal or mucocutaneous)
  - Impetigo
  - Major (noncontained) abscess, cellulitis, or decubitus ulcer
  - Pediculosis
  - Scabies
  - Staphylococcal furunculosis in infants and young children
  - Herpes zoster (disseminated or in the immunocompromised host)

- Viral haemorrhagic conjunctivitis
- Viral haemorrhagic fevers (Ebola, Lassa, Marburg)

Patient Placement and Transport

Patients that are known or suspected to have serious illnesses that are transmitted by contact should be cared for in a private room, but the door can be left open. If a private room is not available, place the patient in a room with other patients who are actively infected with the same microorganism, but with no other infection (cohorting).

Limit the transport of these patients to essential purposes only. When transport is required, ensure that precautions are maintained to minimize the risk of transmitting organisms during transport. Notify the area receiving the patient.

Hand Hygiene and PPE

- Practice hand hygiene and wear clean, nonsterile examination gloves when entering the patient's room. Wash hands with an antimicrobial agent, or use an alcohol handrub after removing gloves.
- Do *not* touch or allow clothing to touch potentially contaminated surfaces or items before leaving the room.
- Change gloves after contact with infectious materials, such as wound drainage or fecal material, and practice hand hygiene. Remove gloves before leaving patient room and practice hand hygiene.
- Wear a clean, nonsterile gown when entering the patient's room if patient contact is anticipated or if the patient is incontinent or has diarrhea, an ileostomy, colostomy, or wound drainage that is not contained by dressing.
- Remove the gown after leaving the patient's room.

Patient-Care Equipment

Reserve noncritical patient-care equipment for use with a single patient if possible, otherwise process the equipment appropriately. Decontaminate, clean, and disinfect any equipment that has been or is being shared among infected and noninfected patients after each use.

6 ISOLATION

Isolation is the creation of a barrier—mechanical or spatial—to prevent the transmission of infectious diseases to or from a patient and to reduce the risk of transmission to other patients, HCWs, and visitors. Isolation is used to prevent the transmission of infectious diseases that are spread by both contact and airborne routes.

All persons accessing the isolation area should practice standard precautions.

6.1 Roles of Health Care Providers

Health care providers should collaborate in the timely and appropriate application of isolation.

Nursing personnel should be responsible for the following:

- Informing the patient's clinician when a patient's condition warrants isolation
- Verifying the clinician 's order to institute isolation
- Explaining procedures and the need for isolation to the patient and family
- Preparing a well-ventilated room or area for isolation with all the necessary equipment
- Notifying the IPC lead person of the patient in isolation within 24 hours of the suspicion or confirmation of an infectious disease
- Displaying a STOP sign clearly in the patient's isolation area

The clinician is responsible for instituting isolation. In the absence of a clinician, the nurse-in-charge institutes isolation.

The clinician or nurse-in-charge must report (using the appropriate form) all infectious cases that are suspected or confirmed to the Public Health Department for onward reporting to the ministries of health.

6.2 Rules Pertaining to Isolation Patients

The following rules and guidelines apply to patients in isolation:

- Patients should be informed of ways in which they can help prevent the transmission of their infectious microorganisms to others.
- Patients in isolation should not share items that could serve as a vehicle for the transmission of microorganisms.
- Patients may leave the isolation area only for essential purposes.
- Stuffed toys for children in isolation should be discouraged. Soft plastic toys should be suggested as an alternative. These plastic toys must be disinfected before discharge.

6.3 Visitors to Patients in Isolation

The following rules and guidelines apply to visitors of patients in isolation:

- Only two persons at a time are allowed to visit and only during visiting hours.
- Visitors must observe the STOP sign and report to the nurse-in-charge prior to entering the isolation area.

- Visitors should not bring in items that could harbour potentially harmful microorganisms.
- Visitors should understand the necessary precautions they must take to prevent the spread of infection to family, friends, and the community.
- Visitors must wash their hands before entering and after leaving the room.
- Visitors must wear PPE (for example, gloves, masks, or gowns) if requested to.
- Visitors must practice standard precautions.

6.4 Transporting Isolation Patients

When patient transport is necessary, the patient should use appropriate barriers, such as masks and barrier-proof dressings, to reduce the transmission of pertinent microorganisms to other patients, staff, and visitors, and to reduce contamination of the area. 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 that need to be taken. The vehicle used for transporting the patient should be decontaminated, cleaned, and disinfected.

6.5 Handling Medical Equipment

Medical devices and patient-care equipment that have been used in the treatment of patients in isolation must be treated appropriately to reduce the risk of transmission of microorganisms to other patients:

- Contaminated, reusable critical medical devices or patient-care equipment (equipment that enters normally sterile tissues or through which blood flows) must be sterilized.
- Semi-critical medical devices or patient-care equipment (equipment that touches mucous membranes) must be sterilized or disinfected (reprocessed). The article and its intended use, the manufacturers' recommendations, the health care-facility policy, and any applicable guidelines and regulations determine the type of reprocessing.
- Noncritical equipment (equipment that touches the skin) that becomes contaminated with blood, body fluids, secretions, or excretions must be decontaminated, cleaned, and disinfected after use, according to the policy of the health care facility.
- Contaminated disposable (single-use) patient-care equipment must 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 appropriately.

6.6 Handling Utensils

No special precautions are required for glasses, cups, and eating utensils. Follow standard procedures for handling utensils. For example, wash them with soap and hot water or 0.5 percent chlorine solution (5000 ppm). Soak them in solution for 10 minutes, and then rinse. Reusable dishes and utensils can be used for isolation patients and can be washed in hot soapy water or disinfected with 0.01 percent sodium hypochlorite solution.

6.7 Housekeeping

The following standard, routine cleaning procedures should be strictly adhered to:

- Decontaminate, transport, and launder soiled linen in a manner that avoids transferring microorganisms to patients, personnel, and environment.
- Perform terminal decontamination, cleaning, and disinfection when the patient no longer occupies the room.
- Clean the room, or area, and bedside equipment of patients on transmission-based precautions using the same procedures that are 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, adequately disinfect bedside equipment and environmental surfaces (bedrails, bedside tables, carts, doorknobs, faucet handles, etc.) if indicated for certain pathogens, especially enterococci, which can survive in the inanimate environment for prolonged periods of time.
- Decontaminate all waste before disposal.

6.8 Requirements for Isolation

Make the following provisions for patients in isolation:

- Provide accommodation for the suspected or confirmed patient in a room or area designated for infectious diseases.
- Ensure that adequate personnel are assigned to the area.
- Ensure that appropriate equipment and supplies are on hand.
- Establish a schedule for the daily routine cleaning and maintenance of the isolation area.
- Educate HCWs, patients, and family members regarding the illness and the precautionary measures it requires.
- Keep the patient's chart and records outside of the patient's room.

6.9 Establishing Priorities for Single Rooms

Where single rooms are limited in number, the institution should set priorities for their use based on risk factors for transmission or adverse outcomes inherent to the patient, microbe, and institution. Consider the severity of the outcome should transmission occur, in the following (descending) order of priority:

- Airborne infections
- Droplet transmission if patients cannot be kept more than 1 meter (3 feet) apart
- Influenza, if in a high-risk unit
- Patients with infections spread by contact and who are noncompliant and cannot be confined to bed
- Diarrhoea in incontinent patients, not contained by diapers

- Respiratory-tract infection in a child unable to appropriately handle respiratory secretions
- Infected wound or skin drainage not contained by dressing
- Large burns
- Dysentery (salmonella infections, cholera, multi-drug-resistant infections)

6.10 Isolation Categories

Isolation for control of infections is used to prevent infected patients from infecting others and is based on the route of transmission of the infection.

Contact Route

The contact route includes the following illnesses or types of illnesses:

- Gastro-intestinal
- Respiratory
- Skin
- Wound infections
- Colonization with multi-drug-resistant organisms
- Enteric infections, e.g., *Clostridium difficile*
- Shigella
- Hepatitis A
- Enteroviral infections in infants and young children
- Respiratory syncytial virus, parainfluenza

Airborne Route

- The airborne route includes the following illnesses:
- Measles
- Varicella (including disseminated zoster)
- TB

7 ENVIRONMENTAL MANAGEMENT PRACTICES

A clean environment plays an important role in the prevention of HAIs. Many factors, including the design of patient-care areas, operating rooms, air quality, water supply, and laundry, can significantly influence the transmission of HAIs.

7.1 Buildings and Premises

Facility design and planning should ensure the following:

- Adequate supply of safe water
- Adequate floor space for beds
- Adequate space between beds
- Adequate hand-washing facilities
- Adequate sanitary facilities
- Adequate ventilation for isolation rooms and high-risk areas like operation theatres, transplant units, intensive-care areas, etc.
- Adequate facilities for airborne, droplet, and contact isolation and precautions
- Regulation of traffic flow to minimize exposure of high-risk patients and to facilitate patient transport
- Measures to prevent exposure of patients to fungal spores during renovations
- Precautions to control rodents, pests, and other vectors
- Appropriate facilities and practices for waste management

Outpatient Areas

Outpatient areas must be able to separate patients who are highly infectious, provide prompt triage, and treat patients immediately. Inpatient areas should have no more than six patient beds per room.

Hand-Washing Basins

Health care facilities must have adequate hand-washing basins, with a minimum of one per patient room, procedure room, and exam room. Each six-bed cubicle must have at least one sink. Each sink should be large enough to avoid splashing and prevent contamination by bacteria that are resident in the drain. Sinks must be sealed to the wall or placed far enough from the wall to allow effective cleaning. They should be located near the entrance or exit for easy access by HCWs. The surrounding area must be nonporous to resist growth of fungus. Taps and soap dispensers should be fitted with hands-off controls, that is, controls that can be operated by elbow, knee, or foot. Elbow-operated systems are preferable because they are less prone to breaking down. Where resources allow, electronically generated systems should be considered.

Ventilation

Ventilation systems should be designed and maintained to minimize microbial contamination. Airconditioning filters should be cleaned periodically and fans, which can spread airborne pathogens, should not be used in high-risk areas such as operating rooms, critical-care units, and transplant units, which require special ventilation systems. In these areas, filtration systems (air-handling units) should have high-efficiency particulate air (HEPA) filters. Unidirectional laminar airflow systems should be available in appropriate areas in the hospital.

Operating Theatres

Ultra clean air is valuable in some types of cardiac surgery, neurosurgery, and implant surgery theatres; and in transplant units. For the operating room, the critical parameters for air quality include the following:

- Frequent maintenance and validation of the efficacy of filters (in accordance with the manufacturers' requirements)
- Pressure gradient across the filter bed and in the operation theatre
- Minimum of 15 air changes per hour
- Temperature between 20°C and 22°C and humidity between 30 percent and 60 percent to inhibit bacterial multiplication
- Good ventilation in general areas if they are not air-conditioned

Contaminated and Isolation Areas

Special air handling is recommended for contaminated areas and is required for the isolation of patients with infections spread by the airborne route. Recommended precautions include negative air pressure that is vented to the outside, and an air-handling system that provides 6 to 12 air changes per hour, with the air being discharged outside through a filtration mechanism. In the absence of rooms that have negative air pressure, an air-conditioned single room with an exhaust or a well-ventilated room is an adequate option. If an air-conditioned single room is not available, a fan can be placed in the room to direct airflow towards an outside window. Doors to an aisle or other rooms should be kept closed at all times.

7.2 Protective Environment

A protective environment might be required for some neutropenic patients. Ultra clean, unidirectional air might be required in some units such as haematology or intensive care due to the level of immunosuppression of the patients. To minimize airborne particles, circulate the air in the room with a velocity of at least 0.25m/sec through a HEPA filter. The HEPA filter removes particles to a certain defined size. If particles 0.3 microns in diameter are removed, air entering the room can be classified as clean and free of bacterial contamination.

Other important practices will help protect patients with severely compromised immune systems:

- Health care workers and visitors that have any infections (for example, upper respiratory tract infections or herpes simplex) should avoid contact with patients.
- Where appropriate, staff and visitors should wear PPE to protect the patient from microorganisms.
- Flowers or plants should not be put in the patients' rooms.
- Maintain a tidy environment.
- Environmental cleaning should be performed twice daily and should consist of damp dusting with a disinfectant cleaning solution so as not to create aerosols.
- Apply strict aseptic techniques for all clinical procedures.
- Practice appropriate hand hygiene at all times.
- Limit the number of visitors.
- Do *not* allow children to visit such patients.

7.3 Housekeeping and Cleaning of the Health Care-Facility Environment

Housekeeping refers to the general cleaning of hospitals and clinics, including the floors, walls, certain types of equipment, furniture, and other surfaces. Cleaning entails removing dust, soil, and contaminants on environmental surfaces. Cleaning helps eliminate microorganisms that could come in contact with patients, visitors, staff, and the community; and it ensures a clean and healthy hospital environment for patients and staff.

Administrative and office areas with no patient contact require normal domestic cleaning. Most patient-care areas should be cleaned by wet mopping. Dry sweeping is not recommended. Hot water (80°C) is a useful and effective environmental cleaner, and using a neutral detergent solution improves the quality of cleaning. Bacteriological testing of the environment is not recommended unless seeking a potential source of an outbreak.

Functional Design

The functional design of health care facilities should allow efficient routine cleaning.

Surfaces

Surfaces, including walls and ceilings must be smooth, easy to clean, impervious, and protected from damage. This is particularly important in areas where contact with blood, body fluids, and other potentially infectious materials could be present, such as delivery rooms, operating theatres, and laboratories. Do not use horizontal, textured, and moisture-retaining surfaces (unless necessary) or inaccessible areas where moisture or dust can accumulate.

Floors

Floors must be nonslip, smooth, impervious, and seamless for easy cleaning. Carpets should not be used, because they harbour large numbers of pathogenic microorganisms, such as coagulase negative staphylococci, *Bacillus* spp, vancomycin-resistant enterococci, and fungi. Carpeting therefore poses a great risk of infection, especially after vacuuming. In addition, carpets are expensive to clean and maintain, they are difficult to disinfect, and they become smelly with time.

Cupboards

Cupboards, which prevent the accumulation of dust, are recommended over shelves. Cupboards must be placed in such a way that all surfaces are easily accessible for cleaning. Furnishings and fittings must be able to withstand appropriate disinfectants. (Items intended for domestic use are unsuitable for health care facilities.)

Furniture and Blinds

Materials that are impervious, easy to clean, and durable should be used on furniture. Fabrics should not be used, because of the great risk of soiling them with blood and other body fluids.

Blinds and curtains must be easy to clean. Use vertical instead of horizontal blinds to avoid dust accumulation.

General Principles of Cleaning Hospitals, Clinics, and Other Health Care Facilities

The following guidelines should be strictly adhered to:

- Cleaning is required prior to any disinfection process to remove dirt, debris, and other materials that can decrease the effectiveness of many chemical disinfectants. Scrubbing (frictional cleaning) is the best way to physically remove dirt, debris, and microorganisms.
- Begin cleaning the least soiled areas first and progress to the most soiled areas. Clean high areas first and proceed from highest to lowest areas, so that the dirtiest areas and debris that falls on the floor will be cleaned last.

- Avoid dry sweeping, mopping, and dusting to prevent dust, debris, and microorganisms from getting into the air and landing on clean surfaces. Airborne fungal spores are especially dangerous, because they can cause fatal infections in immunosuppressed patients.
- Follow mixing (diluting) instructions when using disinfectants: too much or too little water could reduce the effectiveness of disinfectants.
- Base cleaning methods and written cleaning schedules on the type of surface, amount and type of soil present, and the purpose of the area. Schedules and procedures should be consistent and posted.
- Decontaminate any areas that are visibly contaminated with blood or body fluids for 10 minutes with a disinfectant, such as 0.5 percent chlorine, and then clean immediately with detergent and water.
- Clean isolation rooms and other areas that have patients with known transmissible infectious diseases with a detergent and disinfectant solution at least daily.
- Clean all horizontal surfaces at least once daily and as needed.
- Clean toilet areas four times daily and as needed.
- Clean floors twice daily and as needed.

Train housekeeping staff members to perform their assigned tasks and supervise them on a regular basis. As part of their training, housekeeping staff must understand the risk of exposure to contaminated items and surfaces when performing environmental cleaning procedures. They must follow recommended policies and guidelines, including the use of appropriate PPE to avoid exposure.

Selecting a Cleaning and Disinfecting Product

Different types of cleaning products are available: liquid soap and detergents, disinfectants, combinations (detergent and disinfectant), and sanitizers. Each type has different properties. When selecting a disinfectant or other cleaning product, consider factors such as its intended use, efficacy, acceptability, safety, and cost.

An ideal cleaning product should accomplish the following:

- Suspend fats in water
- Make fats water-soluble (saponification)
- Decrease surface tension of water and allow greater penetration of the agent into the dirt (surfaction)
- Break up soil into small particles (dispersion)
- Break up protein (protein destruction)
- Remove calcium and magnesium (soften the water)

Although chlorine-containing solutions are excellent and inexpensive disinfectants, they should not be mixed with cleaning solutions containing acid, ammonia, or ammonium chloride, because doing so will release chlorine gas and other byproducts that can be toxic. A 0.5 percent chlorine solution is ideal for cleaning purposes. Alternatively, you can use 1 percent to 2 percent phenols or 5 percent carbolic acid. Adding enough detergent to these disinfectants will make a mild, soapy cleaning solution.

Cleaning Methods and Frequency

Cleaning should start with the least soiled area and move to the most soiled area and from high to low surfaces. Common methods of cleaning are briefly described below.

Wet Mopping

Wet mopping is the most common and preferred method to clean floors. Three techniques can be used:

- Single-bucket technique: Use just one bucket of cleaning solution. Change the solution when it becomes dirty. The killing power of the cleaning product decreases with the increase of soil and organic material.
- Double-bucket technique: Use two different buckets, one containing a cleaning solution and the other containing a rinsing solution. The double-bucket technique extends the life of the cleaning solution (fewer changes are required), which saves both labour and material costs.
- Triple-bucket technique: Use a third bucket for wringing out the mop before rinsing, which extends the life of the rinse water.

Flooding

Flooding followed by wet vacuuming or scrubbing is recommended in the surgical suite, if possible. This process eliminates mopping, thus minimizing the spread of microorganisms, and increases the contact time of disinfectants with the surface to be cleaned. But it is necessary to leave the floor wet for several minutes. Flooding is best done at night or at times when foot traffic is minimal.

Dusting

Dusting is most commonly used for cleaning walls, ceiling, doors, windows, furniture, and other environmental surfaces.

Clean cloths or mops are wetted with a cleaning solution that is contained in a bucket. The double-bucket system minimizes the contamination of the cleaning solution. Dry dusting should be avoided, and dust cloths and mops should never be shaken—shaking spreads microorganisms. Dusting should be performed in a systematic way, using a starting point as a reference to ensure that all surfaces have been reached.

When dusting ceiling tiles and walls, check for stains that may indicate possible leaks. Leaks should be repaired as soon as possible, because moist ceiling tiles provide a reservoir for fungal growth.

Notes: Appropriate PPE, such as utility gloves, protective shoes, plastic aprons, masks, and protective eyewear should be used at all times during cleaning.

Guidelines for Cleaning Specific Areas

Housekeeping schedules should be planned, written out, and closely followed. Cleaning schedules should be developed according to the needs of each area.

Walls, windows, ceilings, and doors, including door handles. Spot clean when visibly dirty with a damp cloth, detergent, and water. In general, routine damp dusting is adequate for these areas (disinfection is unnecessary). As long as the surfaces remain dry and intact, these surfaces are rarely heavily contaminated with microorganisms.

Chairs, lamps, tables, tabletops, beds, handrails, grab bars, lights, tops of doors, and counters. Wipe daily and whenever visibly soiled with a cloth that is dampened with disinfectant cleaning solution. Pay attention to contaminated areas on these surfaces and treat any blood or other bodyfluid spills as described below.

Noncritical equipment (for example, stethoscopes and blood pressure cuffs). Wipe daily and whenever visibly soiled with a damp cloth, detergent, and water. If the equipment is visibly soiled with blood or other body fluids, or if the patient is under contact precautions, clean and disinfect the equipment before it is reused.

Floors. Clean floors at least twice daily and as needed with a wet mop, detergent, and water. Use a disinfectant when the floor is contaminated with blood or body-fluid spills.

Sinks. Scrub frequently (daily or more often as needed) with a cloth or brush and a disinfectant cleaning solution. Rinse with water.

Toilets and latrines. Scrub frequently at least four times daily and as needed with a separate dedicated mop, cloth, or brush and a disinfectant cleaning solution.

Patient rooms. Clean at least three times daily and after patient discharge. The same cleaning process applies to rooms of patients who are under isolation precautions. Clean and disinfect any cleaning equipment that has been used in the rooms of patients under isolation precautions before the equipment is used in another room.

Procedure rooms. Wipe horizontal surfaces, equipment, and furniture that are used for procedures with a disinfectant cleaning solution after each procedure. Whenever visibly soiled, decontaminate the rooms before cleaning.

Examination rooms. Wipe horizontal surfaces with a disinfectant cleaning solution after each procedure and whenever they are visibly soiled. Change the linen or paper on the examination table after each patient. Decontaminate before cleaning blood or other body-fluid spills.

Laboratory. Wipe countertops with a disinfectant cleaning solution after each shift. Whenever they are visibly soiled, decontaminate before cleaning.

Curtains. Change and clean curtains weekly and when soiled.

Carpets. Carpets should not be used in health care facilities. Instead, use easy-to-clean flooring such as tile.

Soiled linen. Collect soiled linen three times daily (or more often as needed) in closed, leak-proof containers.

Waste. Collect waste from all areas at least three times a day (or more frequently as needed). Do not allow waste to overflow. Transport waste in a covered cart or wheelbarrow.

Waste containers. Disinfect and clean contaminated waste containers every time they are emptied. Disinfect and clean noncontaminated waste containers when they are soiled. Use a disinfectant cleaning solution and scrub to remove soil and organic material.

Cleaning Spills and Other Body Fluids

Clean spills of blood, body fluids, and other potentially infectious fluids immediately:

- For small spills, remove visible materials using a cloth soaked in 0.5 percent chlorine solution while wearing utility or examination gloves.
- For large spills, flood the area with a 0.5 percent chlorine solution, mop up the solution, and then clean as usual with detergent and water.

Schedule and Procedures for the Operating Room

At the beginning of each day, all flat surfaces should be wiped with a clean, lint-free moist cloth to remove dust and lint. Total cleaning is not necessary between each case for surgical procedures. Total

cleaning or terminal cleaning of the operating room should be done at the end of each day. All areas of the surgical suite, scrub sinks, scrub or utility areas, hallways, and equipment should be totally cleaned, regardless of whether they were used during the last 24 hours.

Total Cleaning

At the end of each day, conduct a total cleaning:

- Use freshly prepared 0.5 percent chlorine solution for decontamination.
- Remove all contaminated waste containers and replace with clean containers.
- Close and remove sharps containers if they are three-quarters full.
- Remove soiled linen in closed leak-proof containers.
- Wipe all surfaces from top to bottom using a disinfectant and cleaning solution.
- Wipe any surface that might have come in contact with patients' blood or body fluids with 0.5 percent chlorine solution, clean with disinfectant cleaning solution, and let it dry.
- To reduce microbial contamination of environmental surfaces such as walls, ceilings, and floors, scrub them with a disinfectant cleaning solution. This is safer, quicker, and more effective than fumigating with dilute formaldehyde solution, which is ineffective and time consuming and releases toxic fumes.

Between Each Case

Between each case, clean according to the following guidelines:

- Clean spills with 0.5 percent chlorine solution; if spills are large, flood the area with 0.5 percent chlorine solution.
- Wipe all surfaces and mattress pads with a disinfectant cleaning solution.
- Wipe all the flat surfaces that have come in contact with a patient or a patient's body fluids with a disinfectant cleaning solution.
- Mop the centre of the operating room surrounding the operating room bed with disinfectant cleaning solution.
- Collect and remove all waste from the operating room in closed, leak-proof containers.
- Close and remove containers from the operating room when they are three-quarters full.
- Change covered instrument containers that have 0.5 percent chlorine solution to clean containers that have a fresh 0.5 percent chlorine solution.
- Remove soiled linen in covered and leak-proof linen containers.

Cleaning Soiled and Contaminated Cleaning Equipment

Decontaminate cleaning equipment that has been contaminated with blood or body fluids by soaking it for 10 minutes in 0.5 percent chlorine solution. Wash cleaning buckets, cloths, brushes, and mops with detergent and water daily, or sooner if visibly dirty. Rinse in clean water. Dry completely before reuse by placing them upside down. Wet cloths and mop heads are usually heavily contaminated with microorganisms.

7.4 Management of Health Care Waste

Health care waste is a potential reservoir of pathogenic microorganisms and requires appropriate, safe, and reliable handling. Safe management of health care waste is a key issue in controlling and reducing HAIs. There should be a person or persons responsible for the organization and management (collection, storage, and disposal) of waste. Waste management should be conducted in coordination with the infection-control team.

The purpose of proper waste management is to:

- Protect people who handle waste items from accidental injury
- Prevent the spread of infection to patients, clients, and HCWs
- Prevent the spread of infection to the local community
- Safely dispose of hazardous materials (HAZMATs)

Waste from health care facilities can be noninfectious, infectious, or highly infectious. Certain health care facilities may also generate hazardous waste.

Noninfectious (noncontaminated) waste poses no infectious risk to persons who handle it. Examples of noninfectious waste include paper, trash, boxes, bottles, and plastic containers that contain products delivered to the health care facility. It is estimated that approximately 85 percent of the waste generated in hospitals is noninfectious.

Infectious (contaminated) waste is potentially infectious or toxic if it is not disposed of properly. Contaminated solid or liquid waste includes the following:

- Blood, body fluids, secretions, or excretions
- Items such as sharps and used dressings that have come in contact with blood, body fluids, secretions, or excretions
- Medicines, medical supplies, or other chemicals that might be toxic

Principles of Waste Management

Steps in the management of health care waste are as follows:

1. Generation
2. Segregation (separation)
3. Collection
4. Transportation
5. Storage
6. Treatment
7. Final disposal

The following principles are a general guide to waste management in a health care setting:

- Develop a waste management plan that is based on an assessment of the current situation and that minimizes the amount of waste generated.
- Segregate clinical waste in dedicated colour-coded containers with appropriate bin liners. If colour-coded bins and liners are not available, label the containers used.

- Transport waste in a dedicated covered cart or trolley. Ensure that the carts or trolleys used for the transport of segregated waste collection are not used for any other purpose. They should be cleaned regularly. Transport different categories of waste separately.
- Store waste in specified areas with restricted access. Identify a storage area for waste prior to treating or moving it. Mark the storage areas with a biohazard symbol.
- Collect and store sharps in sharps containers.
- Waste handlers should use appropriate PPE and practice hand hygiene after handling waste.

Waste Generation

Waste generation refers to the quantity of materials or products that enter a waste stream before compositing, incinerating, or recycling. Waste is generated during patient management and care and in other areas of the health care setting.

Waste Segregation

Segregate contaminated and noncontaminated wastes at the point of generation. Separating wastes minimizes costs by reducing the volume of contaminated waste that must be treated with the expensive procedures that are required for managing and disposing of contaminated waste properly.

- Use appropriate colour-coded separate containers for noninfectious, infectious, and highly infectious waste.
- Fill the waste containers not more than three-quarters full.
- Use colour-coded bins and bin liners or label the waste containers (see Figure 14).
- Never sort through contaminated wastes. Do not try to separate noncontaminated waste from contaminated waste, or combustible from noncombustible waste, after they have been combined.

Figure 14: Waste segregation

Preferred Method of Disposal of Sharps and Sharps Containers

The main risk that is associated with infection comes from sharps contaminated with blood. Sharps include all objects and materials that pose a potential risk of injury and infection because of their puncture or cutting properties (syringes with needles, blades, wires, broken glass, etc).

- Place sharps in safety boxes that are resistant to punctures and leakage and are designed so that items can be dropped in using one hand and no item can be removed. The safety box should be marked *"Danger Contaminated Sharps"* and with the biohazard symbol indicated on the outside of the box. It should be closed when three-quarters full and then placed in a yellow plastic bag or containers with other hazardous health care waste for removal from the procedure area for disposal.
- Do *not* handle sharps unnecessarily.
- Always put on heavy-duty gloves when handling sharps waste containers.
- In particular, discard all disposable syringes and needles immediately after they are used. The needle should not be recapped or removed from the syringe—the whole combination should be inserted into the safety box directly after use.
- Destroy sharps together with the hazardous health care waste.
    - The method of choice for destruction of full safety boxes is incineration, preferably in an appropriate double-chamber incinerator.
    - Under exceptional circumstances, full safety boxes may be incinerated in small numbers by open burning.
    - The residues of incineration should be safely buried at a depth greater than 1 meter.
- Do not, under any circumstances, dispose of used syringes, needles, or safety boxes in normal garbage or dump them without prior treatment.

Figure 15: Example of a sharps safety box

Note: *Sharps are one of the most hazardous health care wastes in a health care facility. They pose great danger to HCWs, waste-management operators, and individuals who scavenge in waste disposal sites.*

Encapsulation

Encapsulation is recommended as an alternative method to safely dispose of sharps when burning or burying them is not possible. For encapsulation, sharps are collected in puncture-resistant and leak-proof containers. When the container is three-quarters full, a material such as cement, plastic foam, or clay is poured into the container until it is completely filled. After the material has hardened, the container is sealed and buried. It is permissible to encapsulate chemicals or pharmaceutical waste together with sharps.

Disposal of Liquid Contaminated Waste

Liquid contaminated waste requires special handling, because it could pose an infectious risk to HCWs who handle it. Wastewater from health care facilities might contain various potentially hazardous components, such as microbiological pathogens, hazardous chemicals, pharmaceuticals, and radioactive isotopes. The following basic precautionary practices can reduce the public health risk that is associated with liquid waste and wastewater:

- Always neutralize effluents of all medical-analysis laboratories in a buffer tank before draining them off into the sewer.
- Sterilize blood and other cultures and stocks of infectious agents from laboratory work by steam sterilization (autoclaving) at the earliest opportunity, prior to disposal.
- Discharge radioactive effluents of isolation wards into the sewer or into a septic tank only after they have decayed to background level in adequate retention tanks.
- Wear PPE, including utility gloves, protective eyewear, and a plastic apron when handling and transporting liquid waste.
- Pour waste down a utility-sink drain or a flushable toilet and rinse with water, but avoid splashing.

  If no sewage system is available, dispose of liquid waste in a deep, covered hole, not into open drains.
- Decontaminate containers by placing them in a 0.5 percent chlorine solution for 10 minutes before washing and rinsing them.
- Remove utility gloves and wash hands and dry hands or use antiseptic handrub.

Disposal of Solid Waste (Contaminated and Noncontaminated)

Dispose of contaminated wastes separately from noncontaminated waste, because contaminated waste needs the following special handling:

- Wear heavy-duty or utility gloves when handling and transporting solid wastes.
- Place the solid contaminated waste in a plastic or galvanized metal container with a tightly fitting cover.
- Ensure that there are a sufficient number of waste containers, in convenient locations, to minimize carrying contaminated wastes from place to place.
- Collect the waste containers on a regular basis and transport the burnable ones to the incinerator or area for burning.
- Remove gloves and wash and dry hands or use an antiseptic handrub.
- Noncontaminated solid wastes should be managed at the health care-facility level or through the local authority disposal system.

Do not discard any solid waste, contaminated or noncontaminated, into the sewer system (including conduits, pipes, and pumping stations).

Disposal of Hazardous Waste

Hazardous waste material refers to chemical and pharmaceutical waste, as well as any waste that contains heavy metals. Hazardous waste should be incinerated or buried if the quantity is very small. A large quantity of such materials should be sent back to the original supplier.

Special Waste Situations

The following types of waste require special handling.

Pathological Waste

Pathological waste includes all organs (including placentas), tissues, blood, and body fluids, which should be handled according to these guidelines:

- In operation theatres, all anatomical waste and placentas should be collected separately in a red-coloured bin with a red bin liner.
- Anatomical waste and placentas should be dropped into a concrete-lined placenta pit or buried at a depth greater than 1 meter, inside the health care facility compound in a location totally enclosed and secured from unauthorized access, and at least 100 meters away from any underground water well.
- Anatomical waste that cannot be transported and disposed of immediately should be stored in the mortuary.
- If a patient or family member wants to take home the placenta or body parts for burial, first place them in a plastic bag and then into a rigid container for transport.

Infectious Waste

Infectious waste refers to all biomedical and health care waste known or clinically assessed to have the potential of transmitting infectious agents to humans or animals. It should be handled according to these guidelines:

- Place infectious waste in a yellow bin with yellow bin liners marked *"Danger Hazardous Medical Waste."* When a bag is no more than three-quarters full, seal it with appropriate adhesive tape, remove it, and replace it immediately with a new bag.
- Incinerate infectious waste in double-chamber incinerators; dispose of ashes from the incinerator in an ash pit.
    - In densely populated areas, use an incinerator that reaches 1,200°C, if possible.
    - In other areas, use decentralized, low-cost incinerators.
- Health centres and dispensaries may burn infectious waste in oil drum incinerators.
  Sanitary landfill or burial is an alternative solution when underground water is not at risk for contamination. But be careful to dispose of solid waste on land in a manner that can protect the environment. For example, spread the waste in thin layers, compact it to the smallest practical volume, and then cover it with soil at the end of each working day.

Hazardous Pharmaceutical Waste and Cytotoxic Waste

Hazardous pharmaceutical waste and cytotoxic waste refers to expired pharmaceuticals or pharmaceuticals that are unusable for other reasons (for example, a callback campaign). Pharmaceutical waste can be hazardous (cytotoxic) or nonhazardous.

- Hazardous pharmaceutical waste should be repacked in specific cardboard boxes that have been marked *"Danger Hazardous Pharmaceutical and Cytotoxic Waste!"* The boxes should be returned to the pharmacy department, which should ensure their disposal at the central level.
- Hazardous pharmaceutical waste should be discharged only into the sewerage system or into a septic tank after it has decayed to background level in adequate retention tanks.

Methods of Final Disposal of Wastes

Incineration

Incineration is the controlled burning of solid, liquid, or gaseous combustible wastes to produce gases and residues that contain little or no burnable material. Incineration provides high temperatures and destroys microorganisms. It also reduces the volume of waste to be buried and is the best method for disposing of contaminated wastes.

Simple incinerators can be built from locally available materials—bricks, concrete blocks, or used fuel or oil drums. In general, such an incinerator is useful only for small, usually rural, health care facilities that do not have large quantities of medical waste. If the health care facility is large, it is more efficient to build or install an incinerator large enough to accommodate all of the facility's waste-disposal needs.

