Government of the Republic of Trinidad and Tobago
Ministry of Health

INFECTION PREVENTION & CONTROL

Policies and Guidelines for Health Care Services

JUNE 2020

3rd Edition

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Acknowledgements

The Ministry of Health Trinidad and Tobago wishes to acknowledge all the staff responsible for update of this manual. While it is impossible to name everyone, who participated in the meetings and workgroups during the review and update of the Manual, we wish to acknowledge the contributions of:

- The Oversight Committee Members from the Pan American Health Organization/World Health Organization [PAHO/WHO] and the Ministry of Health.
- The multidisciplinary team of health professionals for their valuable comments/suggestions.
- PAHO/WHO for sponsoring the consultancy.

We would like to thank the Focal point – Dr. Rajeev P. Nagassar, Specialist Medical Officer Microbiology, Head of Department Microbiology and Member of the National Coordinating Committee to Combat Antimicrobial Resistance, for leading this initiative.

This manual was produced by the Principal Medical Officer - Institutions (Under the Office of the Chief Medical Officer), Ministry of Health of Trinidad and Tobago, in collaboration with The PAHO/WHO of Trinidad and Tobago.

Preface

The Government of the Republic of Trinidad and Tobago through the Ministry of Health has implemented a comprehensive Health Sector Reform Programme. This Programme is aimed at improving the quality of health care by introducing new organizational structures and systems, re-engineering ineffective systems and shifting expenditure to health promotion and disease prevention initiatives.

In keeping with one of the main goals, which is to improve and maintain the quality of health care delivered to the population, the ministry has introduced a sector-wide comprehensive Continuous Quality Improvement [CQI] Programme. Key elements of the CQI Programme include Accreditation and Licensing; Monitoring and Audit; Training and Capacity Building; Risk Management; Quality Management Information Systems [QMIS]; Systems Re-engineering and Evaluation.

In the context of the accreditation and risk management systems of the Quality Programme, the Ministry of Health has introduced a structured programme for the prevention and control of infection since it maximizes patient outcomes and is part of the Ministry's strategy for providing safe, effective and efficient quality health services.

In Trinidad and Tobago, like many other countries in the world, increasing numbers of different organisms are developing resistance to greater numbers of available antibiotics. Increased global travel is bringing more persons into contact with diseases, which are incubating; additionally, there are greater numbers of persons in a state of immune suppression who are more susceptible to invasion by pathogens [organisms causing diseases] or those usually considered non- pathogenic.

It is also well recognized that poor infection prevention and control practices result in patient dissatisfaction, increases patient stay and overall costs including litigation. It is therefore imperative that a holistic approach be instituted to the prevention and control of infection in Trinidad and Tobago. To achieve this goal public and private sector partnership has become absolutely essential. It is also mandatory that all health care facilities implement the infection prevention and control policies and guidelines in order to reduce the risks and improve quality.

The scope of the 3rd Edition of the Infection Prevention and Control Policies and Guidelines for Healthcare Services has been updated in four guidelines:

- **Guideline 1 – Prevention and Control of Healthcare-associated infections**
- **Guideline 2 – Occupational safety and health**
- **Guideline 3 – Sterilization and Disinfection**
- **Guideline 4 – Environmental cleaning**
- **Guideline 5 – Healthcare-associated infections surveillance – To be released at a later date**

As Minister of Health, I give the assurance that patient safety is of utmost importance and that the necessary infrastructure and resources will be made available and I feel confident that you the health care professionals, managers, and support staff will ensure that the goals of the programme are achieved and maintained. We thank the Pan American Health Organization (PAHO) for partnering with us to achieve this revision of our manual.

