Standard Hospital Guidelines for Health Workers’ Safety
A Guide for Workers in the Hospital Setting
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Standard Hospital Guideline in Health Worker Safety

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<tr>
<td>AC</td>
<td>Alternating current</td>
</tr>
<tr>
<td>AIDS</td>
<td>Acquired Immune Deficiency Syndrome</td>
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<tr>
<td>ALT</td>
<td>Alanine aminotransferase</td>
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<tr>
<td>ARVs</td>
<td>Antiretroviral drugs</td>
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<tr>
<td>BBP</td>
<td>Blood-borne pathogens</td>
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<tr>
<td>BCG</td>
<td>Bacille Calmette-Guérin</td>
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<td>BMC</td>
<td>Bugando Medical Center</td>
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<tr>
<td>CDC</td>
<td>Centers for Disease Control</td>
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<tr>
<td>CPR</td>
<td>Cardiopulmonary resuscitation</td>
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<tr>
<td>CSF</td>
<td>Cerebrospinal fluid</td>
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<td>CT</td>
<td>Computed Tomography</td>
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<td>CTC</td>
<td>Care and Treatment Clinic</td>
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<td>ECG</td>
<td>Electrocardiogram</td>
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<td>ECT</td>
<td>Electroconvulsive Therapy</td>
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<td>EFV</td>
<td>Efavirenz</td>
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<tr>
<td>EMS</td>
<td>Emergency Medical Services</td>
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<tr>
<td>EMTs</td>
<td>Emergency medical technicians</td>
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<td>ESE</td>
<td>Entrance skin exposure</td>
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<tr>
<td>HAART</td>
<td>Highly Active Antiretroviral Therapy</td>
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<tr>
<td>HBV</td>
<td>Hepatitis B Virus</td>
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<td>HCP</td>
<td>Healthcare personnel</td>
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<tr>
<td>HCV</td>
<td>Hepatitis C Virus</td>
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<tr>
<td>HCW</td>
<td>Healthcare waste</td>
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<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
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<td>HLD</td>
<td>High Level Disinfection</td>
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<td>HMT</td>
<td>Hospital Management Team</td>
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<td>HWS</td>
<td>Health Worker Safety</td>
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<tr>
<td>IEC</td>
<td>Information Education Communication</td>
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<td>IV</td>
<td>Intravascular</td>
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<td>IDV</td>
<td>Indinavir</td>
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<td>IPC</td>
<td>Infection Prevention and Control</td>
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<td>Description</td>
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<tr>
<td>IS</td>
<td>Injection Safety</td>
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<tr>
<td>JHA</td>
<td>Job Hazard Analysis</td>
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<tr>
<td>LPV</td>
<td>Lopinavir</td>
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<tr>
<td>MDR</td>
<td>Multi Drug Resistance</td>
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<tr>
<td>MoHSW</td>
<td>Ministry of Health and Social Welfare</td>
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<tr>
<td>MRI</td>
<td>Magnetic Resonance Imaging</td>
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<tr>
<td>NNRTIs</td>
<td>Non-nucleoside Reverse Transcriptase Inhibitors</td>
</tr>
<tr>
<td>NRTIs</td>
<td>Nucleoside Reverse Transcriptase Inhibitors</td>
</tr>
<tr>
<td>NtRTIs</td>
<td>Nucleotide Reverse Transcriptase Inhibitors</td>
</tr>
<tr>
<td>OPIM</td>
<td>Occupational exposure to Potentially Infectious Material</td>
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<td>PCBs</td>
<td>Polychlorinated Biphenyls</td>
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<tr>
<td>PEP</td>
<td>Post-exposure prophylaxis</td>
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<tr>
<td>PIs</td>
<td>Protease Inhibitors</td>
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<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
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<tr>
<td>PVC</td>
<td>Polyvinyl Chloride</td>
</tr>
<tr>
<td>RNA</td>
<td>Ribonucleic Acid</td>
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<tr>
<td>STI</td>
<td>Sexually Transmitted Infections</td>
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<tr>
<td>TDI</td>
<td>Toluene disocyanate</td>
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<tr>
<td>TFDA</td>
<td>Food and Drug Authority</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<td>ZDV</td>
<td>Zidovudine</td>
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FOREWORD

Healthcare provision in the developing countries faces many challenges in terms of the quality of care, human and financial resources. As governments and other agents desire and struggle to increase the availability of care in their countries, many issues complicate their efforts. One of the major issues that has received little attention is that of health worker safety, especially in hospitals and other health facilities. Indeed, the health workers themselves have not been sensitive to their own safety at work and in most facilities no proper guidelines have been put into place to protect health workers.

Health services provided in hospital settings leave much to be desired in terms of the safety of health workers, patients and clients. Health facilities and health workers naturally and primarily tend to focus on the safety and well-being of their patients, and make it their paramount concern, which is good, but they forget that a safe environment for patient must also be safe for the health workers themselves. To this end, it has been understood that successful health safety standards in the hospital depends mostly on the ability of health workers to implement and sustain the set standards by Quality Improvement Teams (QIT), with little focus on the workers’ safety. This has led to carelessness on the part of the health workers and little or no guidelines or policy for health worker safety on the part of the health facilities.

Nosocomial infections, needle-stick injuries and other health related mechanical hazards are the leading cause of increased absenteeism of health workers, hence decreased productivity. The emergency of HIV/AIDS has complicated the whole picture of safe practice by increasing the risk of infections to health workers, and viral hepatitis, tuberculosis and improper hospital waste disposal further increase the risk to their health. This has led to a call for a special and integrated approach to creating a safer environment for health workers in the hospitals and establishing some safety guidelines.

This guide is intended to provide health workers with a readable and easy to understand reference on the essentials of safe work practices in hospital settings. Effective implementation of the standards provided in this guide will help create a safer working environment for health workers, as well as patients and clients. It will also sensitize the health managers to take special considerations when planning and budgeting for health services in different health departments.

The management of Bugando Medical Centre, in collaboration with AmeriCares, is dedicated to supporting the implementation of such standards. This dedication, coupled with the health workers’ efforts toward compliance with safety standards, will play a key role in improving the quality and safety of health services delivery in the hospital.

Dr. Charles R. Majinge
Director General
Bugando Medical Centre
ACKNOWLEDGEMENT

This guide is a product of intensive work and collaboration between Bugando Medical Centre and AmeriCares through the Health Worker Safety Initiative. We acknowledge the efforts of those who worked to make the working environment safer in the hospital setting.

Bugando Medical Centre would like to express its gratitude to the following:

AmeriCares, for their coordination and financial support provided during development of this guide, particularly Justine MacWilliam (HWSI Project Manager), Megan McDermott, (Senior Associate, Sub-Saharan Africa Partnerships) and Elikem Tomety Archer (Director of Middle East & Africa Partnerships) for their tireless work during the entire preparation of this guide.

Prof. Samwel Manyele (University of Dar es salaam) and Ms. Niyonizigiye Anicet (IPC Nurse - Muhimbili National Hospital) for their efforts in preparation of the ground work for the draft document.

Dr. Eliudi Eliakimu and Dr. Albart Komba for the final review of this guide.

The Health Worker Safety Committee, who contributed to the development of this guide. The list of their names is appended (Annex 4).

We would like to extend our sincere gratitude to all BMC workers who have contributed in developing this guide. However, it should be noted that its achievement is embedded in the commitment of health facility management, health workers and other stakeholders.

Francisco M. Chibunda
Program Coordinator
Health Worker Safety Initiative
Bugando Medical Centre
ABOUT THE HOSPITAL GUIDE ON HEALTH WORKER SAFETY

An evaluation of health worker safety at Bugando Medical Centre (BMC) was made by the BMC Health Worker Safety Initiative in collaboration with AmeriCares through a baseline survey done in July and August 2009. This survey identified key guidelines needed to protect hospital workers in different areas of the hospital. This guide responds to those needs by providing key information to be used for training and reference for health workers on best medical safety practices in hospital settings.

Contents and Organization
The hospital guide contains necessary information to be used in highlighting workers’ safety and advising out what should be done to create a safe working environment.

The guideline is summarized in seven (7) chapters and each chapter stands on its own. The following areas are covered:

- Infection Prevention and Control in the Context of Health Worker Safety
- Management of Occupational Exposures to HIV and Recommendations for PEP
- Healthcare Waste Management
- The Use of Chemicals in a Hospital Fire
- Prevention and Fire Aid
- Electrical Safety for Health Workers
- Safety for Health Workers in Laboratories and Radiology

Using this Guide
This guide is not a substitute for the National Infection Prevention and Control Guidelines, but it is recommended as a supplemental document for everyday use to ensure that health workers are safe while working at the hospital. All units in the hospital are required to use the guidelines outlined in this document as a basis for setting mandatory protocols and procedures which will ensure the safety of workers in their areas. In preparing this guide, long explanations have been avoided unless it was deemed necessary for better understanding of certain concepts.

Overall Objective:
To provide guidance to health workers in protecting against occupational hazards and exposure to pathogens in the hospital setting

Specific Objectives:
1. To assist health workers in protecting themselves against occupational exposure to pathogens
2. To reduce the rate of injuries and illness due to needle sticks and exposure to blood and body fluids
3. To strengthen knowledge of disposal systems for sharps and other infectious waste
4. To increase awareness about personal and hospital hygiene, infection control, and good health for hospital staff
5. To increase the knowledge and skills of hospital staff on electrical and fire safety
6. To increase health workers’ knowledge on safe handling of chemicals
7. To improve the safety of health workers working in laboratory and radiology
CHAPTER 1
INFECTION PREVENTION AND CONTROL IN THE CONTEXT OF HEALTH WORKER SAFETY

1.1. Introduction

Healthcare-associated infections lead to death, disability and excess medical costs to the affected persons, including patients, health workers, and their relatives. Introduction of new technologies in the absence of infrastructure to use them safely may lead to adverse events. On the other hand, these technologies require safety-oriented workers to operate them. Infection prevention and control maximizes positive patient outcomes and is part of the government’s responsibility to provide effective, efficient and quality health services. But, health workers also have great responsibilities in to protect themselves while caring for their patients.

An overall approach to an infection prevention and control policy at the health care facility level is based upon: management; information, education and communication (IEC); and continuous availability of essential equipment and supplies. Specific activities include:

- Health care worker protection;
- Isolation protocols for specific infectious diseases (e.g., tuberculosis, SARS) and high-risk settings (e.g., dialysis);
- Rational use of anti-microbials;
- Safe and appropriate use of injections and infusions;
- Safe and appropriate use of blood and blood products;
- Hospital sanitation; and
- Healthcare waste management.

The Importance of Infection Prevention and Control:

- Protects patients/clients against nosocomial infections
- Protect health workers from occupational exposures
- Protect communities; and
- Protect the environment from being polluted.
1.2. Transmission Cycle

This section describes the different ways that diseases are transmitted.

Objective
To describe components involved in disease transmission cycle.

![Diagram of disease transmission cycle]

**Figure 1.1: Disease transmission cycle**

**Description of the components**

- **Infectious agent**: Microorganisms that can cause infection or disease, e.g., bacteria, viruses, fungi, and parasites

- **Reservoir**: Places where organisms grow and multiply. These include: people, water, solutions, instruments and other items, equipment, soil and air.