To build a drum incinerator:

- Choose a place that is downwind from the clinic to prevent smoke and odours from coming into the health care facility and the neighbouring communities.
- Make sure there are sufficient air inlets on the sides of the oil drum and bottom of the fire bed.
- Place the incinerator on hardened earth or on a concrete base.

For efficient burning, follow these practices:

- Burn only medical waste.
- Treat the ash as general waste.
- Use a regular community disposal site for general waste. This will conserve both time and resources.
- Medical waste might not burn easily, especially if it is wet. Add kerosene to make the fire hot enough to burn all waste. Be sure to add the kerosene before starting the fire—adding kerosene after the fire has started might cause an explosion.
- Bury or otherwise dispose of the ash in a designated area.

The following waste should not be incinerated:

- Pressurized gas containers (aerosol cans)
- Large amounts of reactive chemical waste
- Silver salts and photographic or radiographic wastes
- Plastic containing polyvinyl chloride (blood bags, IV sets, or disposable syringes)
- Waste containing high mercury or cadmium content, for example, broken thermometers, used batteries, and lead-lined wooden panels

Burial

Only contaminated and hazardous waste needs to be buried. For effective and safe burial, follow these guidelines:

- The disposal site should be fenced and off limits to unauthorized persons.
- The burial site should be lined with a material of low permeability, if possible.
- Select a site at least 50 meters away from any water source to prevent contamination of the water table.
- The site should have proper drainage, be located downhill from any wells, free of standing water, and not be in a flood-prone area. The site should not be located on land that will be used for agriculture or development.

To make and use a small burial site for waste disposal, follow these guidelines:

- Find an appropriate location as described above.
- Dig a pit 1-meter square and 2 to 5 meters deep. The bottom of the pit should be 2 meters above water level. Consult the local water engineer or water authority for information about the location of the water table.
- Fence in the area to keep out animals, scavengers, and children.
- Dispose of the contaminated waste in the pit and cover the waste with 10 to 15 centimeters of soil each day. The final layer of dirt should be 50- to 60-centimeters thick and compacted to prevent odors, to keep from attracting insects, and to keep animals from digging up the buried waste.
- Depending on the volume, such a pit should last for 30 to 60 days.
- When the level of the waste reaches within 30 to 50 centimeters of the surface of the ground, fill the pit with dirt, seal it with concrete, and dig another pit.

Burning

Burning can be used for combustible, noninfectious waste such as paper. This should be carried out in a simple pit hole and not in the open. Crude tipping or disposing of waste in open sites should be avoided, because it poses infection risks and fire hazards, produces a foul odour, attracts insects, and is unsightly.

General Tips for Waste Disposal

- Use heavy-duty utility gloves and appropriate PPE when handling wastes.
- Decontaminate and clean gloves between uses.
- Handle wastes carefully to avoid spills or splashes and wear a complete PPE set.
- Always wash your hands after removing gloves and handling contaminated wastes.
- Avoid transferring contaminated waste from one container to another.
- Incineration is the preferred method for waste disposal, as the heat will generally be sufficient to destroy infectious microorganisms and will also prevent scavenging and reuse of discarded items.
- If incineration is not possible, then careful burial is the next best alternative.
- Dispose of used toxic chemicals or medicine containers properly:
    - Rinse glass containers thoroughly with water. Glass containers may be washed with detergent, rinsed, dried, and reused.

- For plastic containers that contained toxic substances, such as glutaraldehyde, rinse three times with water and dispose of by incineration, burial, or both. These containers may be used for sharps-disposal containers, but do not reuse them for any other purpose.
- Equipment that is used to hold and transport wastes must not be used for any other purpose in the clinic or health care facility.

- Contaminated waste containers should be cleaned each time they are emptied and noncontaminated ones whenever they are visibly soiled. Contaminated waste containers should be labelled clearly.

Treating Infectious Waste

Infectious waste can be treated by the methods described below to render it noninfectious before disposal.

Autoclave

- Autoclaves must be operated at a minimum temperature of 121° C for a minimum of 60 minutes.
- Each package of waste in a load should have heat-sensitive tape or the equivalent to indicate the attainment of adequate temperature conditions.
- All autoclaves must be evaluated monthly under full-load conditions for effectiveness against spores. Those that fail to achieve satisfactory spore-test results should be removed for repair or replacement.

Chemical Treatment of Cultures

- Sodium and potassium hypochlorite at 15 percent v/v concentration are approved chemical solutions for treating surface colonies and colonies in suspensions.
- All cultures should be submerged for a minimum of 20 minutes to ensure that waste is rendered noninfectious.
- Cultures can be incinerated.

8 TRAFFIC FLOW AND ACTIVITY PATTERNS

Regulating the flow of visitors, patients, clients, and staff plays a central role in preventing disease transmission in health care facilities. The number of microorganisms in designated areas tends to be related to the number of people present and their activities. Microbial contamination is expected and is found to be high in areas such as waiting rooms and places where soiled surgical instruments and other equipment are initially processed. Contamination can be minimized by reducing the number of people permitted into an area and by restricting the activities that take place there.

An important objective of infection prevention is to minimize the level of microbial contamination in the following areas:

- Areas where patients wait and where HCWs examine and treat them
- Surgical units where major and minor operations are performed, including preoperative and recovery rooms
- Work areas where instruments are processed
- Storage areas for processed instruments and equipment

8.1 Space and Equipment Requirements

Health care facilities vary in size and in the types of services that they provide, but the specific space and equipment requirements to perform a particular procedure generally do not vary.

The space, equipment, and need for well-defined traffic flow and activity patterns become progressively more complex as the type of surgical procedure changes from general surgery and obstetrics to open-heart surgery. The space requirements for the types of surgery typically performed at the provincial hospitals are approximately the same as for high-volume district hospitals. These space requirements include the following:

- Changing room and scrub area for staff
- Preoperative area where clients are examined and evaluated prior to surgery
- Operating room
- Recovery area for patient observation after surgery
- Processing area for cleaning, sterilizing, or high-level disinfecting of instruments and other items
- Space for storing sterile packs and high-level disinfected containers of instruments and other items
- Staff resting rooms

8.2 Procedure Area

The following guidelines apply to areas where HCWs perform procedures on patients:

- Permit only the patient and the staff performing and assisting with procedures in the procedure room. The number of trainees should be kept to a minimum.
- Patients can wear their own clean clothing or facility-provided clothing for procedures that are not considered major surgery, but patients undergoing major surgical procedures must wear facility-provided hospital clothes.
- Staff should wear attire and PPE appropriate for the procedure they are performing.

- A covered container filled with a 0.5 percent chlorine solution should be available for the immediate decontamination of instruments and other items after they have been used.
- A leak-proof, covered waste container should be available for the disposal of contaminated waste items.
- A puncture-resistant container should be available for the safe disposal of sharps at the point of generation.
- Clean, high-level disinfected, and sterile supplies should be stored and available in procedure rooms.

8.3 Surgical Unit

The surgical unit is divided into four designated areas:

- Unrestricted area (a point through which staff, patients, and materials enter the surgical unit). Unrestricted areas need no special traffic flow.
- Transition zone (where staff put on surgical attire). Transition zones should allow only authorized staff.
- Semi-restricted area (a peripheral area of the surgical unit that includes preoperative and recovery rooms, storage space for sterile and HLD items, and corridors leading to the restricted area). Semi-restricted areas should allow only authorized staff and patients.
- Restricted area (the operating room and scrub sinks). Restricted areas should allow authorized staff and patients only.

Environmental controls and the use of surgical attire increase as one moves from unrestricted to restricted areas. Staff with respiratory or skin infections or uncovered open sores should never be allowed to work in any area of the surgical unit unless they can use appropriate protective gear.

Note: Displaying a signboard in local language to limit the entry of unauthorized persons might work in some facilities.

Semi-restricted Area

Limit traffic to authorized staff and patients at all times. Staff members who work in this area should wear appropriate PPE. Semi-restricted areas should have the following:

- A work area for processing clean instruments
- A storage space for clean and sterile or HLD supplies with enclosed shelves
- A door limiting access to the restricted area of the surgical units

Restricted Area

Limit traffic to authorized staff (HCWs who perform and assist with procedures) and patients at all times. Keep the doors closed at all times, except during movement of staff, patients, supplies, and equipment. Staff must comply with the following practices:

- Scrubbed staff must wear full surgical attire and cover their heads and facial hair with a cap and mask.
- Staff should wear clean, closed shoes.
- Staff must wear masks when sterile supplies are opened and when scrubbed HCWs are operating.

Patients entering the surgical unit should be clean, wear clean gowns or be covered with clean linen, and have their hair covered.

Operating Rooms

The operating room should be located away from areas of the health care facility that are heavily travelled by staff and patients. Enclose the operating room to minimize dust and eliminate insects.

Before Surgical Procedures

Before surgical procedures, set up the operating room as follows:

- Organize Mayo and ring-stand tables side by side in an area away from the traffic pattern and at least 45 centimeters from walls, cabinets, and other nonsterile surfaces.
- Cover the Mayo stand and other nonsterile surfaces that are to be used during the procedure with a sterile towel or cloth.
- Check and set up suction, oxygen, and anesthesia equipment.
- Place the following in the operating room:
  - A clean, covered container filled with 0.5 percent chlorine solution for the immediate decontamination of used instruments.
  - A leak-proof covered waste container with appropriate bin liner for contaminated waste items.
  - A puncture-resistant container for the safe disposal of sharps at the point of generation, but do not contaminate the sterile field.
  - A leak-proof covered container for soiled linen away from sterile items.
  - A clean sheet, a canvas, and arm-board covers. (Place them on the operating theatre table.)
  - Supplies and packages that are ready to open (Place them on the tables, not on the floor.)

During Surgical Procedures

The following policies should be observed in the operating room during surgical procedures:

- Limit the number of staff entering the operating room to only those necessary to perform the procedure and to patients. Minimize outside help.
- Keep movement to a minimum.
- Keep doors closed at all times.
- Scrubbed staff should wear full surgical attire: scrub suits, plastic aprons, clean caps and masks, protective eyewear, clean and closed theatre shoes, and sterile surgical gloves. They should keep their arms and hands within the operative field at all times.
- Nonscrubbed staff should wear surgical attire: caps, clean and closed theatre shoes, masks, and protective eyewear. They should stay at the periphery of the operating room.
- Clean accidental spills or contaminated debris in areas outside the surgical field with a 0.5 percent chlorine solution as promptly as possible.

After Surgical Procedures

After each surgical procedure, staff wearing utility gloves should clear the operating room:

- Collect all waste in closed, leak-proof containers and remove them from the room.
- Close and remove puncture-resistant containers when they are three-quarters full.

- Remove covered containers with a 0.5 percent chlorine solution, with instruments and surgical gloves in it.
- Remove soiled linen, soiled instruments and equipment, and supplies that have been opened, but not used, in an enclosed cart for reprocessing.

8.4 Work Areas for Instrument Processing/CSSD

The work area consists of four areas: the "dirty" receiving and cleanup area, the clean work area, the cleaned equipment storage area, and a sterile or HLD storage area.

The dirty receiving and cleanup area should have the following:

- A receiving counter
- Two sinks, if possible, with a clean water supply
- A clean equipment counter for drying

The clean work area should have the following:

- A large work table
- Shelves for holding clean and packaged items
- A high-pressure autoclave, a dry-heat oven, and a steamer or boiler

The clean equipment storage area should have the following:

- Shelves for storing clean equipment
- An office or desk for record keeping

The sterile or HLD storage area should be separated from the sterilization area. Limit access to the storage area. Dispense sterile and high-level disinfected articles from this area. Observe the following guidelines:

- Before dispensing any item that has been stored, check the package to be sure it is not dirty, wet, or damaged.
- Touch or handle sterile packages as little as possible. The packs will remain sterile as long as the integrity of the package is maintained.
- Store items in closed cabinets.
- Keep the storage area clean, dry, and dust- and lint-free by regular housekeeping.
- Packs and containers with sterile or HLD equipment or instruments should be stored 20-25 centimeters off the floor, 45-50 centimeters from the ceiling, and 15-20 centimeters from an outside wall.
- Do not use cardboard boxes for storage.

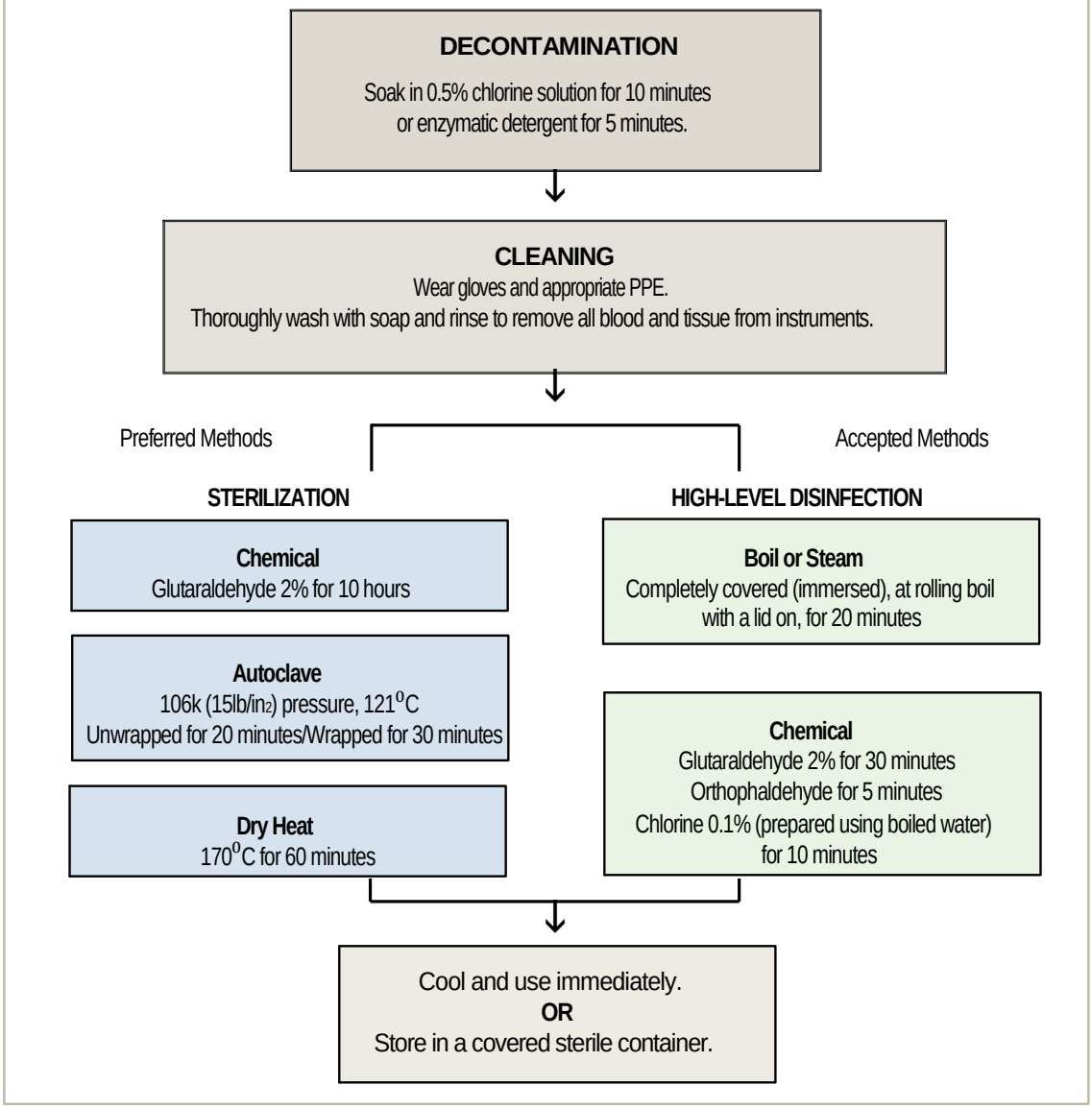
9 REPROCESSING INSTRUMENTS AND EQUIPMENT

The risk of transferring infection from instruments and equipment is dependent on the following factors:

- The presence of microorganisms, their number, and their virulence
- The type of procedure that is going to be performed (invasive or noninvasive)
- The body site where the instrument or equipment will be used (penetrating the mucosal or skin tissue or used on intact skin)

There are certain principles that must be applied to ensure instruments and equipment have been appropriately reprocessed. Figure 16 outlines the basic infection-prevention processes that are recommended for reducing disease transmission from soiled instruments and other reusable items are decontamination, cleaning, and either sterilization or high-level disinfections (HLD). Regardless of the type of operative procedure, the steps in processing surgical instruments and other items are the same. In order to create an infection-free environment, clinic staff at all levels must understand the rationale for each of the recommended infection-prevention processes and their limitations.

Figure 16: Key steps in processing contaminated instruments, gloves, and other items



9.1 Decontamination of Used Instruments and Equipment

Decontamination is the first step in handling used instruments and equipment.

Decontamination Solution

The recommended decontamination agent is a 0.5 percent chlorine solution. Make a fresh solution every morning, or after 8 hours, or more often if the solution becomes visibly dirty. A 0.5 percent chlorine solution can be made from readily available liquid chlorine or chlorine tablets (NaDCC). The formula for making a dilute solution from concentrated solutions is as follows:

> Total Parts (TP) water = (percentage chlorine in manufacturers concentration ÷ % desired chlorine concentration) - 1
>
> Mix 1 part concentrated bleach solution with the total parts water required.
>
> Example: To make a 0.5 percent chlorine solution from 5 percent concentrated chlorine solution:
>
> TP water: (5.0% ÷ 0.5%) - 1= 10 - 1 = 9
>
> Add 1 part concentrated solution to 9 parts water.

Cover containers containing 0.5 percent chlorine solution and protect them from light.

Note: *Do not mix chlorine solutions with ammonia-based solutions, because toxic gas might be produced.*

Decontaminating Equipment

Decontaminate large surfaces that might have come in contact with blood and body fluid, such as pelvic-examination, operating, or delivery tables. Wipe them with a cloth soaked in the 0.5 percent chlorine solution.

Decontaminating Used Instruments and Other Items

Keep surgical or examination gloves on after completing the procedure. Decontaminate the instruments while wearing the gloves:

- Immediately after use, place all instruments in an approved disinfectant, such as 0.5 percent chlorine solution, for 10 minutes to inactivate most organisms, including HBV and HIV.
- Use plastic, noncorrosive containers for decontamination to prevent sharp instruments from getting dull (due to contact with metal containers) and to prevent instruments from getting rusted (due to electrolysis between two different metals when placed in water).
- Remove instruments from 0.5 percent chlorine solution after 10 minutes and immediately rinse them with cool water to remove residual chlorine before thoroughly cleaning them.
- Remove gloves and dispose of them appropriately.

Note: *To prevent rusting, do not soak metal instruments in water for more than one hour, even if they are electroplated.*

Once instruments and other items have been decontaminated, they can safely be cleaned and sterilized or high-level disinfected.

9.2 Cleaning

After decontamination and prior to disinfecting or sterilizing, all instruments and equipment MUST be cleaned to remove organic materials or chemical residue. If instruments and equipment are not cleaned properly, organic matter could prevent the disinfectant or sterilizing agent from making

contact with the instrument or piece of equipment and might also bind and inactivate the chemical activity of the disinfectant. Ensure that all surfaces of instruments and equipment, including channels and bores, are cleaned.

Cleaning Agents

Use liquid soap or enzymatic detergent. Liquid soap suspends grease, oil, and other foreign matters in solution so that they can be removed easily by the cleaning process. Do not use an abrasive cleaner, such as steel wool, for household cleaning, because it can scratch the instruments, which creates potential sites for microorganisms to harbour.

If an instrument or piece of equipment cannot be cleaned thoroughly, then do not sterilize or disinfect it—discard it. It should not be reused.

Cleaning Methods

Manual Cleaning

Follow this procedure to clean instruments manually:

- Wear PPE (a plastic apron, thick rubber gloves, eye protection, a surgical mask or face shield, or both).
- Remove any gross soiling on the instrument by rinsing it in water.
- Take the instrument fully apart and immerse all parts in warm water with a detergent (biodegradable, noncorrosive, nonabrasive, low-foaming and free-rinsing) or enzymatic cleaner.
- To prevent splashing, keep the items being washed under the surface of the water.
- Rinse in clean water.
- Dry the instrument in a drying cabinet or by using a clean, lint-free cloth.
- Inspect the instrument to ensure it is clean.
- Pay particular attention to instruments with teeth, joints, or screws where organic material can collect. Open all jointed instruments.

Mechanical Cleaning

Most modern sterilization units are automated and require minimal handling of dirty equipment by staff. The equipment is placed in trays ready for washing:

- The washing machine gives a cold rinse followed by a hot wash at 71°C for two minutes. This is followed by a 10-second hot-water rinse at 80°C-90°C and then drying by a heater or a fan at 50°C-75°C.
- The washer-disinfector is used for anesthetic equipment. It runs a 45-minute cycle of washing and cleaning, plus a two-minute cycle with water at 80°C-100°C and a detergent solution.
- The ultrasonicator is a sophisticated and expensive, but extremely efficient, piece of equipment that dislodges all organic matter.

Cleaning New Instruments

All new instruments are supplied without lubrication. Carefully wash and dry all new instruments and lubricate any moving part. Whenever cleaning, regardless of methods, keep ratchets unlocked and box joints open.

When they are no longer new, do not let stained steel instruments come in contact with barium chloride, aluminum chloride, or compounds that contain bromide and iodine.

9.3 High-Level Disinfection

Disinfection removes microorganisms from instruments and equipment, but it is not a sterilizing process and it should not be used as a convenient substitute for sterilization. Disinfection is used to destroy organisms on delicate or heat-sensitive instruments that cannot be sterilized or when singleuse items are not available. It is not appropriate for instruments that will be used in critical sites, because these instruments must be sterile.

Different products and processes provide different levels of disinfection, which are classified as follows:

1. *High-level disinfection (HLD)* destroys all microorganisms except some bacterial spores (especially if there is heavy contamination).
2. *Intermediate disinfection* inactivates *Mycobacterium tuberculosis,* vegetative bacteria, most viruses, and most fungi, but it does not always kill bacterial spores.
3. *Low-level disinfection* can kill most bacteria, some viruses, and some fungi, but it cannot be relied on to kill more resistant bacteria such as *M. tuberculosis* or bacterial spores.

Although sterilization is the safest and most effective method for the final processing of instruments, it might not always be available or suitable. In these cases, HLD is the only acceptable alternative. High-level disinfection can be achieved by steaming or by using chemical disinfectants.

How to Prepare a High-Level Disinfection Container

For metallic containers, boil water in the covered container for 20 minutes, and then pour out the water. Replace the cover and allow the container to dry.

For a plastic container, take the cover off and immerse both the container and cover in 0.5 percent chlorine solution (the container itself should be filled with the solution), and leave both to soak for 20 minutes. Rinse the cover and the inside of the container three times with boiled water and allow them to air dry. Large metal containers cannot be used for HLD using chemicals.

High-Level Disinfection by Steaming

The procedure for HLD by steaming is described below:

1. Place instruments and other items in one of the steamer pans with holes in its bottom. Do not overfill the pan.
2. Repeat this process until as many as three steamer pans have been filled. Stack the filled steamer pans on the top of a bottom pan containing water for boiling. A second empty pan without holes should be placed on the counter next to the heat source.
3. Place the lid on the top pan and bring the water to a full rolling boil.
4. When steam begins to come out between the pans and the lid, start the timer or note the time on the clock and record the time in the HLD log.
5. Steam items for 20 minutes.
6. Remove the top steamer pan and put the lid on the pan that was below it. Gently shake excess water from the pan just removed.
7. Put the pan you just removed onto the empty pan. Repeat until all pans are restacked on this empty pan and the top pan is covered with the lid.
8. Allow items to air dry in the steamer pan before using them.
9. Using HLD forceps, transfer the dry items to a dry, HLD container with a tightly fitting cover.

Instruments and other items can also be stored in the stacked and covered steamer pans as long as a bottom pan (the one with no holes) is used.

High-Level Disinfection with Chemicals

Chemical disinfection is used most commonly for heat-labile equipment (for example, endoscopes) where single-use equipment is not cost-effective.

Selecting a Disinfectant

Different grades of disinfectants are used for different purposes. Only instrument-grade disinfectants are suitable to use on medical instruments and equipment. Hospital-grade or household-grade disinfectants are suitable for environmental purposes only and should never be used on instruments.

Glutaraldehyde is generally the most appropriate chemical disinfectant for high-level disinfection. However, this chemical must be used under very strictly controlled conditions and in a safe working environment.

If the disinfectant is a multi-use solution, it is important to store it correctly and according to the manufacturers' instructions. Be careful not to contaminate the solution when pouring it out for use.

The following products should not be used as disinfectants, because they are antiseptics:

- Acridine derivatives
- Cetrimide
- Chlorohexedine gluconate and cetrimide in various concentrations
- Chloroxynelol in alcohol
- Alcohols
- Lodophors

Steps in Chemical High-Level Disinfection

Health care workers should wear PPE and follow these instructions when they perform chemical HLD:

1. Decontaminate by soaking instruments for 20 minutes in 0.5 percent chlorine solution that has been prepared using clean water or 2 percent to 4 percent glutaraldehyde or 6 percent hydrogen peroxide.
2. Disassemble, clean, and dry all instruments.
3. Completely immerse all items in the high-level disinfectant.
4. Remove items using HLD (or sterile) forceps and handle items wearing sterile gloves.
5. Rinse items well with sterile water (or boiled and filtered water) three times and air dry them.
6. Use items promptly or store them in a dry, HLD container with tightly fitting lid.

Factors That Affect High-Level Disinfection

Several factors affect the HLD process:

- The type and concentration of the disinfectant used
- The Ph of the disinfectant
- The presence of organic or inorganic matter
- The nature of the items to be disinfected
- The number of microorganisms present (More microorganisms require more time.)

- Resistance of microorganisms:
  - Some microorganisms are more resistant to disinfection than others, for example, bacterial spores, mycobacteria, hydrophilic viruses, fungi, vegetative bacteria, and lipid viruses, in that order.
  - Organisms flourishing in health care-facility environments (*Pseudomonas aeruginosa*, antibiotic-resistant microorganisms) have inherent resistance to certain disinfectants.
- The presence of organic materials such as blood, blood products, body fluids, and faeces that contain significant amounts of proteins that inactivate or slow the action of disinfectants
- Duration of exposure and temperature:
  - Longer exposures result in higher degrees of disinfection.
  - Higher temperatures increase the killing power of most disinfectants, whereas lower temperatures slow the killing power.
- Surface texture (Rough surfaces—such as those with crevices, lumen, or hinges—need a longer time for disinfection.)

Using Disinfectants

Disinfectants should be supplied, preferably ready for use, from the pharmacy. If they are to be prepared at point of use (for example, chlorine solution is issued from the pharmacy undiluted), the HCW should follow the manufacturers' instructions to ensure that the correct dilution is used. New stocks should be supplied on receipt of empty containers. The health care-facility pharmacy should ensure the following:

- Containers should be thoroughly cleansed, washed, and dried.
- Containers should be clearly labelled with the type of contents, the in-use dilution, and the expiry date.
- None of the disinfectants should be exposed to inactivating substances, such as cork, rubber caps, or incompatible detergents.

Health care workers should follow these guidelines when using disinfectants:

- Do not use a disinfectant in an open container. Open containers of disinfectant should not be tolerated in any health care environment. There is a serious risk of contamination with multiple antibiotic-resistant bacteria such as *Pseudomonas* sp. and spores.
- Always thoroughly decontaminate and then clean articles before disinfecting them.
- When disinfectants are indicated for use on surfaces, wipe the surface. Do not wash, bathe, or flood-wash it.

Disposing of Chemicals and Storing Containers

Pour used chemicals carefully down a utility-sink drain or into a flushable toilet and rinse or flush with water. You can also pour liquid waste into a latrine. Avoid splashing. Do not leave partially filled containers on the wards. Do not use empty containers to store other solutions. Disinfectant containers must be thoroughly cleaned or sterilized before refilling between uses. Never top them up.

Glass containers that are used for storing chemicals should be washed with soap, rinsed, dried, and reused. Alternatively, thoroughly rinse glass containers with water and dispose of them by burying. Plastic containers that are used for toxic substances should be rinsed with water and disposed of by burning or burying. They should never be reused. To further prevent them from being reused, put a hole in each container before disposal so that it will not hold water or other liquids.

Chemical disinfectants should be stored in a cool, dark place.

Notes: Disinfectants should be diluted in manageable quantities, for example, 5 liters or less, to reduce waste. Only knowledgeable personnel should dilute disinfectants.

9.4 Sterilization

Sterilization is the destruction of all microorganisms (bacteria, viruses, fungi, and parasites), including bacterial endospores, from instruments and other items. Sterilization protects patients and is recommended for all instruments and other items that will come in contact with the blood stream or tissues under the skin, as well as on drapes and some surgical attire. Items and equipment can be sterilized by either physical or chemical methods, such as the following:

- High-pressure steam (autoclaving)
- Dry heat (oven)
- Chemical soaking (cold sterilization)

Heat, either steam or dry, is the most effective method of sterilization and is reliable if monitored carefully. It is also less expensive than chemical methods. Heat should be considered first for all medical equipment that can withstand it. Where heat cannot be used, chemicals such as ethylene oxide and glutaraldehyde are the best alternative. Before sterilizing any instrument or equipment ensure that it can withstand the process (e.g., steam under pressure), has been adequately cleaned, and does not require any special treatment. Records should be kept of the sterilization process and for the traceability of instruments.

Wrapping Items for Sterilization

All materials must be wrapped before sterilization. Wrapping helps prevent recontamination after sterilization and prior to the item's use. Only wrapped or packed sterilized materials should be described as sterile. The properties of the wrapping material should allow it to act as a barrier against dust particles, to repel water, and to provide an adequate seal of the contents. The wrapper should resist tears and punctures, and be free of holes and toxic ingredients. The sizes necessary to wrap the instruments and items to be processed must be available in sufficient quantities and be stored in a manner that allows HCWs' access.

All wrappers must be lint free. Wrappers have to completely enclose the instrument or item. The edges need to be properly folded so the tool can be aseptically presented during a procedure. While the edges and corners of the wrapper need to be tucked in, there should not be excessive wrapping material on and around the item as this interferes with the sterilant's penetration. Plus, if the wrapper is to be used as a sterile field, it should provide a field of at least six inches beyond the four sides of the table.

The wrappers should be used sequentially or simultaneously to wrap the contents. Pins, staples, paperclips, and other sharp objects should never be used to secure a wrapped item. All sterile packages should be handled as little as possible.

Autoclaving

Autoclaving is the use of high-pressure steam to sterilize equipment and instruments.

Types of Autoclaves

There are several types of autoclaves:

- Downward (gravity) displacement sterilizers (jacketed and nonjacketed). These are designed for sterilizing waste, solutions, and instruments.
- Self-contained (bench-top) sterilizers. These are recommended for office-based practices, as they are suitable for relatively few or simple items. Bench-top sterilizers do not take wrapped items, which means items must be used immediately after they are removed from the sterilizer.

- Pre-vacuum (porous load) sterilizers. These are suitable for sterilization of clean instruments, gowns, drapes, toweling, and other dry materials that are required for surgery.

Guidelines for Operating and Maintaining Autoclave Machines

An autoclave machine will reliably sterilize items only when it is kept in good working condition and operated correctly. Instructions for the operation and routine maintenance of autoclave machines should be included in HCWs' basic training.

To ensure proper steam contact, first decontaminate, clean, and dry objects before autoclaving, and then follow these instructions:

- Keep instruments disassembled, opened, and unlocked.
- Do not stack the instruments.
- Do not wrap the packages too tightly.
- Do not arrange the packs in the sterilizer too close to each other.
- Position the containers in a way that air can easily be displaced and steam can have enough contact with all surfaces.
- Ensure that the small drain strainer at the bottom of the sterilizer is not clogged. This could result in trapping air inside the sterilizer.
- Maintain the appropriate temperature, timing, and adequate moisture during any autoclaving cycle:
  - 121°C throughout the process
  - 20 minutes for unwrapped items and 30 minutes for wrapped items
  - 100 percent moisture in the steam
- Follow specific operating instructions from the manual that was supplied by the manufacturer.
- Ensure that there is at least 7-8 centimeters (3 inches) of space between the packages and the autoclave chamber walls.
- Place bottles, solid metal, and glass containers on their sides with lids held loosely in place.
- Place instruments trays (mesh or perforated bottom only) flat.
- Do not overload the sterilizer or make packs too large.
- Apply an autoclaving tape on the pack of instruments to indicate whether a specific temperature or pressure has been reached.
- Double wrap items using correct wrapping material (cloth, muslin, or kraft).
- Consult the manufacturer's manual for proper maintenance of the sterilizer. In some cases, however, a weekly flush of hot liquid soap through the exhaust line will keep it cleaned out.

Dry-Heat Sterilization

Dry-heat (hot air) sterilization destroys pathogens by the process of oxidation. Dry-heat sterilization can be achieved with a simple oven as long as a thermometer is used to verify the temperature inside the oven. Dry-heat sterilizers have had limited value, because it is difficult to maintain the same temperature throughout the load, while the high temperatures and the length of time required to achieve sterility make this method undesirable for many situations. Use dry-heat sterilization only for items that can withstand a temperature of 170 C (340 F).

Decontaminate, clean, and dry all instruments and other items before sterilizing them. The manufacturers' instructions must be followed, and the door to the unit must not be opened while it is in the sterilizing cycle.

Follow these guidelines for sterilizing items using dry heat:

- Wrap instruments in aluminum foil or place in a metal container with a tightly fitting, closed lid to help prevent recontamination prior to use. When using dry heat to sterilize items wrapped in cloth, be sure that the temperature does not exceed 170 C (340 F).
- Instruments with cutting edges should be sterilized at lower temperatures (160 C [320 F]), because higher temperatures can destroy the sharpness of cutting edges.
- Place loose instruments in metal containers or on trays in the oven and heat to the proper temperature.
- After the appropriate temperature is reached, begin timing. Depending on the temperature selected, the total cycle time (preheating, sterilization time, and cool down) ranges from 2.5 hours at 170°C to more than 8 hours at 121°C. The recommended length of time depends on the temperature:
  - 60 minutes at 170°C (340°F)
  - 120 minutes at 160°C (320°F)
  - 150 minutes at 150°C (300°F)
  - 180 minutes at 140°C (285°F)
  - Overnight at 121°C (250°F)
- After cooling, remove packs or metal containers (or both) and store in a cool dry area. Loose items should be removed with sterile forceps and used immediately or placed in a sterile container with a tightly fitting lid.

