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Ministry of Health

الإدارة العامة لمكافحة عدوى المنشآت الصحية

General Directorate of Infection Prevention and Control in Healthcare Facilities

(GDIPC)

Infection Control Guideline in Clinical Laboratory

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In the Name of ALLAH, Most Gracious, Most Merciful

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General Director's Message

It is with the utmost enthusiasm that we announce the release 2nd version of infection Prevention & Control Guideline for the clinical laboratory.

The laboratory is a unique work environment that may pose infectious disease threats to those who work there. The Laboratory's role in the infection Prevention Program is fundamental, so laboratorians should be an integral part of an infection prevention program. The microbiology laboratory helps detect and identify microorganisms so that the infection control team can monitor, prevent, and control infection transmission.

This guideline is developed to protect the laboratory personnel from the risk of acquiring occupational infections & to protect them from organisms in their unique environment.

We hope that healthcare facilities will adopt the standard infection control practices for the laboratory settings to ensure the safety of the laboratory environment and staff that work in them.

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Purpose of the Guideline

This guideline was established to assist the laboratory personnel in minimizing or preventing the transmission of infectious agents in the laboratory settings & to ensure the safety of HCWs working in those settings.

It introduces the basic components of an IP&C program, including the roles & responsibilities of laboratory personnel to assist in minimizing and preventing the transmission of infectious agents in the clinical laboratories.

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Introduction

Laboratories are special unique work environments that present identifiable infectious disease threats to working laboratories' staff.

The laboratory is an essential partner of infection preventionist in assisting in the detection and characterization of pathogens, not only for healthcare-associated infections but also for organisms associated with research, community, or bioterrorism outbreaks.

The Laboratories dealing with infectious materials (clinical samples, bacteria, viruses, and fungi) must follow specific Infection Control Guidelines to reduce the risk of transmission during manipulation of patient specimens, cultures, contaminated sharps, and diagnostic equipment.

Supervisors and managers have the primary responsibility for maintaining laboratories under their supervision as safe, healthy places to work and for making sure that applicable health, safety, and environmental regulations are followed.

Laboratory personnel is at risk of exposure to blood-borne pathogens related to injuries from contaminated sharps, splashes to the eyes or mouth, and unprotected exposure of blood/body fluids onto non-intact skin.

In addition, concentrated cultures of specific microorganisms in the microbiology laboratory give a chance for laboratory-acquired infection during activities such as sub-culturing blood culture bottles, whirling, mixing, and separation is done. Examples of microorganisms transmitted to laboratory personnel from these activities include N. meningitides, M. tuberculosis.

Definitions

Personal Protective Equipment (PPE)

Specialized clothing or equipment, worn by an employee for protection against infectious materials" (Occupational Safety and Health Administration (OSHA)

Universal Masking

Wearing surgical face masks, at all times, by all HCWs while in their respective clinical care settings. (HCWs working in all clinical units i.e. inpatient units, ambulatory units, and procedural areas etc.

Infection

Multiplication of microorganisms in the tissues of a host; infections can be asymptomatic or symptomatic.

Contamination

Presence of microorganisms on or in inanimate objects or transiently transported on body surfaces such as hands.

IC Precautions / Interventions are implemented to reduce the risk of transmission of microorganisms between individuals

Biosafety Levels (BSLs)

Determined by combinations of laboratory practices, laboratory techniques, safety equipment, and laboratory facilities, which are appropriate for operations performed (depending on potential hazards imposed by agents and laboratory function). Biosafety Level 1 provides the least strict containment conditions and Biosafety Level 4 the strictest.

Biological Safety Cabinets (BSC)

It is the standard device used to provide containment of hazardous biological agents and toxins when conducting microbiological activities.

Phlebotomy

Phlebotomy is the process of making a puncture in a vein, usually in the arm, with a cannula for drawing blood. The procedure itself is known as venipuncture, which is also used for intravenous therapy

Steam autoclave

Is the method for decontaminating discarded cultures.

Antibiogram

Is an overall profile of antimicrobial susceptibility percentage testing results of a specific microorganism to a battery of antimicrobial drugs.

MDROs

Multidrug-resistant organisms are resistant to one or more classes of antibiotics.

HBV

Hepatitis type B virus.

HIV

Human immunodeficiency virus.

HCV

Hepatitis type C virus.

MTB

Mycobacterium Tuberculosis

Applicability

Infection prevention and control guideline are applicable to lab specialists, lab technicians, and cleaners to provide them with essential practices to prevent and control infectious agent's transmission in the laboratory.