Chief Medical Officer

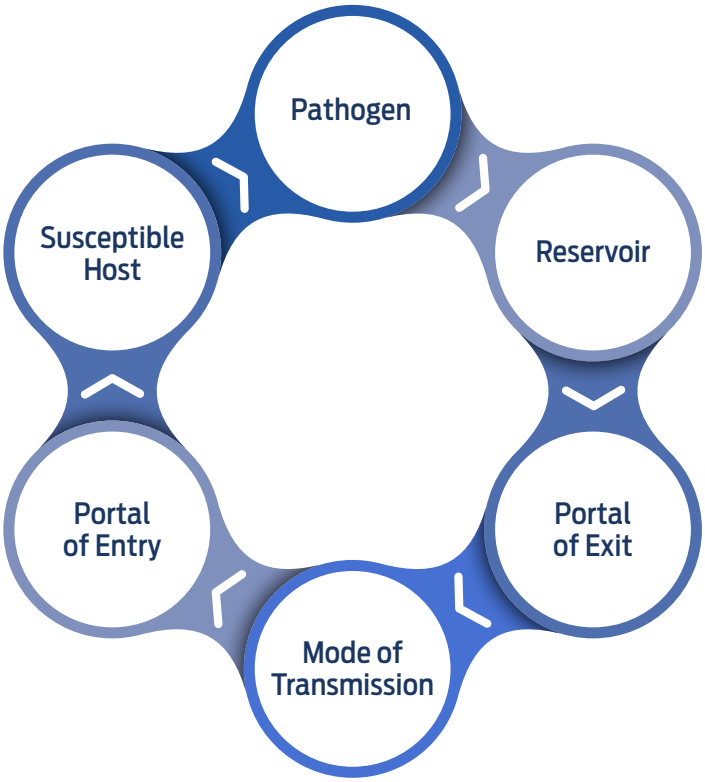
Minister of Health

1. EPIDEMIOLOGY OF INFECTIOUS DISEASES

1.1 BASIC CONCEPTS ON INFECTION PREVENTION AND CONTROL

The sequence of specific interactions, known as the chain of transmission (Figure 1) make it possible for an infectious agent to enter and affect a susceptible host.

Figure 1 – Chain of transmission of infectious diseases



1.1.1 DEFINITIONS

- **Microorganism:** Biological agent capable of colonizing or creating an infection in a host.
- **Infection:** Presence of a microorganism in the host tissue, where it lives, grows, multiplies, and induces an immune response in the host that generates signs and symptoms.
- **Colonization:** Presence of a microorganism in the host tissue, where it lives, grows, and multiplies but does not show signs or symptoms of active infection. It may or may not induce an immune response.

Microorganisms may be bacteria, viruses, fungi, parasites, or prions.

An agent that produces an infection has the following characteristics:

- **Infective dose.**
- **Virulence:** capacity of the agent to cause severe disease or death.
- **Invasiveness:** capacity of the agent to penetrate host tissues and multiply.
- **Pathogenicity:** capacity of the agent to cause disease through a variety of mechanisms.

- **Reservoir:** Habitat in which microorganisms live, grow, and multiply. A reservoir may be an inanimate object, the environment, or an animate being, either animal or human. The main reservoir of agents responsible for HAIs is a patient infected or colonized by a microorganism, regardless of whether the agent is sensitive or resistant to antimicrobial drugs. Often the host is a healthy carrier of the microorganism who does not present symptoms of infectious disease, which makes it more difficult to identify the reservoir.
- **Portal of exit:** Point where the microorganism leaves the host, which tends to be the site where the agent is usually located. The main portals of exit are the upper respiratory tract, the lower digestive tract, and areas near breaks in the skin that are colonized or infected.
- **Mechanism or mode of transmission:** Manner or component by means of which the microorganism travels from the reservoir's portal of exit to the portal of entry on the susceptible host (see examples of infections based on the mechanism of transmission in Chapter IV, Additional precautions based on mode of transmission). In the case of HAIs, the main mechanisms of transmission are as follows (Table 1):

Table 1 – The principal mechanisms or modes of transmission of infectious diseases

Mechanisms or modes of transmission of hospital-acquired infections (HAI)
Direct contact The microorganism goes directly from the reservoir to the susceptible host. This situation occurs in the direct transfer of blood or bodily fluids from a patient to another susceptible patient or to mucous membranes or injured skin of health workers
Indirect contact The susceptible host comes into contact with the infective microorganism through an inanimate object (e.g., clothes, fomites, surfaces of the room)
Droplet transmission Occurs when microorganisms are produced through the expulsion of particles (droplets) of 5 µ m to 100 µ m (micrometers) from the nose or mouth of an infectious patient (e.g., by coughing or sneezing). Microorganisms can travel 1 to 2 meters. They can also be transferred indirectly by touching contaminated surfaces
Airborne transmission Occurs by dissemination of airborne droplet nuclei /small particles (< 5 µ m) containing infectious agents that remain infective over time and distance (e.g., spores of Aspergillus spp., and Mycobacterium tuberculosis). Microorganisms carried in this manner may be dispersed over long distances by air currents and may be inhaled by susceptible individuals who have not had face-to-face contact with or have been in the same room with the infectious individual

Table 2 presents the possible interventions to break the chain of infection.