- **Place of exit**: Where the infectious agent leaves the host, e.g., respiratory, genitourinary, gastrointestinal, and vascular systems; skin; mucous membranes; placenta.
Modes of transmission:

- **Contact** (direct or indirect): touching a person or contaminated surface, sexual contact. Examples of illness include: haemorrhagic fever virus, enteric pathogens, MDR bacteria

- **Droplet**: infected droplets come into contact with eyes, nose or mouth. Examples of illness include: influenza and rubella viruses, corynebacterium diphtheria

- **Airborne**: residue from infected droplets or contaminated dust particles remain in the air for long periods of time and enter the body through the respiratory tract. Examples of illness include: TB, chicken pox, and measles

- **Fecal-Oral route**: organisms infect the digestive system through contaminated food or water. Examples of illness include: salmonellosis, cholera, typhoid fever, hepatitis A.

- **Vector**: Animals capable of transmitting disease, such as rats, mosquitoes, and fleas. Examples of illness spread by mosquitoes include: malaria, yellow fever, dengue fever.

Places of entry:
Location where the infectious agent enters a susceptible host through: broken skin, puncture wound, surgical site, mucous membranes

Susceptible host:
Clients/patients, service providers & auxiliary staff, community members.

1.3. Standard Precautions
Most blood exposures in health settings are preventable. Strategies to protect health workers include implementation of standard precautions, immunization against hepatitis B, provision of personal protective equipment (PPE) and the management of exposures. Successful implementation of these strategies requires an effective infection control committee with support from the health setting management team.

Health workers are exposed to blood and other body fluids in the course of their work. Consequently, they are at risk of infection from blood-borne viruses including human immunodeficiency virus (HIV), hepatitis B (HBV) and hepatitis C (HCV). The risk of infection for health workers depends on the prevalence of disease in the patient population and the nature and frequency of exposures. Occupational exposure to blood can result from percutaneous injury (needle stick or other sharps injury), mucocutaneous injury (splash of blood or other body fluids into the eyes, nose or mouth) or blood contact with non-intact skin.

Types of barriers

- **Physical**: HLD by boiling or steaming and sterilization by autoclaving or dry heat ovens

- **Mechanical**: PPE (gloves, masks, goggles, gowns, aprons and drapes)

- **Chemical**: Antiseptics (iodophors, alcohol based antiseptic agents) and disinfectant in HLD (chlorine, glutaraldehydes).
Two level approach of standard precautions

Standard precautions are the primary strategy for control of the spread of infection in health care settings.

First level:

*Standard Precautions:* Applies when interacting with patients or workers in healthcare facilities, regardless of their diagnosis or presumed infection status when the following are present:

- Blood
- All body fluids
- Non-intact skin
- Mucous membranes

Second level:

*Transmission-based precautions:* These supplement Standard Precautions and disease-specific isolation categories and are used with patients known or suspected to be infected by pathogens spread by airborne or droplet transmission or through contact with dry skin or contaminated surfaces.

**Standard Precautions**
- Consider every person (patient/clients or staff) as potentially infectious and susceptible to infection
- Use appropriate hand hygiene techniques including; routine hand washing, hand antisepsis, antiseptic hand rub and surgical hand scrub
- Wear personal protective equipment which include: boots, aprons, gowns, gloves, masks, protective eyewear and caps
- Appropriately handle sharps, patient care and resuscitation equipment, and appropriately manage patient placement and environmental cleaning
- Safely dispose of infectious waste materials to protect those who handle them and prevent injury or spread to the community
- Process instruments by decontamination, cleaning, and either sterilization or high-level disinfection following recommended procedures

**Breaking the disease transmission cycle by applying standard precautions**
- Reducing the number of infection-causing microorganisms present (e.g., through practicing hand hygiene, decontamination and cleaning of instruments, use of antiseptics on skin prior to I.V. injection or surgical procedure)
- Killing or inactivating infection-causing microorganisms (e.g., hand hygiene with an antiseptic or waterless alcohol hand rub, proper processing of instruments following procedures)
- Creating barriers to prevent infectious agents from spreading (e.g., wearing PPE,
covering mouth when sneezing)

- Reducing or eliminating risk practices (e.g., by passing sharps using hands-free technique, using disposable gloves instead of none, no recapping of needles, disposing of syringes in a safety box at point of use).

**Transmission based precaution**

This is the second level of precautions intended for use in patients known or highly suspected of being infected or colonized with pathogens transmitted by:

- Air (tuberculosis, chicken pox, measles, etc.);
- Droplet (flu, mumps, rubella); or
- Contact (hepatitis A or E and other enteric pathogens [includes fecal/oral transmission], herpes simplex, and skin or eye infections).

These precautions are designed to reduce the nosocomial transmission of particles 5 µm or less in size that can remain in the air for several hours and be widely dispersed. Microorganisms spread wholly or partly by the airborne route include chicken pox (varicella virus) and measles (rubella virus). Airborne precautions are recommended for patients with either known or suspected infections with these agents.

1.4. Health and Safety While Handling Antiseptics and Disinfectants

**Definition**

Antiseptics or antimicrobial agents (terms used interchangeably) are 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 count.

**Types of antiseptics used in hospitals**

- 60 - 90% alcohol (Ethyl, isopropyl or “methylated spirit”)
- 4% chlorhexidine gluconate (Hibitane®, Hibiscrub®, Hibiclens®)
- Chlorhexidine gluconate and cetrimide, in various concentrations (Savlon®)
- 3% iodine aqueous iodine and alcohol containing (tincture of iodine) products, 7.5 – 10%
- Iodophors, various concentrations (Betadine® or Wescodyne®)
- 0.5 – 4% chloroxylenol (Para-chloro-metaxylenol or “PCMX) various concentrations (Dettol®)

**Uses of antiseptics**

- Hand hygiene
- Skin preparation prior for surgical procedures
- Cervical or vaginal preparations
- Wound dressing
Criteria for selection of antiseptics and disinfectants for the hospital
• Safe
• Instructions for use available
• Cost effective
• Accepted by the government/authority
• Disposal not hazardous to the community and environment
• User-friendly

Effectiveness factors to be considered before choosing antiseptics and disinfectants.
• Nature of what is to be disinfected
• Number of microorganisms and time needed (the higher the number, the longer the time)
• Concentration to be used
• Type of surface (smooth v. rough)—rough surfaces require longer treatment time.
• Presence of organic materials (e.g., soiled instruments)

Storage and dispensing conditions of antiseptics
• Unless supplied commercially in small quantities, pour the antiseptic into a small, reusable container for daily use. This prevents evaporation and contamination.
• Make sure the correct name of the solution is on the container each time you refill it. Do not “top off” antiseptic dispensers.
• Do not store gauze or cotton wool in antiseptics because this promotes contamination.
• Establish a routine schedule for preparing new solutions and cleaning reusable containers.
• Wash reusable containers thoroughly with soap and clean water, rinse with boiled water if available and drip dry before refilling.
• Label reusable containers with the date each time they are washed, dried and refilled.
• All containers should have lids which should be well tightened.
• Concentrated antiseptic solutions should be stored in a cool, dark area. Never store them in direct sunlight or in excessive heat (e.g. upper shelves in a tin-roofed building).
Table 1.1. Types of disinfectants and their uses

<table>
<thead>
<tr>
<th>Level</th>
<th>Definition</th>
<th>Types</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High level</strong></td>
<td>Chemicals that kill or inhibit all microorganisms except bacterial endospores on inanimate objects</td>
<td>Glutaraldehyde, 2% Chlorine and Cetrime</td>
<td>Processing instruments and other items.</td>
</tr>
<tr>
<td><strong>Intermediate level</strong></td>
<td>Use to kill microorganisms on inanimate objects</td>
<td>Methylated spirit 60-90% Formaldehyde 8% Iodine or Iodophor solutions</td>
<td>Non critical Items/devices. Decontaminating floors/surfaces, walls, and furniture. NOT instruments</td>
</tr>
<tr>
<td><strong>Low level</strong></td>
<td>Not for use on skin or mucous membranes</td>
<td>Dettol, Lysol 5 %, Carbolic acid 5 %, Hydrogen peroxide 3 %</td>
<td>Stethoscopes, table-tops, bedpans</td>
</tr>
</tbody>
</table>

The dangers that might occur while handling chemicals include:

1. Accidental ingestion.
2. Inhalation of fumes emanating from chemicals.
3. Skin allergies and burns due to contact and splashes.
4. Falls resulting from slippery surfaces.
5. Degradation of ecosystems due to persistent pollutants in the environment.

All chemicals producing fumes, such as chlorinated lime, should be handled using the appropriate personal protective equipment (PPE):

1. Heavy duty rubber gloves
2. Full face mask or nose/mouth mask and goggles
3. Aprons
4. Gumboots

In addition to the PPE, the room must be well-lit and ventilated so as to allow good air circulation.
CAUTION:

Chlorine solutions should **never** be mixed with cleaning products containing ammonia, ammonium chloride, or phosphoric acid. Combining these chemicals will result in the release of a chlorine gas, which causes nausea, eye irritation, tearing, headache, and shortness of breath. If you are exposed to an unpleasantly strong odor following the mixing of a chlorine solution with a cleaning product, leave the room or area immediately until the fumes have cleared completely.

1.5. Hand Hygiene

Definitions

**Hand hygiene:** Includes hand washing, use of antiseptics, care of hands, nails, skin, the use of hand lotions and surgical scrub

**Hand washing:** A process of mechanically removing soil and debris from the skin of hands using plain soap and water

**Essential elements for hand washing**

- Running water
- Friction
- Soap
- Drying

**When to carry-out hand washing:**

- Before and after performing invasive procedures.
- Before and after caring for susceptible patients.
- Before and after handling wounds, drains, catheters etc.
- Before and after gloving when carrying out invasive procedures.
- After contact with blood and body secretions especially in situations where microbial contamination is likely.
Steps for hand washing:

- Thoroughly wet hands.
- Apply plain liquid soap (antiseptic agent is not necessary).
- Vigorously rub all areas of hands and fingers, remembering to get under fingernails and between fingers.
- Rinse hands thoroughly with clean water.
- Dry hands with a paper towel, a dry, clean single-use towel, or air dry them.
- Use a paper towel when turning off the tap if the tap is not elbow-controlled or automatic shut off.

**NOTE:** *A defined techniques for hand washing is probably of greater importance than the anti – microbial agent used.*

Figure 1.2: Hand washing technique with Soap and Water

Source: WHO press (2005)
Technique for Alcohol-Based Hand Rub

Steps:

- Apply enough alcohol-based hand rub to cover the entire surface of hands and fingers (about a teaspoonful).
- Rub the solution vigorously into hands, especially between fingers and under nails, until dry.
- Use 5 ml for each application and continue rubbing the solution over the hands until they are dry (15-30 seconds).

*Note:* Hand rub is more effective in killing transient and resident flora than hand washing with antimicrobial agents or plain soap and water but should not be used when hands are visibly soiled. When hands are visibly soiled hands must be washed following the procedure above.

Surgical Hand Scrub

Steps:

- Remove rings, watches and bracelets.
- Thoroughly wash hands and forearms to the elbow with soap and water.
- Clean nails with nail cleaner.
- Rinse hands and forearms with water.
- Apply an antiseptic agent.
- Vigorously wash all surfaces of hands, fingers and forearms for at least 2 minutes.
- Rinse hands and arms thoroughly with clean water, holding hands higher than elbows.
- Keep hands up and away from the body, do not touch any surface and dry hands with clean, dry, single-use towel, paper towel or air dry by shaking.
- Put on sterile gloves.

*Note:* Gloves should not be regarded as a substitute for hand washing.
Donning of Surgical Gowns

When you put on sterile surgical attire, it is essential that you do not contaminate the sterile items. Sterilized surgical gowns are considered sterile in front from the chest to the level of the sterile field. Sleeves are sterile from 5 cm above the elbow to the cuff. The neckline, shoulders, underarms, and back of the gown are considered to be unsterile.