Infection control requirement regarding the design and finishing of clinical laboratory

- Adequate space shall be provided to accommodate equipment and activities for tests to be performed on-site.
- Provisions shall be included for specimen collection and processing.
- A refrigerator shall be provided.
- Storage shall be provided for reagents, specimens, flammable materials, acids, bases, and other supplies used in the laboratory.
- Laboratory doors should be self-enclosing and have locks.
- The laboratory should be designed to be easily cleaned and decontaminated.
- The carpets and rugs are not permitted.
- Laboratory furniture must be capable of supporting anticipated loads and uses.
- Spaces between benches, cabinets, and equipment should be accessible for cleaning.
- Laboratory windows that open to the exterior are not recommended.
- If a laboratory ~~does~~ have windows that open to the exterior, they must be fitted with screens
- A sign incorporating the universal biohazard symbol must be posted at the entrance of the laboratory.
- An eyewash station must be readily available, easily accessible and checked weekly.
- Specimen collection area shall be permitted to be outside the laboratory work area.
- Laboratories should be located away from public areas.
- All laboratories, except the pathology lab, should be present in the same location and divided into separate entities.
- A separate room should be assigned to the lab for reprocessing glassware and instruments.
- Chairs and other furniture used in the laboratory must be covered with a nonporous material that can be easily cleaned and decontaminated with appropriate disinfectant
- The laboratory should consider mechanical ventilation systems that provide an inward flow of air without recirculation to space outside the laboratory

- BSC must be installed so that fluctuations of the room air supply and exhaust do not interfere with proper operations.
- BSC should be located away from doors, windows that can be opened, heavily travelled laboratory areas, and other possible airflow disruptions.

Handwashing stations:

- A handwashing station shall be provided where staff handles specimens, test reagents, or blood products.
- Each work area contains a dedicated well-equipped sink for washing hands together with an easily accessible eyewash facility to be used in an emergency in case of exposure to blood and body fluids.
- Specimen collection and receiving area must be equipped with hand washing facilities and proper PPEs.
- If more than one workstation is provided, a handwashing station shall be provided within 25 feet (7.62 meters) of all testing and specimen-handling
- A handwashing station shall be provided in each enclosed room where bio-hazardous specimens and/or hazardous chemicals are handled.
- The laboratory must have a sink for handwashing., hands-free, or automatically operated. It should be located near the exit door.
- Each laboratory should contain a sink for handwashing that is separate from that used for the disposal of body fluids or chemicals.
- The sink must be foot, elbow, or automatically operated and must be located near the exit door of the work area.

Biological risk assessment

- Biological risk assessment is an essential component of maintaining safety within a laboratory.
- The goal of risk assessment is to identify and mitigate the risks of working in a laboratory environment.
- It is a process used to identify the hazardous characteristics of known infectious or potentially infectious agents or materials; the activities that can result in a person's exposure to an agent; and, the likelihood that such exposure will cause laboratory-acquired infections (LAIs).
- Each clinical laboratory should perform a biological risk assessment on an annual basis or any time a new risk is identified

The primary factors in the risk assessment and selection of precautions fall into two broads' categories:

A. Agent hazards

B. Laboratory procedure hazards.

- Although there is no standard approach for conducting biological risk assessment, the Biosafety in Microbiological and Biomedical Laboratories (BMBL) documents suggest a five-step approach to prevent LAIs.

1. Identify agent hazards and perform an initial assessment of risk:
   a. Review potential biological agents and their hazardous characteristics. Hazardous characteristics include their capability to infect and cause disease in a susceptible human host, severity of disease, the availability of preventive measures.
   b. Implement regulations that govern the possession, use, and transfer of these types of biological agents and toxins that have the potential to pose a severe threat to public health and safety

2. Identify laboratory procedure hazards often found in a clinical lab include agent concentration, suspension volume, equipment and procedures that generate small-participle aerosols and larger airborne particles (droplets), the complexity of lab procedures, and use of sharps.
3. Make a final determination of the appropriate biosafety level and select additional precautions indicated by the risk assessment.
4. Evaluate the proficiencies of staff regarding safe practices and the integrity of safety equipment.
   a. Evaluate the laboratories training and experience in handling infectious agents.
   b. Proficiency in the use of sterile techniques and Biological Safety Cabinet (BSC).
   c. Ability to respond to emergencies and willing to accept responsibility for protecting one's self and others.

5. Review the risk assessment with a biosafety professional subject matter expert and the institutional biosafety committee.

- Once the risk assessment is completed, it should be reviewed by site-specific, and if necessary, local experts in biosafety. This review should include the Infection Preventionists (IP), laboratory safety, and infection prevention and control committee, as well as, Safety Committee.