Chemical Sterilization

Chemical sterilization, often called *cold sterilization*, is an alternative to high-pressure steam or dryheat sterilization, particularly for items that would get damaged by high-pressure steam or dry heat. Glutaraldehyde is often used for chemical sterilization. Because glutaraldehyde works best at room temperature, chemical sterilization cannot be assured in cold environments (temperatures less than 20ºC or 68ºF), even with prolonged soaking.

First decontaminate, clean, and thoroughly dry all instruments and other items to be sterilized—water from wet instruments and other items dilutes the chemical solution, thereby reducing its effectiveness—and then follow these steps for chemical sterilization:

1. Follow the manufacturers' instructions to prepare a 2 percent glutaraldehyde solution or appropriate concentration of another chemical solution. After preparing the solution, put it in a clean container with a lid. Always mark the container with the preparation date and the expiration date.
2. Open all hinged instruments and other items and disassemble those with sliding or multiple parts. Completely submerge all instruments and other items in the solution. Place any bowls and containers upright, not upside down, and fill with the solutions. The solution must contact all surfaces to ensure sterilization.
3. Follow the manufacturers' instructions regarding the time necessary for sterilization. In general, if the solution contains 2 percent glutaraldehyde, cover the container and allow the instruments

and other items to soak for 10 hours. Do not add or remove any instruments or other items after you begin timing.

4. Use large, sterile pickups (lifters, cheatle forceps) or sterile gloves to remove the instruments and other items from the solution.

5. Rinse items thoroughly with sterile water to remove the residue that chemicals leave on instruments and other items. This residue is toxic to skin and tissues.

6. Place the instruments and other items on a sterile tray or in a sterile container and allow them to air dry before use. Use the instruments and other items immediately or keep them in a covered and dry sterile container and use them within one week.

Note: *Sterilizing chemicals should be changed after 14 days, when they become visibly dirty, or according to manufacturers' instructions.*

Monitoring Sterilization Procedures

A variety of indicators can be used to monitor the sterilization process:

- Use biological Indicators at regular intervals: *Bacillus stearothermophilus*, weekly and as needed for steam sterilizers; and *Bacillus subtilis*, weekly and as needed for dry-heat sterilizers.
- Chemical indicators include tape or labels that monitor time, temperature, and pressure for steam sterilization; and time and temperature for dry-heat sterilization.
- Use external indicators to verify that items have been exposed to the correct conditions of the sterilization process and that the specific pack has been sterilized.
- Place internal indicators inside a pack or container in the area most difficult for the sterilization agent (steam or heat) to reach (for example, in the middle of the linen pack).
- Mechanical indicators for sterilization provide a visible record of the time, temperature, and pressure for that sterilization cycle. This is usually a printout or graph from the sterilizer, or it can be a log of time, temperature, and pressure kept by the person responsible for the sterilization process that day. This is the least expensive way to make sure that the sterilization process was carried out according to the guidelines.

9.5 Storage

Proper storage of sterile instruments and equipment is essential in ensuring that the product maintains its level of sterilization or disinfection. Most instruments and equipment are dry and packaged once they have been sterilized. Store them in a clean, dry environment that is protected from any damage. The storage area should be separate, enclosed, and located next to or connected to the area where sterilization occurs. (In smaller clinics, this area may be just a room close to the Central Supplies Department or in the Operating Room.) The area should be used solely to store sterile and clean supplies for patient care. Access to this area should be limited.

Instructions for Storing Sterile Items

- Keep the storage area clean, dry, dust-free, and lint-free.
- Keep the temperature at approximately 24^0C and the relative humidity below 70 percent when possible.
- Store sacks and containers with sterile (or high-level disinfected) items 20-25 centimeters off the floor, 45-50 centimeters from the ceiling, and 15-20 centimeters from an outside wall.

- Do not use cardboard boxes for storage. Cardboard boxes shed dust and debris and can harbour insects.
- Date and rotate the supplies (first in, first out). This process serves as a reminder, but does not guarantee the sterility of the packs.
- Distribute sterile and HDL items from the storage area.
- Clean supplies, HLD items, and sterile supplies should not be stored together, that is, supplies that have been cleaned, but not sterilized or disinfected, should be kept separate from items that have been disinfected, etc.
- Unwrapped items should be used immediately and should not be stored.

Shelf Life

The shelf life of an item after sterilization is event related:

- The item remains sterile until something causes the package or container to become contaminated—the time that has elapsed since sterilization is not always the determining factor.
- To make sure items remain sterile until you need them, prevent events that can contaminate sterile packs, and protect them by placing them in plastic covers (thick polyethylene bags).
- Before using any sterile item, look at the package to make sure the wrapper is clean, dry, and intact; the seal is unbroken, and no water stains are present.
- If the quality of wrapping cloth is poor and plastic bags are not available, limit the shelf life to help ensure the sterility of the instruments.

10 CLINICAL LABORATORY SAFETY PRECAUTIONS

Any laboratory worker who handles blood or potentially infected body fluids is at risk of accidental injury or exposure. Individuals working in clinical laboratories or research units that isolate or handle pathogenic microorganisms, such as microbiology, biochemistry, hematology, and pathology laboratories, are at the greatest risk. Adherence to standard precautions is necessary to minimize the risk of laboratory-acquired infections and to promote a safe environment for all workers in the laboratory and elsewhere. A well-designed laboratory, proper equipment, and well-trained personnel all contribute to the protection of laboratory workers.

Concentrated cultures of certain microorganisms such as *N. meningitidis, M. tuberculosis, Brucella spp, B. anthracis,* and *Y. pestis* in the microbiology laboratory provide opportunity for laboratory-acquired infection during subculturing, mixing, vortexing, and centrifugation. Other hazardous biological materials and organisms include the following:

- Infectious organisms (bacteria, fungi, parasites, prions, rickettsias, and viruses), which can cause disease in healthy humans and create a significant impact in the environment or agriculture
- Human or primate tissues, fluids, cells, or cell culture
- Recombinant DNA
- Animals known to be vectors of zoonotic diseases

HAZMATs that could be harmful if used or manipulated improperly include the following:

- Physical items, such as needles and glass
- Chemical agents, such as acids and alkalis
- Biological agents, such as clinical samples and microbial cultures

10.1 Biosafety Levels

Biosafety levels are a combination of primary and secondary containment and safety guidelines that are designed for use in microbiology laboratories and bacteriology research units functioning at four levels (BSL-1 to BSL-4) of increasing risk:

- **BSL-1** is the basic level of protection and is appropriate for agents that are not known to cause disease in normal healthy humans. BSL-1 requires the lowest level of containment and microbiologic safety guidelines, which are entirely based on standard laboratory practices. These guidelines are recommended for those working with microorganisms, such as *Bacillus subtilis*.
- **BSL-2** is generally applied in bacteriology laboratories where workers are dealing with agents associated with human diseases of varying severity, such as Salmonella species. When standard microbiologic practices are applied, the agents may be handled on open benches, especially if primary barriers, such as facemasks, gowns, and examination gloves, are used when appropriate. The use of biologic safety cabinets (BSCs) and safety centrifuges might be necessary.
- **BSL-3** is aimed at containing hazardous microorganisms that are transmitted primarily by the airborne route (aerosols and droplets), such as TB or varicella (chicken pox). Laboratory staff members that work in these situations must be trained in the use of appropriate equipment, including suitable ventilation systems and the use of BSCs.
- **BSL-4** is designed for use where agents that cause life-threatening or untreatable diseases, such as haemorrhagic fever viruses, are present and transmittable by air. Workers who perform procedures in these laboratories require special training and they must use BSCs or wear full-body, air-supported, positive-pressure suits. In addition, the facility itself must be totally isolated from other laboratories and have specialized ventilation and waste-management systems.

10.2 Biosafety Practices

Treat all specimens from all patients as potentially infectious:

- All laboratories must make hand-washing facilities available in each procedure room.
- Collect all specimens for laboratory examination carefully using standard precautions. Transport specimens to the laboratory in a manner that prevents breakage or spillage. Tightly seal the caps of all containers and place the requisition forms in a separate envelope instead of wrapping them around the specimen container. This separation will prevent the forms from getting contaminated.
- Collect specimens in well-constructed containers with a secure lid to prevent leakage during transport.
- A requisition form issued by the department that is requesting testing must accompany all specimens submitted to the laboratory. Departments must complete requisition forms properly and provide all of the data required by the headings on the forms. Requisition sheets should be affixed to, but not stapled to, the outside of the plastic bag.
- Supply all additional information relevant to the nature of the specimen, time of collection, and treatment regimen of the patient that might affect the testing and reporting.
- Transport specimens to the laboratory under conditions that preserve the specimen's integrity and that protect the HCW.
- Wear gloves when handling and processing specimens.
- Minimize splashing, spattering, and generating droplets while performing laboratory procedures. (All laboratory staff should adhere to appropriate SOPs.)
- Laboratory workers should follow mechanical pipetting procedures.
- Decontaminate work areas after spills of blood, body fluids, or other potentially infectious material and after completing work.
- Contaminated equipment needing servicing or repair should be decontaminated externally and internally.
- Use disposable specimen containers when possible.

Inhalation, ingestion, puncture wounds, and contamination of skin and mucous membrane are the most common ways that infections from pathogenic organisms occur among laboratory workers.

10.3 General Recommendations for Laboratory Safety

All material of human origin—blood, body fluids, and tissues—should be treated as potentially infectious. Take the following precautions when handling these materials.

- Wear new examination gloves when handling blood, body fluids, or specimens containing pathogenic microorganisms.
- Do not eat, drink, or smoke in the laboratory.
- Do not store food in refrigerators that are used for clinical or research specimens.
- Use proper mechanical devices, such as suction bulbs, for manipulating all liquids in the laboratory. No mouth pipetting is permitted.

- Centrifuge all materials in sealed tubes inside a sealed centrifuge.
- Do not open a centrifuge while it is in motion.
- Always cover the end of blood-collection tubes with a cloth or paper towel, or point them away from anyone's face when opening.
- Decontaminate work surfaces daily or when they become contaminated, such as after spills, with a 0.5 percent chlorine solution.
- Wear protective face shields or facemasks and goggles if splashes and sprays of blood, body fluids, or fluids containing infectious agents are possible.
- Wear heavy-duty or utility gloves when cleaning laboratory glassware.
- Handle sharps with care and dispose of them immediately after use in sharps containers, which should be located close to the work area. Use puncture-resistant, leak-proof containers for sharps.
- Place infectious waste materials in plastic bags or containers.
- Do not perform procedures that produce aerosols, such as mixing or washing, in the open laboratory.
- Report immediately any accident that involves materials of human origin, such as sharps injuries, for appropriate management.
- Vaccinate all laboratory staff members against HBV.

10.4 Hand Hygiene

Hands must be thoroughly washed with plain soap and running water and wiped dry with single-use hand towels after completing laboratory activities, after removing protective clothing, and before leaving the laboratory. Hands must be washed immediately upon contamination with blood or other body fluids.

10.5 Personal Protective Equipment

Laboratory Coats or Gowns

These must be worn while working and must be removed when leaving the laboratory.

Disposable Gloves

Wear clean disposable gloves when there is a risk of the hands coming into contact with potentially infectious materials, contaminated surfaces, or equipment; and follow these instructions:

- Remove gloves after completing laboratory tasks, when using a telephone, or when performing any office work. Gloves must be changed for every task.
- Dispose of gloves after each procedure or when they become overtly contaminated, after completion of work with infectious materials, or when their integrity is compromised.
- Do not wash or reuse disposable gloves.
- Do not touch "clean" surfaces (telephones, door handles, office desks, stationery, computer keyboards, etc.) with gloved hands.
- Do not wear gloves outside the lab.

Face Protection

Equipment for face protection must be worn for anticipated splashes or sprays of infectious or other HAZMATs when microorganisms are manipulated outside the BSC.

10.6 Biosafety Cabinet

A biological safety (biosafety) cabinet (BSC) is a primary containment device that is designed to draw air inward by mechanical means in order to contain infectious splashes or aerosols that are generated during certain laboratory procedures. Biosafety cabinets should be tested and certified at the time of installation within the laboratory, at any time the cabinet is moved, and at least once a year.

There are three types of BSCs, class 1, class 2, and class 3. Most laboratories use class 1 and class 2 BSCs.

Table 4: Types and uses of BSCs

Cabinet Class	Operations and Uses
Class 1	Negative pressure, ventilated cabinets that are usually operated with an open front and a minimum face velocity of air of at least 75 linear feet per minute (lfpm) to protect personnel (not to protect product).
Class 2	Inward airflow velocity to protect personnel (75-100 lfpm); HEPA-filtered downward vertical laminar airflow for product protection and HEPA filtered exhaust air for environmental protection. Class 2 is further subdivided into two types, A and B, based on construction, airflow velocities and patterns, and exhaust systems.
Class 2, Type A	Suitable for microbiological research *in the absence* of volatile or toxic chemicals and radionucleotides, because air is recirculated within the cabinets. HEPA-filtered air is conducted into the room.
Class 2, Type B	These cabinets are hard-ducted to the building exhaust system and contain negative pressure that permits work to be done with toxic chemicals or radionucleotides. The HEPA-filtered air is conducted outside the room.
Class 3	Totally enclosed, ventilated cabinet of gas-tight construction. Class 3 offers the highest degree of personnel and environmental protection from infectious aerosols, as well as protection of research materials from microbiological contaminants. Procedures are conducted through attached rubber gloves. Both supply and exhaust air are HEPA-filtered.

Biological safety cabinets, preferably Class 2, or other appropriate PPE or physical containment devices are used in the following conditions:

- Procedures with a potential for creating infectious aerosols or splashes are conducted. These may include centrifuging, grinding, blending, vigorously shaking or mixing, sonic disruption, opening containers of infectious materials whose internal pressures may be different from ambient pressures, inoculating animals intranasally, and harvesting infected tissues from animals or embryonate eggs.
- High concentrations or large volumes of infectious agents are used. Such materials may be centrifuged in the open laboratory if sealed rotor heads or centrifuge safety cups are used and if these rotors or safety cups are opened only in a BSC.

Note: *HEPA filters remove 99.97 percent of bacteria, viruses, fungi, and spores.*

For guidelines and procedures for handling sharps, see Section 4, Standard Precautions, and for waste disposal, see Section 7, Environmental Management Precautions.

10.7 Disinfection and Sterilization

Work surfaces in laboratories must be decontaminated with a chlorine solution routinely at the completion of work and following any spill of potentially infectious material. Ensure proper contact time and follow appropriate instructions in Section 9, Reprocessing Instruments and Equipment.

In addition, appropriately mark holding containers as follows:

NONINFECTIOUS—TO BE CLEANED

BIOHAZARDOUS—TO BE AUTOCLAVED

10.8 Handling of Specimens

General Guidelines for Collecting, Transferring, and Working with Specimens

Personnel who are responsible for collecting specimens must follow these guidelines:

- Wash hands before collecting each specimen.
- Wear gloves when collecting specimens.
- Follow aseptic techniques when collecting samples.
- Securely close all containers that contain specimens and keep the outside of the container clean.
- Collect samples in a separate area next to the lab, but away from the working area of the lab.

Personnel who are responsible for transferring specimens to the lab must take these precautions:

- Wear gloves.
- Avoid contact with the contents of the container.
- Place specimens in special holders or trays.

Personnel who work with specimens in the lab must take these precautions:

- Wear gloves prior to handling the specimens.
- Wear face and eye protection for procedures that are likely to generate splashes or sprays of blood or other potentially infectious material.
    - Splashguards are an alternative to eye and face protection. These can be mounted on a cabinet and pulled down in front of the face for protection.
    - An eyewash station should be readily available.
- Use care when opening specimens.
- Do not pipette using the mouth.
- Wash hands whenever they are soiled and at the end of the day.

Handling Sputum Specimens

Though sputum becomes noninfectious two weeks after initiation of treatment in patients with TB, handling of sputum during initial diagnosis provides great risk to laboratory workers if precautions are

not adhered to. The formation and exposure to aerosols containing live *Mycobacterium tuberculosis* can be reduced by handling sputum specimens safely.

During preparation of ZN smears:

- Open containers carefully and avoid vigorous shaking of the sputum.
- Use class 1 BSCs that are correctly positioned in the laboratory to prevent outflow of air into the laboratory. The cabinets should be serviced regularly.
- The concentration method use of 1 percent hypochlorite not only increases the sensitivity of the ZN smear, but also increases the safety of handling the specimen by killing the organisms.
- Broken orange sticks should be used instead of loops or swabs for preparing smears.
- In the absence of a centrifuge or a BSC, prepare the smears in a well-ventilated area.

Disposal of Specimens and Containers

- For disposal of waste jars, decontaminate with 0.25 percent hypochlorite.
- For cultures materials, use a 2 percent phenol solution.
- After decontamination, clean and autoclave specimen containers before incineration.

10.9 Spill Cleanup Procedures

Laboratories must develop procedures for dealing with spills and should have appropriate equipment and materials available. A basic spill kit should include a concentrated disinfectant (chlorine bleach or iodophor), a package of paper towels, sponges, heavy-duty utility gloves, forceps for picking broken glass, and a container that can be autoclaved.

Spillage of blood and sputum should be treated with either sodium hypochlorite or sodium dichloroisocyanurate (NaDCC).

- For small spills, wipe with a paper towel soaked in 1 percent hypochlorite.
- For large spills, first cover with NaDCC granules for at least two minutes before cleaning with paper towels. Alternatively, cover the spill with paper towels then gently pour 1 percent hypochlorite and leave for at least two minutes before cleaning.

When spills occur on the body:

- Remove contaminated clothing.
- Wash exposed area vigorously with soap and running water for one minute.
- Obtain medical attention if the spill is on mucous membrane or on nonintact skin.
- Report the incident to the laboratory supervisor.
    - Complete the Accidents, Incidents and Spills Form. (See Appendix 9 for a sample.)
    - As with all medical information, the report must be kept confidential. Information is disclosed only with the HCW's signed consent.

Spill in a BSC

Leave the cabinet turned on and follow these procedures:

- While wearing gloves and a laboratory coat, spray or wipe the cabinet walls, work surfaces, and equipment with the selected disinfectant.

- If necessary, flood the work surface, drain pans, and catch basins below the work surface with disinfectant. Allow at least 20 minutes of contact time.
- Soak up the disinfectant and drain the catch basin below the work surface with disinfectant. Allow at least 20 minutes of contact time.
- Autoclave all cleanup materials and protective clothing. Wash hands and exposed skin areas with disinfectant.
- If the spill overflows into the interior of the cabinet, more extensive decontamination of the cabinet might be necessary.

Spill in the Open Laboratory Level 1 (Biosafety Level 1)

When spills occur in the open laboratory, follow these procedures:

- Notify other HCWs in the area.
- Remove any contaminated clothing and wash exposed skin with soap and water.
- Wear gloves, lab coat, and safety glasses.
- Pour an appropriate disinfectant, such as chlorine, onto the surface of the spill and allow at least 10 minutes of contact time.
- Cover the spill with paper towels, absorb it, and discard the paper towels.
- If the spill contains broken glass, use mechanical tools or rigid sheets of cardboard to remove the glass and place it in a sharps container.
- Spills of concentrated microorganisms should be disinfected first and then absorbed onto disposable materials.

10.10 Packaging of Specimens and Etiologic Agents

Shippers of infectious substances must comply with regulations and prepare shipments in such a manner that they arrive at their destination in good condition and present no hazards to persons or animals during shipment. The packaging must include both inner and outer packaging.

10.11 Environmental Factors and Design Issues for the Laboratory Facility

Location of Laboratory

All laboratories, except the pathology lab, should be located in the same area, preferable away from public areas, and divided into separate entities. The following setup should be used for all laboratories:

- Samples should be collected in a special receiving area located next to the lab.
- Dedicated toilets for the patients should be located next to the receiving area.
- Samples should be transported to the lab by a trained HCW. Samples should be placed in closed tubes for transportation.
- A separate room should be affiliated with the lab for reprocessing glassware and instruments. An autoclave should always be available in this area.

Set-Up of Laboratory

Laboratories should be set up according to the following guidelines.

- Design the laboratory so that it can be easily cleaned. Spaces between benches, cabinets, and equipment must be accessible for cleaning. (Carpets and rugs in laboratories are inappropriate.)
- Provide lockable doors for facilities that house restricted microbiologic agents.
- Provide separate sinks for hand washing and for disposing of body fluids or chemicals.
- Bench tops should be impervious to water and should be resistant to moderate heat and organic solvents, acids, alkalis, and chemicals that will be used to decontaminate the work surfaces and equipment.
- Laboratory furniture should be capable of supporting anticipated loading and uses.
- Cover chairs and other furniture used in laboratory work with a nonfabric material that can be easily decontaminated.
- Install BSCs in such a manner that air flowing into the room and out in the exhaust do not cause the BSCs to operate outside their parameters for containment.
- Locate BSCs away from doors, windows that can be opened, heavily travelled areas, and other potentially disruptive equipment so as to maintain the BSC's airflow parameters for containment.
- Illumination should be adequate for all activities and should not cause reflections and glare that could impede vision.
- Mechanical ventilation systems should provide an inward flow of air without recirculation to spaces outside of the laboratory. Fit windows with fly screens if they open to the exterior.

10.12 Phlebotomy (Blood Drawing)

Blood drawing is one of the highest risk procedures for accidental blood exposure and injuries. When collecting a blood specimen, follow these guidelines:

- Assemble equipment and include needle and syringe or evacuated tube system depending on which is to be used.
- Wash hands with soap and running water and dry them with a single-use towel, or use a hand sanitizer.
- Identify and explain the procedure to the patient or guardian as appropriate.
- Select the site for blood drawing—preferably in the antecubital fossa. Hanging the hand down or warming the site might make it easier to locate the vein. Palpate the area to locate the anatomical landmarks, but do not touch the site after the application of antiseptic.
- Apply the tourniquet about four- or five-fingers width above the selected venepuncture site.
- Ask the patient to form a fist so that the veins are more prominent.
- Wear well-fitting, clean examination gloves.
- Disinfect the site using 70 percent alcohol for 30 seconds and allow to dry completely. Use a spiral motion from in to out to avoid recontaminating the site.
- Anchor the vein by holding the patient's arm and placing your thumb below the venepuncture site.

- Enter the vein swiftly at a 30-degree angle.
- When sufficient blood has been collected, release the tourniquet before withdrawing the needle.
- Withdraw the needle and give the patient a piece of clean gauze or a dry cotton ball to apply to the site with gentle pressure.
- Discard the used syringe and needle or other blood-collection device into a puncture-proof sharps container. Place items that can drip blood or body fluids into the infectious-waste container.
- Label the blood specimen. Check the label and form for accuracy.
- Remove gloves and place them in the general waste.
- Perform hand hygiene. If using soap and water, dry hands with a single-use towel.

10.13 Blood-Transfusion Services

Personnel who work in blood-transfusion services are at risk of accidental injury or exposure to contaminated blood or blood products. Blood-transfusion services involve:

- Selecting, screening, and preparing donors
- Collecting blood from screened donors
- Testing for blood components, antibodies, and infectious diseases
- Storing and transporting blood
- Pre-transfusion testing of patient's blood
- Safely transfusing blood into patients

Donor-Selection Procedure

Follow these procedures for selecting, screening, and briefing donors:

- Complete the medical history and physical examination of each donor to identify any medical problems, behaviours, or events that put the donor at risk of being infected with a serious disease that could be transmitted to the person receiving the transfusion.
- Prior to collecting blood, explain the elements of the donation process to the potential donor in easy to understand language.
- Explain the risks of venipuncture and the potential adverse responses to drawing 400-500 milliliters of blood.
- Explain the laboratory tests that will be performed and how the donor will be informed about the test results, including any other medical abnormalities.
- Perform predonation screening: estimate hemoglobin and take blood pressure and body weight.
- Obtain a written, informed consent form for each donor.

Blood-Collection Procedure

1. Make sure the following items are available:
    - A blood-collection set consisting of a sterile plastic bag containing a sufficient amount of anticoagulant for the quantity of blood to be collected

- IV tubing and large-gauge hypodermic needles
- A pair of clean examination gloves
- Clean tourniquet or blood pressure cuff
- Antiseptic solution and sterile or clean gauze squares or cotton swabs
- Surgical tape
- Towel to place under donor's hand or forearm
- Soap
- A plastic bag or leak-proof, covered waste container for disposal of contaminated items
- A puncture-resistant sharps container

2. Explain the procedure to the donor.
3. Identify the best vein for inserting the IV needle (a prominent, large, and firm vein).
4. Put the tourniquet or blood pressure cuff on the upper arm about 4 centimeters above the antecubital space to confirm that the vein is visible and then release the tourniquet or cuff.
5. If the venipuncture site is visibly soiled, first wash the site with soap and clean water and dry it with a clean cloth, or ask the donor to wash the forearm.
6. Wash your hands and dry them with a clean towel or air dry. (Alternatively, use 5 milliliters of alcohol handrub and rub both hands vigorously until dry.)
7. Place the donor's arm on the clean towel and cleanse an area about 3 centimeters in diameter with an antiseptic solution. Use a circular motion outward from the proposed needle-insertion site over the vein. If using iodine, allow two minutes for the antiseptic to take full effect. Do not touch the area after applying the antiseptic solution.
8. Put the tourniquet or blood pressure cuff on the upper arm again and raise the pressure up to 40-60 mmHg for collecting the blood.
9. Put clean gloves on both hands.
10. Insert the hypodermic needle into the vein without touching the skin, if possible, release the tourniquet or cuff, and then secure the needle by placing a short piece of tape across the bloodcollection tubing below the area cleansed with antiseptic.
11. When the required amount of blood has been obtained, remove the needle without touching the barrel or tip of the needle and place it in a puncture-resistant sharps container.
12. Cover the insertion site with a 2-inch gauze square, and apply pressure until the bleeding stops. Secure the gauze square with surgical tape.
13. Prior to removing gloves, place any blood-contaminated waste items in a plastic bag or leak-proof, covered waste container.
14. Wash your hands or use an antiseptic handrub.

After-Care for the Donor

Following the donation:

1. Have the donor remain resting on a bed or in the donor chair for several minutes.
2. Provide the donor with something to drink and eat.

3. Tell the donor to drink more fluid during the next 24 hours and avoid alcohol and smoking until he or she has eaten more food. Ask the donor to lie down if he or she has any dizziness or nausea.

Handling the Collected Blood

To avoid contamination of collected blood:

- For storing and transporting blood, maintain the temperature between 2°C and 8°C. Monitor temperature continuously and record at least every four hours.
- Test the blood unit without entering the closed collection system.
- Infuse or discard the blood unit within six hours once the closed system has been opened.
- Wear examination or utility gloves and protective eyewear while handling the blood. Segregate the blood bag into a biohazardous container for incineration.

Blood Components and Infectious Diseases

Blood donors should be informed about the tests that will be carried out on the donated blood. Blood should not be released for transfusion unless the results are negative for all tests.

Infectious Diseases

Prior to transfusion, all donated blood should be screened for blood-borne pathologies, antibodies, antigens to HIV-1 and 2, hepatitis B and C viruses, and syphilis, malaria, and others.

Donors should be informed of their HIV status and those who are HIV+ should be referred to the appropriate health facilities for management.

Note: *Even in remote areas where testing facilities are limited, the use of simple or rapid HIV tests (or a combination of the two) for screening is prohibited.*

Recipient (Patient) Procedures

Pre-transfusion

Before transfusing a recipient:

- Withdraw a sample of his or her blood using the recommended IPC practices.
- Confirm the donor's and the recipient's ABO and Rhesus group.
- Cross-match the red cells of the selected donor against the serum or plasma of the recipient to be sure there are no ABO and Rhesus incompatibilities.
- Explain the procedure to the patient if he or she is conscious. Ask the patient or relatives to report any chills, headaches, itching, or rash immediately.
- Correctly identify the blood product and the patient:
  - Confirm the patient's name.
  - Check the compatibility information and expiry date on the blood bag.
  - Check the ABO Rhesus of the patient on the patient card.
  - Double check blood or type of blood product with clinician's order. Check blood for clots.
- Record the patient's baseline pulse, blood pressure, and temperature.

Transfusing

Once the transfusion has started, perform the following procedures:

- Take the patient's pulse, blood pressure, and temperature after the first 15 minutes and half-hourly thereafter.
- Observe the patient for flushing, itching, difficulty in breathing, hives (clear fluids filled lesions on the skin), or rashes when checking the vital signs.

Preventing Complications and HAIs in Patients and HCWs

To prevent complications and HAIs in patients:

- Avoid unnecessary transfusions.
- Screen donors for serious blood-borne infections (HIV, HBV, HCV, syphilis, etc.).
- Collect the donor's blood aseptically into a closed system to minimize contamination.
- Perform all steps in processing the blood within this closed system.
- HCWs should wear gloves while collecting, testing, and transfusing blood.
- HCWs should handle sharps carefully and dispose of them immediately in a puncture-resistant container.
- HCWs should wear PPE at all times.

11 LAUNDRY AND LINEN PROCESSING

In processing linen, staff should be appropriately trained and regularly supervised to help reduce accidents that could lead to increased risk of exposure to infectious materials and HAIs. Although soiled linen could contain large numbers of microorganisms, linen processing poses little risk to HCWs. Work-related infections that do occur are usually a result of failure to practice standard precautions (use of PPE, hand washing, etc.) during and after processing soiled linen. No additional precautions are necessary, regardless of the patient's diagnosis, if standard precautions are used in all situations.

Soiled linen with blood, body fluids, secretions, or excretions should be handled in a manner that prevents skin or mucous membrane exposure, contamination of clothing, and transfer of micro-organisms to other patients and the environment. Laundry workers, as other HCWs, should be offered immunization against HBV.

11.1 General Precautions

Housekeeping and laundry personnel should follow these general guidelines in all stages of processing linen:

- Wear PPE such as gloves and gowns or aprons as indicated when collecting, handling, transporting, sorting, and washing soiled linen. Wash reusable utility gloves after use, allow them to air dry, and discard if punctured or torn.
- Wash your hands whenever you change or remove gloves.
- When collecting and transporting soiled linen, handle it as little as possible and with minimum contact to avoid accidents, injuries, and spreading microorganisms.
- Consider all cloth items, such as surgical drapes, gowns, and wrappers, that have been used during a procedure as contaminated and infectious. Even if there is no visible contamination, the item must be laundered.
- Never place soiled linen on the floor or any clean surfaces.
- Handle soiled linen with minimum agitation to avoid aerosolisation of pathogenic microorganisms. Do not shake linen.
- Watch out for sharps, instruments, or broken glass that might be folded into linen or in the laundry bags.
- Do not sort or rinse linen in patient-care areas.

11.2 Practices and Precautions in Laundry Facilities

Hand-washing facilities should be readily available in laundry facilities. Linen and carts for storing and transporting linen should be handled according to these guidelines:

- Separate clean from soiled linen.
- Use separate carts, labelled accordingly, for dirty and clean linens.
- Use procedures that minimize the risk of cross contamination when transporting linen by cart.
- Transport and store clean linen in a manner that prevents its contamination and ensures its cleanliness.
- Laundry carts or hampers used to collect or transport soiled linen should be covered.

- Clean carts that are used to transport soiled linens after each use with the recommended cleaning product that is used in the health care facility.

Commercial laundries that are used for laundering linen from health care facilities should comply with the IPC policies and guidelines. In particular, adequate separation of clean and dirty laundry in the truck is essential to ensure that there is no possibility of mixing clean and dirty linens.

11.3 Collecting, Sorting, and Transporting Soiled Linen

Collecting Soiled Linen

Collect and remove soiled linen daily and also after each invasive medical or surgical procedure or as needed from patients' rooms. Collect used linen in cloth or plastic bags, containers with lids, or covered carts to prevent spills and splashes, and to confine the soiled linen to designated areas (interim storage areas) until transported to the laundry. If linen is heavily contaminated with blood or body fluids, carefully roll the contaminated area into the centre of the linen and place in a leak-proof bag or container with a lid. Large amounts of faeces or blood clots should be removed from linen with a gloved hand and toilet tissue and placed into a bedpan, toilet, or pit latrine. Tie bags securely when they are three-quarters full and transport them to the laundry area.

Sorting Soiled Linen

Carefully sort all linen in the laundry area before washing it. Do not presort soiled linen or wash linen at the point of use. Sorting must be carefully performed because:

- Soiled linen (large drapes and towel drapes) from the operating room or other procedure areas occasionally contains sharps (scalpels, sharp-tipped scissors, hypodermic and suture needles, etc.).
- Bedding from patients' rooms might contain soiled dressing and be bloodstained or wet with other body fluids.

Note: *Linen from persons with a diagnosis of viral haemorrhagic fevers (for example, Lassa, Ebola, or Marburg) should be separated from other linen, as it requires special handling.*

Follow these guidelines for sorting linens:

- Segregate soiled and nonsoiled linen and place used linen in appropriate bags at the point of generation.
- Place wet linen in a fluid-impervious bag for soiled linen or a regular plastic trash bag before depositing it in a cloth bag for soiled linen.
- Contain linen that is soiled with body substances or other fluids within suitable impermeable bags and close the bags securely for transportation to avoid any spills or drips of blood, body fluids, secretions, or excretions.
- The processing area for soiled linen must be separate from other areas such as those used for folding and storing clean linen.
- Ensure adequate ventilation and physical barriers between the clean and soiled linen areas.
- Always wear protective eyewear, utility gloves, gumboots, and a plastic or rubber apron while handling soiled linen.
- Wash hands after removing gloves.

- Cloth bags are adequate for the majority of patient-care linen. They require the same processing as their contents. This helps prevent spreading microorganisms to the environment, personnel, and other patients. Bags should be colour-coded according to the linen they contain:
    - Red-coded bags should be used for linen from patients with infectious conditions. Disinfect linen before placing it in bags. Place linen in a strong impervious plastic bag to avoid leakage on the linen bag.
    - Yellow bags should be used for soiled linen.
    - White bags should be used for dirty linen from wards and departments and for clean linen from the laundry.
    - Green bags should be used for linen from special departments such as the operating theatre and the labour and delivery wards to be transported to the laundry.
- The storage time for soiled linen before washing is related to practical issues such as available space and aesthetics.

Transporting Soiled Linen

Follow these guidelines for transporting soiled linen:

- Transport dry linen in sealed plastic bags to the laundry.
- Transport collected soiled linen in closed leak-proof bags, containers with lids, or covered carts to the processing area daily or more often as needed. It is not necessary to double-bag or use additional precautions for used linen from patients in isolation.
- Laundry workers should not carry wet, soiled linen close to their bodies even when they are wearing a plastic or rubber apron.