**Note:** *Gowns should be put on after surgical scrub and before gloving*

**Figure 1.3: Standard Procedure for Donning Surgical Gown**

1. With one hand, pick up the folded gown from the wrapper by holding the gown through all layers, being careful to touch only the inside top layer, which is exposed. Step back from the table to allow other team members room to maneuver.

2. Hold the gown in the manner as shown, and allow it to unfold, being careful that it does not touch either your body or other unsterile objects or the floor. Grasp the inside shoulder seams and open the gown with the armholes facing you.

3. Slide your arms part way into the sleeves of the gown, keeping your hands at shoulder level away from the body.
4. With the assistance of your circulator, slide your arms further into the gown sleeves; when your fingertips are even with the proximal edge of the cuff, grasp the inside seam at the juncture of gown sleeve and cuff using your thumb and index finger. Be careful that no part of your hand protrudes from the sleeve cuff.

5. The circulator must continue to assist at this point. He positions the gown over your shoulders by grasping the inside surface of the gown at the shoulder seams.

*Note: The circulator's hands are in contact with only the inside surface of the gown.*

6. The circulator then secures the neck and back with a velcro tab or ties. The circulator then ties the gown at waist level at the back. This technique prevents the contaminated surfaces at the back of the gown from coming into contact with the front of the gown.

Source: India Infection Prevention and Control Guidelines (2011)
1.6. Housekeeping

- Housekeeping refers to general cleaning of hospitals and clinics, including floors, walls, certain equipment, furniture, and surfaces.

- Housekeeping entails
  - Removal of dust, soil, and microbial contaminants on environmental surfaces
  - Reducing the number of microorganisms that may come into contact with the patient, visitors, staff, and the community
  - Provide a clean and pleasant atmosphere

To achieve this:

- Use antiseptics in high-risk areas, e.g., toilets, latrines, blood or body fluid spills
- Use a combination of soap and water, with or without chemical disinfectant to wipe environmental surfaces e.g. floors, furniture

How to select cleaning products

- Different types of cleaning products have different properties. The ideal properties are:
  - Suspend fats in water
  - Make fats water soluble
  - Decrease surface tension of water and allow greater penetration of the agent into soil or dirt
  - Break up of soil into small particles
  - Break up proteins
  - Soften the water (removal of calcium and magnesiu

Note: Cleaning should start with the least soiled area and move to the dirty area and from high surfaces to low surfaces.

Common housekeeping methods:

- Wet mopping: Common and most preferred method.
  - Double bucket technique: One bucket contains cleaning solution and the other rinsing water. Rinse and wring the mop before dipping into the cleaning water.
  - Triple bucket technique: The third bucket is used for wringing out the mop before rinsing. This extends the life of the rinsing water.

Remember: Do not dry mop or sweep the patient care area (this causes dust, debris, and microorganisms to become airborne and contaminate clean areas).

Note: The double and triple-bucket techniques are recommended for cleaning in health facilities
• **Dusting:** Damp dusting is most commonly used for cleaning walls, ceiling, doors, windows, furniture and other environmental surfaces.

  - Avoid dry dusting and never shake the dry dusters or mops.
  - Perform dusting in systematic ways. Use a starting point as a reference to assure that all surfaces have been reached. When cleaning the ceiling check for stains this indicates leakages.
  - Use recommended/appropriate PPE when: handling disinfectants, cleaning patient areas, handling soiled linens, and disposing of wastes.

• **Flooding,** followed by wet vacuuming is recommended for surgical suites

**Schedule and procedure for specific areas**
Housekeeping plans should be written and closely followed in every area according to the need. The following is a standard procedure:

• Walls, windows, ceiling doors including door handles should be damp dusted routinely with damp cloth, water and detergent.

• Chairs, lamps, tables, tabletops, beds, handrails, lights, etc, wiped with damp cloth, water and detergent daily or whenever they are soiled.

• Non-critical equipments, e.g., stethoscope, blood pressure cuffs, wipe daily with a damp cloth, detergent and water. If soiled with blood or body fluids, disinfect before cleaning and reuse.

• **Floors:** Clean at least three times a day or as needed with wet mop, detergent and water. Use disinfectant if contaminated with blood or body fluids.

• **Sinks:** Scrub frequently with a cloth or brush and disinfectant solution

• **Toilets and latrines:** Scrub frequently—at least three times a day, or as needed. Use a separate wet mop, cloth or brush and a disinfectant cleaning solution.

• **Patients’ rooms:** Clean at least three times per day and after discharge.
CHAPTER 2
MANAGEMENT OF OCCUPATIONAL EXPOSURES TO HIV AND RECOMMENDATIONS FOR POST-EXPOSURE PROPHYLAXIS

2.1. Introduction

Workers in hospitals are at risk of exposure to blood-borne pathogens, including hepatitis B, hepatitis C, and HIV/AIDS. All occupational exposure to blood or other potentially infectious materials (OPIM) place workers at risk for infection by blood-borne pathogens.

Many unreported needle-stick injuries and other percutaneous injuries occur annually among health workers. Percutaneous injuries are caused by sharp objects such as hypodermic needles, scalpels, suture needles, wires, surgical pins and saws. Additional exposure incidents include splashes and other contact with mucous membranes or non-intact skin.

Impact of infections in the workplace:

• Absenteeism
• Treatment costs
• Retraining of workers
• Replacement of employees
• Reduced productivity

Definition:

Post-exposure prophylaxis is the immediate provision of medication following an exposure to potentially infected blood or other body fluids in order to minimize the risk of acquiring infection.

HIV infectious bodily fluids:

• **Known**: blood, semen, vaginal fluids.
• **Potentially infectious**: cerebrospinal fluid (CSF), synovial, pleural, peritoneal, pericardial and amniotic fluids.
• **Non-infectious**: feces, nasal secretions, saliva, sputum, sweat, tears, urine, and vomit.
2.2. Risks for Occupational Transmission of HIV

The risk of transmission through percutaneous (needle stick) exposures from HIV-positive patients is estimated at 0.3%.

Common procedures which present a risk of exposure:

- Taking blood samples from arteries or veins and samples of other body fluids
- Inserting an IV line and handling drips, especially in emergency situations
- Activities related to surgery, particularly during major surgical interventions for long durations or where hemorrhage may occur
- The handling of blood or infectious body fluids by laboratory staff
- Activities related to handling, pre-disinfection/cleaning of contaminated medical devices
- Handling and disposal of infectious waste
- Providing injections/intravenous medication
GUIDELINE AND STEPS FOR POST EXPOSURE PROPHYLAXES - BMC

Treatment of Exposure site

1. Wash with soap and water
2. Flush mucous membrane with clean water
3. Flash exposed eye with clean water or normal saline

Report & Document

Inform a senior supervisor

Evaluate the exposure site

1. Was it a high risk injury?
2. Was it a deep and extensive injury?
3. Exposure to a large amount of infectious materials?

Concert of exposed

Supervisor & exposed

No. starter pack initiated

Initial dose (starter pack) initiated

CTC for further Management

Figure 2.1: Initial steps for occupational exposure management
2.3 Initial Steps for Occupational Exposure Management

Exposure site management
- Wash site with soap and running water.
- Flush mucus membrane with normal saline or water.
- Flush eyes with clean water or normal saline.
- There is no evidence to suggest that use of antiseptics or squeezing the wound reduces the risk.
- Use of caustic agents such as bleach is not recommended.

Evaluation of exposed persons
- Health workers exposed to blood and other body fluids should be evaluated as soon as possible; preferably within two hours of exposure.
- PEP is not indicated for exposures of more than seventy-two (72) hours.
- Health worker should receive counseling and testing for HIV.
- In case of refusal to test, PEP should not be continued.

Evaluation of the source person
Evaluation of the source person should be conducted to determine HIV status. HIV testing requires the source person’s informed consent.

Note:
- If the source person is not known or refuses testing, evaluate the exposure as high risk for infection.
- Do not test discarded needles or syringes for viral contamination.
- The exposed person should not be involved in obtaining consent from the source person.

Type and severity of exposure: The risk of acquiring HIV infection depends on the type of exposure and the HIV status of the source person.
HIV status of the source person

a) *HIV positive*

High risk criteria include:

- Source person presenting with symptoms of HIV infection
- Acute sero-conversion
- High viral load (if known)
- AIDS
- Patient under Highly Active Antiretroviral Therapy (HAART) with indications of treatment failure

Low risk criteria include:

- Source person with asymptomatic HIV infection
- Low viral load, and
- Patient under HAART without treatment failure

b) *Unknown status or if the source person is unknown*

If the source person is not known at all, consider the exposure to be high risk. In case the source person refuses to test, it should be assumed that the client is positive.

Table 2.1. Assessment and management of the exposed person

<table>
<thead>
<tr>
<th>Source person</th>
<th>Exposed person</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV positive</td>
<td>HIV negative</td>
<td>• PEP for 28 days, then monitoring for six months</td>
</tr>
<tr>
<td>HIV positive</td>
<td>HIV positive</td>
<td>• Stop PEP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Refer to CTC</td>
</tr>
<tr>
<td>Refuses to be tested</td>
<td>HIV negative</td>
<td>• PEP for 28 days then monitoring for six months</td>
</tr>
<tr>
<td>- assume positive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HIV negative</td>
<td>HIV negative</td>
<td>• No PEP</td>
</tr>
</tbody>
</table>

Source: CDC Guidelines (2001)
2.4. Appropriate Medications used for PEP

Table 2.2. ARV regimens according to level of risk

<table>
<thead>
<tr>
<th>Risk category</th>
<th>ARV regimen</th>
<th>Drug regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low risk</td>
<td>Dual therapy (two drugs)</td>
<td>Zidovudine (ZDV) + Lamivudine (3TC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OR Tenofovir + Emtricibine (TRUVADA)</td>
</tr>
<tr>
<td>High risk</td>
<td>Triple therapy (three drugs)</td>
<td>ZDV + 3TC + Efavirenz (EFV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OR Replace Efavirence with Rotanovir®/Lopinavir (LPV) i.e. Aluvia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ORATRIPLA(Tenofovir) + Emtricibine + Efavirenz in pregnancy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>replace Efavirenz with Aluvia</td>
</tr>
</tbody>
</table>

Follow-up of health workers exposed to HIV

- HIV antibody testing should be performed for at least 6 months post-exposure (i.e., at 6 weeks, 12 weeks and 6 months), even if the exposed person does not want PEP.

- If PEP is used, the exposed person should be monitored for drug toxicity by testing at baseline and again 2 weeks after starting PEP. Minimally, it should include a full blood picture, renal and hepatic function tests.

- Exposed health workers who choose to take PEP should be advised on the importance of completing the prescribed regimen.

- Counseling on possible HIV transmission during the follow-up period should be done.

- The exposed person should be counseled on safe sex practices, including the use of condoms or abstinence.

- The exposed person should not donate blood, plasma, organs, tissue or semen.

- Female health workers should be counseled on family planning methods and avoiding pregnancy for up to 6 months.
2.5. Management of Occupational Exposure to Hepatitis

Pre-exposure vaccination (immunization) for HBV
In healthcare settings, immunization against HBV must be provided to health workers who perform tasks involving contact with potentially infectious blood or other bodily fluids. The risk of acquiring HBV is far greater than that of HIV or Hepatitis C.