General infection control considerations in the clinical laboratory in healthcare facilities

- Consider all patients as potentially infected with blood-borne pathogens and to adhere vigorously to infection-control precautions for minimizing the risk of exposure to blood and body fluids of all patients.
- There should be infection control policies in the clinical laboratory.
- The laboratory doors should be self–enclosing and have locked in accordance with institutional policies with a biohazard label and restricted access.
- Personnel must wash their hands after working with potentially hazardous materials and before leaving the laboratory
- Specimens should be handled with standard precautions.
- Samples should not be collected inside the lab.
- Packaging of Specimens must include both inner packaging and outer packaging.
- No food or drinks are allowed in the clinical laboratory.
- No food or drink will be stored in refrigerators in the laboratory work area.
- Smoking is not allowed in laboratory buildings.
- Application of cosmetics and contact lenses is prohibited in the laboratory working area.
- Hair should be worn or secured so that it cannot become either a safety hazard or a source of contamination.
- Wear nonskid-sole shoes in order to prevent possible serious injuries
- Open cuts and broken skin must be covered.
- All Laboratory personnel must wear protective laboratory coats, gowns, smocks, or uniforms designated for laboratory use while working with hazardous materials. Remove protective clothing before leaving for non-laboratory areas (e.g., cafeteria, library, administrative offices or when leaving at the end of the shift.).
- Wear eye and face protection (goggles, mask, face shield, or another splatter guard) for anticipated splashes or sprays of infectious or other hazardous materials when handling microorganisms outside the BSC or containment device.

Note:

- Persons wearing contact lenses should also wear eye protection.

- All cytology specimens are opened and processed under the biological safety hood.

- All specimens are to be received in a closed container or plastic bag with a biohazard label.
- Masks and protective eyewear or face shields should be worn during procedures that are likely to generate droplets of blood or other body fluid to prevent exposure to mucous membranes of the mouth, nose, and eyes.
- The laboratory supervisor must ensure the staff received adequate training regarding the necessary precautions to prevent exposure.

Infection prevention team member

- Laboratories should be an integral part of an infection prevention program.
- The microbiology laboratory helps to detect and identify microorganisms so that the infection control team can monitor, prevent, and control infection transmission.
- The laboratories staff assists clinicians in diagnosing and determining treatment options. In addition to performing these traditional roles, a laboratory representative should participate as a member of the healthcare organization's infection prevention and control committee.

  Responsibilities of the laboratories staff for the organization and on the infection prevention and control committee may include:

  - Explaining basic microbiology principles and practices.
  - Interpreting culture results and explaining which microbiological approaches could be used to solve specific infection control problems.
  - Explaining the advantages and limitations, the scope and adequacy, and the costs of microbiological methods used to detect, identify, and assess the antimicrobial susceptibility of the most common pathogens implicated in healthcare-associated infections (HAIs)
  - Providing information about changes in methods, reagents, or instrumentation that may substantially affect the laboratory's ability to detect and characterize pathogens that may cause HAIs.
  - Actively participating in surveillance efforts while planning and executing microbiological and molecular epidemiological investigations of HAIs.
  - Providing an annual Antibiogram report of common organisms and the trending associated with resistance patterns of clinical isolates to antibiotics

Routine infection prevention measures in the clinical laboratory

Standard Precautions:

a) Hand Hygiene:

Hand washing is considered the most important single procedure for preventing and controlling the spread of infection, Proper hand washing has been shown to eliminate or greatly reduce hand carriage of pathogens.

Types of Hand Hygiene:

1. **Simple hand washing**
   Washing hands with soap and water.

2. **Antiseptic Hand Washing:**
   Washing hands with antimicrobial soap and water before aseptic techniques.

3. **Antiseptic hand rubbing (or hand rubbing) with 60–80 % alcohol:**
   Applying an antiseptic hand rub to reduce or inhibit the growth of microorganisms without the need for an exogenous source of water and requiring no rinsing or drying with towels or other devices.

Hand hygiene practices must be strictly applied and monitored.

- Wearing gloves is not a substitute for proper hands hygiene
- Following contact with contaminated objects.
- Following contact with patient specimens, particularly "Blood and Body Fluid Precaution" specimens.
- Following removal of protective gloves.
- After removing gloves,
- Before leaving the laboratory,
- Before eating or drinking and when hands are visibly solid
- Nails should be short and clean.
- Artificial fingernails are not allowed.
- Jewellery should not be worn on hand or wrists by Lab staff.

b) Personal Protective Equipment (PPE):

Hand hygiene is a very important practice before donning and doffing PPE.