Table 2 – Possible interventions to break the chain of infection

Component of the chain	Conditions	Possible interventions
Reservoir	Infection	• Specific antibiotic treatment shortens the infectious period
	Environmental and fomites contamination	• Cleaning, disinfection, and sterilization to disrupt the chain of transmission
Portal of exit **Transmission mechanism**	Alive (patients, health workers)	• Immunization or Eradication/decolonization therapy in healthy carriers
Portal of entry **Susceptible host**	Environment and fomites	• Cleaning, disinfection, and sterilization to disrupt the chain of transmission
	Equipment, devices and others	• Antisepsis, sterilization
	Droplets	• Aseptic technique, Standard precautions, Additional precautions
	Contact	• Standard precautions • Additional precautions
	Airborne	
	Prevention	• Aseptic technique • Standard precautions • Additional precautions, according to mode of transmission
	Protection	• Immunization • Specific prophylaxis • Proper therapeutic management of disease

In these Guidelines each of these measures will be reviewed in detail from a practical approach to be accomplished in any patient's health care regardless of its setting.

1.2 MODES OF TRANSMISSION

1.2.1 CONTACT TRANSMISSION

This is the most frequent mode of transmission of nosocomial infection

1. Direct contact: when the infective microorganisms travel from the reservoir to the susceptible person. Examples: (1) direct contact between the blood or body fluids containing the infective microorganism in a patient with Ebola virus disease and the mucous membranes or skin lesions of a caregiver or nearby patient who was not using protective barriers or performing hand hygiene; (2) direct contact without gloves between a health worker or another patient and a nearby patient who has scabies; (3) direct hand contact, without gloves, between a health worker and a patient with oral herpes simplex 1 lesions, leading to subsequent appearance of a herpes whitlow on the finger that was in contact with the patient's mouth

2. Indirect contact: the susceptible person (host) acquires the infective microorganism through an intermediary (e.g., environment (inanimate), healthcare workers or another patient (animated). The infective agent should have the capacity to survive in the environment, however the detection of this in the environment does not necessarily explain the transmission of the infection. An analysis should be completed to determine if the organism is contributing to the infection.

Examples: (1) transmission of *Clostridium difficile* spores on the hands of a health worker from a symptomatic in-fected patient to a susceptible host (for example, by handling feces without using gloves), (2) transmission of respiratory syncytial virus (RSV) particulates on a toy that was in contact with a symptomatic patient and passed on to a susceptible host who touched the toy and then touched his or her facial mucous membranes, and (3) transmission of hepatitis C virus from an infected dialysis patient to other susceptible dialysis patients by administering a drug from a multidose syringe shared by health workers with more than one patient.

Microorganisms transmitted through contact transmission: Acinetobacter spp, *Clostridium difficile,* `*Enterococcus*` spp (including vancomycin-resistant strains, VRE), Pseudomonas aeruginosa, *Klebsiella spp, Staphylococcus aureus* (includes methicillin-resistant strains, MRSA), norovirus, `respiratory syncytial virus`, rotavirus, Gram-negative bacilli including Enterobacteriaceae resistant to the antimicrobial drugs (for example: producers of Extended Spectrum Betalactamase (ESBL) or carbapenemases).

1.2.2 DROPLET TRANSMISSION

Respiratory drops (droplets) that range between 5 and 100 µm in diameter are released from the respiratory tract upon coughing, speaking or sneezing and measure 20 µm in diameter, which means that they can remain in suspension for only a few seconds (smaller droplets can stay in suspension for up to a few minutes). These droplets carry microorganisms (infecting or colonizing patient's oral cavity) that can be transferred to a recipient person and contaminate surroundings They do not have the capacity to travel farther than 1 meter from the person who emits them [2]. Droplet transmission, as with contact transmission, can be indirect (through an intermediary) or direct (without one).

1. Droplets: These are created when an infective patient transmits microorganisms within particles (droplets) ranging from 5 µm (microns) to 100 µm in diameter. They usually come from the respiratory tract (mouth or nose) in the course of coughing, sneezing, or speaking and measure 20 µm in diameter, which means that they can remain in suspension for only a few seconds (smaller droplets can stay in suspension for up to a few minutes). They do not have the capacity to travel farther than 1 meter from the person who emits them [2]. Droplet transmission, as with contact transmission, can be indirect (through an intermediary) or direct (without one).