Recommended standard course for immunization against HBV
The recommended standard course for immunization includes:
- First dose
- Second dose – one month later
- Third dose – 6 months after the first dose
- Antibodies for HBV must be measured 2-6 months after the last dose

Note: There is no danger in vaccinating someone who is already infected with HBV

Management of Occupational Exposure to HBV
In case of occupational exposure to HBV virus, prophylaxis is indicated for those health workers who are susceptible (defined as having a negative HbsAg or negative HBV surface antigen and no history of receiving immune serum globulin).

Table 2.3. Assessment of sero-status for HBV

<table>
<thead>
<tr>
<th>Source person</th>
<th>Health worker</th>
<th>Health worker management</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBV positive</td>
<td>Previously vaccinated</td>
<td>Give booster dose of HBV vaccine</td>
</tr>
<tr>
<td>HBV positive</td>
<td>Not vaccinated</td>
<td>Start vaccination course, i.e. three doses</td>
</tr>
</tbody>
</table>

Steps for managing an exposure to HBV
1. Determine HBV status of the source and the exposed patient.
2. After obtaining consent, collect a specimen from the source person for HBsA in order to determine if there is active HBV virus.
3. If testing is not possible, base on clinical history (jaundice, hepatitis of any viral strain, and previous immunization status).
4. Administer hyper-immune serum globulin (HBIg) (5 ml by intramuscular injection) as soon as possible, but at least within 7 days of exposure.
5. Administer first dose of HBV vaccine; this must be repeated according to the standard course.
6. If the first dose of HBV vaccine is not available, repeat HBIg one month from the first dose.
7. In occupational settings, efficacy is increased by combining immune globulin with HBV vaccine.
Note: The HBIg is indicated in: high risk occupational exposure, individuals failing to respond to vaccine, individuals with disorders, e.g., agammaglobulinemia

Post-exposure immunization
HBV vaccines do not provide any protection from infection if given after an exposure. However, HBIg given to individuals not immune to HBV soon or within 7 days after exposure offers protection.
CHAPTER 3
HEALTHCARE WASTE MANAGEMENT FOR HEALTH WORKER SAFETY

3.1 Introduction
Between 75% and 90% of the waste produced by healthcare providers is non-risk or general healthcare waste, comparable to domestic waste. It comes mostly from the administrative and housekeeping functions of healthcare establishments and may also include waste generated during maintenance of healthcare premises. The remaining 10-25% of healthcare waste is regarded as hazardous and may create a variety of health risks.

Over the past 30 years, there have been growing concerns in Tanzania and other developing countries regarding the management of healthcare waste (HCW). The reasons for these concerns include:

- Increased production of HCW due to a growing number of healthcare facilities, particularly in urban areas
- Development of healthcare services in large facilities (secondary and tertiary level facilities) which has been extending parallel to the population growth.
- Danger of contracting HIV and AIDS and other blood born diseases.

Healthcare waste is defined as the total waste generated by medical activities and includes both contaminated (potentially infectious) waste and non-contaminated (non-infectious) waste.

- **Non-infectious healthcare waste**: all waste from a healthcare facility that has no potential of transmitting infectious agents to humans.
- **Infectious Waste**: Infectious waste comprises all the biomedical and healthcare waste known or clinically assessed by a medical practitioner to have the potential of transmitting infectious agents to human beings.

3.2. Composition of Healthcare Waste
The composition of waste is often characteristic of the type of source.

- **Medical wards**: mainly have infectious waste such as dressings, bandages, sticking plaster, gloves, disposable medical items, used hypodermic needles and intravenous sets, body fluids and excreta, contaminated packaging, and meal scraps.
- **Operating theatres and surgical wards**: mainly have anatomical waste such as tissues, organs, and body parts as well as other infectious waste, and sharps.
- **Other healthcare units**: mostly have general waste with a small percentage of infectious materials.
- **Laboratories**: mainly have pathological (including some anatomical), highly infectious waste (small pieces of tissue, microbiological cultures, stocks of infectious agents, infected animal carcasses, blood and other body fluids), sharps, and some radioactive and chemical waste.
- **Pharmaceutical and chemical stores**: small quantities of pharmaceutical and chemical wastes, mainly packaging (containing only residues if stores are well managed), and general waste.

- **Support units**: general waste only.

### 3.3. Types/Categories of HCW

<table>
<thead>
<tr>
<th>Table 3.1: Types/Categories of Healthcare Waste</th>
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</thead>
<tbody>
<tr>
<td>Waste category</td>
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<tr>
<td>-----------------</td>
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<tr>
<td><strong>Infectious waste</strong></td>
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<td></td>
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<tr>
<td><strong>Pathological waste</strong></td>
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<td></td>
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<tr>
<td><strong>Pharmaceutical waste</strong></td>
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<td></td>
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<tr>
<td><strong>Genotoxic waste</strong></td>
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<tr>
<td></td>
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<tr>
<td><strong>Chemical waste</strong></td>
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<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td><strong>Waste with high content of heavy metals</strong></td>
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<tr>
<td></td>
</tr>
<tr>
<td><strong>Pressurized containers</strong></td>
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<tr>
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<td></td>
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<tr>
<td><strong>Radioactive waste</strong></td>
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</tbody>
</table>
3.4 Health Impacts of Healthcare Waste
All individuals exposed to hazardous healthcare waste are potentially at risk, including those within healthcare establishments that generate hazardous waste, and those outside these facilities who either handle such waste or are exposed to it as a consequence of careless management.

3.5. Management of HCW

Segregation of HCW
- Waste must be separated by persons generating the waste immediately according to its type, and placed in a bin with an appropriate color and bin liner or a sharps receptacle.
- Separate waste by type where it is generated (bed side or laboratory). Waste handlers shall never sort through waste after it has been placed in the bin.

Waste containment and color coding
To ensure an immediate and non-equivocal identification of hazards associated with the type of healthcare waste that is handled or treated, the following color coding system is used in the hospital. Each waste shall be stored in the receptacles corresponding to its coded color.

| Table 3.2: Color coding for different waste categories |
|-----------------------------------------------|-----------------------------------|
| **Category**                          | **Examples**                     | **Color of the Receptacle** |
| Non-infectious                        | • Paper                          | Black/Blue                   |
|                                  | • Packaging materials           |                                 |
|                                  | • Plastic bottles               |                                 |
|                                  | • Food remains                  |                                 |
|                                  | • Cartons                       |                                 |
| Infectious and Highly-Infectious    | • Gloves                        | Red                           |
|                                  | • Dressings                     |                                 |
|                                  | • Used specimen receptacles     |                                 |
|                                  | • Anatomical waste              |                                 |
|                                  | • Blood                         |                                 |
|                                  | • Body fluids                   |                                 |
|                                  | • Pathological waste            |                                 |
| Sharps                             | • Syringes with needles         | Yellow Safety Boxes           |
|                                  | • Retractable syringes          |                                 |
|                                  | • Syringes with needles removed |                                 |
|                                  | (use needle remover)            |                                 |
|                                  | • Needles                       |                                 |
|                                  | • Scalpels                      |                                 |
|                                  | • Prickers                      |                                 |
|                                  | • Blades                        |                                 |
|                                  | • Broken glass (pipettes, ampoules, and vials) | |
The receptacles must have lids which can be easily opened, and should also be lined with non-PVC plastic bags which overlap beyond the rims of the receptacle. This will allow for easy tying of the bag once the receptacle is 75% full.

**Figure 3.1:** Waste storage bins with non-PVC plastic liners for waste segregation. Red bins hold infectious waste; blue bins hold non-infectious waste.

**Figure 3.2:** Safety boxes to be used for collecting, storing, transporting, and introducing sharps waste into the incinerator.
Handling of healthcare waste

The handling of healthcare waste poses occupational hazards if not properly done. It is recommended that:

- Waste handlers should wear appropriate personal protective equipment (PPE) that includes: utility gloves, mask, boots, and apron. Figures 3.3 and 3.4 show some of the personal protective equipment to be used during handling of the healthcare waste.

- All healthcare waste should be handled with special care and separate from other domestic wastes as it may cause infection.

- Sharps are considered one of the most hazardous categories of healthcare waste and must be managed with the utmost care.

Figure 3.3: Examples of recommended PPE for healthcare waste management

Source: World Health Organization
Figure 3.4: Specifications for personal protective equipment

<table>
<thead>
<tr>
<th>PPE</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloves</td>
<td>• Embossed grip for a secure, skid-resistant grip</td>
</tr>
<tr>
<td></td>
<td>• Neoprene shell is tough yet flexible</td>
</tr>
<tr>
<td></td>
<td>• Cotton liner resists punctures, cuts, snags, and abrasion</td>
</tr>
<tr>
<td>Boots</td>
<td>• Molded polyvinyl or other plastic to ensure that it is waterproof</td>
</tr>
<tr>
<td></td>
<td>• Resistant to blood and easy to disinfect for maximum protection and hygiene</td>
</tr>
<tr>
<td></td>
<td>• Anti-skid tread prevents slipping</td>
</tr>
<tr>
<td></td>
<td>• Resistant to sharps puncture</td>
</tr>
<tr>
<td>Aprons</td>
<td>• Longer length extends to overlap with boots</td>
</tr>
<tr>
<td></td>
<td>• Cotton ties and neck loop for easy on/off</td>
</tr>
<tr>
<td></td>
<td>• Moisture proof and chemical resistant</td>
</tr>
<tr>
<td></td>
<td>• Reusable, non-sterile</td>
</tr>
<tr>
<td>Eye Protection</td>
<td>• 100% polycarbonate material resists impact</td>
</tr>
<tr>
<td></td>
<td>• Vented-side shields allow air to flow through</td>
</tr>
<tr>
<td></td>
<td>• Durable and cleanable design</td>
</tr>
<tr>
<td></td>
<td>• Properly fit and comfortable</td>
</tr>
<tr>
<td>Mask</td>
<td>Mask with cartridge (for incinerator operators)</td>
</tr>
<tr>
<td></td>
<td>or ordinary mask</td>
</tr>
<tr>
<td>Cap</td>
<td>Head protection from falling object, dusts, etc.</td>
</tr>
</tbody>
</table>
Minimum specifications for waste bins and receptacles

- Leak-proof with well fitting lid
- Made of non-corrosive material (reusable polypropylene bins)
- Lined with colour-coded non-PVC plastic (disposable polyethylene liner-bags)
- Washable after each use
- Portable (fixed with handle and volume of 50–100 liters)
- Puncture-proof sharps containers (safety boxes) for keeping sharps

NOTE: The number of standard waste bins in a health facility or section of the health facility depends on generation rate and frequency of removal. Waste bins should ONLY be used for the purpose intended. Bins should be placed in a convenient place to allow ease of use and collection to the main storage.

Treatment and disposal of healthcare waste

Proper disposal of contaminated waste minimizes the spread of infection to healthcare personnel and to the local community. It is preferred that the infectious waste is incinerated but it can also be disposed of using non-incineration technology such as microwave, autoclave, maceration, and tissue digestion.

The final disposal sites should be fenced in and locked to prevent scavenging by both animals and people. Open piles of waste should be avoided because they:

- Pose infection risks and fire hazards
- Produce foul odors
- Attract insects
- Are unsightly

To improve working conditions for healthcare waste handlers the following should be provided:

- Vaccinate workers against communicable diseases (e.g., hepatitis B)
- Increase the number of workers in this department depending on the workload
- Provide transportation to/from work
- Provide proper personal protective equipment
- Provide training on hazards of healthcare waste
CHAPTER 4
HEALTH WORKER SAFETY IN THE USE OF CHEMICALS

4.1. Introduction
If improperly handled, chemicals have the potential to cause serious harm to health workers, the public, and the environment. In view of their toxicity, chemical waste can have catastrophic effects on the environment and pose risks of explosions and fire. There is an urgent need to protect health workers and the environment from the harm that could be caused by chemicals. This calls for the establishment of a safety measures aimed at the promotion of safety, health and the well-being at work.