Gloves:

- Gloves should be worn for touching blood and body fluids, for handling items or surfaces soiled with blood and body fluids, and for performing venipuncture
- Gloves Should be removed promptly after use and before contact with other patients (blood sample taken)
- After wearing gloves, do not touch the face or adjust PPE.
- Remove gloves if torn and wash hands before wearing new gloves.
- Change gloves when contaminated, or when integrity has been compromised.
- Disposable gloves should not be washed or reused.

Remember:

- Don't wear gloves when **touching clean surfaces**, such as telephones, computer keyboards, doorknobs etc.
- Gloves should not be worn outside the lab.

Gown:

- Should be worn while working with infectious aerosols or splashes hazardous materials.
- Should be removed before leaving for laboratory areas.
- Change gown when contaminated.

Surgical mask:

- Should be used during procedures that may generate splashes or spray with blood and body fluid, secretion.

Face shields / Goggles:

- Should be used, if anticipating blood and body fluids to HCW mucous membrane of their eyes.
- Personal glasses are not considered a substitute for eye protection equipment.

The sequence of PPE Donning:

- Gown
- Mask
- Eyes goggles or Face Shield
- Gloves

The sequence of PPE Doffing:

- Gloves
- Eyes goggles
- Gown
- Mask

Note:

- For more information, Refer to the MOH, hand hygiene & PPE guidelines

Decontaminations

- Decontaminate work surfaces after completion of work and after any spill or splash of potentially infectious material with approved MOH-Disinfectant.
- Decontaminate all cultures, stocks, and other potentially infectious materials before disposal using an effective method (e.g.: **Steam autoclave**)
- Materials to be decontaminated outside of the immediate laboratory must be placed in a durable, leak-proof container and secured for transport.
- Laboratory Equipment must be decontaminated before repair or removal from the laboratory.

Phlebotomy

- In most hospital settings, the laboratory is responsible for most phlebotomy procedures.
- All patients should be handled using standard precautions, use of PPE, and safe injection practices and safe needles. Hand hygiene is the single most effective means of preventing transmission of infection.
- Bloodborne Pathogen Standard requires that gloves be worn when performing venipuncture. Other protective equipment such as goggles, mask, or lab coat may be

required for a procedure based on the risk of exposure (i.e., combative patient, arterial punctures)

- All phlebotomy needles should be disposed of promptly in a puncture-resistant container to Prevent their reuse or accidental injury to a handler.

To protect the patient from colonization or infection after phlebotomy, the following measures should be Employed:

a. Tourniquets should be one-time use or one-patient use only
b. The skin should be aseptically prepared before phlebotomy with either a 70 per cent isopropyl alcohol preparation or in the case of blood cultures a 10 per cent povidone-iodine solution or chlorhexidine gluconate.
c. A clean gauze pad, cotton ball or bandage should be placed over the puncture site to stop bleeding if necessary.

Samples collection

- Laboratory staff are responsible for collecting specimens and samples. They must be collected in a primary container accompanied by enough absorbent material to contain the whole sample, a waterproof container, and an outer container with a sample identification document. The identification document must be located outside the secondary containment.
- All specimens are to be received in a closed container or plastic bag with the appropriate patient information attached. All tissues for a pathological examination, dissection, sectioning and gross description shall be placed in one of the provided exhausted cutting stations before removal from its container and before any of the mentioned procedures are started.
- Additionally, labels clearly marking the biohazard level must be prominently displayed on the outside container. Depending on the level of biohazard, additional labels and information may need to be displayed, as well.
- All tissues for a pathological examination, dissection, sectioning and gross description shall be placed in one of the provided exhausted cutting stations prior to removal from its container before any of the mentioned procedures are started.
- All sharps including scalpels tissue prep blades, needles and discarded glass slides are to be disposed of in a suitable biohazard marked sharps container. All disposable gloves, paper towels, empty specimen containers and personal safety equipment shall be disposed of in a biohazard yellow plastic bag for treatment by the process of incineration.
- All soiled linen with blood and body fluids or washable personnel safety apparel should be placed in a soluble bag and put in linen hamper for laundering at hospital laundry.

- Upon leaving the laboratories, all staff shall store, remove, and dispose of all personal safety equipment in the appropriate fashion.

Handling cytology specimens

- All cytology specimens are opened and processed under the biological safety hood.
- The cryostats used for the frozen section shall be cleaned and disinfected with 95% ETOH as per lab policy.
- The cutting stations shall be rinsed and cleaned of bloody fluids and tissue debris in between cases as the need arises.
- The cutting stations should be cleaned thoroughly at least once a day with MOH approved detergent.
- Cleaning should be performed at the beginning or the end of each working day.
- Heavily soiled contaminated areas may require more frequent cleaning.