11.4 Laundering Linen

All linen items, including bed sheets, surgical drapes, masks, and gowns, should be thoroughly washed before reuse. Heavy-duty washers and dryers are recommended for the hospital laundry. Decontaminating linen prior to washing it is not necessary unless linen is heavily soiled and will be washed by hand.

Washing Linen by Machine

The following guidelines apply to routine laundering of soiled linens by machine:

- Wash heavily soiled linen separately from nonsoiled linen.
- Wash used linen (sheets, cotton blankets) in hot water (70°C to 80°C), disinfectant, and detergent; rinse; and dry, preferably in a dryer or in the sun.
    - If low-temperature water is used for laundry cycles, use chemicals suitable for low temperature washing at the appropriate concentration.
    - High-temperature washes (hotter than 71.1°C) are necessary if cold water detergents are not used.
- 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.
- Wash coloured and white linen separately.

- Wash linen from the nursery separately.
- When the wash cycle is complete, check the linen for cleanliness. Rewash if it is dirty or stained. (Heavily soiled linen might require two wash cycles.)
- Do not remove excrement by spraying with water.
- Wash woolen blankets in warm water and dry them in the sun or in dryers at cool temperatures, or dry-clean them.

The following guidelines apply to items that require additional cleaning or sterilization:

- Surgical gowns and linens that have been used in sterile procedures should be sterilized by steam after the normal washing-and-drying cycle to destroy any residual spores.
- Autoclave linen that is to be used in the operating rooms or theatres.

Washing Linen by Hand

When washing linen by hand, following these guidelines:

- Wash heavily soiled linen separately from nonsoiled linen.
- Presoaking in soap, water, and bleach is necessary only for heavily soiled linen.
- Wash the entire item in water with soap to remove all soiling, even if no soiling is visible.
- Use warm water and add bleach (30-60 milliliters, about 2-3 tablespoons, of 0.5 percent chlorine solution) to aid cleaning and bactericidal action.
    - Oxygen-based bleach (hydrogen peroxide) is preferable to chlorine solution.
    - Also add some sour mild acetic acid to prevent yellowing of linen, if available.
- Rinse linen with clean water.
- Check items for cleanliness. Rewash if they are dirty or stained.

11.5 Drying, Checking, Ironing, and Folding Linen

The steps for drying, checking, ironing, and folding linen are the same for both hand- and machinewashed linens:

- Completely air or machine dry before further processing. Air dry in direct sunlight, if possible, keeping the fabric off the ground and away from dust and moisture.
- After linen is totally dry, check for holes and threadbare areas.
- Iron and fold clean and dry linen, including drapes, if acceptable. Do not iron and fold inen that is going to be sterilized. If surgical drapes are to be sterilized, do not iron them. Ironing dries out the material, making autoclaving more difficult.

11.6 Storing, Transporting, and Distributing Clean Linen

Storing Clean Linen

Keep clean linen in clean, closed storage areas:

- Use physical barriers to separate folding and storage rooms from soiled areas.

- Keep shelves clean.
- Handle stored linen as little as possible.

Transporting Clean Linen

Transport clean and soiled linen separately:

- Containers or carts used to transport soiled linen should be thoroughly cleaned before being used to transport clean linen. If different containers or carts are used to transport clean and soiled linen, they should be labelled.
- Clean linen must be wrapped or covered during transport to avoid contamination.

Distributing Clean Linen

Protect clean linen until it is distributed for use:

- Do not leave extra linen in patients' rooms.
- Handle clean linen as little as possible.
- Avoid shaking clean linen, which releases dust and lint into the room.
- Clean soiled mattresses before putting clean linens on them.

12 OCCUPATIONAL SAFETY AND EMPLOYEE HEALTH

Health care workers are exposed to blood and other body fluids in the course of their work. Consequently, they are at risk of infection with blood-borne viruses including HIV, HBV, and HCV. In addition, they are at risk of contact diseases and respiratory infections. Risk of infection for HCWs depends on the prevalence of disease in the patient population, the nature and frequency of exposure, and their vulnerability.

To eliminate or minimize the risk of infection, health care facilities must institute good health and safety measures and ensure that all HCWs adhere to them. These measures include the following:

- Relevant IPC training for HCWs
- Issuing PPE to HCWs
- Establishing an effective occupational health programme that includes immunization, PEP, and medical surveillance

12.1 Policies for Occupational Safety and Employee Health

All health care facilities should institute as many engineering and work practice controls as possible to eliminate or minimize employees' exposure to blood, body fluids, and other potentially infectious materials:

- All HCWs should be knowledgeable about specific operating procedures pertinent to their work area.
- All supervisors should be responsible for informing HCWs of any special precautions pertinent to their areas of work.
- All HCWs should adhere to standard precautions and to additional precautions as necessary.
- All health care facilities should have PEP procedures in place.
- All HCWs should immediately report an incident of contact with blood or other potentially infectious material that is sustained during the course of occupational duties, according to the PEP procedures.
- Susceptible workers, including pregnant women, should not care for patients with chickenpox, herpes zoster, or rubella.
- Responsibility for compliance with IPC policies and guidelines, including PEP, rest with the supervisor and individual employee.
- HBV vaccine should be offered to all HCWs whose occupational tasks place them at risk of exposure to blood or other potentially infectious material.

12.2 Improving Compliance

The following recommendations are intended to improve compliance with procedures and eliminate the risk of HAIs:

- Establish appropriate engineering controls in health care facilities.
- Make available and use appropriate supplies and equipment:
    - Readily accessible hand-washing facilities

- Puncture-resistant, leak-proof, labelled or colour-coded sharps containers that are located as close as possible to their places of use
- Leak-proof containers for specimens and other regulated wastes that are properly labelled or colour-coded
- Appropriate equipment specific to the type of work involved
- An easily accessible first-aid kit in all departments

- Implement controls for work practices:
  - Prohibit eating, drinking, smoking, applying cosmetics, and handling contact lenses in the work areas and on work surfaces that carry an inherent potential for contamination.
  - Do not store food and drink in refrigerators, freezers, or cabinets where blood or other potentially infectious material is stored. Such storage equipment should be clearly labelled to prevent this possibility.
  - Wash hands and other skin surfaces that become contaminated with blood or other potentially infectious materials immediately and thoroughly with soap and running water.
  - Thoroughly wash with water mucous membranes that become contaminated.
  - Prohibit HCWs with open wounds or weeping skin rashes from all direct patient-care, potentially hazardous laboratory procedures, and handling patient-care equipment until recovery. Cuts or abrasions should be protected with a waterproof dressing and gloves prior to performing any procedure that involves contact with blood and other potentially infectious material.
- Adequately staff health care facilities.
- Implement policies and procedures in the workplace.
- Provide information and training.
- Record and monitor exposures to blood and body fluids.
- Monitor and maintain surveillance of work practices.

12.3 Training

All health care facilities should develop and implement appropriate orientation and in-service training programmes for new employees and ongoing in-service training for existing employees:

- Training should be designed to cover all cadres of staff, including doctors, nurses, clinical officers, laboratory workers, nonmedical workers, and support staff.
- Training should highlight the employees' roles and responsibilities with respect to IPC.
- Health and safety training should ensure that workers know and understand the potential risks that are associated with waste from health care facilities, the value of immunization against HBV, and the importance of using the PPE available to them.

12.4 Occupational Exposure

Occupational exposure to blood can result from percutaneous injury (needle-stick or other sharps injury), mucocutaneous splashing (splashing of blood or other body fluids into the eyes, nose,

or mouth) or blood contact with nonintact skin. Needle-stick injury is the most common form of occupational exposure to blood and the most likely to result in infection. The most common causes of needle-stick injuries are recapping and unsafe collection and disposal of sharps.
Health care workers in areas such as operating, delivery, and emergency rooms and laboratories have a higher risk of exposure. Cleaners, health care waste collectors, and others whose duties involve handling blood-contaminated items are also at risk.

The health care worker is also exposed to various other infections. These include respiratory (TB, influenza), mucocutaneous (syphilis, anthrax) and those affecting other body systems.

12.5 Strategies to Protect HCWs

Most exposure to blood and body fluids in health care settings is preventable. Strategies to protect health workers include the following:

- Implementing standard precautions
- Immunizing all health workers against HBV, especially those working in health care settings
- Providing PPE
- Managing exposures in a timely manner
- Eliminating unnecessary sharps and injections

Successful implementation of these strategies requires an effective quality improvement or infection prevention and control committee (IPCC) with support from the hospital management team.

12.6 Managing and Preventing Sharps Injuries

Procedures for Sharps Injuries

Immediately following an exposure to blood or body fluids with visible blood, the HCW should follow these procedures:

- Wash sharps injury sites and cuts with soap and water. Do not squeeze the injury site.
- Irrigate eyes with clean water, or saline.
- Report to a designated person and receive the first dose of ARVs.
- Visit the designated clinician for initial assessment and counseling for follow-up testing and appropriate treatment.
- Assess the serological status of the source patient, if known.
- Obtain PEP based on HIV and hepatitis B status.

Facility Interventions To Reduce Sharps Injuries

Eliminate the use of needles where safe and effective alternatives are available. When sharps must be used, follow these guidelines:

- Use devices with safety features and evaluate their use to determine which are the most effective and acceptable.
- Incorporate improved engineering controls (modifications in devices) into a comprehensive program. Examples of engineering controls include a sheath that can slide over a needle once

an injection is given, an angiocatheter that offers a retractable needle once the catheter is in the vein, and needleless connectors for IV systems.

- Train HCWs on newly introduced devices.

Programmatic Interventions To Reduce Sharps Injuries

- Analyze needle-stick and other sharps-related injuries in the facility to identify hazards and injury trends.
- Set priorities and strategies for prevention by examining local, national, and international information about risk factors for sharps injuries and successful intervention efforts.
- Ensure that HCWs are properly trained in the safe use and disposal of needles. This is particularly important for less experienced or new personnel as the frequency of injuries tends to be higher when learning to use invasive devices.
- Modify work practices that pose a needlestick-injury hazard to make them safer.
- Promote safety awareness in the work environment.
- Establish procedures for and encourage the reporting and timely follow-up of all needlestick and other sharps-related injuries.
- Monitor and evaluate prevention efforts and provide feedback on performance to personnel.

12.7 Exposure to HIV

The risk of occupational transmission of HIV to medical personnel has been recognized since 1984. Correct estimation of the likelihood of transmission following occupational exposure is limited by the relative infrequency with which HIV transmission to HCWs is reported. The estimated risk of HIV transmission following a single needle-prick exposure is about 0.32 percent.

Type and Risk of Exposure to HIV

There is a risk of exposure whenever nonintact skin (through percutaneous sharps injury or skin abrasion) or mucous membranes through splashes to the eyes, nose, or oral cavity) come in contact with a potentially infected body fluid from a source that is HIV-positive or has unknown HIV status. Body fluids that can transmit HIV include blood; genital secretions; and cerebrospinal, amniotic, peritoneal, and pleural fluids.

The likelihood of HIV infection following exposure is affected by the following factors:

- Type of contact—intact skin or broken skin
- Quantity of blood
- Disease status of source patient
- Disease status of person injured (terminal illnesses and acute or recent infections)
- Host defenses
- Access to PEP

Table 5: Degree of risk of HIV-infection after occupational exposure

	Low Risk	Medium Risk	High Risk
Type of Exposure	Intact skin	Mucus membrane / nonintact skin	Percutaneous injury
Source	HIV negative	HIV status unknown: Clinically well/unwell	HIV positive with advanced disease, or confirmed drug resistance (consider treatment history)
Material	Saliva, tears sweat, feces, urine, sputum, vomitus	Semen, vaginal secretions, pleural, pericardial, peritoneal, amniotic fluids	Blood and blood body fluids: CSF; viral cultures in labs, and amniotic fluids

Note: Standard HIV-testing and counselling protocols should be followed in testing the source of the exposure, including informed consent and confidentiality.

PEP

Health care workers should have immediate access to PEP, 24 hours a day, seven days a week, regardless of the location or type of work they do. The minimum care following potential exposure to HIV should be risk assessment and the first dose of PEP medication.

When PEP Is Not Indicated

Post-exposure prophylaxis is not indicated under the following circumstances:

- If the exposed person is already HIV-positive
- If the exposure does not pose a risk of transmission:
  - Exposure of intact skin to potentially infectious body fluids
  - Exposure to noninfectious body fluids (such as faeces, saliva, urine, and sweat)
  - Exposure to body fluids from a person known to be HIV-negative, unless this person is
  - identified as being at high risk for recent infection and thus likely to be within the window period
- If the exposure occurred more than 72 hours previously

When PEP Should Be Offered

Assess the following to evaluate eligibility for HIV PEP:

- The timing of the potential exposure
- The HIV status of the person exposed
- The nature and risk of the exposure
- The HIV status of the source of the potential exposure

A starter pack (or a first dose) of PEP drugs should be offered to individuals who are determined to be at risk as soon as possible, within one hour and not later than 72 hours, after exposure. Do not offer PEP to anyone more than 72 hours after exposure.

An HIV test should normally not be a condition of initiating PEP, nor should PEP be delayed until the results of a HIV test become available.

Counselling the HCW for PEP

At the time that the HCW first presents after exposure, counselling should be provided about their risk, the need for PEP, and its specific aspects. The counselling should include information about the importance of adherence to the regimen, the possibility of side effects or toxicity, possible resistance to antiretroviral (ARV) drugs, and the risk of transmission. The counselor should assess the HCW's understanding of the dosing instructions.

Risk-reduction counselling should be reinforced in later visits with appropriate follow-up support services to maximize adherence to the PEP regimen and to manage any side effects. Counselling to reduce risk is also necessary to prevent the transmission of HIV. Exposed persons should be counseled as follows:

- Use condoms or other protective preventive measures with sexual partners until an HIV test after six months is negative.
- Discontinue breastfeeding (if applicable).
- Do not donate blood.

Discussing the risk of HIV transmission associated with consensual sex after a person has been occupationally exposed could be difficult given the sensitive nature of the issue, but this dialogue is essential. HCWs need to be aware that some of the exposed people might not welcome the prospect of having to talk to sexual partners about the need to use a condom, and this can create barriers to follow-up and PEP adherence. Offering exposed individuals assistance in talking to their sexual partners about using condoms might be appropriate.

People who have been exposed to HIV require emotional support in the period following the exposure. The mental-health and social-service needs of these people should thus be met whenever possible.

In the process of seeking informed consent for HIV PEP, people who have been exposed to HIV must be made fully aware of the following:

- Their risk of acquiring HIV infection from the specific exposure
- What is known and not known about the efficacy of PEP
- The importance of taking an HIV test and receiving appropriate post-test counseling
- The need for mandatory HIV testing to rule out the possibility that they might already be infected with HIV
- The importance of adhering to the medicine
- The duration of the course of medicine (four weeks) and the necessity of continuing the medication in order to get the full benefit of PEP (if the source to which they were exposed was HIV positive)
- The common side effects that may be experienced while taking PEP medicine

Note: *Informed consent for PEP services need not be in writing.*

People already living with HIV should be referred to an appropriate clinic for treatment of their infection, and if they had started PEP, the medication will be discontinued if their initial HIV test is positive, because this medication does not work for people living with HIV and could increase the risk of drug resistance among people already infected.

People with discordant rapid HIV test results should be offered PEP while waiting for results of the pending laboratory-based confirmatory testing.

Counselling women of childbearing age about the use of condoms and getting pregnant during PEP is critical. Whereas most drugs that are prescribed for PEP are safe during pregnancy, women should be informed of the possible risk of transmitting HIV to the baby during pregnancy, especially at the initial stage of infection. Women who are breastfeeding should be told that although taking PEP is not harmful, if a woman gets infected by HIV while breastfeeding, the risk of transmitting HIV through breastfeeding is higher at the early stage of infection. Appropriate counselling should include a discussion of safe alternatives to breastfeeding if they are acceptable, feasible, affordable, safe, and sustainable. Exclusive breastfeeding is strongly recommended for babies less than six months of age whenever alternatives are not possible.

PEP Drug Regimens

Two-Drug Regimen. A two-drug regimen based on two nucleoside reverse-transcriptase inhibitors should be used when drug resistance is not suspected. This minimizes the risk of side effects and toxicity from ARV drugs and the consequent negative impact on adherence to PEP. A regimen of two nucleoside reverse-transcriptase inhibitors is adequate where background prevalence of resistance to antiretroviral therapy (ART) in the community is less than 15 percent as determined through threshold surveys and if the source person has either never used ART or is unlikely to have an HIV infection resistant to ART, based on ART and adherence history.

Table 6: Recommended two-drug combination therapies for HIV PEP

Preferred Regimens	Alternative Regimens
zidovudine + lamivudine	tenofovir + lamivudine stavudine + lamivudine

The National ART Taskforce should be consulted for specific guidelines where background prevalence of resistance to nucleoside-analogue reverse-transcriptase inhibitors in the community is known to exceed 15 percent.

Three-Drug Regimen. If ARV drug resistance is known or suspected in the source patient, a three drug regimen based on two nucleoside reverse-transcriptase inhibitors plus a boosted protease inhibitor is recommended. Either of the following is an indication for this regimen:

- The source person is HIV positive and is on ARVs.
- The source person's HIV status is unknown and the background prevalence of resistance to ART in the community is known to exceed 15 percent.
- The source person is on ART and there is likelihood of treatment failure. Consultation with a senior consultant is important to offer the best PEP, but this should not delay the initial doses.

Table 7: Recommended three-drug combination therapies for HIV PEP

Preferred Regimens	Alternative Regimens
zidovudine + lamivudine plus lopinavir with ritonavir boost	stavudine + lamivudine plus lopinavir with a ritonavir boost or others in consultation with HIV care clinician

Notes: *Nevirapine (NVP) is not recommended for PEP due to the risk of toxicity.*

Efavirenz (EFV) should be avoided in women of childbearing age, because it is teratogenic.

If the resistance profile of the source person is known, the selection of PEP medicines should take that profile into account.

PEP Side Effects

The most commonly reported side effects are nausea and fatigue. Side effects can be reduced, for example, by taking prescription drugs (such as antiemetic for nausea) and by taking medicines with food. It is important for the person to anticipate and understand the side effects to avoid confusing them with symptoms of HIV seroconversion.

Duration of PEP

The recommended duration of PEP for HIV infection is 28 days. The first dose of it should always be offered as soon as possible after exposure and the full PEP should be taken, unless there are specific reasons to stop. Starter packs with an incremental, full 28 days of dosing can be used.

Laboratory Evaluation

Baseline HIV Testing

Baseline testing for HIV antibodies should be done to establish serostatus of the HCW at the time of exposure. This allows identification of HCWs who are already living with HIV, thereby avoiding the use of PEP for such people. Rapid HIV testing is the preferred option for testing both the exposed and source person. Rapid testing reduces the risk of prescribing PEP to people already infected. It also helps prevent giving PEP to an exposed person unnecessarily, that is, when the source person tests negative for HIV infection or is unlikely to be in the window period.

If delays in testing of HIV are common, first dose of PEP should be provided based on the risk evaluation and the likelihood that the source person is HIV positive. Further evaluation should be made as soon as possible after the test results are known.

A positive rapid test should be confirmed with a second, different rapid test. If rapid testing is not available, offer pre-test counselling. People who have a positive rapid test result should be referred to a comprehensive care clinic for management and further follow up.

Follow-Up HIV Testing

Follow-up testing should be performed at 6 and 12 weeks and six months post-exposure, regardless of the use of PEP.

Other Laboratory Testing

Additional laboratory testing should be offered on an individual basis:

- Test haemoglobin level when AZT is used for PEP. AZT should be avoided if anaemia is confirmed.
- Test female workers of reproductive age for pregnancy.
- Test for other blood-borne diseases such as HBV and HCV, depending on the nature of the risk and the local prevalence.

Record-Keeping

PEP services need to be documented at several levels. A national registry should be maintained to document the extent and outcomes of PEP use. Data are also needed to evaluate PEP services and identify trends, to make comparisons across services and over time, to guide future service planning and resource allocation, to support operational studies, and to demonstrate accountability to donors. This can often be facilitated by using a set of programme indicators. At the local level, incident reports are critical for reviewing when and how exposure occurs and for identifying safety concerns and possible preventive measures.

The quality of data will be compromised if reporting requirements are excessively time-consuming, too complicated, or too difficult. Thus, record-keeping systems should be kept as simple as possible. Data should be collected and analyzed based on existing collection mechanisms whenever possible. The data collected as part of the record-keeping system also need to be reviewed and reported. The results of any data analysis should be shared with service providers and stakeholders.

Maintaining the confidentiality of client data is of paramount importance. Written records of risk assessments, HIV tests, and PEP prescriptions should be subject to the same rigorous confidentiality controls as any other medical records. Secure systems for storing data and controls on access to medical records should be developed.

Clinical Follow-Up

Follow-up and clinical monitoring to determine adherence and to identify and manage side effects should be provided. All available methods of communication should be considered; for example, if in-person contact is not possible, a system of 24-hour telephone contact with service providers might be a suitable alternative.

Follow-Up Counselling

In addition to the counselling outlined above, appropriate psychosocial support and further treatment assistance should be offered to all people who have received PEP, as and when required. Exposed individuals should be made aware of the support services available and how to access them until the entire process—including all testing—is completed. This could be achieved by using a wider range of communication methods or by partnering with other local services to provide support during extended hours.

Table 8: Summary of clinical management of PEP for HIV

Item	Recommended Action and Notes
Eligibility	Exposure was within 72 hours. Exposed individual is not known to be infected with HIV. Significant exposure occurred. Person who was the source of exposure is HIV-infected or has unknown HIV status.
Informed consent for PEP	Inform HCW about risks and benefits. Consent may be given verbally.
Medicine	Two nucleoside-analogue reverse-transcriptase inhibitors (usually part of first-line ART medicines) should be dispensed by an appropriately qualified person.
Time to initiation	The initial dose of ART medicines should be given as soon as possible, but no later than 72 hours after exposure.
Duration of therapy	Medication should be taken for 28 days.
HIV testing with informed consent and pre- and post-test counselling according to protocols	Conduct baseline HIV test in the exposed person. Follow-up HIV testing at 6 and 12 weeks and 6 months after exposure. Conduct rapid HIV test of the source person if feasible and if informed consent is obtained. Use standard operating procedures.
Additional laboratory evaluations	Test for pregnancy, Haemoglobin (for zidovudine-containing PEP regimens), HBV and HCV screening if available.
Counselling	Stress the need for adherence and discuss side effects, risk reduction, trauma or mental health problems, social support, and safety.
Referral	Make referrals as appropriate.
Record-keeping	Maintain accurate, confidential records.
Clinical follow-up	Assess and manage side effects. Assess and support adherence.

12.8 Exposure to HBV

The suggested steps for managing an injury are as follows:

1. Treat the exposure site appropriately.
2. Give tetanus immunization or booster if more than 10 years have passed since immunization.
3. Assess the risk of HBV exposure and determine the immune status of the patient (history of jaundice, hepatitis, or previous immunization with hepatitis B vaccine).
4. If possible, collect a specimen from the HCW and from the patient for HBsAg testing.
5. Give the first dose of HBV vaccine, which should be repeated at one and six months. If hepatitis B immunoglobulin (HBIG) is available, give 5 milliliters intramuscularly for passive immunization as soon as possible, but within seven days of exposure.

Table 9: Management of occupational exposure to HBV

HBV Immunization	Personal Protection	Post-exposure Management
Routine immunization of HCWs against infection with HBV is an effective way to protect them. HBV is the most infectious blood-borne virus. Long-term sequelae of HBV infection include liver cirrhosis and hepatocellular carcinoma. HB vaccine is effective, relatively inexpensive, and widely available. All HCWs should be immunized. Pre-vaccination serological testing is not necessary. Use a 0-, 1-, and 6-months schedule of three injections. If possible, measure antibody levels between two to six months after the last dose. Do not administer boosters routinely—protection is life long.	PPE (gloves, goggles or glasses, masks, gowns, and plastic aprons) should be used to minimize risk of infection. Needle-stick prevention devices (devices where the sharp is sheathed or retracted after use) should be used where available. Adequate supplies of PPE in all areas should be available. Involvement of staff in the selection of PPE improves compliance to its use since equipment that is of poor quality or uncomfortable to wear is unlikely to be used. Staff must be trained in the correct use of PPE. Use of influential senior staff as role models might promote the use of PPE. Monitor compliance and inappropriate use of PPE. Inappropriate use of gloves wastes resources. Compliance with eye protection often requires additional efforts. Safe disposal of used PPE must be ensured.	The risk of infection following a needle-stick injury with a needle from an infected source patient is 0.3% for HIV, 3% for HCV, and 6%-30% for HBV. An effective response to occupational exposure to blood or other body fluids involves: • Clear policy guidelines and procedures posted in visible places • Confidentiality of exposed staff and source person • Training of HCWs on prevention and what to do after exposure • Rapid access to clinical care, PEP. • Testing of source patient and exposed staff • Injury-prevention assessment Provide immediate care to wound, encourage bleeding, and wash with soap and water. Do not scrub or cut the site. Report exposure. Assess infection risk: the type of blood-borne infection and the status of source person Treat appropriately, follow-up, and counsel.

12.9 Exposure to HCV

There is no post-exposure vaccine or drug prophylaxis for HCV (immunoglobulin is ineffective). Prevention of exposure, therefore, is the only effective strategy for preventing HCV. The following steps should be considered for follow-up of HCWs who become exposed to HCV-positive blood or other body fluids:

- Conduct baseline testing of the source patient (if available and a consent form is signed) for anti-HCV antibody (if the test is available).

- Conduct baseline and six-month follow-up testing of exposed HCW for anti-HCV anti-body and liver function tests.
- Refer the exposed HCW to an appropriate clinician for treatment of early HCV infection with appropriate medication, such as glycated α-interferon, before significant liver damage occurs.

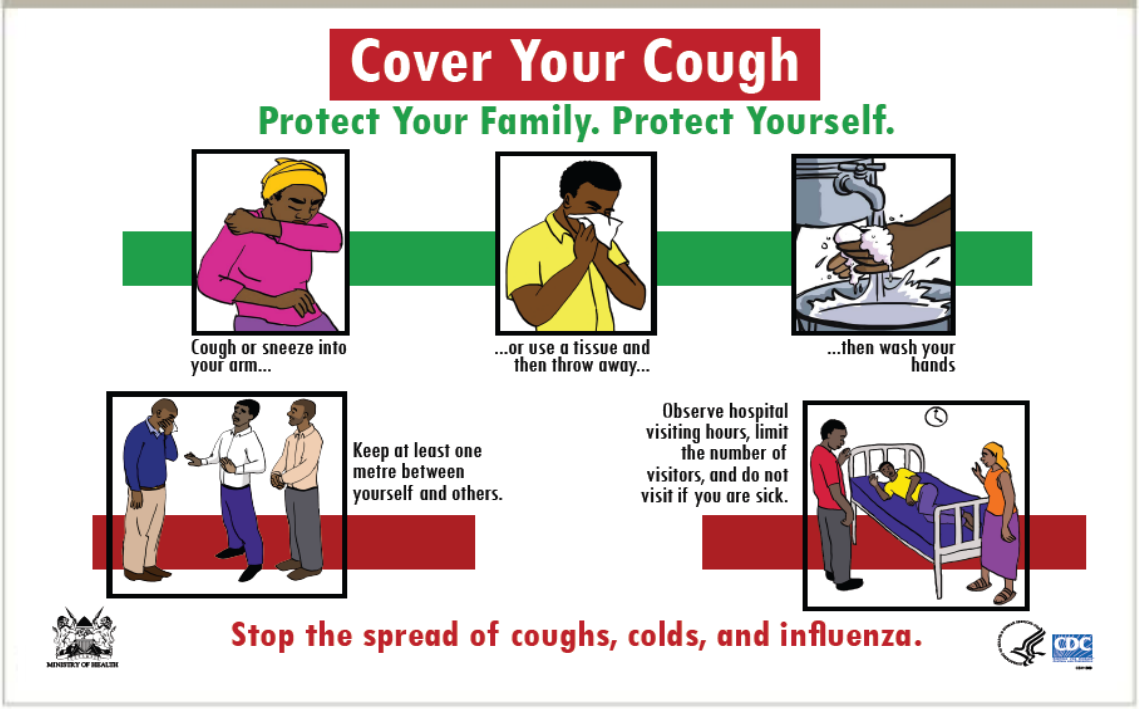
12.10 Respiratory Infections

Health care workers have varying risks for exposure to respiratory infections such as TB, influenza, and severe acute respiratory syndrome (SARS). To prevent and limit respiratory illnesses in health care settings, a universal respiratory-hygiene strategy should be adopted in all health care facilities:

- Post visual alerts at the entrances to all health care facilities, instructing patients and those who accompany them to:
  - Inform health care personnel of symptoms of a respiratory infection when they first register for care.
  - Practice respiratory hygiene.
  - Advise visitors with respiratory symptoms to defer their visit until symptoms have resolved.
- Provide a surgical mask and instructions on its proper use and disposal to all patients and visitors who have symptoms of an infectious respiratory illness (cough, runny nose, sore throat, or sneezing). Also provide instructions on hand-hygiene.
- For those who cannot wear a mask, provide tissues and instructions on when to use the tissues (for example, when coughing, sneezing, or controlling nasal secretions), where to dispose of them, and the proper hand hygiene after using them. Emphasize the importance of following these instructions.
- Make soap and running water readily available for washing hands and make waste bins available for disposing of tissues.
- Provide hand-hygiene materials in the waiting room areas and encourage persons with respiratory symptoms to perform hand hygiene.
- Instruct registration, reception, and triage staff of their risk of exposure to infections spread by droplets. Encourage them to wear masks whenever registering or assessing patients who have respiratory symptoms and are not wearing a mask. Instruct them to remain at least three feet from unmasked patients.
- Consider using plexiglas barriers at the point of triage or registration to protect HCWs from contact with respiratory droplets.
- Where possible, designate an area, cubicle, or separate room in waiting areas where patients with respiratory symptoms can be segregated (ideally by at least three feet) from others without respiratory symptoms.
- Clean and then disinfect commonly used surfaces such as door handles, handrails, table surfaces, etc., with a chlorine-releasing disinfectant twice daily.

Use droplet precautions to manage patients with respiratory symptoms until it is determined that the cause of the symptoms is not an infectious agent that requires more than standard precautions.

Figure 17: Poster on respiratory hygiene



Tuberculosis

All HCWs, including nurses, doctors, clinical officers, nursing and medical students, housekeeping staff, and others are vulnerable to TB exposure, infection, and disease. Health care workers are at even greater risk in the following circumstances:

- When they are working with difficult-to-treat TB such as relapses, treatment failure, MDR, and XDR TB
- When they are working in TB-risk areas such as dispensaries, medical wards, chest clinics, sputum-induction rooms, outpatient waiting rooms or corridors, bronchoscopy units, radiology units, TB laboratories, HIV wards, autopsy rooms, and human anatomy laboratories

In addition to performing work that involves diagnosis and treatment of TB, other risk factors for HCWs include the following:

- Frequent, prolonged direct patient contact especially with patients who have not yet been started on treatment
- Longer duration of employment
- Working with cough-inducing procedures
- Working without following IPC procedures
- HIV infection

IPC Procedures

Transmission of TB is through the airborne route. Persons with untreated smear-positive TB are the major source of infection. Initiation of treatment reduces the risk of infection from the patients. Environmental contamination, such as from blankets or linen, is not a source of infection.
All health care environments should be assessed to identify areas where TB transmission can occur. The amount of airflow and natural light should be determined. Where airflow by cross-ventilation is

inadequate, extractor fans should be installed. Natural light should be increased where necessary. Curtains should not be used.

Follow these procedures for patients who are suspected of having TB:

- Give the patient a sputum smear examination as a matter of urgency. This is best done on an outpatient basis. Use disposable, nontransparent sputum cups with lids. Avoid reusable sputum mugs.
- Ask patients who are coughing and are in the outpatient clinic or in Casualty to wait outside, preferably, or in a well-ventilated area. Prominently display signs reminding patients about precautions, such as the use of tissues when coughing.
- Examine patients you suspect of having TB in a well-ventilated area.
- If a patient who is suspected of having TB is admitted to the ward, place him or her in either a separate, well-lit, and well-ventilated room or with similar patients in a separate section of the ward, which should be equally well lit and well ventilated. Windows must stay open even at night and in cold weather. Provide extra blankets if necessary. Be sure windows are screened and use bed-nets if mosquitoes are a problem.
- The sputum smear result should be returned to the ward within 24 hours so that the patient can be treated as soon as possible.
- Wear well-fitted masks—they are the only masks that offer some degree of protection. These are usually expensive and should only be worn in high-risk situations such as when performing or assisting with the following:
  - Bronchoscopy
  - Endotracheal intubation
  - Suctioning
  - Open-abscess irrigation
  - Autopsy
- Cough hygiene should be maintained when patients are moved from one part of the hospital to another or from one hospital to another. Paper tissues can be used or patients can wear masks as an effective means to prevent droplet emission during transport. Inform staff in the area or ward to which the patient is taken or transferred so that they can implement effective IPC measures.
- For patients on TB treatment, delay any operative procedures until the patient is no longer infectious (two to four weeks following initiation of treatment). Where surgery cannot be delayed, use a negative pressure theatre (if available) and place the patient at the end of the list.
- Isolation is not necessary once a patient has commenced treatment because infectiousness diminishes rapidly after commencement of the intensive chemotherapy. Initial hospitalization is re-evaluated as a form of directly observed therapy (DOT). It is well proven that it is not the admission, but the direct observation of treatment that matters for the cure of the patient and control of TB.

Notification of TB

Every diagnosed TB patient should be notified.

It is a public health requirement under the National Public Health Act that diagnosed cases of every form of TB should be reported to the ministries of health using the relevant TB notification form(s).

Contact tracing for screening should be performed and the patient should be monitored to ensure full compliance with treatment.

Staff Health

TB disease is a high risk factor of HIV infection. All staff must be made aware of the significant risk of developing TB if they are HIV-positive. Voluntary testing and counselling should be offered to all staff in contact with TB.

Every HCW should report a cough lasting more than three weeks. Sputum specimens must then be examined. This is the only effective way of detecting TB early.

Infection Control Measures for TB

There are three levels of TB-infection control measures: administrative (managerial), environmental, and PPE (respiratory protection). Administrative control measures are the most important among the three levels. Environmental control measures and PPE will not work in the absence of solid administrative controls.

Each level operates at a different point in the TB-infection control process:

- First priority: Administrative control measures reduce HCWs' and patients' exposure
- Second priority: Environmental control measures reduce the concentration of infectious droplet nuclei.
- Third priority: PPE (respiratory protection) protects HCWs, patients, and family members in areas where the concentration of droplet nuclei cannot be adequately reduced by administrative and environmental control measures.