4.2. Chemicals and Human Body
Health workers can be exposed to chemicals through three main ways:
• Breathing
• Contact with skin
• Ingestion/swallowing

They may also be injected into the body or enter through the eyes.

4.2.1. Breathing
Most chemicals enter the body through breathing. Sometimes we breathe in air containing chemicals in the form of dust, vapors, gases or mists. Depending on their make-up, gases and vapors may be absorbed in the blood. The smaller the size of the particles inhaled, the more deeply they are likely to penetrate into the respiratory system.

Health effects depend on:
• The amount of chemicals we breathe
• The longer we are exposed to them
• Some individuals are more prone to the effects of chemicals than others.
• Children, the elderly, pregnant women and those weakened by illness are more at risk from the unhealthy effects of chemicals.

4.2.2. Absorption Through the Skin
The skin is composed of a number of layers which can protect us from biological, physical and chemical hazards encountered in the natural environment. But a number of chemicals corrode or burn the skin. Once chemicals enter through the skin, they may be carried away in the blood stream, causing harm to other organs or to bodily functions related to breathing, the nervous system, etc.

Most alkalines and acids have corrosive effects on the skin and can cause burns and boils. Most organic solvents can penetrate through the protective layer of the skin. If the skin is damaged by cuts, burns or other injuries, it is more likely to be penetrated by chemicals. Many pesticides also
cause skin and other health problems.

4.2.3 Swallowing
Ingesting chemicals can occur accidentally or by consuming contaminated food or drinks, touching your mouth with contaminated hands or by inhaling airborne particles.

4.3. Health and Safety Problems Caused by Chemicals
The harmful effects of chemical substances depend on the toxicity of the chemical and the level of exposure to that chemical.

- Toxicity is a property of the chemical substance, while the exposure depends on the way the chemical is used.
- The level of exposure depends on the concentration of the hazardous chemical and the period of contact time.
- Many substances do not have an odor, so it can be hard to detect if the substance has reached dangerous concentration in the air.

The effects of chemicals on health depend upon a number of factors, such as how they get into the body, their chemical and physical properties, how dangerous they are, the amount and duration of exposure, and the personal characteristics of the individual, such as age, sex, health status and susceptibility to certain chemicals.

4.3.1. Length of Exposure
Brief exposure to hazardous chemicals (minutes, hours, and several days) is usually referred to as acute exposure. Health effects from such exposure are usually immediate and are often reversible, when the intensity of exposure is not very high. Irreversible or permanent health effects, including death, may occur from acute exposure at very high concentrations of toxic chemicals. Repeated exposure to small doses of hazardous chemicals over long periods of time is usually more dangerous, and is referred to as chronic exposure.

4.3.2: Health Hazards of Chemicals
The effects of chemicals on health may range from temporary discomfort to permanent damage. The actual effect depends on the dose and toxicity of the chemical and the duration of exposure, in addition to personal factors.

Acute effects v. Chronic effects
- After acute exposure, physical effects are usually experienced right away.
- Chronic effects usually require repeated exposure and a delay is observed between the first exposure and appearance of adverse health effects.
- A substance may have acute and chronic effects.
- Both acute and chronic conditions can result in permanent injury.
Acute exposure- Chronic exposure

- Injury from exposure to a chemical substance can be temporary, i.e. reversible.
- Exposure to solvents may cause contact dermatitis, headache or nausea. These effects can be both acute and temporary.
- Solvents can also cause chronic effects and result in an irreversible, permanent injury to the nervous system.

Problems of the nervous system
The nervous system can be affected by a number of chemical agents. Sometimes the effects may be limited to temporary headaches or dizziness or a feeling of being drugged, which goes away soon after the source of exposure is removed. Several chemicals are capable of inflicting serious damage to the nervous system, though this may not present itself immediately.

Note: The nervous system:
- Is sensitive to chemicals.
- Can be affected by organic solvents commonly used at work.

Allergic reactions
- An allergic reaction, or sensitization, may appear after repeated contact to a substance.
- Once the sensitization has been produced, even very low doses can provoke a reaction.
- Allergic responses can range from minor skin irritations to cardiac arrest.
- In humans, the skin and the eyes are the most common areas of allergic response.

Skin problems
Corrosive chemicals like concentrated acids, alkalis and certain metal salts can cause immediate damage to the skin. Most organic solvents cause skin problems if exposure continues for long periods (from a few hours to several days) by dissolving the protective lipid layer of the skin and making the skin dry, rendering it more permeable to other chemicals. Such chemicals are labeled primary irritants. Other chemicals can cause allergic dermatosis, a condition in which the skin becomes sensitive, and rashes and redness become visible. Some allergies, once acquired, remain with the person for a lifetime, even though the source of exposure may be removed.

Breathing problems
- Most chemicals from the work and natural environment enter the body through breathing. There is a whole group of respiratory diseases caused by the inhalation of different kinds of dusts, called pneumoconioses.
- Some of these diseases like byssinosis (caused by inhalation of cotton dust and trash), silicosis (caused by inhalation of free silica) and asbestosis (caused by inhalation of asbestos fibres) have debilitating effects on the health of the affected persons. Several of the common pollutants found in urban and work environments may cause chronic bronchitis, a chronic cough with spitting.
• If large amounts of dust particles are inhaled for a long time, they may cause permanent damage and scarring of the lung tissue, resulting in a disorder called emphysema.

Effects on the Liver
The liver is responsible for detoxification of drugs and chemicals which enter the body through various routes. Damage to the liver therefore can result in a build-up of toxic materials in the body.

Examples of chemicals toxic to the liver:
• Chlorinated and nitrated organic chemicals (like chloroform, tetrachloroethane, and nitrobenzene)
• Barbiturates and paracetamol
• Alcohol

Kidney problems
Several chemicals found in the working environment can also damage the tissue of the kidneys.
• Acute poisoning by carbon monoxide gas can cause kidney failure.
• Heavy metals, such as mercury, chromium, and arsenic
• Oxalic acid, tartrates, ethylene glycol, carbon tetrachloride, tetrachloroethane and arsine all cause damage to the tissue

Cancer
Several chemicals have the potential to cause cancer. Cancer can remain unnoticed for long periods of time and may develop long after exposure to the causative agents (carcinogens) has ceased to exist.

Effects on the Reproductive System
Chemicals can affect fertility in men and women. Some have been known to damage the foetus; still others can cause developmental disorders in new-born babies. Pregnant women exposed to such chemicals have an increased likelihood of giving birth to malformed babies.

Example: Certain mercury compounds have been shown to affect the brain development of a foetus.

4.4. Safe Management of Chemicals
It is EVERYONE’S responsibility, including supervisors, health managers and staff to ensure that chemicals are used in a safe manner.
4.4.1. Labeling
The label contains all the important information regarding the health and safety measures to be taken when the chemical is in use or in case of emergencies. The label should contain the following information:

(i) Trade name of the chemical.
(ii) Identity of the chemical.
(iii) Hazard symbols.
(iv) Nature or special risks associated with the use of the chemical.
(v) Safety precautions.

Unlabeled chemicals can put staff and patients at serious risk.

4.4.2. Handling and use of Chemicals
The control of chemical hazards include isolation (contact between the user and the product is minimized by incorporating physical barriers) and ventilation, which involves the removal or dilution of the hazardous chemicals in the air, so they are no longer a health risk.

*Note: Personal protective equipment may be a bit uncomfortable, but it must be used when risk of exposure is anticipated.*

Storage of chemicals
General precautions for storage of chemicals:

• No unauthorized person should be allowed access to stored chemicals.
• Store only the minimum possible amounts.
• Store chemicals in a cool, dry and dark place.
• All containers being stored should be properly labeled.
• Firefighting and personal protective measures should be readily available in storage areas.
• Smoking, eating, and drinking in chemical storage areas is strictly prohibited.
• Do not store incompatible materials near each other; they may react and cause health risks.

4.5. Managing Exposure to Chemicals

4.5.1 First-aid and medical procedures
The basic information about specific first-aid measures to be taken in case of accidental exposure to a chemical can usually be found on the label of the container. All hospital settings handling, storing and using chemicals must have first-aid units in case of accidental exposure. It is even more essential that workers in the first-aid unit are trained to administering first-aid and resuscitation.
4.5.1 First-aid according to the route of exposure

**Eye exposure**
If chemicals splash into your eyes while handling or usage, rinse continuously for at least 15 minutes, until the irritation goes away. In case the irritation or pain persists after 15 minutes of rinsing, medical attention should be sought.

**Inhalation of chemicals**
In case of irritation, headache, dizziness and nausea resulting from inhalation of vapors, fumes, dust or gases, the person should immediately move to fresh air.

**Ingestion/Swallowing**
Exposure through ingestion can occur by accident or by consuming contaminated food and drinks or by eating food with contaminated hands. Do not induce vomiting to get rid of ingested chemicals. Many alkalis, acids and organic solvents may do more damage when vomiting is induced. Check the label of the chemical container which may include information on how to respond to ingestion of the chemical. Contact a doctor immediately.
CHAPTER 5
FIRE PREVENTION AND FIRE AID FOR HEALTH WORKERS

5.1. Fire Prevention Measures
It is extremely important to be aware of conditions that may cause a fire emergency and thereby endanger the safety of occupants in the workplace, as well as the patients. The major causes of fire at the workplace include overloaded electrical outlets and extension cords, misuse of space heaters, mishandling of flammables, improper storage of combustibles, and unsupervised cooking. Implementing fire prevention measures is key to ensuring one’s personal safety and the safety of other health workers and patients.

5.1.1 Prevention Measures
- Regularly observe emergency evacuation routes, fire extinguishers and emergency exit doors.
- Maintain the lobby, corridors, and stairwells clear of obstructions.
- Keep all exits clear of obstructions AT ALL TIMES.
- Report any tampering with the fire alarm, smoke detection and suppression systems to the city/municipal/district council fire office or engineering department.
- Inspect offices in search of:
  - Overloaded circuits
  - Frayed or damaged electrical cords
  - Improperly used extension cords
  - Improperly used appliances
- Forbid the use of candles or any other open-flame devices for any purpose in the hospital buildings.
- Respect the "No Smoking" policy in all hospital areas.

5.1.2 Housekeeping
- Exits, stairways and passageways leading to and from exits must be kept free of obstructions at all times. Furnishings, decorations, combustible or flammable objects, must not block exits, access to exits, or any means of egress. Dispose of all trash as soon as possible in trash cans or dumpsters. Waste materials must never be piled in corridors or stairways while awaiting removal.
- Flammable and combustible materials should be present in the work area only in the quantities required for the day’s job. These materials must be placed in an approved storage area at the end of each day.
5.1.3 Electrical Wiring and Appliances

- Supervisors should periodically inspect all electrical equipment and cords to ensure proper use and safe conditions. Improper use of electrical devices to obtain more outlet capacity can result in overloaded circuits and fire.

- The use of extension cords should be minimal and used only when a flexible, temporary connection is necessary. The cord and the outlet should be checked periodically to ensure overheating is not occurring. Extension cords cannot be used for fixed wiring, and should never be tacked, stapled, tied, hidden under rugs or draped over pipes or other supports, fastened to or through woodwork, ceilings or walls. When there is a permanent need of an electrical outlet, one should be installed.