Transporting the sample

- Samples should be transported to the lab by a trained health care worker.
- Samples have to be placed in closed tubes for transportation.
- Personnel who package and ship these specimens must be concerned with their safety and the protection and safety of those who receive the material.
- Samples transported by local carriers such as cabs, hospital and clinical vehicles, or personal cars must meet packaging standards.
- The sample identification document must be located outside the secondary containment. additionally, labels clearly mark the biohazard level that must be prominently displayed on the outside container.
- Depending on the level of biohazard, additional labels and information may need to be displayed as well.

Microbiology accident emergency plan

1. Notify supervisor
2. Gloves are to be worn during all clean-up procedures

All clinical laboratories must have blood spill biohazard equipment/kits available to safely and effectively clean up any spills. This kit must include the following:

i. Personal protective equipment (PPE) such as gown, gloves, eyewear, mask.

ii. Supplies such as forceps, plastic scoop and scraper, absorbent granules or absorbent pads, hospital-approved disinfectant, yellow plastic bag and sharp container

Liquid spills on the bench or floor cleaning:

- If the spills on the floor, prevent people from walking through the affected area and spreading the blood or other potentially infectious material to other areas Contain spill, use other absorbent granules or absorbent pads to contain the spill.
- Put on appropriate PPEs
- Use a plastic scoop or other mechanical means to remove any broken glass or other sharp objects from the spill area, and dispose of them in the sharp container
- Sprinkle absorbent granules over the spill and leave for two minutes or as per the manufacturer's recommended contact time. Allow the spill to solidify before removing.
- Remove the solidified waste material using the scoop and scraper and carefully dispose of all contaminated materials into the infectious waste bag
- If there are no available absorbent granules contain the spill by placing absorbent pads (i.e. paper towel) on top of the spill and apply the appropriate disinfectant. To avoid creating aerosols, never spray disinfectant directly onto the spilt material. Instead, gently pour disinfectant on top of paper towels covering the spill or gently flood the affected area, first around the perimeter of the spill, then working slowly toward the spilt material.
- If sodium hypochlorite solution (5.25% household chlorine bleach) is used, prepare a fresh solution on a daily basis. Leave for the recommended contact time.
- Pick up all absorbent material and carefully place it in the infectious yellow bag for disposal. Remove PPEs and place them in a yellow bag for disposal.
- Seal the yellow bag.
- Wash hands thoroughly with soap and water.
- Contact housekeeping to clean the affected area with hospital-approved disinfectant.

Centrifuge Spills Cleaning:

- Shut off the instrument. Do NOT open the centrifuge for at least one hour.
- In addition to gloves, the person responsible for clean-up of the area is to wear a mask and gown

- Absorbent materials should be used as noted above (If liquids are present).

Remove glass by forceps

After removal of contaminated material, the instrument is to be thoroughly cleaned with a tuberculocidal disinfectant before resuming work.

Spills Occurring Within the Biosafety Cabinet:

1. With cabinet airflow running, cover the affected area immediately with absorbent material.
2. Using hospital-approved disinfectant, gently spray the top of the covered spill.
   a. Leave for the recommended contact time.
   b. Pick up the absorbent material and place it in a small autoclave bag inside the biosafety cabinet.
   c. Clean the affected area again with disinfectant. If chlorine bleach is used, the affected area should be cleaned with 70% ethanol afterwards to remove residual bleach.

> **Note:**
>
> - Chlorine bleach will pit and corrode the stainless-steel work area inside the biosafety cabinet

   d. Place the sealed bag in a biohazard waste receptacle.

Infectious waste management

The laboratory wastes must be stored before disposal. The site must be properly identified with a biohazard label, have restricted access, and be located near the site of generation, clean the areas thoroughly each time it is emptied of waste contents.

Four (4) methods of waste segregation must be followed at the point of generation (i.e., by the end-user):

1. Black bags

- Used to dispose of general hospital waste.

2. Yellow bags

- Used to dispose of infectious waste.
- Containers with blood/body fluids that cannot be emptied.
- All microbiological waste (specimens, autoclaved cultures, and stocks of etiologic agents).
- Items moderately or heavily soaked (dripping) in blood or body fluids.
- Chemotherapy waste: Trace amounts of cytotoxic liquid waste (e.g. contaminated PPEs and empty IV bags).
- Place infectious waste in the appropriate designated container, lined with yellow disposal bags.
- One designated infectious waste garbage bin lined with a yellow disposal bag can be kept.