Where multiple-drug-resistant tuberculosis (MDR-TB) is suspected, HCWs should use special N95 masks and the patient should use a normal surgical mask to reduce the number of nuclei that are released into the environment.

SARS

The health care facility should have a clear set of guidelines for preventing staff members' exposure to SARS. Health care workers in contact with suspected or probable SARS patients should be monitored daily for signs and symptoms of SARS, particularly for changes in temperature. If HCWs indicate any signs or symptoms of SARS, they should be assessed by the clinician as to the appropriateness of home isolation.

12.11 Meningococcal Meningitis

Transmission of meningococci to HCWs is most likely within 24 hours of the infected patient's admission, prior to the patient receiving appropriate antibiotics or chemoprophylaxis. Health care workers in close respiratory contact with such cases should receive chemoprophylaxis with ciprofloxacin or an effective alternative agent. Close respiratory contact with the patient includes mouth-to-mouth contact and sharing drink containers or cigarettes.

12.12 Viral Haemorrhagic Fevers

Follow these IPC procedures when treating patients with viral haemorrhagic fevers (Ebola, Lassa, Marburg):

- Wash your hands as needed.

- Isolate the patient.
- Wear protective clothing.
- Dispose of needles and syringes safely.
- Dispose of waste safely.
- Use safe burial practices.

The following items are necessary to facilitate the transportation of patients with viral haemorrhagic fever:

- Scrub suits
- Plastic aprons
- Head gear
- Goggles
- Latex gloves
- Heavy industrial gloves
- Gum boots
- Sharps containers
- Sodium hypochlorite or household bleach
- Soap dispensers
- Waste buckets with lids
- Large bins with lids for soaking linen

12.13 Varicella, Influenza, Pertussis, Diphtheria, Rabies, Influenza A (H1N1)

Transmission of these microorganisms might be uncommon, but policies to manage staff exposure should be developed. Vaccinating HCWs against varicella is recommended. Influenza vaccinations should be given yearly. Rabies vaccinations might be appropriate in some facilities in countries where rabies is enzootic.

Health care workers should be vaccinated against immunizable infections.

Organisms that cause most HAIs usually come from the patient's own body (endogenous flora), but they can also result from contact with staff members and other patients (cross-contamination), contaminated instruments and needles (iatrogenic), and the environment (exogenous flora). Practicing good hand hygiene and standard precautions can greatly reduce these infections. Additional strategies to reduce HAIs include judicious and appropriate use and care of urinary and vascular catheters, good surgical practices, therapy, and support.

The most common HAIs are urinary tract infection (UTI), surgical-site infection (SSI), pneumonia, and blood stream infection.

13.1 Preventing Urinary Tract Infections

Urinary tract infections account for 40 percent of all HAIs. About 80 percent of these occur following urinary catheterization. Since almost 10 percent of all hospitalized patients are catheterized, preventing UTIs is a major factor in decreasing HAIs. Factors that can lead to bacteriuria and UTIs include:

- Passage of organisms from the urine bag to the bladder (retrograde contamination) that occurs in patients with indwelling catheters
- The ability of some organisms to grow on the outside or inside of the tubing and even in the urine itself

Reducing Hospital-Acquired Urinary Tract Infections

Except for the end of the urethra or penis, the urinary system is normally sterile. Catheterization bypasses the body's defense mechanisms, introduces microorganisms from the end of the urethra, and provides a pathway for organisms to reach the bladder. Placement of an indwelling catheter should be performed only when other methods of emptying the bladder are not effective, and it is particularly important to limit the duration as much as possible.

Other methods for managing urinary tract problems include intermittent catheterization using a sterile straight catheter, condom catheters for male patients, adult diaper pads, bladder retraining, and the use of drugs to stimulate urination.

Insertion Procedure

Before inserting a catheter, make sure you have all of the following available: a sterile indwelling urinary catheter with a closed continuous drainage system, a sterile syringe filled with sterile water for blowing up the balloon, a pair of sterile gloves, antiseptic solution (2 percent chlorhexidene gluconate or 10 percent povidone-iodine), a sponge, and holding forceps with a sterile, single-use packet of lubricant. Follow these steps:

1. Practice hand hygiene and wear sterile gloves.
2. Separate and hold the labia apart or the head of penis with the nondominant hand and prep the urethral area two times with an antiseptic solution using sponge forceps with sterile gauze.
3. Grasp the catheter about 5 centimeters from the catheter tip with the dominant hand and place the other end in the urine collection container.
4. Gently insert the catheter until urine flows. Inflate the balloon.
5. If the catheter is indwelling, pull it out gently to feel resistance, and secure the indwelling catheter properly to the thigh. For in and out catheterization, allow the urine to slowly drain into the collection container and then gently remove the catheter.
6. Dispose of waste appropriately.
7. Remove gloves and practice hand hygiene.

Removal Procedure

1. Practice hand hygiene.
2. Wear clean, single-use examination gloves.
3. Empty the catheter balloon using a sterile syringe.
4. Prep the urethra two times with an antiseptic solution using sponge forceps with sterile gauze.
5. Gently remove the catheter.

Tips for Preventing Infections in Catheterized Patients

- Remove the catheter as soon as possible within 24 hours.
- The catheter collection system should remain closed and not be opened unless absolutely necessary for diagnostic or therapeutic reasons.
- Caution the patient against pulling on the catheter.
- Urine flow through the catheter should be checked several times a day to ensure that the catheter is not blocked.
- Avoid raising the collection bag above the level of the bladder.
- If it becomes necessary to raise the bag above the level of the patient's bladder during transfer of the patient to a bed or stretcher, clamp the tubing.
- Before the patient stands up, drain all urine from the tubing into the bag.
- The urine drainage (collection) bags should be emptied aseptically. Do not touch the tip of the emptying tube to the side of the collection bag or permit the tip to touch the urine in the vessel.
- Replace bags with new or clean containers when needed.

13.2 Preventing Surgical-Site Infections

The following factors predispose a patient for an SSI:

- Obesity
- Infection at another site
- Immunosuppression
- Malnutrition and anaemia
- Old age and chronic diseases such as diabetes and malignancy

General Guidelines

Follow these guidelines to help prevent SSIs in patients:

- Avoid prolonged preoperative hospitalization and recommend ambulatory surgery as often as possible.
- Avoid preoperative hair removal. If hair must be removed, clip it with scissors just before the surgery. Do not shave using a blade.
- Widely prepare the proposed incision site with antiseptic solution preoperatively.

- Practice good surgical techniques that minimize tissue trauma, control bleeding, eliminate dead space, use minimal sutures, and maintain adequate blood supply and oxygenation.
- Keep the duration of surgical procedures as short as possible. The rate of infection doubles with each hour of surgery.
- Discharge patients promptly after surgery.

Notes: Putting topical antibiotic ointments on closed skin incisions does not decrease the risk of SSI. Healthy tissue growth is damaged when dry gauze is removed. Moisten the dry gauze with sterile normal saline solution before removing it.

Antibiotic Prophylaxis in Surgery

The use of antibiotics preoperatively can reduce the rate of infection, particularly wound infections, after certain operations. The benefits, however, must be weighed against the risks of toxic and allergic reactions, the emergence of resistant bacteria, drug interactions, super infection, and cost. About 5 percent of patients receiving an antibiotic will have a serious reaction to the drug. In general, antibiotic prophylaxis is recommended only for procedures with high infection rates and those in which the consequences of infection are especially serious.

Ideally the prophylactic drug(s) should be directed against the most likely infecting organisms, but it need not kill or inactivate all pathogens. Because of the frequent development of microbial resistance to drugs, the following recommendations should be followed whenever possible:

- Use antibiotics with a moderately long half-life.
- Use antibiotics with broad-spectrum activity.
- Avoid using an antibiotic prophylactically if the same drug is going to be used in postoperative treatment.
- Use antibiotics according to the sensitivity pattern of the area or health care facility.

In most instances, a single IV dose of an antibiotic administered 30 minutes or less before the skin incision provides adequate tissue levels throughout the operation. If surgery is prolonged (more than four hours), if major blood loss occurs, or if an antibiotic with a short half-life is used, one or more additional doses should be given during the procedure.

13.3 Preventing Health Care-Associated Pneumonia

Hospital-acquired pneumonia is the infection that is most likely to be fatal and that is the most expensive to treat. Most of these infections occur by aspiration of bacteria growing in the back of the throat or stomach. Intubation and mechanical ventilation greatly increase the risk of infection in the follow ways:

- They block the normal body defense mechanisms—coughing, sneezing, and the gag reflex.
- They prevent the washing action of the hair (cilia) and mucus-secreting cells that line the upper respiratory system.
- They provide a direct pathway for microorganisms to get into the lungs.

Other procedures that could increase the risk of infection include oxygen therapy, intermittent positive pressure ventilation (IPPV) treatment, and endotracheal suctioning. The combination of severe illness, the presence of multiple invasive devices (IVs, urinary catheters, and mechanical ventilators), and frequent contact with the hands of personnel often leads to cross-contamination.

Risk Factors

The following risk factors are associated with health care-associated pneumonia:

- Old age (over 70)
- Chronic lung disease
- Severe head injuries with loss of consciousness
- Severe medical conditions, such as end-stage renal disease and liver cirrhosis
- Cigarette smoking
- Alcoholism
- Obesity
- Major cardiovascular or pulmonary surgery
- Endotracheal intubation and mechanical ventilation

Preoperative Pulmonary Care

Follow these guidelines prior to surgery:

- Limit the use of narcotics.
- Prevent colonization and infection with new organisms.
- Prevent the transfer of organisms among hospitalized patients.
- Prevent cross-contamination from HCWs to patients.
- Teach patients about these practices:
  - Deep breathing, moving in bed, and frequent coughing
  - Early ambulation

Chest Physiotherapy

To reduce the risk of contamination and possible infection from mechanical respirators and other equipment follow these guidelines:

- Use mechanical ventilation only when necessary and for no longer than necessary.
- Drain and discard any fluid in the tubing, taking care not to allow the fluid to drain towards the patient.
- Use small nebulizer bulbs.
- Decontaminate, clean, and high-level disinfect breathing circuits by steaming or soaking in a chemical HLD.
- Reprocess resuscitation devices, such as Ambu bags, promptly.

To minimize cross-contamination when suctioning patients on ventilators, follow these guidelines:

- Decontaminate and clean suction catheters and then disinfect them with high-level steam.
- Practice hand hygiene.
- Wear clean examination gloves, a mask, and protective eyewear.

- Discard waste appropriately.
- Remove gloves immediately after therapy and practice hand hygiene.

13.4 Preventing Infections Related to Use of Intravascular Devices

Intravascular devices inserted into the venous or arterial bloodstream bypass the normal skin defense mechanism, and provide a route for microorganisms to enter the bloodstream from one or more of the following:

- The device at the time of insertion
- Subsequent contamination of the device or attachments
- Pathogens on the skin surrounding the insertion site

Risk Factors

The following risk factors are associated with infections related to the use of intravascular devices:

- Immunosuppression
- Cracks in infusion bottles and punctures in plastic containers
- Contaminated infusion fluid or additives
- Leaky IV administration sets with multiple connections
- Nonsterile preparation of intravenous infusion fluid
- Multiple changes of IV fluid containers while using the same IV administration set
- Multiple injections and irrigations of the system
- Central venous pressure measurement apparatus

Reducing the Risk of HAIs with Intravascular Devices

The following practices should help reduce the risk of infection:

- Practice hand hygiene before and after inserting and handling IV lines.
- If the site for inserting the catheter is dirty, wash it with soap and clean water and dry it before applying the skin antiseptic. If using PVI as the antiseptic agent, allow it to dry after applying or wait at least two minutes before inserting the device.
- Use transparent, adherent dressings to allow inspection of the site later.
- Dressings can be left in place for up to 72 hours if they are kept dry. Change the dressing immediately if it becomes wet, soiled, or loose.
- Change gauze and tape dressings after inspecting the site.
- Gently palpate the cannula site daily for tenderness. Use cannulas instead of steel needles when possible.
- Inspect the insertion site if the patient develops tenderness or fever without an obvious cause.
- For peripheral IV lines in adults, hand veins are preferred over arm veins, and arm veins are preferred over leg and foot veins.
- Change IV sites after 72 hours to reduce phlebitis and local infection.

- Because straight and butterfly needles frequently infiltrate, do not use them with solutions that could cause tissue necrosis.
- For inserting central venous lines, wash the catheter site with soap and clean water and dry it before applying the skin antiseptic. Prepare the skin using 2 percent chlorhexidine gluconate, 10 percent PVI, or 60 percent to 90 percent alcohol. Follow full barrier precautions (sterile gloves, gown, mask, and site drape) in a procedure area, not at the bedside, for insertion.

Changing Fluids and Infusion Sets

Follow these guidelines for changing fluids and infusion sets in patients:

- Change infusion bottles or plastic bags with parenteral solutions every 24 hours.
- Change infusion bottles or plastic bags with lipid emulsion given alone within 12 hours.
- Change Infusion sets whenever they are damaged and after 72 hours routinely. If the tubing becomes disconnected, wipe the hub of the cannula with 60 percent to 90 percent alcohol and connect a new infusion set.
- Replace tubing that is used to administer blood products or lipid emulsions within 24 hours.

Inserting and Maintaining Peripheral IV Lines

Follow these practices to reduce the risk of infection when inserting and maintaining peripheral IV lines:

- Maintain asepsis during insertion and removal.
- Use an aseptic technique to assemble the infusion set and do not touch the ends of the tubing.
- Practice hand hygiene and wear clean, single-use examination gloves.
- Cleanse the insertion site with antiseptic solution using a circular motion outward from the insertion site.
- Insert the cannula and secure it with transparent dressing.
- Dispose of waste appropriately.
- Remove gloves and practice hand hygiene.
- Mark the site on the plaster with the time and date that the IV line was inserted and make sure the site is dry.

Removal Procedure

Follow these practices to reduce the risk of infection when removing peripheral IV lines:

- Practice hand hygiene.
- Put on clean examination gloves.
- Check the patient's hand or wrist for phlebitis or evidence of infection. If phlebitis is associated with other signs of infection, such as fever or pus coming from the exit site, it is classified as a clinical exit-site infection.
- Carefully remove the needle or the plastic catheter with one hand and with the other hand cover the insertion site with sterile gauze.
- Press the insertion site firmly for about a minute and cover it with a sterile band-aid.
- Dispose of waste appropriately, remove gloves, and practice hand hygiene.

13.5 Preventing Gastric Reflux

Follow these practices to reduce the risk of gastric reflux:

- Avoid prolonged use of nasal gastric tubes for feeding.
- Feed small, frequent amounts rather than large amounts at one time.
- Raise the patient's head on the bed so that the patient is in a semi-sitting position.

13.6 Postoperative Management

Surgical units should have effective plans for postoperative management that include the following guidelines:

- Optimize the use of pain medication to keep the patient comfortable enough to cough effectively.
- Move and exercise patients regularly.
- Encourage deep breathing in the immediate postoperative period and for the next few days.

13.7 Preventing Health Care-Associated Diarrhoea

Controlling the spread of nosocomial diarrhoea from contaminated food is an ongoing concern in hospitals and nursing homes. Frequently, this results from poorly trained staff members who use unsafe practices to store, prepare, and handle raw meat, chicken, fish, fresh eggs, and vegetables. Health care workers should be aware of common agents and factors that could lead to health care-associated diarrhoea. Workers should take all possible precautions to protect patients.

Common Agents

Health care workers should be aware of the common agents, such as salmonella, that cause food contamination. Rotavirus is the most common cause of diarrhea in children under five years of age and could become endemic in health care facilities.

Risk Factors

Factors that put patients at particular risk for health care-associated diarrhea include the following:

- Old age
- Burns
- Immunosuppression
- Decreased gastric acidity
- Altered gastrointestinal flora resulting from antibiotic treatment
- Lack of hand hygiene, especially by food handlers
- Noncompliance with glove use

Precautions

Health care workers should follow these guidelines to reduce the risk of health care-associated diarrhea:

- Ensure that bedpans and bathroom equipment that are regularly handled by patients and staff are cleaned and wiped with a disinfectant (0.5 percent chlorine solution) daily and whenever they have been used.
- Immediately disinfect and clean all soiled articles.
- Wear utility or heavy-duty gloves before sorting out linen, and bundle soiled linen to prevent leakage.
- Remove food handlers with diarrhoea immediately from food preparation tasks and areas.
- Manage patients with diarrhoea according to standard and additional (transmission-based) precautions.
- Do not place infants born to mothers with diarrhea in the regular nursery.

GLOSSARY

Airborne transmission: Transfer of particles 5 µm or less in size into the air, either as airborne droplets or dust particles containing the infectious microorganism. They can be produced by coughing, sneezing, talking, or procedures such as bronchoscopy or suctioning. They can remain in the air for several hours and can be spread widely within a room or over longer distances. Special air handling and ventilation are needed to prevent airborne transmission.

Animate: Property of having life or being alive (for example, human tissue or organs).

Antisepsis: Destruction or inhibition of microorganisms to reduce their number on living tissues (skin, mucous membranes, or other body tissue) by applying an antimicrobial (antiseptic) agent.

Antiseptic or antimicrobial agent (used interchangeably): Chemicals that are applied to the skin or other living tissue to inhibit or kill microorganisms (both transient and resident), thereby reducing the total bacterial counts.

Antiseptic handrub or waterless, alcohol-based antiseptic handrub (used interchangeably): Fast-acting antiseptic handrubs that do not require use of water to remove transient flora, reduce resident microorganisms, and protect the skin. Most contain 60 percent to 90 percent alcohol, an emollient, and often an additional antiseptic, such as 2 percent to 4 percent chlorhexidine gluconate that has residual action.

Asepsis and aseptic technique: Combination of efforts made to prevent entry of microorganisms into any area of the body where they are likely to cause infection. The goal of asepsis is to reduce to a safe level or eliminate the number of microorganisms on both animate (living) surfaces (skin and tissue) and inanimate objects (surgical instruments and other items).

Autoclave: A process that destroys or removes all microorganisms (bacteria, viruses, fungi, and parasites, including bacterial endospores) from inanimate objects by high-pressure steam. Also refers to the device that sterilizes equipment and items through high-pressure, saturated steam.

Bactericide: Agent that kills bacteria.

Biosafety level (BSL) guidelines: Combination of primary and secondary containment and safety guidelines that are designed for use in microbiology laboratories and bacteriology research units functioning at four levels (BSL-1 to BSL-4) of increasing risk.

Biological safety cabinet (BSC): Device that provides protection for personnel, the agent being processed, and the environment. BSCs range in complexity from level 1 (general research cabinets for use with low- to moderate-risk microorganisms) to level 3 (totally enclosed cabinets with gas-tight construction that provide maximum protection to HCWs and the environment).

Clean water: Natural or chemically treated and filtered water that is safe to drink and use for other purposes, such as hand washing and cleaning medical instruments, because it meets specified public health standards. These standards include zero levels of microorganisms, such as bacteria (fecal coliform, *Escherichia coli*, etc.), parasites (such as *Giardia lamblia*), and viruses (such as hepatitis A or E); low turbidity (cloudiness due to particulate matter and other contaminants); and minimum levels of disinfectants, disinfectant byproducts, inorganic and organic chemicals, and radioactive materials. At a minimum, clean water should be free of microorganisms and have low turbidity (is clear, not cloudy).

Cleaning: Process that physically removes all visible dust, soil, blood, or other body fluids from inanimate objects as well as removing sufficient numbers of microorganisms to reduce risks for those who touch the skin or handle the object.

Cleaning solution: Any combination of soap (or detergent) and water used to wash or wipe down environmental surfaces such as floors, walls, ceilings, and furniture.

Clinically significant antibody: Antibody capable of producing an adverse reaction to transfused blood or blood product that is obtained from a donor (allogenic antibody) or recipient (autologous antibody).

Closed system for obtaining blood: System in which the blood is not exposed to air or outside elements during collection, processing—including separation of components, such as platelets, if required prior to transfusion—and storage. It is the safest way to collect, process, and store blood.

Colonization: Pathogenic (illness- or disease-causing) organisms are present in a person (they can be detected by cultures or other tests), but they are not causing symptoms or clinical findings (no cellular changes or damage).

Contact time: Amount of time a disinfectant is in direct contact with the surface or item to be disinfected. For surface disinfection, this time period is framed by the application of the disinfectant to the surface until the disinfectant has completely dried.

Contact transmission: Infectious agent (bacteria, virus, or parasite) transmitted directly or indirectly from one infected or colonized person to a susceptible host (patient), often on the contaminated hands of an HCW.

Contaminated: State of having been actually or potentially in contact with microorganisms. As used in health care, the term generally refers to the presence of microorganisms that could be capable of producing disease or infection.

Corrosion: Action of chemical solutions, such as those containing salt (sodium chloride) or commercial bleach (sodium hypochlorite at concentrations above 0.5 percent), that causes metal instruments to be gradually eaten away (rusted) with prolonged contact (more than one hour).

Critical medical device (or item): Device that penetrates skin or invades normally sterile parts of the body (such as a central venous catheter). These items contact blood and require sterilization.

Culture: Growth of microorganisms in or on a nutrient medium; to grow microorganisms in or on such a medium.

Decontamination: Process that makes inanimate objects safer to be handled by staff before cleaning. It inactivates HBV, HCV, and HIV and reduces, but does not eliminate, the number of other contaminating microorganisms.

Detergent or soap (used interchangeably): Cleaning product (bar, liquid, leaflet, or powder) that lowers surface tension and thereby helps remove dirt and debris and transient microorganisms from hands. Plain soaps require friction (scrubbing) to mechanically remove microorganisms while antiseptic (antimicrobial) soaps also kill or inhibit the growth of most microorganisms.

Disinfectant: Chemical that destroys or inactivates microorganisms. Disinfectants are classified as low, intermediate, or high-level depending on their ability to kill or immobilize some (low- or intermediatelevel) or all (high-level) microorganisms (but not all spores). Phenols, chlorine, or chlorine-containing compounds and quaternary ammonium compounds (QUATs) are classes of disinfectants that are frequently used to clean noncritical surfaces such as floors, walls, and furniture.

Disinfectant cleaning solution: Product that is a combination of detergent (soap) and chemical disinfectant. Not all detergents and disinfectants are compatible. Several combinations are available commercially or can be prepared, such as alkaline detergents with chlorine compounds, alkaline detergents with QUATs or other nonionic surfactants, and acid detergents with iodophors.

Disinfection: A process of reducing microbial load without complete sterization. Disinfection refers to the use of a physical process or chemical agent to destroy vegetative pathogens, but not bacterial spores.

Droplet transmission: Contact of the mucous membranes of the nose, mouth, or conjunctivae of the eye with infectious particles that are larger than 5 µm and are produced by coughing, sneezing, talking, or procedures such as bronchoscopy or suctioning. Droplet transmission requires close contact between the source and a susceptible person, because particles remain airborne briefly and travel only about 3 feet (1 meter) or less.

Dry-heat sterilization: Sterilization procedure in an oven to sterilize metal instruments, glass syringes and bottles, and other items by dry heat. Plastic and rubber items cannot be dry-heat sterilized, because the temperatures that are used (160°C-170°C) are too high for these materials.

Encapsulation: Filling a sharps container when it is three-quarters full with cement or clay. After the clay or cement hardens, the container can be safely disposed of in a landfill.

Endemic illness or disease: Infectious disease, such as cholera or AIDS, that is continuously present at some level (prevalence) in a particular country or region.

Endometritis: Acute postpartum infection of the lining (endometrium) of the uterus with extension into the smooth muscle wall (myometrium). Clinical features include fever, (usually developing on the first or second postpartum day), uterine tenderness, lower abdominal pain, foul-smelling vaginal discharge (lochia), and signs of peritonitis in women who have had a Caesarean section.

Endospore or spore (used interchangeably): Relatively water-poor, round or elliptical resting cell that consists of condensed cytoplasm and nucleus surrounded by an impervious cell wall or coat. Spores are relatively resistant to disinfectants and sterilants, specifically the bacillus and clostridium species.

Environmental controls: Standards specifying procedures for the routine care, cleaning, and disinfection of environmental surfaces, beds, bedrails, bedside equipment, and other frequently touched surfaces.

Epidemic: Rapid spread of an infectious disease, such as cholera, among many individuals in a health care facility or community at the same time.

Episiotomy: Surgical cut made in the perineum (usually at the 6 o'clock position) just prior to delivery. The purpose is to facilitate delivery of the presenting part of the baby and minimize the risk of injury to the perineal area. Episiotomies are, however, associated with increased bleeding and might result in increased tearing (3^{rd} or 4^{th} degree perineal laceration). They frequently become infected and, more importantly, are usually not necessary.

Exposure time: Period of time in a sterilization process during which items are exposed to the sterilant at the specified sterilization parameters. In a steam-sterilization process, exposure time is the period during which items are exposed to saturated steam at the specified temperature.

Hand washing: Process of mechanically removing soil and debris from hands using plain soap and water.

Hazard: Any agent, equipment, material, or process that has the intrinsic potential or ability to cause harm.

Health care-associated infection (HAI) or nosocomial: An infection that was acquired in a health care facility by a health care user, HCW, or a visitor—that is, the infection was neither present nor incubating at the time the person made initial contact with the facility. HAIs include infections that were acquired in the hospital, but did not appear until after discharge, including any infection in a surgical site up to six weeks postoperatively. Occupational infections among staff of the health facility are also considered HAIs.

Health care worker (HCW): Any person whose main activities are intended to enhance the health of patients. HCWs include the people who provide health services (doctors, nurses, pharmacists, laboratory technicians, etc.) and workers in management and support services (financial officers, cooks, drivers, cleaners, etc.) (Adapted from WHO: (http://www.who.int/mediacentre/factsheets/fs302/en/index.html)

High-level disinfection (HLD): Process that eliminates all microorganisms except some bacterial endospores from inanimate objects by boiling, steaming, or using chemical disinfectants.

Incineration: Controlled burning of solid, liquid, or gaseous combustible (burnable) wastes to produce gases and residues that contain little or no burnable material.

Infection prevention and control committee (IPPC): A multidisciplinary committee that deals with IPC issues. Each member of the committee contributes according to his or her discipline and fosters cooperation among all disciplines. The IPPC is made up of medical microbiologists, clinicians, pharmacists, public-health officers, representatives from hospital administration, and other HCWs who represent sterilizing services, housekeeping, laundry, and training services.

Infection prevention and control programme: A comprehensive programme that encompasses all aspects of IPC—education and training; surveillance; environmental management; waste management; investigating outbreaks; developing and updating IPC policies, guidelines, and protocols; cleaning, disinfection, and sterilization; employee health; and quality management in infection control.

Infection prevention and control team: The team of HCWs that are involved in the day-to-day IPC programme activities.

Infectious microorganisms: Microorganisms that are capable of producing disease in appropriate hosts.

Infectious waste: Medical waste that is capable of causing infectious diseases.

Intermediate-level disinfectant: Agent that destroys all vegetative bacteria, including tubercle bacilli, lipid and some nonlipid viruses, and fungus spores, but not bacterial spores.

Intra-amniotic infection syndrome (IAIS) (also referred to as **amnionitis or chorioamnionitis**): Acute, clinically detectable infection in the uterus and its contents (fetus, placenta, and amniotic fluid) during pregnancy.

Invasive group B streptococcal sepsis: Newborn infection characterized by bacteremia, pneumonia, meningitis, and death in up to 25 percent of infants with the infection. It occurs most commonly following IAIS. Other sites of the infection include the newborn's skin (cellulitis) and bones (osteomyelitis).

Laboratory-acquired infection: Any nosocomial infection in staff that results from performing laboratory activities.

Linens: Cloth items that are used in health care facilities: bedding and towels handled by housekeeping staff; cleaning cloths, gowns, and caps used by cleaning staff; caps, masks, scrub suits, surgical gowns, drapes, and wrappers used by surgical personnel; and items used by staff who are working in specialty units such as ICUs and other units and performing invasive medical procedures such as anaesthesiology, radiology, or cardiology.

Low-level disinfectant: Agent that destroys all vegetative bacteria (except tubercle bacilli), lipid and some nonlipid viruses, and some fungus, but not bacterial spores.

Mechanical indicator: Automated device that monitors the sterilization process (graphs, gauges, printouts, etc.).

Medical devices: All equipment, instruments, and tools that are used in health care settings for diagnosis, prevention, monitoring, treatment, or rehabilitation. These devices include products such as contact lenses, condoms, heart valves, hospital beds, resuscitators, radiotherapy machines, surgical instruments and syringes, wheelchairs and walking frames, etc.

Microorganisms: Causative agents of infection, such as bacteria, viruses, fungi, and parasites. For infection prevention purposes, bacteria can be further divided into three categories: vegetative (e.g., staphylococcus), mycobacteria (e.g., tuberculosis), and endospores (e.g., tetanus). Of all the common infectious agents, endospores are the most difficult to kill because of their protective coating.

Municipal waste: General waste for collection by municipalities (local city or town authorities) generated mainly by households, commercial activities, and street sweeping.

Mycobacteria: Bacteria with a thick, waxy coat that makes them more resistant to chemical disinfectants than other types of vegetative bacteria.

Noncritical medical device (or item): Device that normally makes contact with the patient's intact skin, such as a blood-pressure cuff or oxygen mask. These devices require low- to intermediate-level disinfection, and reusing them carries little risk.

Nonionic: Neutral (neither positively nor negatively charged) particle or substance.

Nonlipid viruses: Nonlipid viruses [also referred to as nonenveloped or hydrophilic (water-seeking) viruses] are viruses whose core is not surrounded by a coat of protein. Nonlipid viruses are generally viewed as more resilient to inactivation than lipid viruses.

Nosocomial or health care-associated infection (HAI): Infection that is neither present nor incubating at the time the patient comes to the health care facility. (Nosocomial refers to the association between care and the subsequent onset of infection. It is a time-related criterion that does not imply a cause-and-effect relationship.)

Nosocomial diarrhea: At least two consecutive days of at least three loose or watery stools, with the onset more than 72 hours after the patient was admitted to the health care facility (or more days than the incubation period if the agent is known).

Nosocomial infection in newborns: Infection occurring after birth, but excluding those infections known to have been transmitted across the placenta such as congenital syphilis, cytomegalovirus, rubella, varicella (chicken pox), and the protozoan parasite *Toxoplasmosis gondii*.

Nosocomial infection in obstetrical patients: Infection that is neither present nor incubating at the time the patient is admitted to the health care facility. Most UTIs and endometritis are nosocomial, even though the causative organism might be endogenous (that is, it present in the maternal lower genital tract prior to delivery).

Occupational injury or infection: Injury or infection that is acquired by HCWs while they are performing their normal duties.

Operating room (OR): Area or space where surgical procedures are performed.

Organ/Space SSI: Any part of the body other than the incised body wall parts that were opened or handled during an operation.

Parts per million (ppm): Concentrations of trace contaminant gases in the air (or chemicals in a liquid) are commonly measured in parts per million (ppm) by volume. To convert percent concentration to ppm and vice versa, use this formula: ppm = percent (%) x 10,000.

Personal protective equipment (PPE): Specialized clothing or equipment, such as gloves, facemask, protective eyewear, gowns, caps, and plastic aprons, that HCWs wear to protect themselves from exposure to body substances, such as blood or body fluids, airborne droplet organisms, or other hazards. Uniforms, pants, shoes, and shirts that are not designed to function as protection against a hazard are not considered to be PPE.

Phlebitis: Area of swelling, redness, warmth, and tenderness of the skin around the site where the intravascular catheter comes out of the skin (the exit site). If phlebitis is associated with other signs of infection, such as fever and pus coming from the exit site, it is classified as a clinical exit-site infection.

Protective barrier: Physical or mechanical barrier, or a chemical process that helps prevent the spread of infectious microorganisms from person to person (patient, health care client, or HCW); and from equipment, instruments, and environmental surfaces to people.

Quaternary ammonium compound (QUAT): A surface-active, water-soluble, low-level disinfecting substance that has four carbon atoms linked to a nitrogen atom through chemical (covalent) bonds.

Reprocessing: Decontaminating, disassembling (if necessary), cleaning, inspecting, testing, packaging, relabelling, and sterilizing or high-level disinfecting single-use devices (SUDs) after they have been used on a patient for their intended purpose. Reprocessing is also performed on SUDs that were removed from the package (or container), but not used on a patient, or whose expiration date has passed.

Resident flora: Microorganisms that live in the deeper layers of the skin, as well as within hair follicles, and cannot be completely removed, even by vigorous washing and rinsing with plain soap and clean water.

Resterilization: Repeat application of a terminal process that removes or destroys all viable forms of microbial life, including bacterial spores, to an acceptable level of sterility assurance. This process is performed on devices whose expiration date has passed or that have been opened and might or might not have been used.

Risk management: All of the processes that are involved in identifying, assessing, and judging risks; assigning ownership; taking actions to mitigate or anticipate risks; and monitoring and reviewing progress.

Safe zone (also **Neutral zone):** Device or designated area of the sterile field in which sharps are placed, accessed, returned, and retrieved to avoid hand-to-hand transfer of sharps between personnel.

Sanitary landfill: Engineered method of disposing of solid waste on land in a manner that protects the environment (for example, spreading the waste in thin layers, compacting it to the smallest practical volume, and then covering it with soil at the end of each working day).

Scavenging: Manually sorting solid waste at landfills and removing usable material.

Segregation: Systematic separation of solid waste into designated categories.

Semi-critical medical device (or item): Device or item that comes in contact with mucous membranes or nonintact skin during use, such as an endoscope or respiratory equipment. These devices require HLD if sterilization is not practical, and reuse carries a greater risk for cross-contamination than noncritical items.

Septic pelvic thrombophlebitis: Thrombosis (blockage) of deep pelvic veins resulting from inflammation and blood clots. It is uncommon (occurs in approximately 1 in 2,000 deliveries). Predisposing factors include Caesarean section after long labor (more than 24 hours), premature rupture of membranes, difficult delivery (forceps or vaginal extraction), anaemia, and malnutrition.

Sharps: Suture needles, scalpel blades, scissors, wire sutures, broken glass, or any objects that can cause a puncture or cut.

Soap and detergent (used interchangeably): Cleaning product (bar, liquid, leaflet, or powder) that lowers surface tension and thereby helps remove dirt, debris, and transient microorganisms from hands. Plain soaps require friction (scrubbing) to mechanically remove microorganisms, while antiseptic (antimicrobial) soaps remove and kill (or inhibit the growth of) most microorganisms.

Soiled or contaminated linen: Linen from multiple sources within the health care facility that has been collected and brought to the laundry for processing.