2. Droplet nuclei (airborne transmission): Alternatively, when microorganisms are transmitted via particles smaller than 5 μm in diameter, they can stay airborne for prolonged periods and are capable of traveling longer distances than droplets when moved by air currents [3]. Once they are airborne, they can be inhaled and enter the alveoli of individuals sharing the same room, even if these individuals have not had direct contact with the infected patient. Droplet nuclei can be generated directly by patients through a cough or sneeze (as in the case of tuberculosis) or during procedures such as tracheal intubation, noninvasive positive-pressure, BASIC RECOMMENDATIONS 25, ventilation, invasive high-frequency ventilation, pre- and post-intubation airway aspiration, tracheotomy, respiratory kinesiotherapy, nebulization, fibro bronchoscopy, resuscitation, sputum induction, or centrifugation of samples and instruments used to cut tissues

Microorganisms that are transmitted through droplet transmission; Diphtheria, whooping cough (B. pertussis), meningitis by N. meningitidis, influenza, rhinovirus, adenovirus.

1.2.3 AIRBORNE TRANSMISSION

Airborne particles can be transmitted when an infected patient coughs or sneezes and also when performing clinical procedures that include: tracheal intubation, tracheotomy, non-invasive respiratory ventilation with positive pressure, invasive mechanical ventilation of high frequency, aspiration of airway, respiratory therapy, bronchoscopy, induction of sputum, centrifugation of samples, resuscitation and procedures with air drills. The greater risk procedures are tracheal intubation, non-invasive mechanical ventilation, tracheotomy, and manual ventilation.

Microorganisms transmitted through airborne transmission: Mycobacterium tuberculosis (patients with TB bacilli); virus measles, varicella zoster (Chicken pox), herpes disseminated zoster, amongst other pathogens.

1.2.4 FOOD AND WATERBORNE TRANSMISSION

Food and water borne transmission applies to micro-organisms transmitted by contaminated items such as:

Foods – *e.g., salmonellosis*
Water – *e.g., shigellosis*

These serve to transmit infection to multiple hosts. Such transmission may result in an explosive outbreak. Environmental sources of contamination also may contain a mixture of human and animal pathogens, emphasizing the potential for introduction of animal pathogens into the food chain through routes that are not controlled. Thus, a One Health approach must always be considered. Demand for seasonal produce all year has globalized the food market, with the challenge to work with the same highest hygienic standards across the world. These food production programmes illustrate the vulnerability of the global food supply: contamination may occur with pathogens from across the globe if there is a flaw in the process, including those that have recently emerged such as SARS-CoV-2. Careful review of possible scenarios that may require our attention for the future of food safety is of utmost importance.

The main steps to for safe food handling include:

- **Clean** — Wash hands and surfaces often
- **Separate** — Don't cross-contaminate
- **Keep worktops clean**
- **Separate raw food**, such as meats, from ready to cook food, such as vegetables
- **Check labels** for expiry dates, for example
- **Cook** — Cook to the right temperature
- **Chill** — Refrigerate promptly

In hospital kitchens persons may use diluted bleach or vinegar to wash vegetables and other products. Vinegar is preferable. Water-related diseases can be classified into 4 major categories, as follows: **1: Water-borne diseases:** infections spread through contaminated drinking water **2: Water-washed diseases:** diseases due to the lack of proper sanitation and hygiene **3: Water-based diseases:** infections transmitted through an aquatic invertebrate organism **4: Water-related vector-borne diseases:** diseases transmitted by insects that depend on water for their propagation

Water is a major reservoir for many organisms that cause diarrhea. Swimming pools have been associated with outbreaks of Shigella organisms, and Aeromonas species are associated with exposure to the marine environment. Water borne diseases may present with diarrhoea or may not. Waterborne bacteria that may be transmitted solely through oral route include the following pathogens –*Bacteria: Campylobacter jejuni/coli, E. coli – enterohaemorrhagic, Legionella spp, Salmonella typhi, Shigella spp, Vibrio cholerae, Yersinia enterocolitica, Pseudomonas aeruginosa.* The orally transmitted viruses include *Adenoviruses, Enteroviruses (Polio), Hepatitis A, Hepatitis E, Noroviruses and Sapoviruses, Rotavirus.* The protozoa include *Cryptosporidium parvum, Entamoeba histolytica, Giardia lamblia/intestinalis, Naegleria fowleri* and *Toxoplasma gondii*, while the *Helminths* include *Dracunculus medinensis and Schistosoma spp.*

In as much as there are many sources of water it is an established fact that hospital water distribution systems might be the most overlooked, important and controllable source of healthcare-associated infections (HAIs). This is so because hospital water and water-related devices as well as moist environments and aqueous solutions can serve as a reservoir of waterborne pathogens in healthcare settings.