3. Sharps containers

- Used to dispose of all used and unused sharps (e.g., blades, needles and discarded glass slides)
- Do not disassemble blades or needles from equipment.
- Discard sharps so that they do not protrude from the opening of the container.
- Replace the sharps container promptly when the sharps container is ¾ filled.

4. Red bags

- Used to transport body tissues & body organs.

Note:

- All cutting instruments, forceps, rulers and applicable dissection equipment should be washed in a 20% aqueous bleach solution with liquid hand soap, dried and stored in a dry state until further use.

Environmental services (Housekeeping Services)

- Pick up waste at least once per day and as needed.
- Handle bags at the top so that the bags do not come in contact with your body.
- Do not use your hands to compress (squeeze) waste in containers/bags.

- Tie bags using a self-lock plastic tie and securely before placing them in a temporary holding area such as a dirty utility room (Do not store waste bags in hallways or corridors)
- Replace the sharps container promptly when it is ¾ full or reaches the fill line.
- Fasten the cover of a full sharps container securely before removing.

Label the infectious waste bags or sharp containers with the following information:

a. Generating department

b. Date collected

c. Time

d. Weight

- Decontaminate disposal bins/containers or frames when visibly soiled.
- Decontaminate carts used for transporting waste within the hospital daily using a hospital approved disinfectant solution.
- Use leak-proof carts that are readily cleanable to transport infectious waste from the point of generation or storage to the point of disposal and treatment.
- Place yellow bags in a holding area for incineration by an approved MOH company.
- Pick up and discard broken glass using a mechanical device such as forceps or a brush and Dustpan (Broken glass should never be handled with gloved or non-gloved hands).
- Clean blood spills according to a written procedure.

Note:

- For more details, see Liquid spills on bench or floor cleaning on page 15.

- Work surfaces must be decontaminated with a chlorine solution (e.g. bleach) routinely at the completion of work and following any spill of potentially infectious material. Make sure proper contact time is followed.

- Use intermediate-level disinfectants for surface decontamination in laboratory areas. Examples of these include diluting bleach, ethyl or isopropyl alcohol, or phenols, which are designed for disinfection and not for skin antisepsis.

Infection prevention and occupational exposures

The goal of occupational health in a clinical lab is to promote a safe and healthy workplace. Educate laboratory workers about the biohazards to which they may be occupationally exposed.

- Provide vaccines to workers to protect them against infectious agents to which they may be Occupationally exposed.
- Encourage workers to seek medical evaluation for symptoms that they suspect may be related to infectious agents in their work area without fear of reprisal. A high index of suspicion for Potential occupational exposures should be maintained during any unexplained illness among Workers or visitors to worksites containing biohazards.
- Report all occupational injuries to Employee Clinic or Occupational Health Department.

Protocol for laboratory employee protection

If one has such an accident involving blood, plasma or serum from a **Specific Identifiable Patient**, he should report immediately to his supervisor.

HCW must seek medical evaluation post-injury, which should include the following:

1. The potential infectious agent.
2. The mechanism and route of exposure.
3. Time and place of the incidence.
4. Personal protective equipment used at the time of injury.

Hepatitis B Exposure management

Post exposure management of health-care personnel after occupational percutaneous and mucosal exposure to blood and body fluids, by health-care personnel HepB vaccination and response status					
Health-care personnel status	Post exposure testing		Post exposure prophylaxis		Post vaccination serologic testing†
	Source patient (HBsAg)	HCP testing (anti-HBs)	HBIG*	Vaccination	
Documented responder§ after complete series (≥3 doses)	No action needed				
Documented nonresponder¶ after 6 doses	Positive/unknown	—**	HBIG x2 separated by 1 month	—	No

	Negative	**No action needed**			
Response unknown after 3 doses	**Positive/unknown**	**<10mIU/mL****	**HBIG x1**	**Initiate revaccination**	**Yes**
	Negative	**<10mIU/mL**	**None**		
	Any result	**≥10mIU/mL**	**No action needed**		
Unvaccinated/incompletely vaccinated or vaccine refusers	**Positive/unknown**	**—****	**HBIG x1**	**Complete vaccination**	**Yes**
	Negative	**—**	**None**	**Complete vaccination**	**Yes**

Abbreviations:

HCP = health-care personnel; **HBsAg** = hepatitis B surface antigen; **anti-HBs** = antibody to hepatitis B surface antigen
HBIG = hepatitis B immune globulin.
*** HBIG** should be administered intramuscularly as soon as possible after exposure when indicated. The effectiveness of HBIG when administered >7 days after percutaneous, mucosal, or nonintact skin exposures is unknown. HBIG dosage is 0.06 mL/kg.

Note:

- For more details, refer to Occupational Health Clinics Program 2019.