Sorting: Process of inspecting and removing foreign and, in some cases dangerous, objects such as sharps or broken glass from soiled linen before washing. This step is extremely important, because soiled linen from the OR or clinic occasionally contains sharps (scalpels, sharp-tipped scissors, hypodermic and suture needles, towel clips, etc.). Sorting takes place in the laundry room.

Spaulding classification: Strategy for reprocessing contaminated medical devices. The system classifies medical devices as critical, semi-critical, or noncritical based on the contamination risk to a patient.

Spore or endospore (used interchangeably): Relatively water-poor, round or elliptical resting cell that consists of condensed cytoplasm and nucleus surrounded by an impervious cell wall or coat. Spores are relatively resistant to disinfectants and sterilants, specifically the bacillus and clostridium species.

Steam sterilization: Sterilization process that uses saturated steam under pressure for a specified exposure time and at a specific temperature as the sterilizing agent.

Sterilant: Chemical that is used to destroy all forms of microorganisms, including endospores. Most sterilants are also HLDs when used for a shorter period of time. Sterilants are used only on inanimate objects (e.g., surgical instruments) that are used in semi-critical and critical areas (e.g., surgery). Sterilants are not meant to be used for cleaning environmental surfaces.

Sterile or sterility: State of being free from all living microorganisms, usually described in practice as a probability function (the probability of a microorganism surviving sterilization as being one in a million).

Sterilization: A process that destroys or removes all microorganisms (bacteria, viruses, fungi, and parasites, including bacterial endospores) from inanimate objects by high-pressure steam (autoclave), dry heat (oven), chemical sterilants, or radiation.

Sterilizer: Apparatus used to sterilize medical instruments, surgical gloves, equipment, or supplies by direct exposure to the sterilizing agent (autoclave or dry-heat oven).

Surfactant: Agent that reduces the surface tension of water or the tension at the interface between water and another liquid—a wetting agent found in many sterilants and disinfectants.

Surgical asepsis: Preparation and maintenance of a reduced (safe) level of microorganisms during an operation by controlling four main sources of infectious organisms: the patient, personnel, equipment, and the environment.

Surgical-site infection (SSI): Either an incisional or organ/space infection occurring within 30 days after an operation or within one year if an implant is present. Incisional SSIs are further divided into superficial incisional (involves only skin and subcutaneous tissue) and deep incisional (involves deeper soft tissue, including fascia and muscle layers).

Surgical unit: The whole surgical area: lockers and dressing rooms; preoperative and recovery rooms; peripheral support areas, including storage space for sterile and high-level disinfected items and other

consumable supplies; corridors leading to restricted areas; the operating room(s); scrub-sink areas; and the nursing station.

Surveillance: Systematic collection of relevant data on patient care, the orderly analysis of the data, and prompt reporting of the data to those who need it. Surveillance can be either active or passive: active surveillance refers to collecting information directly from patients or HCWs; passive surveillance refers to examining reports, laboratory information, and data from other sources.

Transfusion service: Health care facility unit that provides storage, pretransfusion testing and crossmatching, and infusion of blood or blood products to intended patients (recipients).

Transient flora: Microorganisms acquired through contact with patients; other HCWs; or contaminated surfaces such as examination tables, floors, or toilets during the course of the normal workday. These organisms live in the upper layers of the skin and are partially removed by washing with plain soap and clean water.

Unit of blood: Sterile plastic bag in which a fixed volume of blood is collected in a suitable amount of anticoagulant.

Urticarial reaction: Allergic reaction that occurs during or following a transfusion of blood or blood products. The reaction can be one of or a combination of the following: itching (pruritis), hives, skin rash, or a similar allergic condition.

Vegetative bacteria: Bacteria that are devoid of spores and usually can be readily inactivated by many types of germicides.

Visibly soiled hands: Hands showing visible dirt or that are visibly contaminated with blood or body fluids (urine, feces, sputum, or vomit).

Waste management: All activities—administrative, operational, and transportation—involved in handling, treating, conditioning, storing, and disposing of waste.

Waterless, alcohol-based antiseptic handrub or antiseptic handrub (used interchangeably): Fast-acting antiseptic handrubs that do not require water to remove transient flora, reduce resident microorganisms, and protect the skin. Most contain 60 percent to 90 percent alcohol, an emollient, and often an additional antiseptic, such as 2-4 percent chlorhexidine gluconate, that has residual action.

(WHO Aide Memoir, 2007)

All patients in the health care facility should be treated with the same standard precautions in order to provide a high level of protection to patients, HCWs, and visitors. The key elements of standard precautions are outlined below.

Hand Hygiene

The key elements of hand hygiene are described below:

- Hand washing (40-60 seconds): Wet hands and apply soap, rub all surfaces, rinse and dry hands thoroughly with a single-use towel, and use the towel to turn off the faucet.
- Handrubbing (20-30 seconds): Apply enough product to cover all areas of the hands and rub hands until they are dry.

Hand hygiene may be indicated before, during, and after contact with a patient:

- Before and after any direct patient contact and between patients, whether or not gloves are worn
- Immediately after gloves are removed
- Before handling an invasive device
- After touching blood, body fluids, secretions, excretions, nonintact skin, and contaminated items, even if gloves are worn
- During patient care, when moving from a contaminated body site on the patient to a clean body site
- After contact with inanimate objects in the immediate vicinity of the patient

Personal Protective Equipment (PPE)

Gloves

Wear gloves when touching blood, body fluids, secretions, excretions, mucous membranes, and nonintact skin.

- Change gloves between tasks and procedures on the same patient after contact with potentially infectious material.
- Remove gloves after use, before touching noncontaminated items and surfaces, and before going to another patient. Hand hygiene should be performed immediately after removing gloves.

Facial Protection

Facial protection should be used to protect mucous membranes of the eyes, nose, and mouth during activities that are likely to generate splashes or sprays of blood, body fluids, secretions, and excretions. This protection should be achieved by wearing one of the following:

- Surgical or procedure mask and eye protection (eye visor, goggles, etc.)
- Face shield

Gowns

Wear gowns to protect skin and prevent soiling of clothing during activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions.

- Remove gowns at the earliest opportunity once they become soiled.
- Perform hand hygiene after removing a gown.

Sharps

To prevent sharps injuries, use care when performing the following activities:

- Handling needles, scalpels, and other sharp instruments or devices
- Cleaning used instruments
- Disposing of used needles and other sharp instruments

Respiratory Hygiene and Cough Etiquette

A person with respiratory symptoms should apply source control measures:

- Cover the nose and mouth with a tissue or mask when coughing or sneezing.
- Dispose of used tissues and masks.
- Perform hand hygiene after contact with respiratory secretions.

Health care facilities should, if possible, take these precautions:

- Place acute febrile respiratory-symptomatic patients at least 1 meter (3 feet) away from others in common waiting areas, if possible.
- Post visual alerts at the entrance to health care facilities instructing persons with respiratory symptoms to practice respiratory hygiene and cough etiquette.
- Make hand-hygiene resources, tissues, and facemasks available in common areas and areas that are used for evaluating patients with respiratory illnesses.

Environmental Cleaning

Use adequate procedures for the routine cleaning and disinfection of environmental and other frequently touched surfaces.

Linen

Linen should be handled, transported, and processed in a manner to:

- Prevent skin and mucous membrane exposures and contamination of clothing
- Avoid the transfer of pathogens to other patients or the environment, or both.

Waste Disposal

To ensure safe waste management:

- Regard all waste that is contaminated with blood, body fluids, secretions, and excretions as clinical waste and dispose of it in accordance with guidelines for safe disposal of clinical waste.
- Treat all human tissues and laboratory waste that are directly associated with specimen processing as clinical waste and manage accordingly.
- Discard all single-use items properly.

Patient-Care Equipment

When soiled with blood, body fluids, secretions, and excretions, all equipment that has been used for patient care should be handled in a manner that prevents skin and mucous membrane exposures, contamination of clothing, and transfer of pathogens to other patients or the environment. If the equipment is reusable, it should be cleaned, disinfected, and reprocessed appropriately before use with another patient.

APPENDIX 2: Hand-Hygiene Products

Products	Indications	Special Considerations
Plain soap, bar soap, liquid soap, granules, etc.	For routine care of patients For washing hands soiled with dirt, blood, or other organic material	Soap may contain very low concentrations of antimicrobial agents to prevent microbial contamination growth in the product. Bar soap should be on racks that allow water to drain. Small bars that can be changed frequently are safest.
Waterless antiseptic agents: • Alcohol rinses • Alcohol foams • Alcohol wipes • Alcohol towelettes • Germicidal hand rinse (Hibistat)	Demonstrated alternative to conventional agents For use where hand-washing facilities are inadequate, impractical, or inaccessible (e.g., ambulances, home care, and mass immunization) For situations in which the water supply is interrupted (e.g., planned disruptions or natural disasters)	Waterless antiseptic agents are not effective if hands are soiled with dirt or heavily contaminated with blood or other organic material. Follow manufacturer's recommendations for use. Efficacy is affected by concentration of alcohol in the product. Lotions should be readily available to protect skin integrity.
Antiseptic/Antimicrobial agents: • Cholorhexidine gluconate scrub strengths: 2% aqueous foam or 4% liquid preparation, 9.5% tincture • Povidone-iodine scrub strengths: 10%, 7.5%, 2%, or 0.5% • Usually available in liquid formulations	May be chosen for hand scrubs prior to performance of invasive procedures (e.g., placing intravascular lines or devices) When caring for severely immunocompromised patients Based on risk of transmission (e.g., specific micro-organisms) Critical-care areas Intensive-care nurseries Operating-theatre hand scrub When caring for individuals with antimicrobial resistant organisms	Antiseptic agents should be used in these situations: • If it is 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 unit, operating theatre, labour and delivery rooms, isolation areas, laboratories, and dialysis units; and for invasive procedures • When persistent antimicrobial activity on the hand is desired Antiseptic agents differ in activity and characteristics.

Source: Canada Communicable Disease Report Vol. 24S8. *Infection Control Guidelines: Handwashing, Cleaning, Disinfection and Sterilization in Health Care.* Health Canada. Ottawa. 1998. P.3 (modified)

APPENDIX 3: IPC Practices in the Operating Room

Most postoperative incisional or superficial wound infections are caused by microorganisms that are normally found on the patient's skin and mucous membranes adjacent to the surgical site and, less often, from other sites and from the surgeon or the assistants.

Preoperative Surgical Antisepsis

Preoperative surgical antisepsis consists of the following processes:

- Surgical hand scrubbing
- Gloving the surgical team
- Applying an antiseptic agent to the surgical site (preparing the surgical site)

Preparing Skin and Mucous Membranes Prior to Procedures

Although skin cannot be sterilized, applying an antiseptic solution minimizes the number of microorganisms around the surgical site that could contaminate the surgical wound and cause infection.

- If visibly soiled, clean any injection site, operative site, or external genitalia with soap and water before applying any antiseptic. No skin preparation is required prior to giving intramuscular, subcutaneous, or intradermal injections unless the injection site is visibly soiled.
- Prepare surgical sites with an appropriate antiseptic solution, using a circular motion starting from the centre and working outward.
- Prepare the vagina and cervix using a speculum to apply an appropriate antiseptic solution two to three times prior to inserting anything into the cervical os.
- Never use alcohol containing an antiseptic to prepare mucous membrane (for example, the vagina and cervix).
- Always allow the antiseptic enough time to dry.
- Do not allow the antiseptic to pool underneath the patient's body, because it can irritate the skin.
- Do not shave surgical sites—shaving increases the likelihood of infection.
- Do not remove hair from surgical sites at all unless absolutely necessary. If hair must be removed, trim the hair close to the skin surface immediately before surgery, being careful not to nick or injure the skin.
- Always ask the patient about allergic reactions before selecting an antiseptic solution.

The following products are recommended for surgical antisepsis:

- Alcohol-based solutions of iodine and chlorhexidine
- Alcohols (60 percent to 90 percent ethyl, isopropyl, or methylated spirits)
- Chlorhexidine gluconate (2 percent to 4 percent)
- Chlorhexidine gluconate and cetrimide, various concentrations, at least 2 percent
- Iodine (3 percent) aqueous iodine and alcohol-containing products

  Iodophors (7.5 percent to 10 percent), various other concentrations
- Chloroxylenol (Para-chloro-metaxylenol or PCMX) (0.5 percent to 3.75 percent), various other concentrations

The following products should not be used as antiseptics:

- Hexachlorophene
- Benzalkonium chloride
- Mercury laurel or other mercury-containing compounds

Antiseptics should be stored and used in the following manner:

- Pour the antiseptic into a small, reusable labelled container for daily use.
- Do not store gauze or cotton wool in antiseptic, because this promotes contamination.
- Do not refill an antiseptic dispenser before washing and cleaning it when it is near empty or empty.
- Wash reusable antiseptic containers thoroughly with soap and clean water, rinse with boiled water if available, and drip dry before refilling.
- Label reusable antiseptic containers with the date each time they are washed, dried, and refilled.
- Store concentrated antiseptic solutions in a cool, dark area. Never store them in direct sunlight or in excessive heat.
- Always follow the manufacturers' instructions for diluting an antiseptic solution.

Using Drapes for Surgical Procedures

Sterile drapes made of cloth are placed around a prepared surgical-incision site to create a work area. There are four types of drapes:

- Towel drapes
- Drapes or lap sheets
- Site drapes
- Pack wrapper drapes

Cloth drapes allow moisture to soak through and facilitate the spread of organisms from skin into the incision, even after surgical cleansing with an antiseptic agent. Therefore, gloved hands and sterile surgical instruments and other items should not touch drapes once they are in place. Using towel drapes to create a work area around the incision limits the amount of skin that needs to be cleaned, and it reminds the surgical team not to touch the other areas.

- Apply drapes around a completely dry, widely prepared skin.
- Wear sterile gloves when placing the drapes.
- Handle the drapes as little as possible and never shake or flap them.
- Always hold a drape above the area to be draped, and discard the drape if it falls below this area. Once a sterile drape touches the patient's skin, it is no longer sterile.

For minor surgical procedures:

- Use a site drape if the open skin required around the incision is not bigger than 5 centimeters.
- Place the hole in the drape over the prepared incision site and do not move it once it has touched the skin.

- If the site being draped is not sterile, put on sterile gloves after placing the drape on the patient to avoid contaminating the gloves.

For major surgical procedures:

- Use large drapes or lap sheets to cover the patient's body.
- After preparing the skin, place the sterile towel drapes to square off the incision site.
- Begin by placing the drape on the area closest to you. Once in place, the drape should NEVER be moved closer to the incision. It can, however, be pulled away from the incision.
- Use nonperforating towel clips to secure the corners of the towel drapes.
- During the procedure, do not place instruments on the patient's body or on the draped area. Keep all instruments on the instrument stand and cover them with a sterile towel or drape throughout the operation.

Safe Handling of Sharps

The operating room has special characteristics that increase the chance of accidents. Staff often use and pass sharp instruments without looking at the them or letting the other person know what they are doing. The workspace is confined and the ability to see what is going on in the operative field may be poor for some members of the team. Stress, anxiety, fatigue, frustration, the need for speed, and even anger can lead to injury. In many instances exposure to blood occurs without the person's knowledge, usually not until the gloves are removed. The fact that fingers are frequently the site of minor scratches and cuts further increases the risk of infection with BBPs.

Follow these guidelines in order to avoid all injuries that could result from handling sharps (hypodermic needles, wire sutures, skin hooks, towel clips, sharp-toothed tenaculums, scalpel blades, etc.):

- Use small Mayo forceps (not fingers) when holding the scalpel blade, putting it on or taking it off, or loading the suture needle.
- Always use tissue forceps (not fingers) to hold tissue when using a scalpel or suturing.
- Use a hands-free technique to pass or transfer sharps by establishing a safe or neutral zone in the operative field.
- Always remove sharps from the field immediately after use and put them in a sharps container.
- Place sharps containers as close and conveniently as possible to where sharps are being used and ensure that sharps containers are replaced when they are three-quarters full.

The hands-free technique for passing surgical instruments reduces the risk of sharps injuries during surgical procedures:

- Place a sterile kidney basin, or other suitable small container, on the operative field between assistants and the surgeon. The container is designated as the safe or neutral zone in which sharps are placed before and immediately after use. To avoid dulling scalpel blades, place a sterile cloth or gauze in the safe zone.
- Before transferring a sharp instrument to the surgeon, say "Sharp," and then pass the instrument.

Make operations as safe as possible:

- Have a brief preoperative discussion regarding the needs of the surgeon during surgery and how team members should handle sharps during the procedures.

- Review procedures for making each step in the operation safe.
- Avoid using straight suture needles and use curved ones instead.
- Use blunt needles for suturing soft tissues, if available.

Introduction

Infection prevention and control is important in the practice of dentistry, because dental HCWs and patients are exposed to a wide variety of microorganisms, which can include HBV and HCV, HIV, *Mycobacterium tuberculosis*, Staphylococci, Streptococci, and other viruses and bacteria.

Infections can be transmitted in the dental operatory through several routes:

- Direct contact with blood, saliva, and respiratory secretions during dental procedures
- Indirect contact with contaminated instruments, operatory equipment, or environmental surfaces
- Contact with aerosolized microorganisms in droplet spatter and with patient's blood or saliva when using air or water sprays or high-speed equipment

The nature of dentistry predisposes dental HCWs to exposure to microorganisms for two main reasons:

- Dental HCWs routinely work in an environment where there is frequent spatter of blood and bloody saliva and where there is the potential for exposure to percutaneous sharps while handling numerous dental instruments. All blood, saliva, and other patient fluids are potentially infectious.
- Dental HCWs often work with syringe needles and sharp instruments with little visualization of the treatment field.

A set of IPC strategies common to all health care settings should reduce the risk of transmission of infectious diseases caused by BBPs such as HBV, HCV, and HIV. Dental HCWs, like all other HCWs, should be vaccinated against HBV, influenza, and other immunizable diseases as appropriate.

Implementing safe and realistic IPC measures requires the full compliance of the whole dental team. These procedures should be regularly monitored during clinical sessions and practice meetings. All members of the dental team must understand and practice these procedures routinely.

Transmission of Blood-Borne Pathogens

From Patient to Dental HCWs

Generally, dental HCWs are far more likely to be exposed to BBPs *from* patients than they are to transmit BBPs to patients. Transmission is primarily through sharps injuries. Risks for transmission are increased when barrier precautions are not used. Adherence to IPC practices and HBV vaccination minimize the risk considerably.

From Dental HCWs to Patients

The possibility of transmission of BBPs from dental HCWs to patients is small. But transmission of HBV, HCV, and HIV from dental HCWs to patients can occur, particularly when barrier precautions (primarily gloves) are not used. Adherence to IPC practices minimizes the risk considerably.

From Patient to Patient

Patient-to-patient transmission of BBPs can occur in dental settings and is mostly a result of poor disinfection and sterilization practices and a lack of disposable instruments. Adherence to IPC practices minimizes the risk considerably.

Aseptic Technique in the Dental Setting

Aseptic techniques and procedures are fundamental components of IPC in the practice of dentistry. These techniques help to break the cycle of infection and to eliminate cross-contamination. Practicing hand hygiene between patients and using PPE and appropriate barrier techniques are primary aseptic techniques.

Hand Hygiene

As in any clinical-practice setting, hand hygiene plays a central role in the reduction of cross-contamination and in IPC. For most routine dental procedures, washing hands with plain soap is sufficient. For more invasive procedures, such as cutting gums or tissues, hand antisepsis with either an antiseptic solution or alcohol-based handrub is recommended. If available, waterless alcohol handrub could be used in place of hand washing if hands are not visibly soiled.

Important points to remember about hand hygiene in dentistry include the following:

- If you have exudative lesions or weeping dermatitis, particularly on the hands, refrain from direct patient contact and from handling dental patient-care equipment until the condition is resolved.
- Plain soap and water are sufficient in most of the cases. For surgical procedures, use an antiseptic solution or alcohol handrub.
- When washing hands, always use running water—avoid dipping or washing hands in a basin of standing water.
- Always dry hands completely with a clean or disposable paper towel.

See Section 4 for further details on hand hygiene.

PPE and Barrier Techniques

Dental HCWs must wear PPE such as eyewear, facemasks, face shields (if available), disposable gloves, and gowns when performing procedures that have a risk of contact with blood, blood-contaminated saliva, or mucous membranes. Full details on PPE are provided in Section 4.

Gloves

Properly fitting gloves protect dental HCWs from exposure through cuts and abrasions on their hands.

- Always wear a new pair of gloves for each patient. Never reuse them on another patient. Latex gloves for patient examinations and procedures are disposable, single-use items. Do not wash them with detergent.
- Always wash your hands before gloving and after removing any type of gloves.
- Use disposable nonsterile latex gloves for examinations and other nonsurgical techniques.
- Wear sterile gloves for surgical procedures.
- If a procedure will take longer than three hours, perform a surgical hand scrub and wear a new pair of sterile surgical gloves.
- Wear heavy utility gloves when handling and cleaning contaminated instruments and for surface cleaning and disinfection.

Eyewear

Protective eyewear should be worn during procedures that involve splashing and spatter of saliva and blood or that have the potential for creating projectiles, such as an amalgam. Eyewear protects the eyes from damage and from microbes such as HBV, which can be transmitted through the conjunctiva. Spectacles do not provide eye protection.

Facemasks

Masks serve as barriers in dental procedures to protect the mucous membranes of the nose and mouth from spatter. Dental HCWs should routinely wear facemasks during dental treatment and should change them when they become wet (typically between patient treatments). They should use a new mask for each patient. Masks should not be worn outside of the dental operatory.

Face Shields

Face shields serve as barriers to protect the mucous membranes of the eye, nose, and mouth from spatter.

Protective Clothing

- Wear protective clothing such as reusable or disposable gowns or uniforms when clothing is likely to be soiled with blood or other body fluids. Clothing typically should have a high neck and long sleeves to protect the arms from splashes and spatters.
- Change protective clothing at least daily and when it is visibly soiled.
- Remove protective clothing before leaving the workplace.
- Wash protective clothing and veils in the laundry of the health care facility.
    - If there is no laundry present, the attire should be washed separately from other clothing.
    - For additional antimicrobial activity, assuming the fabrics to be washed are not coloured or dyed, add bleach (e.g., 0.5 percent chlorine) to the laundry cycle.

Rubber Dam

A rubber dam is primarily used to isolate a tooth or teeth and to keep them dry during a dental procedure. The routine use of a rubber dam provides an effective barrier for both dental HCWs and patients. Rubber dams and high-volume evacuation also minimize potential spatter during treatment and whenever the dental HCW has direct contact with the patient's oral mucosa. Rubber dams are effective for reducing microbial contamination in the patient's mouth.

IPC during the Pre-treatment Period

The process of IPC begins during the preparation for clinical treatment. Paying attention to IPC at this time has several payoffs. In addition to reducing the risk of transmission of infectious agents during patient care, thinking ahead will make the treatment session more efficient and will also make the post-treatment IPC process easier and more effective. The following IPC procedures should be practiced:

- Remove unnecessary items from the dental procedure area and arrange the area to facilitate a thorough cleaning after each patient.
- Prepare the materials ahead of time that will be needed during treatment. Set out all instruments, medications, impression materials, and other items that are needed for a procedure. Thinking ahead minimizes the need to search for additional items or to enter cabinets and drawers once you are wearing gloves.
- Use disposable items whenever possible, which saves time during cleanup and decontamination and solves the problem of proper reprocessing.
- Use prearranged tray setups for routine or frequently performed procedures.
- Use individualized, sterilized bur blocks (containing only the burs required for that procedure) for each procedure to prevent contaminating other, unneeded burs and to facilitate cleanup.
- When a rubber dam will be used during a clinical procedure, include it on the tray setup. Include items that are needed for high-velocity evacuation.
- Identify items that will become contaminated during treatment. While preparing the procedure area prior to beginning a clinical procedure, consider which items will become contaminated during treatment. Examples of such surfaces include countertops, light handles, X-ray unit heads, and tray tables. Decide whether to use a barrier, such as plastic wrap or aluminum foil, to prevent contamination of these surfaces and items or to disinfect them when the procedure is complete.

- Review patient records before initiating treatment and place radiographs on the view box. Do not leave the record on the countertop or handle it after beginning treatment. Place the record in a drawer or out of the procedure area so that it does not become contaminated. Make entries into the record before and after the procedure.
- Follow manufacturers' directions for care and maintenance of dental unit water lines (DUWL) to prevent the growth or accumulation of bacteria within DUWL. Run hand pieces and air-water syringes for at least three minutes each morning to flush out any residual material. If no water check valves are present, flush the lines after each patient.
- Prepare personnel involved in patient care. This includes hand hygiene and the use of PPE (gown, eyewear, mask, and gloves).

Chairside Infection Control

Many of the instruments used in dentistry are sharp and can easily cut gloves and skin, thereby posing a potential risk of injury and infection. When items such as syringes with needles, blades, broken glass, and wires are contaminated with patient blood and saliva, they should be considered as potentially infective and handled with care to prevent injuries. During dental treatment, follow these guidelines for handling sharp items:

- Use proper techniques when passing sharp instruments (see Appendix 3.)
- To avoid injury while separating the needle and syringe of reusable dental syringes, use the single-hand technique in recapping. Alternatively, use tweezers to recap. Remove the cartridge first and then unscrew the needle from the syringe while taking care to prevent injury. (See Figure 11, Section 4.)
- Place used sharps in safety boxes that are resistant to punctures and leakage. Safety boxes should be designed so that items can be dropped in using one hand and no item can be removed. (See Section 4.) The safety box should be marked "Danger Contaminated Sharps" and with the biohazard symbol on the outside of the box. It should be closed when three-quarters full and then placed in a yellow plastic bag or container with the other hazardous health care waste for final disposal.
- In particular, discard all disposable syringes and needles immediately following use. Do not recap or remove the needle from a disposable syringe. The whole combination should be inserted into the safety box directly after use.
- Never bend, break, or cut needles before disposing of them.
- Never, under any circumstances, dispose of used syringes or needles, or safety boxes, in normal garbage or dump them randomly without prior treatment.
- Destroy full safety boxes by incineration, preferably in an appropriate double-chamber incinerator. The residues of incineration should be safely buried at sufficient depth (deeper than 1 meter). If an appropriate incinerator is unavailable, use an alternative method, such as sharps pits that are well protected.
- Use puncture-resistant sharps containers and work practices that minimize the unnecessary handling of sharps.
- Always put on heavy-duty gloves when handling sharps waste containers.
- Use a rubber dam whenever possible.

Additional precautions can reduce the risk of infection:

- Avoid touching unprotected switches, handles, drawers, cabinets, and other equipment once you have worn gloves. If objects are touched or handled, carefully clean and disinfect them at the end of the procedure. Adequate planning will reduce and often eliminate the need to reach into drawers and cabinets for additional items with contaminated gloves. Should the need to reach into drawers arise despite prior good planning, follow these guidelines to maintain effective infection control:
  - Ask another person for assistance.
  - Use another barrier, such as a plastic glove, to grasp the handle of the cabinet or drawer.
  - Remove the contaminated gloves and wash your hands before entering a drawer of a cabinet, and then reglove before resuming the procedure.

Infection Control during the Post-treatment Period

The process of IPC continues even after completing procedures and discharging the patient from the dental health care facility. Effective pre-treatment planning simplifies post-treatment IPC practice. Additional procedures to further reduce the risk of transmission of infectious agents include the following:

- After patient care is completed, remove the contaminated gloves that were used during treatment.
- Wash your hands and put on utility gloves before cleaning up.
- Continue to wear PPE (protective eyewear, mask, and gown) during cleaning and disinfecting.
- Remove all disposable barriers that were put in place before treatment, such as light handle covers and countertop barriers. Place them in a leak-proof waste bag inside a trash container.
- Dispose of blood and suctioned fluids that have been accumulated in the collection bottles during treatment. Proper disposal of these fluids is essential.
  - Pour the blood, liquid wastes, and suctioned fluids into a special sink connected to a sanitary sewer that is be used solely for this purpose.
  - Disinfect the unit collection bottle using a 0.5 percent chlorine solution.
  - Completely fill the bottle with the solution and leave it standing for 10 minutes before emptying and rinsing with fresh water.
  - Use disposable suction collection systems where available.
- Decontaminate, clean, and disinfect all items not protected by barriers.
- Remove the tray with all instruments to a sterilization and cleanup area separate from the treatment room. (Ideally, dental offices should have a separate room for reprocessing instruments.)
- Pick up instruments one at a time. Never pick up a handful of instruments, which greatly increases the risk of cuts or punctures.
  - Use special care when handling double-ended instruments.
  - Carefully decontaminate dental instruments, using a brush with soap and water to scrub, and then rinse thoroughly before sterilization.

- Sterilize hand pieces whenever possible:
  - Hand pieces that are designed for steam sterilization between uses are preferred.
  - When a hand piece cannot be sterilized by dry heat or steam, use chemical disinfection as an alternative.
  - To reprocess hand pieces, flush the hand piece, discharging the water into a sink or container, scrub with detergent and water to remove any adherent material, and sterilize using the appropriate method.
- Place waste that is contaminated with blood or saliva in sturdy, leak-proof bags.
- Handle sharp items carefully.
- After instruments have been scrubbed and packaged for sterilization and after other cleanup tasks have been completed, remove PPE:
  - Remove your mask by grasping it only by the cloth or elastic strings, not by the mask itself (see Figure 8, Section 4).
  - Clean protective eyewear and face shields with soap and water and then disinfect them or prepare them for sterilization.
  - Do not to touch eyewear with an ungloved hand, because it is likely to have become contaminated with spatter of blood and saliva during patient care.
  - After removing the gown, immediately place it in the soiled linen container.
  - Wash gowns (you can use the normal laundry cycle).
  - Wash utility gloves with soap and water before removing them.
  - Thoroughly wash your hands.

Reprocessing Instruments, Hand Pieces, Anti-retraction Valves, and Other Intraoral Dental Devices in the Dental Setting (See also Section 9)

Classification of Dental Instruments

As with other medical and surgical instruments, dental instruments are classified into three categories—critical, semi-critical, or noncritical—depending on their risk of transmitting infection and on the need to sterilize them between uses. Each dental practice should classify all instruments as follows:

- Critical: Surgical and other instruments that touch bone or penetrate soft tissue are classified as critical and should be sterilized after each use. These devices include forceps, scalpels, bone chisels, scalers, burs, etc.
- Semi-critical: Instruments that touch mucous membranes, but do not touch bone or penetrate tissue are classified as semi-critical. These devices should be sterilized after each use. If, however, sterilization is not feasible because the instrument will be damaged by heat, the instrument should receive high-level disinfection, at a minimum. Examples include mirrors and amalgam condensers.
- Noncritical: Equipment and environmental surfaces that come into contact only with intact skin are classified as noncritical. Because this equipment and these noncritical surfaces have a relatively low risk of transmitting infection, they may be reprocessed between patients with intermediate-level or low-level disinfection or by washing with detergent and water if they are not contaminated with blood. External components of x-ray heads are examples.

Sterilizing Hand Pieces and Removable and Intraoral Instruments

Routinely sterilize between patient use all high-speed dental hand pieces, low-speed hand-piece components used intraorally, and reusable prophylaxis cups and brushes by an appropriate method. Follow manufacturers' instructions for cleaning, lubrication, and sterilization procedures closely to ensure both the effectiveness of the sterilization process and the longevity of these instruments.

Surface disinfection by wiping or soaking in liquid chemical germicides is not an acceptable method for reprocessing high-speed hand pieces, low-speed hand-piece components used intraorally, or reusable prophylaxis angles. Internal surfaces of high-speed hand pieces, low-speed hand-piece components, and prophylaxis cups and brushes may become contaminated with patient material during use. This retained patient material may be expelled intraorally during subsequent use.

Virtually all high- and low-speed hand pieces in production today are heat tolerant, and most heatsensitive models manufactured earlier can be retrofitted with heat-stable components.

Clean and sterilize other reusable intraoral 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, after treatment of each patient in the same manner as hand pieces. Follow manufacturers' directions for reprocessing to ensure effectiveness of the process as well as to ensure the longevity of the instruments.

Note: Restricted physical access, particularly to internal surfaces of these instruments, limits the necessity for cleaning and disinfecting, or sterilizing with liquid chemical germicides.

Maintaining Anti-retraction Valves

Because retraction valves of water lines from dental units can cause aspiration of patient material back into the hand piece and water lines, dental practices should install anti-retraction valves (one-way flow check valves) to prevent fluid aspiration and to reduce the risk of transferring potentially infective material. Routine maintenance of anti-retraction valves is necessary to ensure effectiveness. Consult the manufacturer of the dental unit to establish an appropriate maintenance routine.

Flushing High-Speed Hand Pieces

Run high-speed hand pieces for a minimum of 20-30 seconds to discharge water and air after use on each patient. This procedure is intended to aid in physically flushing out patient material that might have entered the turbine and air or water lines. Using an enclosed container or high-velocity evacuation should be considered in order to minimize the spread of spray, spatter, and aerosols generated during discharge procedures.

Flushing DUWLs

To substantially reduce overnight or weekend microbial accumulation in DUWLs, remove the hand piece and allow water lines to run and discharge water for several minutes at the start of each clinic day. Standard procedures such as flushing DUWLs at the beginning of each clinic day and between patients, and sterilizing dental hand pieces between patients are interventions that can minimize the risk of transmitting infectious agents from water lines. Microbial biofilms are ubiquitous in the environment and can be found on any water delivery system. For most nonsurgical dental procedures, such as subgingival scaling, restorative procedures, and initial access into the dental pulp, using water as a coolant and irrigating the patient's dental cavity from the DUWL is sufficient. For more invasive procedures in the oral cavity, such as cutting bone, use sterile solutions for irrigation and cooling.

Disinfecting Heat-Sensitive or Permanently Attached Items

Some dental instruments have components that are heat sensitive or are permanently attached to DUWL. Some items might not enter the patient's oral cavity, but are likely to become contaminated

with oral fluids during treatment procedures, including, for example, handles, arm rests, hand-piece tubings or dental-unit attachments of saliva ejectors, high-speed air evacuators, and air or water syringes. Cover these components with impervious barriers that are changed after each use or, if the surface permits, carefully clean and then treat them with a chemical germicide having at least an intermediate level of activity. As with high-speed dental hand pieces, flush water lines to all instruments thoroughly after the treatment of each patient. Flushing at the beginning of each clinic day also is recommended.

Certain chemicals are used in the HLD processing of heat-sensitive, semi-critical medical and dental instruments. Follow the product manufacturers' directions closely regarding appropriate concentration and exposure time.