- Be sure all electrical equipment is properly grounded. If any evidence is found of frayed, cracked or damaged wiring or electrical outlets, the equipment affected should be taken out of service until repairs are made.

5.2. Fire Safety Education and Training

Educating and training hospital workers is a vital component of the health worker safety program. The goal of Health Worker Safety (HWS) is to educate and train staff and students in the following areas of fire safety:

- Fire prevention and safety measures.
- Proper use of fire equipment.
- Fire drill and emergency evacuation procedures.
- Dangers of tampering with safety equipment and failing to respond to safety procedures.
- Detection and reporting of fire and safety hazards.

5.2.1 Fire Safety Equipment

Modern office buildings are designed with fire detection and suppression equipment to protect life and property from fire. Fire safety equipment includes sprinkler systems, smoke alarms and heat detectors.

5.2.2 Fire Alarm Activation Procedure

All employees should be familiar with fire alarm pull station locations in their building. The building’s alarm should be immediately activated in the event of a fire, or if a person smells or sees smoke. Even if the fire is small, the alarm should be activated, because a fire can grow quickly and endanger building occupants. After activating the alarm, get out of the building.

A fire emergency exists whenever:

- A building fire evacuation alarm is sounding.
- There is visible smoke, or the odor of burning.
- An uncontrolled fire or imminent fire hazard occurs in any building or area of the campus.
• There is a spontaneous or abnormal heating of any material, an uncontrolled release of combustible or toxic gas or other material, or a flammable liquid spill.

**Steps to take during a fire emergency:**
• Activate fire alarm system located along exit routes.
• Evacuate the building; do not use elevators.
• Remain at a safe location at least 100 feet away from the building until you are told to re-enter by the City/Municipal/District Council Fire Department, Hospital Fire Safety Officer, or other emergency personnel.

### 5.2.3. Evacuation
The primary concern in the event of a fire is to evacuate everyone from the building as quickly and safely as possible. In order to accomplish this, occupants must be prepared in advance for a quick and orderly evacuation.

#### Evacuation procedures
When a fire evacuation alarm is sounding, all occupants must:
• Shut down any procedures that should not be left unattended.
• Take or secure all valuables, wallets, purses, keys, etc.
• Evacuate the building immediately and in an orderly manner. The last occupant to leave a room should close the door leading to the corridor.
• Never use the elevators.
• Proceed to the nearest and safest exit.
• If possible, assist non-ambulatory occupants to areas of refuge, or to ground level exits. (All members of hospital setting are responsible, within the limits of their abilities, to assist those individuals requiring assistance prior to, during, or after an emergency.)

### 5.3. Fire Safety in Storage Areas
Storage in itself does not constitute a fire hazard. A fire hazard is created when items are stored improperly or in a hazardous location, or block egress and exits.

#### 5.3.1 Flammable Storage
It is critical that flammables are used properly and stored safely.
• Rooms used for flammable storage must be constructed to meet the requirements for ventilation, heating, electrical systems, fire detection and/or suppression systems.
• Flammables generally are not permitted to be stored in basements of buildings.
• A "daily use" of flammable liquids may be stored on open shelves. “Daily use” refers to a small amount of consumable flammables that are expected to be used in a
repetitive nature, and the amount used would not constitute more of a hazard than other ordinary combustibles in the room.

5.3.2 Storage of Hazardous Materials
Hazardous products may produce a substantial amount of toxic vapors, as well as react with a fire to create a fast moving or explosive situation. Storage of such materials must be strictly controlled.

- Hazardous materials may not be stored within 15 meters of an open flame or heat source.
- Hazardous materials must not obstruct evacuation routes or be stored under stairs.
- Hazardous materials must be stored on separate shelves or rooms according to their reactive properties.

5.4. Fire Extinguishers
The engineering department is responsible for the installation, tracking, and maintenance of fire extinguishers in all hospital buildings. The Health Worker Safety Committee gives hands-on training to hospital employees and students on a regular basis.

Fire extinguishers are special pressurized devices that release chemicals or water to aid in putting out a fire. They keep small fires from spreading, assist in fighting fires until the Fire Department personnel arrive, and may help provide an escape route for you.

REMEMBER:
A fire extinguisher is not a substitute for the Fire Department. Always call the Fire Department first no matter how small you think the fire is.

5.4.1 The Fire Triangle

Figure 5.1: Elements of the fire triangle
Four things must be present at the same time in order to produce fire:

1. Enough oxygen to sustain combustion,
2. Enough heat to raise the material to its ignition temperature,
3. Some sort of fuel or combustible material, and
4. The chemical, exothermic reaction that is fire.

Oxygen, heat and fuel are frequently referred to as the “fire triangle.” Add the fourth element, the chemical reaction, and you actually have the “fire tetrahedron.” The important thing to remember is when you take any of these four things away, you will not have a fire, or the fire will be extinguished.

Essentially, fire extinguishers put out fires by taking away one or more elements of the fire triangle/tetrahedron. Fire safety, at its most basic, is based upon the principle of keeping fuel sources and ignition sources separate.

5.4.2 Rules for Fighting Fires

Fires can be very dangerous and you should always make certain not to endanger yourself or others when attempting to put out a fire. For this reason, when a fire is discovered:

- Assist any person who is in immediate danger to safety if it can be accomplished without risk to you.
- Activate the building’s fire alarm system or notify the fire department.
- Only after completing the above two, you may use an extinguisher if you are trained and the fire is small.

NEVER FIGHT A FIRE IF:

*You do not know what is burning and you do not know what type of fire extinguisher to use.*

Even if you have ABC (multi-purpose) fire extinguishers, there may be something in the fire, which could explode or produce toxic smoke. If you do not know what is burning, let the fire department handle it.

*The fire is spreading rapidly beyond the spot where it started.*

The time to use the fire extinguisher is in beginning stages of the fire. If the fire is spreading quickly, it is best to simply evacuate the building, closing windows and doors as you leave.
5.4.3. Types of Fire Extinguishers

The extinguisher must be appropriate for the type of fire being fought. Using the wrong type of extinguisher can cause harm to a person and make the fire worse. In some cases, it may be dangerous to use a fire extinguisher, regardless of the type.

a) **Pressurized water** extinguishers are being phased out because they do not work with class B and C fires. They can be used for ordinary combustibles like wood, paper, many plastics, cloth and rubber.

![Pressurized water extinguisher]

*Figure 5.2: Pressurized water extinguisher*

b) **Carbon dioxide** extinguishers are generally used in areas of sensitive electrical or electronic equipment since it is gas and leaves no residue that damages the equipment. Carbon dioxide functions by removing or displacing the oxygen in a fire.

![Carbon dioxide extinguisher]

*Figure 5.3: Carbon dioxide extinguisher*
c) **Dry chemical** fire extinguishers are by far the most common in the hospital. They are effective on all three classes (ABC) of fires. Dry chemicals function by interrupting the chain reaction of the fire tetrahedron.

![Dry chemical extinguisher](image)

**Figure 5.4: Dry chemical extinguisher**

### 5.4.4. How to Use Fire Extinguisher

It is easy to remember how to use a fire extinguisher if you can remember the acronym **PASS**, which stands for **PULL, AIM, SQUEEZE, and SWEEP**.

**Figure 5.5: How to use Fire Extinguisher**

| **PULL** | Pull the pin.  
This will allow you to discharge the fire extinguisher. |
| --- | --- |
| **AIM** | Aim at the base of the fire.  
If you aim at the flames (which is usually the temptation), the extinguisher agent will fly right through and do no good. You have to hit the fuel. |
| **SQUEEZE** | Squeeze the top handle or lever.  
This depresses a button that releases the pressurized extinguishing agent in the extinguisher. |
| **SWEEP** | Sweep from side to side until the fire is completely out.  
Start using the extinguisher from a safe distance away moving forward sweeping the nozzle from side to side. Once the fire is out, continue to watch the area in case it re-ignites. |
Table 5.1. Classes of fire and extinguishing materials required

<table>
<thead>
<tr>
<th>Class of fire</th>
<th>Types of materials which may cause it</th>
<th>Extinguishing media required to fight this class of fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Ordinary combustible materials like wood, paper, rags, rubbish, rubber and plastics</td>
<td>Water spray and sprinkling system. Special dry chemicals douse the flames quickly and prevent the spreading of fire.</td>
</tr>
<tr>
<td>B</td>
<td>Flammable or combustible gases and liquids like gasoline, kerosene, thinners, paints, grease and similar materials</td>
<td>Materials which limit the supply of air, like carbon dioxide, dry chemicals, foam and halogenated hydrocarbons. Use of water may spread the fire; however fine water spray can be used to cool the containers which are likely to catch fire.</td>
</tr>
<tr>
<td>C</td>
<td>Fires involving or near electrical equipment</td>
<td>Non-conducting materials like carbon dioxide or dry powders should be used. Water and foam should not be used as they may cause short circuiting, electrical shock and damage to the equipment.</td>
</tr>
<tr>
<td>D</td>
<td>Fires involving active metals like magnesium, sodium, titanium potassium, zirconium</td>
<td>Special extinguishing agents are available for such fires; normal extinguishing agents should not be used as they may increase the intensity of the fire.</td>
</tr>
</tbody>
</table>

5.5. Fire and Life Safety:

**Maintenance of Exit Pathways Guidelines**
An exit path is a continuous and unobstructed way to exit the building. An exit path consists of:
- Corridors, stairways, and/or aisles leading to an exit door.
- An exit door.
- The path or way outside of the exit door that leads away from the building.
- Associated emergency lighting and signage, as required by code.

All buildings that are designed for human occupancy must have continuously unobstructed exit paths for quick evacuation, and to allow immediate access for responding emergency personnel.
**Exit Signs**
All exits must be clearly visible and marked with an illuminated EXIT sign. An arrow must be placed on all EXIT signs such that health workers and clients can determine the direction of the nearest exit from any point. If a door is likely to be mistaken for an exit, a NOT AN EXIT sign must be posted on it. The Hospital Management Team (HMT) is responsible for ensuring that EXIT and NOT AN EXIT signs are posted where appropriate in their buildings.
CHAPTER 6

ELECTRICAL SAFETY FOR HEALTH WORKERS

6.1. Introduction
Whenever health workers work with power tools or electrical circuits, there is a risk of electrical hazards, especially electrical shock. Any health worker can be exposed to these hazards at work. Health workers are exposed to more hazards because job sites can be cluttered with tools and materials, fast-paced, and open to the weather. Risk is also higher at work because many jobs involve electric power tools (e.g., ultrasound, ECG machine, MRI machine, ECT machine, electric suction machine, etc.).

Health workers must pay special attention to electrical hazards because they work with tools which comprise of electrical circuits. Coming in contact with an electrical voltage can cause current to flow through the body, resulting in electrical shock and burns. Serious injury or even death may occur.

Terms heath workers need to know

What is "voltage"? Voltage is a measure of the electrical force that seems to push the current along. The symbol for voltage is "V".

What is "amperage"? Amperage is the unit used to measure the amount of electrical current. Amperage is often referred to as "current" by electrical workers and engineers. The symbol for Amperage is "I".

What is "resistance"? Resistance is the unit (ohms) used to measure the opposition to the flow of electrical current. In an electrical circuit, components are usually sources of resistance. Any component that heats up due to electrical current is a source of resistance. The symbol for resistance is "R".

6.2. How do you receive an electrical shock?
An electrical shock is received when electrical current passes through the body. Current will pass through the body in a variety of situations. Whenever two wires are at different voltages, current will pass between them if they are connected. Your body can connect the wires (completing the circuit) if you touch both of them at the same time, causing the current to pass through your body.