Hepatitis C Exposure management

Testing for HCV:

- For the source, perform testing for anti-HCV.
- For the person exposed to an HCV-positive source.
- Perform baseline testing for anti-HCV and ALT activity; and perform follow-up testing (e.g., at 4--6 months) for anti-HCV and ALT activity (if earlier diagnosis of HCV infection is desired, testing for HCV RNA may be performed at 4--6 weeks).
- Confirm all anti-HCV results reported positive by enzyme immunoassay using supplemental anti-HCV testing (e.g., recombinant immunoblot assay [RIBA™]).
- As recommended for all HCW, those who are chronically infected with HBV or HCV should follow all recommended infection-control practices, including standard precautions and appropriate use of hand washing, protective barriers, and care in the use and disposal of needles and other sharp instruments.

Vaccination and Testing Recommendations for laboratory health care worker

- All laboratory staff must have an annual TB screening.
- Provide vaccines to workers to protect them against infectious agents to which they may be occupationally exposed (*see* **Table 1)**.

Table 1: recommended vaccine for healthcare workers

Infection	Category/ timing	Requirement
Measles, Mumps, Rubella	All HCW/ pre-employment	Proof of receiving at least two doses of MMR vaccine or Proof of immunity by lab test (IgG)
Chickenpox (Varicella)	All HCW/ pre-employment	Proof of receiving at least two doses of Varicella vaccine or Proof of immunity by lab test (IgG) or Clinically documented previous infection
Hepatitis B virus (HBV)	All HCW/ pre-employment	Proof of receiving at least three doses of HBV vaccine or Proof of immunity by lab test (HBsAb =/< 10U)
Meningococcal meningitis	HCW working at Microbiology lab pre-employment and then every 5 years	Proof of receiving at least one doses of a quadrivalent Meningococcal meningitis vaccine
Influenza vaccine	All HCW annually	Proof of vaccination is required during the influenza season (usually December through the end of April)

Source: Occupational Health Clinics Program 2019

Note:

- Upon leaving the laboratories all personnel shall remove, store and dispose of all personal safety equipment in the appropriate fashion. Lightly soiled fluid impermeable nylon surgical gowns may be stored upon exit and reused on return to the laboratories

Laboratory Equipment

Biosafety cabinet's

- Is a primary containment device designed to draw air inward by mechanical means in order to contain infectious splashes or aerosols generated during certain laboratory procedures?
- There are three types of biosafety cabinets, class I, II and class III. Most laboratories use class I and class II cabinets. An independent professional must recertify all BSCs annually

a) Class I BSC

This cabinet is similar to a chemical fume hood and has an inward airflow through the front opening. Exhaust air from the BSC is passed through a HEPA filter so that the equipment protects both workers and the public. However, the specimen and other materials are potentially subject to contamination. **Class I** are not generally recommended for work that involves Biohazardous material.

b) Class II BSCs

Designed to protect the worker, the public, and the specimen. Airflow velocity at the face of the work opening is at least 75 linear ft/min (lfpm). Both the supply air and exhaust air are HEPA-filtered.

- There are four types of Class II BSCs (**IIA, IIB2, and IIB3**).
- They differ in the amount of recirculation, downflow, and inflow. Usually, all but IIA are considered satisfactory for biohazardous and toxic agents.

c) Class III BSCs

are totally enclosed, ventilated cabinets of gas-tight construction that offer the highest degree of protection from infectious aerosols. They also protect research materials from biological contamination. Class III BSCs are most suitable to work with hazardous agents that require containment at **BL-3 or BL-4**.

- All operations in the work area of the cabinet are performed through attached rubber gloves. The cabinets are operated under negative pressure. Supply air is HEPA filtered, and cabinet exhaust air is filtered by two HEPA filters in series or HEPA filtration followed by incineration before discharge outside of the facility.
- The CLASS II BSC must be connected to double door autoclaves and chemical dunk tanks to permit sterilization or disinfection of all materials before leaving the cabinet and to allow supplies to enter the cabinet.

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

*HEPA filters (High-efficiency particle air filter). It removes bacteria, viruses, fungi and spores with 99.97% efficiency.

*Biosafety cabinets should be tested and certified at the time of installation within the laboratory, at any time the BSC is moved, and at least annually.

Centrifuges

- Are commonly used in the clinical laboratory as part of specimen processing. Hazards Associated with centrifuging include mechanical failure (e.g. rotor failure, tube or bucket failure) and the Creation of aerosols.
- Use safety precautions to decrease the risk and associated with centrifugation.