1.2.5 VECTOR-BORNE TRANSMISSION

Vector-borne transmission refers to transmission by insect vectors and is prevented by appropriate health care facility construction and maintenance, closed or screened windows, and proper housekeeping. In addition, nets may be used over beds. Vector-borne transmission occurs when vectors such as mosquitoes, flies, rats and other vermin transmit micro-organisms.

There are several vector-borne infections including viruses (Chikungunya, Dengue, Rift Valley fever, Yellow Fever, Zika, Japanese encephalitis, West Nile fever); parasites (Lymphatic filariasis, Malaria, Chagas disease - American trypanosomiasis. All the viruses mentioned above are transmitted by mosquito species (Aedes, Anopheles and culex) and according to the WHO, vector-borne diseases are one of the greatest contributors to human mortality and morbidity in tropical settings and beyond. Although significant progress is currently being made in combating some diseases such as malaria, lymphatic filariasis and Chagas disease, other diseases such as dengue continue to spread and increase their number of cases at an alarming pace.

The silent expansion of mosquito vectors and their ability to develop resistance to insecticides threatens the gains made through vector control and calls for concerted planning and collaboration across sectors including health, agriculture, and the environment. In areas where vector-borne diseases overlap, integrated management of insecticide resistance is essential, supported by adequate capacity of trained personnel and resources.

Environmental changes have also facilitated the recent spread of some diseases in rural areas. This has major implications for health systems, straining the limited resources in many developing countries. Events in the past five years – simultaneous outbreaks in several countries and the emergence of vector-borne diseases in new parts of the world – clearly highlight the increasing threat of these diseases to global public health.

Vector control programs need to adapt to match the changing epidemiological patterns of new emerging threats. This will require increased research to develop a sustained approach to ecological and environmental changes in the years ahead.

Prevention and control of these viral diseases definitely will hinge on vector control. Control Methods include physical, biological and chemical methods. Please contact the Insect Vector Control Division (IVCD) for further information.

2. STANDARD PRECAUTIONS

According to available scientific evidence, interventions that yield the best results are those that are allowed to be used only if they are performed correctly, which often require structural and cultural changes on the part of health teams. So far, no single method has been discovered that meets all of these requirements with respect to healthcare-associated infections (HAIs). However, there is consensus on some of the basic elements that will help ensure sustained application of standard precautions, as well as other measures designed to reduce the incidence of HAIs.

Standard precautions represent the minimum infection prevention practices that apply to all patient care, regardless if the patient is known to have an infection or not (e.g., assume everyone you come in contact with has an infectious agent in their blood and/or body fluid).

Elements of Standard Precautions include the following:

- hand hygiene,
- use of personal protective equipment,
- respiratory hygiene and cough etiquette,
- safe handling of sharps materials,
- Appropriate decontamination of medical equipment
- Safe laundry practices
- Environmental cleanliness
- Safe waste management

Standard Precautions Golden Rules
Healthcare workers assume any patient they take care of may have an infectious disease
Healthcare workers implement standard precautions whether patient shows symptoms or not
Healthcare workers protect themselves and patients

2.1 HAND HYGIENE

2.1.1 SKIN PHYSIOLOGY AND MICROBIOTA

Hands normally contain microorganisms (referred to as superficial bacterial flora), as well as, transitory flora acquired by contact with patients and contaminated environments. Contaminated hands of healthcare workers (HCWs) can then transfer germs to other patients and their environment or to themselves if they touch their eyes, nose or mouth. Hence, hand hygiene in HCWs is a fundamental issue to protect themselves and patients (Figure 2).