In most wiring in Tanzania, the black wires and the red wires are at 240 volts. The green wires are at 0 volts because they are connected to ground. The connection to the ground is often through a conducting ground rod driven into the earth. The connection can also be made through a buried metal water pipe. If you come in contact with an energized black wire and you are also in contact with a neutral green wire, current will pass through your body and you will receive an electrical shock.

You can even receive a shock when you are not in contact with an electrical ground. Contact with both live wires of a 240-volt cable will deliver a shock. (This type of shock can occur because one live wire may be at +120 volts while the other is at -120 volts during an alternating
current cycle—a difference of 240 volts.) You can also receive a shock from electrical components that are not grounded properly. Even just touching another person who is receiving an electrical shock may cause you to be shocked.

6.3. The Dangers of Electrical Shock to Health Workers
The severity of injury from an electrical shock depends on the voltage of the current and the length of time the current passes through the body. The effects of an electrical shock can range from a simple tingling sensation to severe muscle contractions, burns and even cardiac arrest. Another indirect risk of electrical shock is that you may lose your balance, which may result in a fall that can cause broken bones or bruising.

A severe electrical shock may cause damage that is not externally visible, such as internal bleeding or the destruction of tissues, nerves and muscle. The length of time of the shock greatly affects the amount of injury. If the shock is short in duration, it may only be painful. A longer shock (lasting a few seconds) could be fatal if the level of current is high enough to cause the heart to arrest. At high currents death is highly likely.

6.4. The most common injuries
The most common shock-related nonfatal injury is a burn. Burns caused by electricity are divided into three categories: electrical burns, arc burns and thermal contact burns.

Electrical burns can result when a person touches electrical wiring or equipment that is used or maintained improperly. Typically, such burns occur on the hands. Electrical burns are one of the most serious injuries you can receive. They need to be given immediate attention.

6.4.1. What Should I Do If a Co-Worker Is Shocked or Burned by Electricity?

1. Shut off the electrical current if the victim is still in contact with the energized circuit. While you do this, have someone else call for help. If you cannot get to the circuit breaker quickly, pry the victim from the circuit with something that does not conduct electricity, such as a dry wood or plastic pole. Do not touch the victim yourself if he or she is still in contact with an electrical circuit!

2. Do not leave the victim unless there is absolutely no other option. You should stay with the victim until emergency personnel are contacted. If the victim is not breathing, does not have a heartbeat, or is badly injured, quick medical treatment is the individual’s best chance for survival.

3. Once you know that electrical current is no longer flowing through the victim, call out to the victim to see if he or she is conscious. If the victim is conscious, tell the victim not to move. It is possible for a shock victim to be seriously injured but not realize it. Quickly examine the victim for signs of major bleeding. If there is a lot of bleeding, place a clean cloth over the wound and apply pressure. If the wound is in an arm or leg and keeps bleeding, gently elevate the injured area while keeping pressure on the wound.

4. Keep the victim warm and talk to him or her until help arrives.
6.5. The Electrical Safety Model

What Should You Do to Be Safe
To make sure all health workers are safe before, during, and after electrical work is performed, electrical workers should follow the three-step process of the Electrical Safety Model:

1. Recognize hazards
2. Evaluate risk
3. Control hazards

To be safe, you must think about your job and plan for hazards. To avoid injury or death, you must understand and recognize hazards. You need to evaluate the situation you are in and assess your risks. You need to control hazards by creating a safe work environment, by using safe work practices, and by reporting hazards to a supervisor.

Step-1: Recognize hazards
The first step of the safety model is recognizing the electrical hazards around you. Only then can you avoid or control the hazards. It is best to discuss and plan hazard recognition tasks with your co-workers.

How to recognize hazards
To do this, you must know which situations can place you in danger. Knowing where to look helps you to recognize hazards.

Hazards include:
- Inadequate wiring
- Exposed electrical parts
- Overhead power lines
- Wires with bad insulation
- Electrical systems and tools that are not grounded or double-insulated
- Overloaded circuits
- Damaged power tools and equipment
- Using the wrong PPE
- Using the wrong tool

Electrical hazards can be made worse if the worker, location, or equipment is wet.

Step-2: Evaluate hazards
When evaluating hazards, it is best to identify all possible hazards first, and then evaluate the risk of injury from each hazard. Do not assume the risk is low until you evaluate the hazard. It is dangerous to overlook hazards. Job sites are especially dangerous because they are always changing.
**Evaluating Risks:** This entails evaluation of the risk of injury from each hazard by checking for a number of conditions that indicate electrical hazard:

- Tripped circuit breakers and blown fuses show that too much current is flowing in a circuit. This condition could be due to several factors, such as malfunctioning equipment or a short between conductors.
- An electrical tool, appliance, wire, or connection that feels warm may indicate too much current in the circuit or equipment.
- An extension cord that feels warm may indicate too much current for the wire size of the cord.
- A cable, fuse box, or junction box that feels warm may indicate too much current in the circuits.
- A burning odor may indicate overheated insulation.
- Worn, frayed, or damaged insulation around any wire or other conductor is an electrical hazard because the conductors could be exposed.

**Step-3: Control hazards**
Once electrical hazards have been recognized and evaluated, they must be controlled.

**6.6. Safe Working Environments**

**Creating a Safe Working Environment**
You need to guard against contact with electrical voltages and control electrical currents in order to create a safe work environment.

Make your environment safer by doing the following:
- Treat all conductors (even "de-energized" ones) as if they are energized until they are locked out and tagged.
- Lock out and tag out circuits and machines.
- Prevent overloaded wiring by using the right size and type of wire.
- Prevent exposure to live electrical parts by isolating them.
- Prevent exposure to live wires and parts by using insulation.
- Prevent shocking currents from electrical systems and tools by grounding them.
- Prevent too much current in circuits by using over current protection devices.
CHAPTER 7

SAFETY FOR HEALTH WORKERS IN LABORATORIES AND RADIOLOGY

7.1. Introduction
Health workers working in laboratories are exposed to many kinds of hazards. This can be said of most work places. In some, the hazards are well recognized. Laboratories, however, involve a greater variety of possible hazards than do most workplaces and some of those hazards call for precautions not ordinarily encountered elsewhere.

7.2. General precautions for laboratory workers
1. Wear gloves when handling infectious materials or where there is a possibility of exposure to blood or other body fluids. All laboratories that work with material that is potentially infected with HIV require a generous supply of good-quality gloves.

2. Discard gloves whenever they are thought to have become contaminated. Wash your hands, and put on new gloves.

3. Do not touch your eyes, nose or other exposed membranes or skin with gloved hands.

4. Do not leave the workplace or walk around the laboratory wearing gloves.

5. Wash your hands with soap and water immediately after any contamination and after work is completed. If gloves are worn, wash your hands with soap and water after removing the gloves.

6. Wear a laboratory gown/coat. Remove this protective clothing before leaving the laboratory.

7. When work with material that is potentially infected with HIV is in progress, close the laboratory door and restrict access to the laboratory. The door should have a sign “Biohazard. No Admittance”.

8. Keep the laboratory clean, neat, and free from extraneous materials and equipment.

9. Disinfect work surfaces when procedures are completed and at the end of each working day. An effective all-purpose disinfectant is a hypochlorite solution with a concentration of 0.5%.

10. Whenever possible, avoid using needles and other sharp instruments. Place used needles, syringes, and other sharp instruments and objects in a puncture-resistant container. Do not recap used needles and do not remove needles from syringes.

11. Never pipette by mouth.

12. Perform all technical procedures in a way that minimizes the risk of creating aerosols, droplets, splashes or spills.

13. Do not eat, drink, smoke, or store food or personal items in the laboratory.

14. Make sure that there is an effective insect and rodent control program (This is a
standard biosafety recommendation).

7.3. Good Safety Practices
Staff must behave in a safe and responsible manner at all times. Staff must not:

- Store food and drinks in technical areas or refrigerators meant for samples and reagents.
- Smoke in the laboratory facility.
- Apply cosmetics in the laboratory.
- Wear jewelry that can be caught in equipment or hang into infective materials.
- Store personal property in the technical areas.
- Wear sandals/open-toed shoes.

7.4. General Chemical Spill Guidelines
Determine the extent and type of spill by considering:

- Spill category
- Release to the environment
- Acutely hazardous chemical (as listed in the HWMP) spill
- Whether there is any one trained in the proper procedures for cleaning chemical spills

Table 7.1: Spill Category and Response Required

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
<th>Response</th>
<th>Treatment Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>Spilled material &lt; 300 milliliters</td>
<td>Chemical Treatment</td>
<td>Neutralization or absorption spill kit</td>
</tr>
<tr>
<td>Medium</td>
<td>300 ml &lt; spilled material &lt; 5 Liters</td>
<td>Absorption</td>
<td>Absorption Spill Kit</td>
</tr>
<tr>
<td>Large</td>
<td>Spilled material &gt;5 Liters</td>
<td>Call engineering department</td>
<td></td>
</tr>
</tbody>
</table>

Action to be taken in case of spills
For the safety of workers in the laboratory or nearby offices, the following must be done immediately after a spill:

1) Immediately alert area occupants and supervisor, and evacuate the area if necessary.

2) Attend to any people who may be contaminated. Contaminated clothing must be removed immediately and the skin flushed with water for at least fifteen minutes. Clothing must
be laundered separately from other clothing before reuse.

3) Immediately warn everyone when a volatile flammable material is spilled. Control sources of ignition. Ventilate the area by turning on the fume hoods with the sashes completely open and open all windows.

4) Use the appropriate personal protective equipment for the hazard.

5) Cover or block floor drains or any other route that could lead to an environmental release.

6) Absorbent materials used on the chemical spill will most likely require disposal as hazardous waste.

7) Clean the surface where the spill occurred using a mild detergent and water.

7.5. Laboratory Doors
It is a good practice to keep laboratory doors closed and unlocked while occupied. Laboratory doors must remain closed to ensure that any hazardous materials spills will be isolated to that laboratory/area.

7.6. Personal Protective Equipment (PPE)
PPE is required in all laboratories with chemical hazards. The minimal PPE is:
- chemical resistant gloves or gloves appropriate to the hazard
- laboratory jacket or apron
- goggles
- closed-toed shoes

7.7. Eating in the Lab and Food Storage
Eating, drinking, gum chewing, the use of tobacco, and the application of cosmetics are not allowed in laboratories. These actions may cause contamination of individuals partaking in them. Food storage is not allowed in laboratories. Other actions that may result in contamination that should be noticed and avoided are; pencil chewing, touching the face, adjusting eyeglasses, scratching, etc. Laboratory jackets must not be worn into eating and food preparation areas.

7.8. Hand Washing
Hands and forearms must be washed properly prior to leaving the laboratory.

7.9. Housekeeping
Working laboratories often become cluttered with empty and partially full containers, glassware, and other apparatus. These working apparatus should be cleaned and arranged properly or disposed if they are not needed.

7.9.1. Elements of Good Housekeeping

Chemical Storage
The failure to store chemicals according to their properties poses a risk to personnel and property.
The following are general regulations for safe storage of chemicals in the laboratory:

- The quantities of chemicals that are stored within a laboratory should be minimized.
- Bulk quantities of chemicals (i.e., larger than one-gallon) must be stored in a separate storage area.
- Chemicals must be stored at an appropriate temperature and humidity level.
- Chemicals should be dated when received and when opened. If the chemical is one that degrades in quality or becomes unsafe after prolonged storage, the shelf-life expiration date should also be included.