Examples of these precautions include:

a) Use sealed tubes and safety buckets that seal with O-rings.
b) Filling open centrifuge tubes, rotors, and accessories in a BSC.
c) Always balance buckets, tubes, and rotors properly before centrifugation.

Critical /panic values

Are defined, as values that are outside the normal range (high or low values) that require immediate action on the part of the ordering physician.

1. **Notification:**

- Immediate notification by the laboratory of critical value/ critical patient result to infection control office (The critical limits of specified patient test results are exceeded than normal expectations).
- Flagging, Electronic Notification or phone notification.
- The logbook should be available in each laboratory section.

2. **For verification:**

- Repeat the critical value results back
- To verify the accuracy of patient information communicated via the telephone, the physician or designee responsible for patient care is required to read back the patient name, unique patient numeric identification, and the critical test result(s).

Documentation in the laboratory computer information system and Logbook should include the following:

- First name
- Last name
- Title of the person receiving the call
- The time the call was made.
- The critical test result value

Note:

- The supervisor will document in the computer the reporting of the critical value to the Clinical Pathology Resident or Laboratory Director (*see* **Appendix 1 and Appendix 2)**
- Logbook of critical value is required in the laboratory department

Antibiotic stewardship programs

Microbiology lab is considered as a member for the implementation of an antibiotic stewardship program in the hospital by helping the clinicians to improve the clinical outcomes and minimize harms by improving antibiotic prescribing (Reducing antibiotic resistance to improve antibiotic use).

Antibiogram report:

Antibiogram report should be prepared according to current CLSI guideline and released from the microbiology lab annually (every year) according to the approved GDIPC form. Moreover, it should be sent to the infection control office in the hospitals, Regional Health Directorate and General Directorate of Infection Prevention and Control in Healthcare Facilities (GDIPC) /MOH.

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Appendix 1: Critical Values Organisms

Type	Definition
Methicillin-resistant Staphylococcus aureus	Includes S. aureus which can be cultured from any sample and test for, cefoxitin-resistant, methicillin-resistant or oxacillin-resistant by standard sensitivity testing methods, or by other FDA-approved laboratory test for MRSA discovery from isolated colonies; these methods may also include a positive result by any FDA-approved test for MRSA detection from specific sources.
Vancomycin-resistant Enterococcus spp	Any Enterococcus spp. that is resistant to vancomycin, by standard sensitivity testing methods or by results from any FDA approved test for VRE detection from specific specimen sources.
CRE Carbapenems resistance Enterobacteriaceae	Any Enterobacteriaceae spp. testing resistant to ertapenem, imipenem, meropenem, or doripenem, by current Clinical and Laboratory Standards Institute breakpoints; or a positive result by any FDA approved method for carbapenemase detection from specific specimen sources.
MDR-Acinetobacter	Non-susceptible strain (i.e., resistant or intermediate) to at least one agent in at least 3 antimicrobial classes of the following 6 classes: ; Cephalosporins (cefepime, ceftazidime) ;Ampicillin/sulbactam β-lactam/β-lactam β-lactamase inhibitor combination (piperacillin, piperacillin/tazobactam); Carbapenems (imipenem,meropenem, doripenem); Fluoroquinolones (ciprofloxacin or levofloxacin); Aminoglycosides (gentamicin, tobramycin, or amikacin.
MDR-Pseudomonas	Non-susceptibile strain (i.e., resistant or intermediate) to at least one agent in at least 3 antimicrobial classes of the following 5 classes: β-lactam/β-lactam β-lactamase inhibitor combination (piperacillin, piperacillin/tazobactam); Carbapenems (imipenem, meropenem, doripenem); Cephalosporins (cefepime, ceftazidime); Aminoglycosides (gentamicin, tobramycin, or amikacin. Fluoroquinolones (ciprofloxacin or levofloxacin);
Extended-spectrum beta-lactamase Gram-negatives (ESBL)	Enterobacteriaceae spp. non-susceptible (i.e., resistant or intermediate) to cefepime , ceftazidime, ,ceftriaxone, or cefotaxime.
Clostridium difficile	A positive laboratory test result for C. difficile toxin A or B, (includes molecular assays [PCR] or toxin assays) .
Drug-resistant Streptococcus pneumoniae	S. pneumoniae isolated from a sterile site and nonsusceptible to at least one antimicrobial agent currently approved for use in treating pneumococcal infection.

Appendix 2: CRITICAL VALUES LOG Book

Region:_____ **Hospital Name:** _____

CRITICAL VALUES LOG Book

Date	Patient NAME	HEALTH Record Number	Sample ID	UNIT	TEST	CRITICAL VALUE	**PHONED TO**		TIME	TECH	Doctor review
							NAME	ID#			

وزارة الصحة

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