Tips and Reminders for Dental HCWs when Reprocessing Dental Instruments

- Do not just disinfect instruments when you can sterilize them.
- Sterilize all reusable, heat-stable instruments, and other items that come in contact with a patient's blood, saliva, or mucous membranes in a heat sterilizer before reuse. The majority of reusable dental instruments are heat stable and can withstand repeated exposure to heat sterilization cycles.
- Proper cleaning of instruments before sterilization is essential for successful sterilization.
- Handle all contaminated instruments and items carefully.
- Wear PPE, such as heavy-duty utility gloves, protective eyewear, and a protective garment, while reprocessing instruments. Do not use latex examination gloves for reprocessing procedures—they do not provide adequate protection against percutaneous accidents.

Maintaining and Storing Dental Instruments and Other Items

Store wrapped instruments and other items in a place where they will not get torn and wet. Place reprocessed instruments on clean shelves or in clean drawers. If packaging becomes compromised, repackage the items and sterilize them again.

Cleaning and Disinfecting Environmental Surfaces

After each patient and at the completion of daily work activities, use disposable towels, an appropriate cleaning agent, and water to clean the countertops and dental-unit surfaces that might have become contaminated with patient material. Then disinfect surfaces with a suitable chemical germicide.

Intermediate-Level Disinfection

Use a chemical germicide with mycobactericidal activity for disinfecting surfaces that have been soiled with patient material. These intermediate-level disinfectants include phenolics and chlorine-containing compounds. Because mycobacteria are among the most resistant groups of microorganisms, germicides that are effective against mycobacteria should be effective against many other bacterial and viral pathogens. A fresh solution of sodium hypochlorite prepared daily is an inexpensive and effective intermediate-level germicide. Concentrations of 500 ppm chlorine are effective on environmental surfaces that have been cleaned of visible contamination. Caution should be exercised—chlorine solutions are corrosive to metals, especially aluminium.

Low-Level Disinfection

Low-level disinfectants have no mycobactericidal activity. These include QUATs or hypochlorite solution (200 ppm). They are appropriate for general housekeeping purposes such as cleaning floors, walls, and other housekeeping surfaces.

Disinfecting the Dental Laboratory

Clean and disinfect laboratory materials and other items that have been used in the mouth, such as impressions, bite registrations, fixed and removable prostheses, and orthodontic appliances, before handling them in the laboratory, whether in an on-site or in a remote location. These items should also be cleaned and disinfected after being manipulated in the laboratory and before placement in the patient's mouth.

Because of the increasing variety of dental materials used intraorally, dental HCWs should consult with manufacturers regarding the stability of specific materials relative to disinfection procedures. A chemical germicide should have at least an intermediate level of activity for such disinfection.

Table 10. Guide for selecting appropriate disinfection methods for items transported to or from the dental laboratory

Item	Method*	Recommended Disinfectant	Comments
Appliances	Immerse	Chlorine compounds	Rinse thoroughly after disinfection.
Metal/Acrylic			
All Metal		Glutaradehyde	
Articulators, face bows	Spray-wipe-spray	Phenolics	Face-bow forks should be heat-sterilized before reuse.
Casts Custom impression trays (Acrylic)	Spray until wet or immerse	Chlorine compounds	
Impressions	Immersion disinfection preferred		Heat-sterilize reusable impression trays. Discard plastic trays after use.
Irreversible hydrocolloid (Alginate)	Immersion disinfection with caution, using only disinfectants with short-term exposure times (no more than 10 minutes for alginate)	Chlorine compounds	Short-term immersion in glutaraldehyde has been found to be acceptable; but time is inadequate for disinfection.
Reversible hydrocolloid			Do not immerse in alkaline glutaradehyde.
Polysulfide rubber Silicone rubber	Immersion disinfection	Glutaraldehyde, chlorine compounds, phenolics	Disinfectants requiring more than 30-minute exposures are not recommended.
Polyether	Immersion disinfection with caution using only disinfectants with short term exposure times (10 minutes maximum)	Chlorine compounds	ADA recommends any of the disinfectant classes, but short-term exposures are essential to avoid distortion.
ZOE impression paste	Immersion spraying for bite registration	Glutaraldehyde	This is not compatible with chlorine compounds. Phenolic sprays can be used.
Impression compound		Chlorine compounds	Phenolic sprays can be used.
Prostheses	Immersion disinfection—caution to avoid erosion of metal	Rinse thoroughly after disinfection	Clean "old" prostheses by scrubbing with hand-wash antiseptic or by ultrasonic cleaner before disinfection.
Removable (acrylic/porcelain)		Chlorine compounds	Rinse thoroughly after disinfection; store in diluted mouthwash.
Removable (metal/acrylic)		Chlorine compounds	Rinse thoroughly after disinfection.
Fixed (metal/ porcelain)		Glutaraldehyde, chlorine compounds	

Polishing Dental Prostheses			
Pumice slurry	Mix with disinfectant	Chlorine compounds (1:10 dilution), Virkon§	Change the pumice slurry regularly.
Polishing and finishing lathe trough	Spray until wet	Chlorine compounds (1:10 dilution), Virkon§	Thoroughly disinfect before reuse.
Polishing mops and brushes	Spray until wet or immerse	Chlorine compounds (1:10 dilution, Virkon§	Thoroughly disinfect before reuse.
Shade guides		Phenolics	Wipe afterwards with water or alcohol to avoid discolouration.
Wax rims, wax bites	Spray until wet	Phenolics	Rinse thoroughly after disinfection

* Use appropriate exposure time to disinfectant as recommended by the disinfectant's manufacturer. All items must be rinsed thoroughly (at least 15 seconds) under running tap water after disinfection.

§ Virkon is a multipurpose disinfectant that contains oxone, potassium peroxomonosulphate, sodium dodecylbenzenesulfonate, sulphamic acid, and inorganic buffers.

Using Single-Use Disposable Instruments

Use single-use disposable instruments (prophylaxis angles; prophylaxis cups and brushes; tips for high-speed air evacuators, saliva ejectors, air/water syringes, etc.) for one patient only and discard them appropriately. These items are neither designed nor intended to be cleaned, disinfected, or sterilized for reuse.

Handling Biopsy Specimens

In general, each biopsy specimen should be put in a sturdy container with a secure lid to prevent leaking during transport. Be careful not to contaminate the outside of the container when collecting specimens. If the outside of the container is visibly contaminated, it should be cleaned and disinfected or placed in an impervious bag. (See Section 10.)

Using Extracted Teeth in Dental-Education Settings

Standard precautions should be adhered to whenever extracted teeth are handled. Extracted teeth used for the education of dental HCWs should be considered infective and classified as clinical specimens, because they contain blood. All persons who collect, transport, or manipulate extracted teeth should handle them with the same precautions as a specimen for biopsy. Because preclinical educational exercises simulate clinical experiences, dental students should adhere to standard precautions in both preclinical and clinical settings. In addition, all persons who handle extracted teeth in dental-education settings should receive the hepatitis B vaccine.

Before extracted teeth are handled in dental-educational exercises, they should first be scrubbed with detergent and water or by using an ultrasonic cleaner to remove any adherent patient material. Teeth should then be stored by immersion in a fresh solution of 0.5 percent sodium hypochlorite or any liquid chemical germicide suitable for clinical specimen fixation.

Persons handling extracted teeth should wear gloves, dispose of them properly after completion of work activities, and wash their hands.

Note: *Extracted teeth that are used in dental-education settings are handled differently than a patient's own extracted teeth.*

Disposing of Waste Materials

Blood, suctioned fluids, or other liquid waste may be poured carefully into a drain connected to a sanitary sewer system. Sharps should be placed intact into puncture-resistant containers before disposal. Solid waste contaminated with blood or other body fluids should be placed in sealed, sturdy impervious bags to prevent leakage of the contained items. All contained solid waste should then be disposed of safely.

IPC in Dental Radiology

It is also necessary to use IPC practices when taking radiographs. Both the radiographic equipment and the film can become contaminated and could transmit infectious agents from patient to patient or from patient to dental HCW.

Personal Protective Equipment

Always wear gloves while exposing films in a patient's mouth and for processing. Other PPE (masks, eyewear, protective clothing, etc.) is required when spatter or splash is anticipated.

Protective Covers for Radiographic Equipment

In preparation for exposing periapical radiographs, place a polyethylene bag over the tube head to protect it from contamination when it is positioned for various exposures. It is easier to protect the tube head by using a barrier than to disinfect it using chemicals afterwards. The exposure control switch should be protected with a plastic covering if a foot-activated switch is not available. After the radiographs have been taken, remove and discard covers without contaminating the film. Remove and discard the gloves, and process the noncontaminated film in the darkroom.

When Not Using Protective Covers

If protective covers are not used, follow these guidelines: n

Place exposed films into a container.

- Remove and discard gloves, put on a fresh pair of gloves, and transport the container to the darkroom.
- Carefully open packs and drop the films on a clean surface. Discard contaminated wrappers and remove and discard gloves.
- Process the film.

Processing Film

Because there is no practical way to disinfect the film, the following procedure is suggested to prevent contamination:

- Place the exposed film in a paper cup.
- Remove soiled gloves and put on a pair of clean gloves.
- Place the paper cup inside the daylight loader and close the lid.
- Place the gloved hands through the light shield, unwrap the film packet, and drop the film onto the surface inside the loader.
- Place the film wrapping into the cup. Remove gloves, turn them inside out, and place them in the paper cup.
- Drop the film in the chute for developing.

- Remove hands from the loader, lift the lid, and dispose of the paper cup and other waste.
- Wash hands thoroughly.

Reprocessing the Bite Holder

The bite holder required for X-rays should be autoclaved if it is not disposable.

Environmental Factors and Design Issues for the Dental Unit

- Good ventilation is necessary—usually an open window will suffice.
- Clearly define clean and dirty areas.
- A washbasin with an elbow-operated tap and soap should be present in the treatment area.
- Do not use carpeting. The floor covering should be impervious, nonslip, and seam-free. Junctions between the floor and wall should be sealed to prevent inaccessible areas where cleaning might be difficult.
- Work surfaces should be impervious and easy to clean and disinfect.
- Do not allow smoking.
- Avoid overstaffing and overcrowding in the treatment area.
- If you have more than one dental chair in a room, you must have a partition between the chairs.

Methicillin-Resistant *Staphylococcus Aureus*

Methicillin-resistant *staphylococcus aureus* (MRSA) is resistant to common antibiotics, but not more pathogenic than other strains of *S. aureus.* It does not colonize normal skin, but it does colonize the nose, axillae, perineum, and broken skin.

- No special IPC precautions are necessary for dental treatments of patients who are colonized with MRSA.
- Dental staff members who are colonized with MRSA should not participate in invasive procedures.

Most postpartum infections are caused by endogenous flora—microorganism that are normally present in the genital tract, but that usually cause no disease until labor, delivery, or postpartum. Nearly 30 types of bacteria exist in the lower genital tract (vulva, vagina, and cervix) at any time. While some of these, including several fungi, are considered nonpathogenic under most circumstances, at least two-thirds of them are pathogenic. These include *Escherichia coli*, *Staphylococcus aureus*, *Proteus mirabilis*, and *Klebsiella pneumoniae*.

Preventing Maternal Infections before, during, and after Vaginal Births

Several steps can be taken to decrease the risk of maternal infection prior to delivery:

- Wear PPE, including a plastic or rubber apron and face shield (or a facemask and goggles), to minimize the risk of infection from splashing of blood and blood-tinged amniotic fluid.
- Once the patient is positioned for childbirth, observe appropriate hand hygiene, put examination gloves on both hands, and wash the perineal area (vulva, perineum, and anal region) with soap and clean water.
    - Use a downward and backward motion when washing the perineal area so that fecal organisms will not be introduced into the vagina.
    - Clean the anal area last and place the washcloth or towel in a plastic container.
- Thoroughly wash hands, especially between the fingers, and forearms up to the elbows with soap and clean water and dry with a clean, dry towel.
- Put sterile surgical gloves on both hands for the delivery of the baby.

Factors that increase the risk of infection during labour and vaginal delivery include the following:

- Prolonged ruptured membranes (more than 18 hours)
- Trauma to the birth canal, such as episiotomy, vaginal or perineal lacerations, and urethral tears
- Manual removal of a retained placenta or placental fragments
- Prolonged labour

These precautions should be taken to decrease the risk of maternal infection during delivery:

- If resuscitation of the infant is required, use mechanical suction.
- If manual removal of the placenta is required, use elbow-length gloves to avoid contaminating the forearms with blood.

These precautions should be taken to decrease the risk of maternal infection after delivery:

- Use forceps to hold suture needle during repair of episiotomy or vaginal/perineal tear, if present.
- Dispose of sharps in a sharps container.
- Before removing gloves, dispose of all waste, including the placenta, appropriately.
- Remove gloves and perform hand hygiene.

Preventing Maternal Infections before, during, and after a Caesarean Section

Caesarean sections should be performed using the same standards that are used in any general surgical procedure. In addition, the following procedures are recommended:

- Do not shave patients before surgery. If it is necessary to remove pubic or abdominal hair, clip the hair with scissors just prior to surgery.

- The surgeon and assistant should wear a facemask and goggles (or face shield) and a plastic or rubber apron.
- Give prophylactic antibiotics to the mother before surgery.
- With prolonged ruptured membranes or with documented chorioamnionitis, avoid spilling amniotic fluid into the abdominal cavity.
- Do not explore the peritoneal cavity unless absolutely necessary, and then only after closing the uterine incision and changing the surgical gloves.

To minimize postoperative infections after a Caesarean section:

- Do not place drains in the subcutaneous layer unless absolutely necessary.
- Apply a sterile dressing on the repaired skin incision.
- Remove the urinary catheter immediately after surgery unless it is necessary to retain it. This will minimize the risk of health care-associated UTI.

To minimize the risk of HAIs in mothers during the postpartum period:

- Provide adequate analgesia to promote early ambulation and coughing.
- Encourage breastfeeding and demonstrate the correct breastfeeding technique. For mothers who will not breastfeed, provide appropriate breast support, lactation suppression, and analgesia.

Preventing Fetal and Newborn Infectious Diseases

Colonization and Infection in Newborns

Most infants are delivered from a sterile environment inside the uterus. During and after birth, however, they are rapidly exposed to numerous microorganisms that colonize their skin, nasopharynx, and gastrointestinal tract. Sick newborns, subjected to multiple invasive procedures, such as endotracheal tubes or umbilical artery catheters, might be colonized at multiple sites with numerous other organisms, particularly gram-negative bacteria.

The skin of the newborn is a major initial site of bacterial colonization, particularly by *S. aureus*, which is most often acquired from within the nursery rather than from the mother. Any break or cut in the skin provides an opportunity for infection to develop with this pathogenic organism. To minimize the risk of infection in the newborn period, use aseptic techniques at all sites.

Although severe infection in a full-term infant is uncommon, when infection does occur, it often is secondary to group B-hemolytic *Streptococcus, E.coli, Listeria monocytogenes, Citrobacter diversus,* salmonella, chlamydia, herpes simplex virus (HSV), or enteroviruses. All of these organisms can be transmitted to other infants in the nursery on the hands of HCWs unless standard precautions are strictly adhered to, especially hand hygiene and the use of gloves.

Most fetal and newborn infectious diseases have been prevented by improved maternal immunization against diseases, such as tetanus; antenatal treatment of maternal infectious diseases, such as syphilis; the prophylactic use of medications, such as postnatal eye drops or ointment to prevent conjunctivitis; and ARV drugs to prevent mother-to-child transmission of HIV. To reduce the risk of cross-infection, each infant must be issued with his or her own tube of eye ointment.

To minimize the risk of exposure to HIV and other blood-borne viruses during labor, childbirth, and resuscitation of the baby, use standard precautions, especially hand washing and the use of gloves, face shields, and plastic or rubber aprons.

Postnatal Care of the Newborn

The following precautions help minimize the risk of HAIs in newborns:

- Wear gloves and a plastic or rubber apron when handling the infant until blood, meconium, or amniotic fluid has been removed from the infant's skin.
- Practice hand hygiene and put on clean examination gloves before holding or handling the infant.
- Place the infant on a clean towel.
- Carefully remove blood and other body fluids using a cotton cloth, not gauze, soaked in warm water and then dry the skin.
- Delay bathing or washing the newborn until its temperature has stabilized (usually about six hours).
- Apply the following general instructions for cord care:
  - Practice hand hygiene before and after cord care.
  - Keep the cord stump clean and dry.
  - Do not cover the cord stump with a dressing or bandage.
  - Fold the diaper or baby napkin below the cord stump.
  - If the cord stump gets soiled or dirty, gently wash it with soap and boiled clean water that has been brought to the appropriate temperature, rinse with boiled water, and dry with a clean cloth.
  - Instruct the mother that if the cord stump becomes red or begins to drain blood or pus, she should take the baby to a health care facility equipped to care for newborns as soon as possible.

Managing Outbreaks in the Nursery or NICU

If an epidemic or outbreak of a particular disease is suspected:

- Identify the disease and its source—patients, staff, or visitors—and the means of transmission, such as contamination via hands of staff, parents, or visitors.
- Decide on the type of control measures that are required to prevent the spread of the infection and determine the need for laboratory or epidemiologic studies.

APPENDIX 6: Immunobiologics and Schedules for Hcws as Recommended by CDC (1998)

Generic Name	Primary Booster Dose Schedule	Indications	Major Precautions and Contraindications	Special Considerations
Hepatitis B recombinant vaccine	Two doses IM in the deltoid muscle 4 weeks apart, 3rd dose 5 months after 2 nd dose Booster doses not necessary	Health care personnel at risk of exposure to blood and body fluids	Not contraindicated in pregnancy (No apparent adverse effects to developing fetuses) History of anaphylactic reaction to common baker's yeast	There were no therapeutic or adverse effects on HBV-infected persons. Cost-effectiveness of prevaccination screening for suceptibility to HBV depends on costs of vaccination and antibody testing and prevalence of immunity in the group of potential vaccinees. Health care personnel who have ongoing contact with patients or blood should be tested 1-2 months after completing the vaccination series to determine serologic response.
Influenza vaccine (inactivated whole-virus or split-virus)	Annual single-dose vaccination IM with current vaccine (either whole-virus or split-virus)	Health care personnel who have contact with high-risk patients or working in chronic-care facilities; personnel with high-risk medical conditions; per-sonnel who are 65 or older.	History of anaphylactic hypersensitivity after egg ingestion	There was no evidence of maternal or fetal risk when vaccine was given to pregnant women with underlying conditions that put them at high risk for serious influenza complications.
Measles live-virus vaccine	1st dose SC; 2nd dose at least 1 month later	Health care personnel born in or after 1957 with-out documentation of (a) receipt of two doses of live vaccine on or after their 1st birthday, (b) clinician - diagnosed measles, or (c) laboratory evidence of im-munity. Vaccine should be considered for all person-nel, including those born before 1957, who have no proof of immunity.	Pregnancy Immuno-compromised* state (including HIV-infected persons with severe immunosuppression) History of anaphylactic reactions after gelatin ingestion or receipt of neomycin; or recent receipt of immune globulin	MMR is the vaccine of choice if recipients are also likely to be susceptible to rubella and/or mumps. Persons vaccinated between 1963 and 1967 with (a) a killed measles vaccine alone, (b) a killed vaccine followed by live vaccine, or (c) a vaccine of unknown type should be revaccinated with two doses of live measles vaccine.
Mumps live-virus vaccine	One dose SC; no booster	Health care personnel believed to be susceptible can be vaccinated. Persons born before 1957 can be considered immune.	Pregnancy Immuno-compromised* state History of anaphylactic reaction after gelatin ingestion or receipt of neomycin	MMR is the vaccine of choice if recipients are also likely to be susceptible to measles and rubella.
Rubella live-virus vaccine	One dose SC; no booster	Health care personnel, both male and female, who lack documentation of receipt of live vaccine on or after their 1st birthday, or of laboratory evidence of immunity. Persons born before 1957 can be considered immune, except women of childbearing age.	Pregnancy immuno-compromised* state History of anaphylactic reaction after receipt of neomycin	Women who are pregnant when vaccinated or who become pregnant within 3 months of vaccination should be counseled on the theoretic risks to the fetus. (The risk of rubella vaccine-associated malformations in these women is negligible.) MMR is the vaccine of choice if recipients are also likely to be susceptible to measles or mumps.
Varicella-zoster live-virus vaccine	Two 0.5 ml doses SC 4-8 weeks apart if 13 or older	Health care personnel without reliable history of varicella or laboratory evidence or varicella immunity.	Pregnancy immuno-compromised* state History of anaphylactic reaction after receipt of neomycin or gelatin Salicylate use should be avoided for 6 weeks after vaccination.	Because 71%-93% of persons without a history of varicella are immune, serologic testing before vaccination may be cost-effective.

IM= Intramuscularly; SC= Subcutaneously.

**Persons immunocompromised because of immune deficiencies. HIV infection, leukemia, lymphoma, generalized malignancy, sor immunosuppressive therapy with corticosteroids, alkylating drugs, antimetabolites, or radiation.*

APPENDIX 7: Precautions for Handling and Disposing of Dead Bodies and Human Remains

Human remains have risks associated with each stage of handling and disposal. The precautions described in this appendix should be adhered to while handling human remains at accident scenes, in wards, in mortuaries, in funeral homes, and in pathology and human anatomy laboratories.

The main stages of handling include:

- Initial collection of the remains from the site of death
- Transporting the remains from the initial collection point to the funeral home or mortuary
- Storing the remains prior to burial or cremation
- Hygienic preparation
- Post-mortem preparation
- Embalming
- Domestic duties (cleaning vehicles, trolleys, etc.)
- Laundering, cleaning instruments, and disposing of waste
- Exhuming the remains

For each stage, there are risks of exposure to potentially infectious material in body fluids, direct skin contact, or waste. There can be a risk of exposure to airborne infections during any stage that involves manual moving of the remains. In the event of exhumations, the risks also include exposure to infectious material in the soil.

Standard Precautions for IPC

Using standard precautions while handling all human remains is of utmost importance, and is the most effective means of preventing the spread of infection. Standard precautions are based on the principle that all blood, body fluids, secretions, excretions, nonintact skin, and mucous membranes might contain transmissible infectious agents. (See Section 4 for more details on standard precautions).

Policy Documents

All premises should provide policy documents and codes of practice to staff on the correct handling of dead bodies.

Risk of Transmission of Infection after Death

When a person dies, the environment in which pathogens live can no longer sustain them, but this is not immediately the case for all pathogens. Transmission of an infectious agent from a dead body or fragmented remains to a living person can occur. The most likely types of pathogens that HCWs who routinely handle human remains are exposed to include the following:

- Blood-borne viruses, such as HBV, HCV, and HIV
- Gastrointestinal infections such as shigella and salmonella
- *Mycobacterium tuberculosis*

The list of infectious diseases that continue to pose a risk after death is extensive and includes, but is not limited to, the following:

- Anthrax
- Typhoid and paratyphoid fever

- Meningococcal septicaemia with or without meningitis
- Viral haemorrhagic fevers
- Invasive Group A streptococcal infections, such as necrotising fascitis, and other Group A streptococcal infections in persons who didn't have at least 24 hours of effective antibiotic therapy before death
- Viral hepatitis
- HIV/AIDS
- Creutzfeldt-Jacob disease, new variant Creutzfeldt-Jacob disease, and other transmissible spongiform encephalopathies

Microorganisms involved in the decay process (putrefaction) are not pathogenic. Although organisms in the dead body are unlikely to infect healthy people with intact skin, people who directly handle human remains are at risk of infections via the following routes:

- Sharps injuries, such as needle-stick injuries or sharp fragments of bone
- Intestinal pathogens from anal and oral orifices
- Abrasions, wounds, and sores on the skin
- Contaminated aerosols from body openings or wounds, such as *M. Tuberculosis*
- Splashes or aerosols into the eyes

Handling Human Remains—Pandemic Influenza Specific Risks

In the event of a pandemic influenza, special IPC measures are not required for handling persons who died from influenza, as the body is not contagious after death. If the pandemic influenza-infected patient died during the infectious period, however, the lungs might still contain virus.

- Use additional respiratory protection during autopsy procedures that you perform on the lungs or during procedures that generate small-particle aerosols, such as using power saws or washing intestines.
- Use additional respiratory protection during the embalming process (preparing the deceased for burials and cremations).

Communication

If a person died with a known or suspected infection, it is essential that all persons who might be involved in handling the body are informed of the potential risk:

- Identify and label the body correctly.
- Use body bags as risk assessment dictates. Bodies that are likely to be infective to handlers, likely to leak in transit, are offensive, etc., should be placed in body bags.
- Attach a biohazard label to the bags.
- Make the undertakers aware immediately if a body they are to handle is either known or suspected to be infectious.

At a Mass Fatality Disaster Site

Recovery personnel need protection from the additional risks or hazards that are specific to a mass fatality incident:

- Hazards associated with building fires—flames, heat, combustion by-products, smoke, etc.
- Rubble and debris
- Air choked with fine particles
- Hazardous materials—anhydrous ammonia, battery acids, etc.
- Potential risk of secondary devices or a follow-on attack if the incident is an act of terrorism

Provide accurate information to address public concerns on the risks and risk management. Recommend precautions and use of PPE, if applicable. Instruct the public not to handle human remains until a report to law enforcement authorities has been made. This is important to:

- Facilitate accurate identification
- Preserve evidence if a crime has been committed
- Protect the public from possible exposure to blood-borne viruses and bacteria
- Protect the public from other safety threats that might be associated with the incident

In Funeral Homes and the Mortuary

The health, safety, and welfare of employees and members of the public have to be safeguarded. Vaccination of staff against immunizable diseases is recommended.

- Use thin, plastic body covers for all bodies, unless a stronger body bag (cadaver bag) is required for infectious cases or to prevent excessive leakage.
- The body should remain in the body cover until release from the mortuary.

Use of Cadaver Bags

Cadaver (body) bags might be required for use after death in certain situations in order to protect subsequent body handlers (mortuary staff, undertakers, porters, etc.) Cadaver bags should not be used unnecessarily as the body cools more slowly inside these bags, which accelerates decomposition that could render tissues unsatisfactory for histopathological examination. Such decomposition can also cause distress to family members viewing bodies at funeral parlours. All bodies that require bagging should be dealt with and transported for refrigeration as quickly and efficiently as is practicable.

Cadaver bags are required for use in the following situations:

- Death from certain infectious diseases, such as anthrax. In such situations, never reopen the bag after it has been sealed.
- For transporting bodies to the mortuary following severe trauma (to physically contain remains, body substances, and leaking that is not containable by packing and dressings).

Last Offices

Following some deaths there might be a statutory requirement that last offices are not undertaken, for example, in forensic studies. If last offices are to be performed, the same precautions that would be taken for living patients should be taken for laying out deceased patients. Other preparations include:

- Pack all orifices and pad and seal leaking wounds with waterproof tape.
- Leave all catheters, tubes, airways, IV access lines etc., in situ, sealed, and occluded.
- Do not shave a deceased patient who has died of an infectious disease.

- Attach a *Danger of infection/Biohazard* label to the body or to the outside of a cadaver bag if one is used. Ensure that details of the deceased are completed and enclosed in the clear sleeve of the cadaver bag.
- Inform mortuary staff of the diagnosis.

  Inform the porters who are transferring the body to the mortuary of the infection risk and any precautions they need to take, but do not disclose the actual diagnosis.
- Wear aprons and gloves while handling all bodies within the mortuary.
- Wash hands after removing aprons and gloves.

The mortuary technicians must inform the undertakers of the risks of infection, in addition to enclosing the body in a cadaver bag with a *Danger of Infection/Biohazard* label attached.

Property and Valuables

Enclose any valuables or clothing soiled with body fluids in a sealed plastic bag. Advise relatives or those likely to handle the items about the need to decontaminate or wash them. Do not destroy property without the permission of the next of kin.

Religious Rites and Viewing of the Body by Relatives

Seek advice from the IPC team, pathologist, or mortuary technicians. Advise relatives and other visitors on how to avoid risks associated with infection, but do not breach confidentiality as to the cause of death.

Ritual preparation, if required, should be undertaken under supervision, while observing the appropriate IPC precautions.

Transporting Bodies That Have Leaking Wounds and Have Had Severe Trauma

Use cadaver bags to transport bodies that have leaking wounds or that have had severe trauma. Label the bags with the following information:

- Danger of Infection
- Infection Status Not Known
- Major Trauma
- Drainage Problems

Work-Practice Controls

Always practice standard precautions:

- Treat all human blood and other potentially infectious materials as if they were contaminated with BBPs.
- Practice hand hygiene (using waterless antiseptic hand cleansers when hand-washing facilities are not available).
- Wear appropriate PPE.

Practice additional precautions as applicable:

- Avoid touching your skin, mouth, nose, eyes, or any skin lesions or cuts with contaminated gloves, fingers. Do not make contact with other items or surfaces. Cover cuts, abrasions, or other skin lesions with an appropriate bandage prior to donning PPE.

- Contain and confine blood and other potentially infected materials.
- Place human remains and disassociated portions in plastic burial bags.
- Avoid splashing, splattering, and generating aerosols.
- Manage sharps properly:
  - Be alert for sharp objects (bones, broken glass, metal, knives, etc.).
  - Store reusable sharps in a manner to prevent lacerations or puncture wounds.
  - Use mechanical means to clean up broken glass and other sharp objects.
- Disinfect contaminated equipment, environments, and working surfaces:
  - Use protective covers on equipment and work surfaces that are difficult to decontaminate.
  - Disinfect all interior and exterior surfaces of reusable equipment and regulate medical waste containers between uses.
  - Maintain a cleaning schedule that requires the cleaning of work surfaces, equipment surfaces, and waste containers immediately after completion of procedures; when surfaces become contaminated; after any spill of blood or other potentially infectious material; and at the end of each work shift.
- Handle contaminated PPE and clothing properly:
  - Wear PPE, including gloves, when handling contaminated PPE.
  - Never wear contaminated PPE and clothing outside the working area.
  - Remove and replace PPE and underlying clothing immediately or as soon as possible when they become damaged or penetrated.
  - Avoid contact with skin when removing contaminated PPE and clothing.
  - Place contaminated reusable PPE and clothing in a leak-resistant bag or container immediately after removing them.
  - Never wash contaminated PPE and clothing with personal laundry.
  - Decontaminate reusable gloves, protective eyewear, face shields, and similar PPE before reusing them.
  - Brush and scrub contaminated boots and leather goods with soap and hot water.
- Clean up spills of potentially infectious materials immediately and decontaminate the area with appropriate disinfectant. Wear appropriate PPE.
- Practice good personal hygiene:
  - Never consume food or beverages in areas where you are exposed to blood or other potentially infectious material.
  - Never store food and beverages in an area where they or their containers might become contaminated.
  - Refrain from handling personal items such as pens and combs to prevent soiling or contaminating them.

Supervisors have these additional responsibilities:

- Provide hand-washing facilities stocked with soap, clean running water, and paper towels.
- Make provisions for laundering contaminated clothing and disinfecting PPE.
- Ensure adequate supplies of containers, laundry bags, disposable PPE, disinfectants, and materials for cleaning up spills.
- Oversee personnel to ensure that they adhere to recommended safe work practices.
- Provide all PPE.
- Define work-area boundaries and require personnel to remove PPE before leaving the work area.
- Provide designated areas or containers for storing contaminated PPE.
- Permit only trained personnel to handle PPE.

See Section 4 for more details on PPE.

APPENDIX 8: Control and Prevention of Antimicrobial Resistance in Health Care Facilities

Introduction

Antibiotics are used to prevent infection and to treat patients with proven or suspected infection. The goal is to administer a safe and cost-effective dose of antibiotic that will eliminate the infecting or potentially infecting organism.

Excessive and inappropriate use of antibiotics and failure to adhere to basic IPC principles have been responsible for the rapid emergence and spread of antibiotic-resistant organisms (AROs) in health care facilities worldwide. Overusing antibiotics results in bacterial resistance not only to the antibiotic prescribed, but also often to other antibiotics in the same classes or groups. By causing the emergence of AROs, misuse of antibiotics increases the cost of health care delivery at the health care facility and community levels. A reservoir of patients colonized with AROs becomes a source of cross-transmission to other susceptible patients in a health care facility. When infections with AROs occur, there is increased mortality, especially among those with underlying diseases or multi-organ failure. Health care facilities can amplify the transmission of resistant strains through misuse of antibiotics. This resistance can then be transferred to the community. Failure to complete a full course of prescribed antibiotics and lack of resources and personnel for facility IPC programmes additionally contribute to the development of antibiotic resistance.

Normal microbial flora is protective. Antibiotics get rid of susceptible strains of normal bacteria, which allows resistant strains to predominate. These tend to be resistant to many different classes of antibiotics. For example, replacement of normal gastrointestinal flora with resistant microorganisms can cause these organisms to spread from patient to patient in health care facilities through transfer by staff, bedpans, and nonclinical and poorly sterilized equipment.

Strategies for Reducing the Transmission of AROs

The following strategies are essential to reduce the transmission of AROs:

- Good IPC practices and adherance to IPC policies and guidelines
- Repeat emphasis on hand hygiene
- Appropriately use of PPE
- Surveillance data to target specific areas at high risk for AROs
- Identifying bacterial isolates per patient rather than per site
- A well-controlled testing system
- A lab capacity that can identify antibiotic sensitivity patterns correctly
- Spatial separations between patients that are known to be infected or colonized with MRSA or VRE and patients who are not known to be infected or colonized with these organisms
- Appropriately screening of microbiologic patients for AROs as part of epidemiologic investigations of possible outbreaks
- Implementation of antibiotic policies

If only soap and water are available for hand hygiene, then reinforce its use. Evidence does suggest, however, that using hand antisepsis helps remove AROs from hands, especially in high-risk areas and populations.

Note: *Extraordinary environmental cleaning or disinfection is not needed for preventing transmission of AROs.*

Formulating an Antibiotic Policy

Antibiotic formularies or policies should be determined by the drugs and therapeutics committee and should be established after wide consultation with the clinical and hospital staff. Formulating an antibiotic policy requires ownership by the staff and needs constant support from antibiotic surveillance.

It is difficult to formulate a general antibiotic policy, because bacterial populations and antibiotic resistance patterns differ between health care facilities, and clinical choices vary. Each health care facility should have an antimicrobial management programme that monitors the use of antibiotics. The purpose of an antibiotic policy is to:

- Improve patient care by considered use of antibiotics for prophylaxis and therapy. The goal is to ensure treatment of confirmed infection and not to cause unnecessary colonization of resistant strains.
- Make more efficient use of finances.
- Retard the emergence of multiple-antibiotic-resistant bacteria.
- Improve education of clinicians by providing guidelines for appropriate therapy.