Chemicals should not be routinely stored on the bench top. In such locations they are unprotected from exposure and in a fire situation are more readily knocked over. Each chemical should have a specific storage area and be returned after use.

**Equipment**

All laboratory equipment must be cleaned and decontaminated after use or when necessary.

### 7.10. Fume Hoods

A fume hood is one of the most important pieces of laboratory safety equipment the hospital can afford for researchers, staff, and students. A fume hood prevents the inhalation of potentially harmful substances, deters uncontrolled splashes and spills from entering the laboratory environment, and removes flammable vapors from the indoor atmosphere.

#### 7.10.1 When to Use a Chemical Fume Hood

A chemical fume hood is a necessary part of your laboratory procedure when:

- Working with hazardous or suspect hazardous chemicals.
- Working with chemicals having unknown properties.
- Pouring, mixing, weighing and dispensing chemicals.

#### 7.10.2 Fume Hood Safety Practices

A chemical fume hood cannot provide complete safety against all hazards. A functioning fume hood and appropriate laboratory ventilation will provide adequate protection during standard laboratory manipulations.

The following is a list of mandatory laboratory safety practices:

1. Keep all apparatus at least 6 inches from the face of the hood.
2. Do not put your head in the hood when contaminants are being generated.
3. Do not use the hood to evacuate containers of volatile waste chemicals.
4. Minimize the quantity of chemicals and apparatus being used in the hood.
5. Maintain the slots in the hood baffle free from obstructions.
6. Minimize traffic in front of the hood while in use.
7. Do not remove hood labels that indicate the maximum safe operating level of the sash.
8. Ensure all fume hoods have a spill protection lip.

7.11. MEDICAL X-RAYS

7.11.1. Radiation Protection Techniques
The basic radiation protection principles of time, distance and shielding, apply equally to x-ray and radioisotopic sources. The primary difference is the physical facility. X-ray facilities tend to be designed around the equipment and the source of radiation usually remains within a well defined area in the room.

Considerations for implementing these principles for x-rays include:

- **Time**: When you need to use an x-ray system, work quickly and efficiently. Examinations should be carefully planned and rehearsed beforehand to minimize the exposure (beam-on) time and consequently reduce the total radiation exposure in the room.

- **Distance**: When an x-ray system is being used, if you are not required to be near the system, move away. Radiation is significantly reduced by distance; standing at least 6 feet from an x-ray radiation source provides a great deal of protection. Note that many analytical x-ray systems use very narrow x-ray beams.

- **Shielding**: When a new x-ray system is being installed, ensure each tube is protected by fixed shielding.
  - Do not rely on protective aprons and other shielding worn by the person using the system. Individuals may forget to wear them, there may not be enough protective aprons to go around or people may be going in and out of the room. Shielding that is permanently in place is the most effective mechanism for protecting workers from unnecessary x-ray exposure.
  - Always operate these systems with all shielding and safety components in place and never tamper with system interlocks.

7.11.2. Precautions and Guidelines while working in X-ray rooms
Precautions for workers to take when working in X-ray rooms:

- Receive proper training / instruction from the person in control before operating analytic x-ray machines.

- Wear dosimeters between the collar and waist on the side facing the radiation source.

- Carry out radiation survey and monitoring of newly installed machines, especially before and after modifying the machine for special work.

- Never assume the unit was left in a safe working condition by the previous user; check the shielding before turning the unit on. Unless verified by a pre-operational check, do not trust the warning lights.
7.11.3. Health Worker Safety in X-Ray
Radiation exposure to technologists, nursing staff, physicians, and to others must be kept as low as reasonably achievable. Time, distance, and shielding effect levels of radiation exposure.

- Only personnel who are required for x-ray procedures or training should be present in the x-ray room during exposures. All personnel who must be present in the room during x-ray exposures should do the following:
  - Wear lead aprons, leaded safety glasses, thyroid shield, and leaded gloves as deemed appropriate by the head of the respective department; or utilize portable or fixed lead panels.
  - Maximize the distance between themselves and the patient as practical. If you do not need to be at the patient's side, remain a minimum of 2 meters from the tube head.
  - Wear personal dosimeters to monitor radiation exposure.

- If your hand must be in or near the primary beam, wear a finger dosimeter and a lead glove. The finger dosimeter must be worn under the glove.

- Keep the time of radiation exposure short, especially during fluoroscopy procedures.

- Follow proper techniques to minimize the number of repeat exposures.

- Staff should not routinely hold patients. Use mechanical holding devices when a patient or film requires added support. If not possible, patients should be held by a relative or friend who is wearing lead aprons and gloves.

- If pregnant, notify your head of the department.

7.11.4. Patient Radiation Safety Principles
The radiation exposure to the patient should be minimized without compromising the diagnostic quality of the examination. Obtaining a good quality radiograph, while controlling radiation exposure of the patient, is one of the goals of a viable quality assurance program. Toward that end, there are many precautions that the operator can take to minimize the patient dose while maximizing image quality:

- Follow the proper technique for each examination (reduces retakes).

- Obtain a good quality radiograph the first time and reduce the number of repeat examinations.

- Collimate the primary X-ray beam to the area of interest (reduces scatter radiation).

- Identify pregnant patients and notify the referring physician before they undergo any x-ray examinations.

- Use protective eyewear and aprons when appropriate.

- When portable x-ray machines are used, make sure that other patients in the room are located at a safe distance (e.g., 6 feet) from scatter radiation or utilize portable lead panels for shielding.
ANNEX 1: POST EXPOSURE REPORTING FORM

HEALTH WORKER SAFETY INITIATIVE

<This information is confidential.>

To be filled by Ward/Section/Unit in charge/supervisor

Exposed person

Name ...........................................Ward/unit/section...........................................................

Designation .................................. P/F. No............Mobile/Phone ...........................................................

Age (years) ..................................Sex .....................................................................................

Exposure

Date of accident .................................. Time ...........................................................................

Contact with blood /___/, other body fluid (specify) ...........................................................................

Description of contact with:

  Sharp instrument /___/   hollow needle /___/

  Plain needle /___/, Specify size of needle ......................................................................................

  Others (specify) ..........................................................................................................................

Description of circumstances of the accident:

...........................................................................................................................................................

...........................................................................................................................................................

...........................................................................................................................................................
Contact on:

Healthy skin /____/ yes /____/ no
Broken skin /____/ yes /____/ no
Mucous membrane /____/ yes /____/ no. (Specify),

During accident:
Were protective gears worn (specify),

Type of first aid provided (if any)

Health status of source person:
Is the source person known /____/ yes /____/ no?
If yes, give result of medical evaluation including HIV test.

Prophylactic treatment:
Advised /____/ yes /____/ no
Prescribed /____/ yes /____/ no
Type of treatment (starter pack) given:

Date and time treatment started:

Recommendation:

Date.................Unit/ward/section
Signature of exposed person
Name and signature of ward/ unit/section in charge/supervisor
Designation
ANNEX 2: POST EXPOSURE PROPHYLAXIS FOLLOW-UP REPORTING FORM

HEALTH WORKER SAFETY INITIATIVE

Exposed person reference number……………………………………………………………………

Problems related to drugs given

Adherence to drug regimen: Yes / No

Adverse effect: (Specify) …………………………………………………………………………………

Outcome of adverse effect:

   a) Death
   b) Discontinue drugs
   c) Managed and continued with drugs

PEP completed: Yes/ No, If No give reasons…………………………………………………………

Laboratory investigation

Are the investigations during PEP done according to National Guidelines? Yes/No

If No, give reasons…………………………………………………………………………………………

Results of ALAT/ASAT at 0, 2, 4 …………….and weekly………………………………………………

Safe Sex Measures during PEP: Yes/No

PEP outcome:

HIV transmission prevented Yes/No.

If No, what are the suspected reasons?

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ANNEX 3: PREPARING AND USING CHEMICAL DISINFECTANTS

HEALTH WORKER SAFETY INITIATIVE

Preparation of 0.5% Chlorine Solution for Decontamination

1. Check concentration (% concentrate) of the chlorine product you are using.

\[
Total \text{ Parts (TP) water} = \frac{% \text{ Concentrate}}{% \text{ Dilute} - 1}
\]

Mix 1 part concentrated bleach with the total parts water required.

2. Check concentration (% concentrate) of the powder you are using:

\[
\text{Grams/Liter} = \left( \frac{% \text{ Dilute}}{% \text{ Concentrate}} \right) \times 1000
\]

Mix measured amount of bleach powder with 1 liter of water.

To make a dilute chlorine-releasing solution (0.5%) from a concentrated powder (35%).

Add 14 g to 1 liter of water or 280 g to 20 lt of water

3. To make a dilute chlorine-releasing solution (0.5%) from a concentrated powder (65%)

\[
\text{Grams/liter} = \left( \frac{% \text{ Dilute}}{% \text{ Concentration}} \right) \times 1000
\]

Add 8 g to 1 liter of water or 160 g to 20 lt of water

4. Dilution Instructions for Presept Disinfectant Tablets

<table>
<thead>
<tr>
<th>Item to be disinfected</th>
<th>Concentration</th>
<th>Mixture</th>
<th>Instructions for use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soiled or infected linens</td>
<td>140 ppm</td>
<td>1 tablet in 10 liters of water</td>
<td>Immerse for 1 hr prior to washing</td>
</tr>
<tr>
<td>Work surfaces and Floors</td>
<td>140 ppm</td>
<td>1 tablet in 10 liters water</td>
<td>Wash</td>
</tr>
</tbody>
</table>
ANNEX 4: LIST OF PARTICIPANTS FOR THE DEVELOPMENT OF THE HEALTH WORKERS’ SAFETY GUIDE

<table>
<thead>
<tr>
<th>S/N</th>
<th>NAME</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>FRANCISCO M. CHIBUNDA</td>
<td>HWSI-Program coordinator and Principal Pharmacist-BMC</td>
</tr>
<tr>
<td>2.</td>
<td>ESTHER MKUNGU</td>
<td>HEAD, IPC department</td>
</tr>
<tr>
<td>3.</td>
<td>DOMINA KAYENZE</td>
<td>HWSI-Reinforcement team nurse</td>
</tr>
<tr>
<td>4.</td>
<td>GERMITRIDA KATOROGO</td>
<td>HWSI-Reinforcement team nurse</td>
</tr>
<tr>
<td>5.</td>
<td>FARIDA DAUDA</td>
<td>HWSI-Committee member, Registered Nurse</td>
</tr>
<tr>
<td>6.</td>
<td>GERALD CHUWA</td>
<td>HWSI-Committee team member and Laboratory Technologist</td>
</tr>
<tr>
<td>7.</td>
<td>DEBORAH L. MOLLEL</td>
<td>HWSI-Committee team member and Nurse in charge female medical ward</td>
</tr>
<tr>
<td>8.</td>
<td>DR. ADOLFINE HOKORORO</td>
<td>HWSI-Committee team member and Pediatrician</td>
</tr>
<tr>
<td>9.</td>
<td>JOHN L. MUYOMBE</td>
<td>HWSI-Committee team member and Laboratory safety officer-BMC</td>
</tr>
<tr>
<td>10.</td>
<td>TAUSI KA JWANGYA</td>
<td>HWSI-Reinforcement team nurse</td>
</tr>
</tbody>
</table>
ANNEX 5: BIBLIOGRAPHY

This guide to health worker safety was compiled with the use of the following sources, and also drew from the experience of the pilot Health Worker Safety Initiative at Bugando Medical Centre.