An antibiotic policy should include the following:

- Different classes of antibiotics for prophylaxis and therapy.
- A list of the available antibiotics of similar spectrum, safety, and pharmacokinetics.
- A list of the indications for which the antibiotics are required, and whether they are needed for prophylaxis or therapy. Determine indications for the use of each antibiotic after consultation with the clinicians.
- Information on the class of antibiotic and the possible impact that this class could have on the emergence of resistance.

When the policy has been agreed upon, ensure that sensitivity testing of selected pathogens to these antibiotics can be carried out. Enter the policy in the hospital formulary and display the policy on the walls of the relevant departments, including wards. Review the policy periodically (after 18-24 months). Policies should change if there are changes in the antibiotic resistance patterns, a change in the functions of a unit, a change in staff, a price increase in a certain antibiotic or availability of new antibiotics.

Antibiotic Therapy

Empiric therapy is based on the “best-guess” antibiotic for the suspected organism and its predicted antibiotic sensitivity patterns. Knowledge of local antibiotic sensitivity patterns is useful so that prescribing is not based on publications from other countries. The decision should be based on:

- The site of infection
- The probable pathogen
- The known bacterial spectrum
- Safety and pharmacokinetics of the chosen antibiotic

The following are recommendations for good antibiotic use:

- Reconsider whether or not the patient actually requires an antibiotic.

- Do not change antibiotic therapy if the patient's clinical condition indicates improvement.
- If clinical response is noted in 72 hours, then the therapy should be continued through completion.
- If there is no clinical response within 72 hours of the initiation of therapy, consider the choice of antibiotic and a secondary infection.
- Review the duration of antibiotic therapy (for example, after 7 to 10 days).
- Have a list of available antibiotics that have been agreed to by all clinicians.
- Have guidelines for therapy and prophylaxis.
- Use a high dosage for a short-duration therapy.
- Consider laboratory testing of antibiotic susceptibility and naturally occurring resistance.
- Rotate the antibiotics chosen for the policy after a set period of time in order to reduce selective pressure.

The range of antibiotics is broad and a combination of two or more may be used initially. This may be reduced to one when the bacteriology results become available.

Targeted therapy is instituted when microbiological results are known or when the results are pending but the clinical picture requires immediate treatment. An example would be treating meningococcal meningitis on the basis of a gram stain from the cerebrospinal fluid.

Antibiotic Prophylaxis

Surgical antimicrobial prophylaxis (AMP) refers to a very brief course of an antimicrobial agent initiated just prior to an operation. Maximum blood levels of antibiotic at the time of the procedure help ensure that bacteria arising during the procedure can be reduced to a level that the natural defenses of the patient's body can destroy. AMP does not prevent SSI caused by postoperative contamination. Use of antibiotics for contaminated or dirty operations does not constitute AMP. In such operations, patients are frequently receiving therapeutic antibiotics perioperatively for established infections.

A single dose or a maximum of three doses should be administered starting with the induction of anaesthesia. Starting antibiotics too early or continuing for longer than 24 hours after the procedure provides no benefit and can result in the emergence of resistance. Antibiotic use after 24 hours constitutes treatment and should be documented as such.

APPENDIX 9: Accidents, Incidents, and Spills Report Form

Please complete this form and return to the supervisor.

PERSONAL INFORMATION

Name: _____ Date of birth (dd/mm/yy): _____

Address: _____ Home phone #: _____

Department: _____ Work phone #: _____

Employment category: Staff ( ) Student ( ) Visitor ( ) Contractor ( ) Other ( ) _____

Occupational title: (e.g., technician, electrician, nurse, etc.) _____

Supervisor's name: _____

STATEMENT OF ACCIDENT, INCIDENT, OR SPILL

Date of accident, incident, or spill: _____ Time _____ am/pm

Location of accident, incident, or spill: _____

Type of injury: (e.g., cut, fracture, puncture, etc.) _____

Treatment of injury or exposure: (e.g., first aid, medical treatment, lost work days):

_____

Name of person rendering treatment, if any: _____

Worker's compensation report filed? Yes ( ) No ( )

Did any defects of equipment or tools contribute to this accident, incident, or spill? Yes ( ) No ( )

Was there any property or equipment damage? Yes ( ) No ( )

Was the correct equipment, tools, or material used? Yes ( ) No ( )

What environmental, if any, conditions were contributing factors? (e.g., slippery floors, noise level, illumination, etc.) _____

Was the lack of personal protective equipment (PPE) or safety controls a contributing factor in this accident, incident, or spill? Yes ( ) No ( )

Explain: _____

_____

_____

Was adequate emergency equipment available? Yes ( ) No ( )

Was training in accident prevention given to the injured employee prior to duties performed at the time of the accident, incident, or spill? Yes ( ) No ( )

Specify: _____

_____

_____

_____

_____

Describe how this accident, incident, or spill occurred and the remedial actions. (In the case of a spill, list the name of the material and quantities released.)

_____

_____

_____

_____

What preventive measures will be taken to avoid a reccurrence of this accident, incident, or spill?

_____

_____

_____

_____

The undersigned agree to the accuracy of this report and the preventive measures.

Supervisor's signature:_____ Date (dd/mm/yy): _____

Employee's signature:_____ Date (dd/mm/yy): _____

Reviewed by Medical Director and/or Health Worker -In-Charge of clinic

Director's signature:_____ Date (dd/mm/yy): _____

Comments:

_____

_____

_____

_____

Source: World Health Organization Regional Office for Africa (WHO/AFRO), 2004. Manual of infection prevention and control. WHO: Geneva

APPENDIX 10: Health Care Facility Cleaning and Disinfection

Items, Equipment, and Areas	Frequency and Procedure	Agent and Supplies	Remarks
CLEANING EQUIPMENT			
Cleaning cloths	Clean daily after use.	Liquid detergent and water Sodium hypochlorite 0.5% POASB 1% Clean water Bucket	Rinse in soapy water. In high-risk areas, disinfect after each use and at night. Store cloths dry. Incinerate cloths if heavily contaminated.
Floor, mops, brooms, and brushes	Clean and disinfect after use.	Liquid detergent and water Sodium hypochlorite 0.5% POASB 1%	Wash items thoroughly with detergent after each use. Rinse in water. Immerse in disinfectant for 30 minutes and then dry. Always colour-code and confine use of each mop to its designated room, e.g., kitchen, toilet, ward, etc. DO NOT MIX MOPS. Store mops dry and upright with head up.
Plastic buckets for use during cleaning	Clean daily after use or as required.	Abrasive materials to clean Liquid detergent and water **Disinfectants in Isolation areas:** • Sodium hypochlorite 1.0% • POASB 1% **Disinfectants in TB areas:** • Sodium hypochlorite 0.5% • Phenolic disinfectant 2%	Each area should have its own bucket. Clean general wards daily or as required with detergent and water. **In isolation areas:** • Soak items in sodium hypochlorite or POASB for 10 minutes. • Rinse items with tap water. **In TB areas:** • Soak items for 20 minutes in sodium hypochlorite or phenolic disinfectant 2%. • Rinse items with tap water.

Items, Equipment, and Areas	Frequency and Procedure	Agent and Supplies	Remarks
ABLUTION FACILITIES			
Ablution blocks: • Toilets • Toilet seats • Toilet cistern and urinal Used toilet brushes	Thoroughly clean items daily. Clean items when soiled. Clean items between patients and after discharge. Disinfect seats. Soak items in desinfectant. Soak brushes in disinfectant for one hour, wash in warm soapy water, rinse, and hang to dry.	Liquid detergent and water Sodium hypochlorite 0.01% POASB 1% Deodorizer	Use a low-level disinfectant. Use a deodorizer if necessary as per manufacturer's instructions.
Bedpans and urinals Sputum mugs	Scrub with Vim, soap, and water daily. Regardless of patient's status of infection: • Empty bedpan/ urinal/washing bowl down sewer. Clean items with soapy water and use scouring powder for stains. In case of diarroeal disease: • Sprinkle dry disinfectant (NaDCC powder, if available) into receptacle and then empty. **OR** • Fill items with pre-pared disinfectant solution. Leave 30 minutes and then empty and wash again in freshly pre-pared solution. • Rinse with clean water and dry. Pour full strength disinfectant in sputum mugs after washing and before dispatching them to patients.	Detergent and water Vim In case of diarroeal disease: Sodium hypochlorite 0.25% (2,500 ppm) NaDCC powder **OR** POASB 1%	Store extra bedpans/ urinals/sputum mugs in cupboards when not in use. Do not use cleaning equipment for toilets, e.g., mops, rags, anywhere else.

Items, Equipment, and Areas	Frequency and Procedure	Agent and Supplies	Remarks
ABLUTION FACILITIES			
Jugs (for measuring urine, emptying bags) Bedpans	Wash and sterilize after use and daily.	Liquid detergent and warm water Sodium hypochlorite 0.5% 1% phenol	If sterilizer is not available, soak bedpans in 1% phenol for at least 1 hour after pouring contents in sluice. Store them dry and inverted.
Floors Walls	Clean walls once a week or as necessary. Scrub with Vim, soap and water daily. Clean spills according to policy. Scrub floors and walls to remove any residues.	Liquid detergent and warm water Vim For spills: Sodium hypochlorite 0.5% POASB 1%	Clean and dry drainage hole. Clean walls from top to bottom.
Sluice rooms	Pour contents of urinals and bedpans GENTLY down the sluice. Clean once a day and as required. Disinfect surfaces after use and after contamination.	Liquid detergent and warm water For spills: Sodium hypochlorite 0.5% POASB 1%	Avoid splashing and spilling walls and surrounding area.
Bathrooms: Enamel baths and basins (bathtubs and sinks) Washing bowls: • Autoclavable • Polyprophylene	Clean and disinfect items between patients.	Liquid detergent to clean bath and sink Sodium hypochlorite 0.5% POASB 1% Autoclaves	Do **not** use ammonia detergent and chlorine-based compound together because of the release of toxic compounds. Rinse thoroughly to remove disinfectant. Do **not** use abrasive material to clean bath and sink because it will damage the surface.

Items, Equipment, and Areas	Frequency and Procedure	Agent and Supplies	Remarks
ABLUTION FACILITIES			
Shower, floor, and walls	Wash and disinfect before, between, and after each patent use. Scrub floors and walls to remove any residues. Disinfect when spills occur. Clean and dry drainage hole.	Liquid detergent and warm water Sodium hypochlorite 0.5% POASB 1%	Clean walls from top to bottom.
Pedal bin and container	Without liner: Empty daily and as required. Wash daily and as required with soapy water. Use scouring powder as necessary. Disinfect daily and after spills, etc. With liner: Damp wipe daily and clean thoroughly once a week and as necessary with detergent. Disinfect when spills occur.	Scouring powder Liquid detergent and water Sodium hypochlorite 0.5% POASB 1%	Rinse off detergent and dry before disinfecting. Dispose of the liner when it is 3/4 full.
Drains	Clean once per week and as necessary. Pour soapy water down the drain.	Liquid detergent and water Drain cleaner for unblocking	If drain is blocked use (colour-coded) plunger. Use drain cleaner only if necessary.
FURNITURE, FITTINGS, AND EQUIPMENT			
Beds (including frames)	Daily damp clean. Scrub the bedframe with detergent and water. Disinfect after each patient use, and after spills.	Liquid detergent and water	When possible in between patients, take the mattress and the pillow(s) from the bed and place in the sun for at least one hour. ***Never admit a patient into a bed that has not been disinfected.***

Items, Equipment, and Areas	Frequency and Procedure	Agent and Supplies	Remarks
FURNITURE, FITTINGS, AND EQUIPMENT			
Bedside lockers (General ward)	Damp clean daily. Throughly clean once per week after spills, and after discharge of patient. If splashed with blood and body fluids, wipe with disinfectant.	Liquid detergent and water Sodium hypochlorite 0.5%	Check lockers for pest-control requirements.
Bowls (dressing, surgical, vomit, kidney) For communal use For infected patients	Damp clean daily. Thoroughly clean once a week and after patient is discharged. If splashed with blood or body fluids, wipe with disinfectant. Wash with detergent and hot water, then wipe with disinfectant. Clean (wash) after each use. Decontaminate by washing with detergent and hot water before sterilizing. Sterilize or disinfect after patient is discharged.	Liquid detergent and hot water. Sodium hypochlorite 0.5% Liquid detergent and hot water. Hypochlorite 1% (10,000ppm) Phenol Phenolic for bacterial and hypochlorite for viral infections Autoclave at CSSD	Store bowls dry and inverted. (Always store bowls dry.) An individual bowl for each patient is preferred.
Couches in occupational, physiotherapy, and radiography departments	Wipe daily or as necessary.	Liquid detergent and warm water	
Dental equipment surfaces	Wipe at end of each day and clean or disinfect as necessary.	Methylated spirit **OR** Sodium hypochlorite 0.5%	An individual bowl for each patient is preferred.

Items, Equipment, and Areas	Frequency and Procedure	Agent and Supplies	Remarks
FURNITURE, FITTINGS, AND EQUIPMENT			
Bed curtains Window curtains	Clean every week or after infectious cases. For infectious cases soak for 30 minutes. Launder after disinfectioning.	Laundry detergent and water Sodium hypochlorite 0.5%	For infectious cases avoid use of curtains.
Electronic equipment	Wipe surfaces between patients.	Methylated spirit	
Fans	Clean routinely and on discharge of patient. Damp wipe with clean cloth.	Liquid detergent and warm water	Dismantle the fan for terminal cleaning and when visibly dirty.
Furniture and fittings	Damp dust routinely. If contaminated by spills, wipe with disinfectant and leave to dry.	Liquid detergent and warm water Methylated spirit	Always dry after disinfecting.
Hydrotherapy pool Tiled areas and floor area surrounding pool	Clean after each use.	Water Chlorine-based compound Sodium hypochlorite 0.5%	Check chlorine levels and pH of pool daily. Conduct bacteriological investigations of pool water to ensure level of disinfection is sufficient to cope with level of use. Maintain the chlorine level in the pool at 1.4 to 2.0 ppm.
Flower vases and containers	Change water daily and wash vases and containers.	Liquid detergent and hot water	Pour dirty water down sluice (not sink). Store vases and containers dry and inverted.
Linen	Collect as per health care facility policy. If soiled, remove solid soil and discard into sluice for flushing. If contaminated soak with disinfectant for 30 minutes, remove, wring, rinse, put in colour-coded container, and send to laundry.	Laundry detergent and water Sodium hypochlorite 0.5%	If not soiled, put linen into laundry bin and send to laundry.

Items, Equipment, and Areas	Frequency and Procedure	Agent and Supplies	Remarks
FURNITURE, FITTINGS, AND EQUIPMENT			
Mattress, pillows: With plastic covering With mackintosh	Wipe and disinfect when necessary and after each patient. Wash mackintosh with liquid detergent and disinfect after each patient.	Laundry detergent and water Sodium hypochlorite 0.5% if contaminated	All mattresses should be covered with soft impervious plastic.
Stands for: IV sets Gas tanks Bedscreens	Damp clean daily and as necessary. Disinfect spills. Wipe with disinfectant.	Laundry detergent and water Methylated spirit	Methylated spirit should be used to disinfect spills in preference to chlorine-based disinfectant and POASB, as these are corrosive.
Sinks	Clean daily or as necessary.	Laundry detergent and warm water	
Safety cabinet (Pharmacy)	Wipe and disinfect at end of each procedure. Treat spills as per policy.	Sodium hypochlorite 0.5%	Clean airflow and change filters as per manufacturer's instructions.
Trolleys and trays Procedure trolleys and trays Food trolley	Daily damp clean and disinfect after every use. Disinfect before and after every use. Wipe daily with disinfectant.	Liquid detergent and water Methylated spirit 70% 0.5% chlorhexidine in alcohol Sodium hypochlorite 0.5% POASB 1%	
Pharmacy glassware and other equipment	Clean per the requirements of the pharmacy.	Liquid detergent and warm water	
Image intensifier	Clean daily and after each use. Routinely damp dust. Wipe with alcohol.	Laundry detergent and water OR Methylated spirit	
X-ray equipment	Clean daily and after each use. Routinely damp dust.	Laundry detergent and water	Allow to dry before use.

Items, Equipment, and Areas	Frequency and Procedure	Agent and Supplies	Remarks
FURNITURE, FITTINGS, AND EQUIPMENT			
Tooth mugs	Wash daily or use disposable. Disinfect.	Detergent and hot water if mugs are reusable Sodium hypochlorite 0.5%	For infected patients, use individual mugs or disposables.
Toys	After discharge or as required. Wash, rinse, and dry thoroughly Do not soak toy in disinfectant if contaminated. Heat disinfect or wipe the surface with disinfectant.	Sodium hypochlorite 0.5% OR 70% Methylated spirit	For patients with infections, do not use communal toys that cannot be easily disinfected. Heavily contaminated toys should be destroyed.
FLOORS, WALLS AND WINDOWS, etc.			
Floors: • General wards and areas • Laundry • Pharmacy • Occupational, physiotherapy, radiotherapy and dental Departments	Thoroughly damp mop daily. Clean when soiled. Clean between patients and after discharge (if single-room accommodations). Damp mop and clean spills as per policy. Wash 3 times per day or as necessary. Wash once daily and as necessary.	Liquid detergent and warm water Spills: Sodium hypochlorite 0.5% POASB 1%	See section on floor mops, broom, or care. Use colour-coded mops to prevent cross-contamination between areas.
Floors-special areas: • Operating theatre • Renal unit • Isolation unit • ICU • Labour and delivery rooms • Neonatal unit • Burns unit • Kidney unit	Damp clean daily and disinfect and as required at the end of each operating list and as required. Clean spills as per policy. Operating Theatre: Damp clean and disinfect between each patient. Clean the total area at the end of each day.	Detergent and warm soapy water Sodium hypochlorite 0.5% POASB 1% Spills: Sodium hypochlorite 0.5% POASB 1%	Wipe floor with disinfectant after every cleaning and leave it to dry.

Items, Equipment, and Areas	Frequency and Procedure	Agent and Supplies	Remarks
Walls: • General wards • Laundry • Pharmacy • Occupational, Physiotherapy, Radiology, and Dental Departments	Thoroughly wash once every 3 months and when visibly dirty or splashes occur. Disinfect spills as required. Wash once per week or as necessary. Damp dust daily and when necessary.	Liquid detergent and warm water Bucket Clean cloth Spills: Sodium hypochlorite 0.5% POASB 1%	
Walls: Operating theatres Kitchen	Damp clean daily disinfect and as necessary. Disinfect spills as necessary. Disinfect twice a week and as required.	Detergent and warm water Routine disinfectant: Sodium hypochlorite 0.5% POASB 1% For spills, see policy as to appropriate disinfectant	Treat spills as described in the policy. Use a kitchen mop.
Walls (dusting and removal of cobwebs) Light fittings Pelmets	Clean when dirty and during terminal disinfection.	Detergent and warm water. Long-handled broom covered with a damp cloth.	Pay particular attention to corners.
Window screens Insect wire	Damp clean daily.	Short mop or cloth Liquid detergent and hot water	Do not use the short mop for floors. Wash mop after use, disinfect, and dry.
Window glass	Clean when dirty and during terminal disinfection. Damp clean and dry.	Liquid detergent and hot water Bucket	
Windows: Kitchen	Clean once every two weeks.	Liquid detergent and water	
Rooms (terminal cleaning)	Clean and disinfect after discharge of patient. Wash surfaces.	Detergent and warm water Disinfectant 1% phenol or hypochlorite solution as appropriate	

Items, Equipment, and Areas	Frequency and Procedure	Agent and Supplies	Remarks
SPECIAL PROCEDURES AND SURFACES			
High-level decontamination of surfaces	Pre-clean with detergent solution then wipe or mop with disinfectant.	Liquid detergent and water Methylated spirit POASB 1% Sodium hypochlorite 0.5%	POASB does not require precleaning of items.
Kitchen: • Pots and pans • Utensils, crockery, trays, and feeding and medicine cups	After each use, wash, rinse, and dry on a rack. Disinfect as necessary.	Dishwasher Liquid detergent and hot soapy water Heat disinfect **OR** Sodium hypochlorite 0.5%	Cover food to prevent contamination by flies, ants, cockroaches. Dish towels (if used) should be used once for every dish washing. Hand or machine wash thoroughly at minimum temperature of 60°C with final rinse at 80°C. Store kitchen items dry.
• Refrigerators • Freezers	Damp wipe and disinfect as necessary. Defrost every two weeks.	Liquid detergent and warm water	In case of infection, if dishwashers are not available, soak in sodium hypochlorite 0.5% for 10-15 minutes.
Cupboards Stoves	Wash once weekly and rinse with clean water. Clean 3 times a week with detergent and water or as necessary. Scrub once weekly.	Liquid detergent and warm water Vim or scouring powder or grease cutter	Perform vector control if necessary. Use grease cutter to remove stubborn stain.

Items, Equipment, and Areas	Frequency and Procedure	Agent and Supplies	Remarks
Neonatal unit ICU Transplant unit Burns unit	Daily and when necessary, damp clean with warm soapy water and wipe with disinfectant.	Liquid detergent and water Sodium hypochlorite 0.5% POASB 1%	
Operating theatre tables	After each use and at end of day, wash with disinfectant.	Liquid detergent and water Sodium hypochlorite 0.5% POASB 1%	
Terminal disinfection of isolation rooms: • Floors and walls • Mattresses • Plastic-covered pillows • Lockers and furniture • All plastic items • Mop heads • Bedpans and urinals	Soon after discharge or death or an infectious patient, wash thoroughly with detergent, hot water, and scouring powder, then boil for 30 minutes or soak in disinfectant or place in bedpan sterilizer.	Liquid detergent and water Sodium hypochlorite 0.5% POASB 1%	Change curtains and ventilate.
Infected body-fluid spillages	Cover small spills and spots with powder or liquid disinfectant and allow to stand for 3 minutes. Cover large liquid spills with NaDCC granules or POASB powder and leave for at least two minutes before cleaning with paper towels. Wash and disinfect area.	Liquid detergent and water POASB 1% Sodium hypochlorite 0.5% (5,000 ppm) to 1% (10,000 ppm) **OR** NaDCC powder Sodium hypochlorite 0.5% or 1% POASB	Use gloved hands to scrape powder or use paper towels to transfer spillage mixture into a safe receptacle for disposal.

Items, Equipment, and Areas	Frequency and Procedure	Agent and Supplies	Remarks
Ambulance: • Delicate equipment, e.g., radios, cardiac monitors • Oxygen masks, nebulizers	After each patient and daily, wipe with soap and water. Wipe with disinfectant if contaminated. After each patient and daily, wash in warm water with detergent. Rinse and dry. Soak in sodium hypochlorite 0.5% for 30 minutes or 1% POASB for 10 minutes. Soak in glutaraldehyde for 20 minutes.	Liquid detergent and water Sodium hypochlorite 0.5% Liquid detergent and water Sodium hypochlorite 0.5% POASB 1% For any suspected TB patients: Glutaraldehyde 2%	
Soiled linen	Wash daily.	Laundry detergent and water	Transport in leakproof bags. Treat as per policy.
Inside ambulance: • Walls • Windows • Floors • Slats	Wash daily and as necessary (after spills). Treat spills as per policy.	Liquid detergent and warm water	See section on floors and walls.
Mortuary: • Trays • Floors	Disinfect trays after every removal of body. Wash floors daily and as required.	Routine disinfection: Sodium hypochlorite 0.5%, **OR** POASB 1% Deodorizer Liquid detergent and water Deodorizer	Wipe trays thoroughly and mop floor. If there are excessive odours, use deodorizer. Sweep first, them mop with detergent solution. Wipe and deodorize.

Adapted from: World Health Organization Regional Office for Africa (WHO/AFRO), 2004. Manual of infection prevention and control. WHO Geneva

APPENDIX 11: Cleaning and Disinfecting in the Laboratory

Item	Agent	Remarks
Equipment		All disposables must be discarded in black bags or sharps containers and incinerated. Equipment that has become contaminated must be rendered safe to handle before it is thrown away or washed and used again.
Blood analyser Centrifuges	Disinfect according to manufacturer's intructions. For routine use: Mythylated spirit After breakages: POASB 1%	Wipe with tissue or cotton wool soaked in alcohol at the end of the day. After breakages: Flood affected area with disinfectant. Leave for no longer than 10 minutes. Remove with tissue or cotton wool and rinse with clean water. Dry thoroughly.
Laboratory discard jars (Only reusable glassware and instruments)	Sodium hypochlorite 0.25% (2500 ppm) **OR** POASB 1%	Soak in disinfectant for a minimum of 10 minutes and wash thoroughly after use. Do not soak metal instruments longer than the recommended time as they will corrode. Autoclave them if posible. Rinse thoroughly with tap water prior to disinfection. Never top-up discard jars. Use 'in-use' disinfectant tests to monitor effectiveness of disinfectant, as levels of organic matter will vary daily.
Other laboratory glassware and instruments	Steam sterilize where possible to render glassware safe to handle. If disinfection is necessary use: Sodium hypochlorite 0.25% (2500 ppm) **OR** POASB 1%	Soak equipment for at least 30 minutes. Rinse clean according to laboratory requirements.
Safety cabinet	Sodium hypochlorite 0.5% POASB 1% To treat spills, refer to policy. If cultures inoculated in the cabinet are consistently contaminated, fumigate with formaldehyde.	Ensure that the cabinet is sited correctly. If not, it will not function effectively. Wipe benches and inner walls at the end of every day. Check air flow regularly and change filters as per manufacturer's instructions. Fumigate only if absolutely necessary and before filters are changed. Fumigation is a high-risk procedure and should be supervised by experienced personnel.

Item	Agent	Remarks
Bench tops Floors Walls	Sodium hypochlorite 0.5% POASB 1% Liquid detergent and water	Wipe at the end of each day or as necessary. Walls adjacent to bench tops that may come into contact with contaminated aerosols should be disinfected at the same time. Wash floors daily and as necessary. Wash walls weekly. To treat spills refer to policy.

Adapted from: World Health Organization Regional Office for Africa (WHO/AFRO), 2004. Manual of infection prevention and control. WHO: Geneva

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LIST OF CONTRIBUTORS

NAME	ORGANIZATION
Dr. Saade Abdallah	National AIDS and STI Control Programme
Dr. Joseph Abuodha	Ministry of Medical Services, New Nyanza PGH
Dr. W. S. Akhwale	Department of Disease Prevention and Control, Ministry of Public Health and Sanitation
Elizabeth Ambani	Lecturer, School of Health Sciences, Kenyatta University
Dr. Micah Anyona	National AIDS and STI Control Programme
Martha Atandi	Kenyatta National Hospital
Claryce Auma	Jhpiego, Kenya
Roula Awiti	Kenyatta National Hospital
Antony Ayieko	School of Nursing, University of Nairobi
Dr. Barnarbus Bakamutumaho	Research Officer, UVRI, Ministry of Health, Uganda
Nancy Bungei	National AIDS and STI Control Programme
Felesia Chawani	Quality Assurance Desk Officer, Ministry of Health, Malawi
Dr. Peter Cherutich	National AIDS and STI Control Programme
Steven Chombo	Department of HRH Development, Ministry of Health and Social Welfare, Tanzania
Cyrus Gitahi	Ministry of Medical Services, Port Reitz District Hospital
Longolomoi Ibrahim	Ministry of Public Health and Sanitation
Koome Impwii	Ministry of Medical Services, Central Province
Dr. Alice Inyangala	Department of Pharmacy, Ministry of Medical Services
Dr. Hwany Inzune	Centers for Disease Control, USA
Dr. S. M. Irungu	Division of Dental Health, Ministry of Medical Services
Dr. Evelyn Isaacs	HRH Consultant, New York, USA
Dr. Oduor Johansen	Division of Diagnostic and Forensic Services, Ministry of Medical Services
Dr. Rachel Kamau	National AIDS and STI Control Programme
Dr. Tatu Kamau	Division of Vaccines and Immunization, Ministry of Public Health and Sanitation
Rosemary Kamunya	Jhpiego, Kenya
Veronica Kasyoka	Ministry of Medical Services, Eastern Province
Jemimah Katam	Kenyatta National Hospital
Esther Kathini	Division of Disease Surveillance and Research, Ministry of Public Health and Sanitation
Dr. Mark Katz	Chief Influenza Lead, Centers for Disease Control/Kenya
Daniel Kavoo	Department of Primary Health Services, Ministry of Public Health and Sanitation

Mary Kazungu	Division of Diagnostic and Forensic Services, Ministry of Medical Services
Dr. Daniel Kibuga	WHO/AFRO
Dr. David Kiima	Division of Mental Health, Ministry of Medical Services
Dr. Daniel Kimani	Technical Advisor, Blood & Injection Safety, Centers for Disease Control/Kenya
Steven Kimanzi	Ministry of Medical Services, Embu
Dr. Kamene Kimenye	Division of Leprosy, Tuberculosis, and Lung Disease, Ministry of Public Health and Sanitation
Josephine Kioli	National AIDS and STI Control Programme, Ministry of Medical Services
Micah Kisoo	Chief Clinical Officer, Ministry of Medical Services
Erick Kitangala	Training Officer, John Snow, Inc., Kenya
Dr. Mwavali Kivale	Ministry of Medical Services, Garissa PGH
Catherine Koskei	Kenyatta National Hospital
Joy Kuboka	Centers for Disease Control/Kenya
Dr. Shiphrah Kuria	Division of Reproductive Health, Ministry of Public Health and Sanitation
Purity Macharia	Mater Hospital, Nairobi, Kenya
Philomena Maina	Chief Nurse, Kenyatta National Hospital
Dr. Pamela Mandela	Department of Human Anatomy, University of Nairobi
Stephen Masha	Ministry of Medical Services, Coast PGH
Bernard Mbogua	Department of Environmental Health, Ministry of Public Health and Sanitation
Lemmy Medard	Mabiega Jhpiego, Tanzania
Dr. Tom Menge	Kenyatta National Hospital
Anne Merimbet	Division of Orthopaedics, Ministry of Medical Services
Ondari Mogeni	Kenya Medical Research Institute/Centers for Disease Control
Deborah Mogoa	Division of Leprosy, Tuberculosis, and Lung Disease; Ministry of Public Health and Sanitation
Rose Mokaya	National AIDS and STI Control Programme
Pharis Momanyi	School of Dental Sciences, University of Nairobi
Dr. Rex Mpazanje	WHO/Kenya
Dr. Benard Mua	School of Dental Sciences, University of Nairobi
Dr. Njeri Mucheru	Department of Pharmacy, Ministry of Medical Services
Dorcas Mugure	Ministry of Medical Services
Francis Muna	Ministry of Medical Services

Danny Mungai	Ministry of Medical Services, Murang'a
Denis Munune	PCEA Chogoria Hospital
Dr. Nicholas Muraguri	National AIDS and STI Control Programme
Ruth Muthuku	Ministry of Medical Services, Machakos General Hospital
John Mutiso	Kenyatta National Hospital
Dr. Christine Mwachari	Kenya Medical Research Institute
Tabitha Mwangi	Ministry of Public Health and Sanitation
Virginia Mwatha	Ministry of Medical Services, Karatina District Hospital
Ralpher Mwenesi	Ministry of Medical Services, Kakamega
Dr. Linus Ndegwa	Program Manager Infection Control, Centers for Disease Control/ Kenya
Dr. Gathari Ndirangu	Kenyatta National Hospital/Technical Consultant
Rukia Nduthu	Phillips Pharmaceuticals, Johnson & Johnson, Kenya
Rose Ngugi	The Nairobi Hospital
Dr. Daniel Nguku	Department of Technical Planning and Coordination, Ministry of Medical Services
John Njau	Lecturer, School of Health Sciences, Mt. Kenya University
Joseph Njau	Ministry of Public Health and Sanitation
Janet Njeri	National AIDS and STI Control Programme
Anne Njeru	Division of Reproductive Health, Ministry of Public Health and Sanitation
Leah Muthoni Nkuchia	Ministry of Medical Services, Loitoktok
Dr. Senge Nkurikiye	Director of Epidemiology and Health Statistics, Ministry of Health, Burundi
Dr. Placide Nshirungu	Gihundwe Hospital, Rwanda
Yunuke Nyabiosi	Kenyatta National Hospital
Dr. M. A. Ochola	Ministry of Medical Services, Port Reitz District Hospital
Dr. Joseph Odhiambo	Technical Advisor, TB, Centers for Disease Control/Kenya
Dr. Izaq Odongo	Department of Medicine, Ministry of Medical Services
Dr. Elizabeth Ogaja	Department of Pharmacy, Ministry of Medical Services
Dr. Esther Ogara	Department of Standards and Regulation Services
Teresa Okiri	Ministry of Medical Services, New Nyanza PGH
Fredrick Okuku	Health Care Waste Management Advisor, John Snow, Inc., Kenya
Jacinta Omariba	John Snow, Inc., Kenya
Joseph Ombayo	National Public Health Laboratories Service
Consolata Omondi	Lecturer, Kenya Medical Training College

Denis Omondi	Kenyatta National Hospital
Frederick Osundwa	Ministry of Medical Services, Western Province
Susan Otieno	Deputy Chief Nursing Officer, Ministry of Medical Services
Scholastica Owondo	Department of Noncommunicable Diseases, Ministry of Public Health and Sanitation
Elizabeth Oywer	Registrar, Nursing Council of Kenya
Wambua Patrick	National Blood Transfusion Services, Embu
Chris Rakuom	Chief Nursing Officer, Ministry of Medical Services
Prof. G. Revathi	Aga Khan University Hospital, Nairobi
Charles Rombo	National Blood Transfusion Services
Beatrice Rukenya	Ministry of Medical Services, Machakos General Hospital
Dr. David Rutere	Norbrook Kenya Limited
Dr. Tamer Saied	Infection Control Practitioner, Naval Medical Research Unit, Egypt
Ukende Shalla	Jhpiego, Tanzania
Catherine Shitemi	Department of Nursing, Ministry of Medical Services
Dr. Jackson Songa	Country Director, John Snow, Inc., Kenya
Wesley Tomno	National AIDS and STI Control Programme/Chairman, Kenya Clinical Officer Association
Patrick Wafula	Division of Dental Health, Ministry of Medical Services
Dr. Evelyn Wagaiyu	School of Dental Sciences, University of Nairobi
Linyonyi Wamabonga	Ministry of Medical Services
Lucy Wanjiru	National AIDS and STI Control Programme
Ernest B. Wanyama	Division of Preventive Ophthalmic Services, Ministry of Public Health and Sanitation
Dr. G.K.B. Warui	Ministry of Medical Services, Nakuru PGH
Dr. Jane Wasike	National Public Health Laboratory Services
Njuguna Waweru	Radiography, Ministry of Medical Services
Cara Winters	Global Antibiotic Resistance Partnership
Dr. Celia Woodfill	WHO/AFRO