Two methods have been defined for hand hygiene (Table 3):

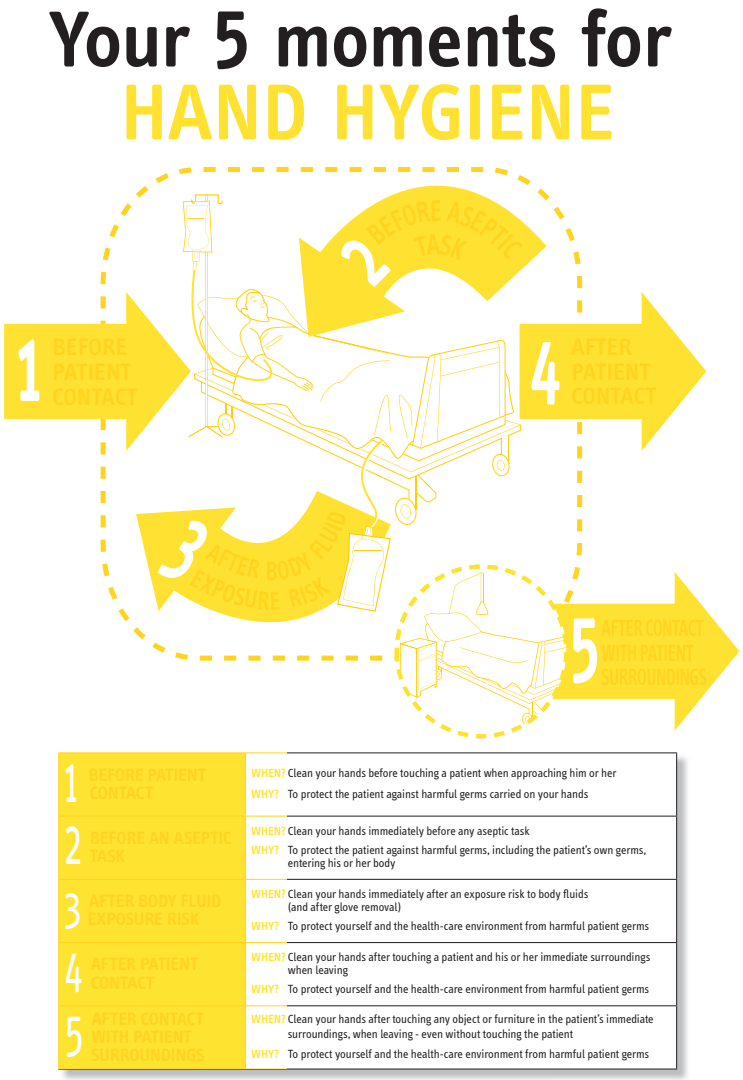
- Hand washing with water and soap and drying with single-use towel
- Hand rubbing with alcohol-based solutions

Table 3 – Characteristics of the two main hand hygiene methods used as a standard precaution

Hand washing	Application of alcohol-based solution
Scrubbing of the hands with soap and water and then rinsing, usually under a stream of water, to remove microorganisms by wiping them away and removing the chemical product.	Scrubbing or rubbing of the hands with an alcohol-based solution to remove microorganisms through the microbicidal effect of the alcohol.
Between 0.6 and 1.1 log10 CFUs are removed in 15 seconds and between 1.8 and 2.8 log10 CFUs are removed in 30 seconds.	Between 3.2 and 5.8 log10 CFUs are removed in 10 seconds

Note. CFUs = colony-forming units. Adapted from: Widmer AF. Replace hand washing with use of a waterless alcohol hand rub? Clin Infect Dis. 2000;31(1):136-43.

Figure 2 – Five moments of hand hygiene



Available at: http://www.who.int/gpsc/tools/5momentsHandHygiene_A3.pdf?ua=1

2.2 HAND HYGIENE PRACTICES

2.2.1 HAND WASHING

This is the most frequent mode of transmission of nosocomial infection

The purpose of hand washing with soap and water is to remove dirt and organic matter. Rinsing hands under a jet of water will eliminate the soil along with the transitory flora.

Indispensable elements for these actions are:

- Water: Should always be potable and obtained from a pipe and faucet to ensure a unidirectional flow. If this is not possible, clean water contained in covered dispensers with a spigot in its lower part that makes it possible to obtain water while maintaining a unidirectional flow can be used.

- Soap: Can be solid or liquid and, if using a solid bar of soap, a soap holder with grill that permits the runoff of water should be used. Soaps can be used with or without antiseptics.

- Elements for hand drying: Use of disposable paper towels is recommended for drying hands. It is important to ensure there is sufficient supply of towels to prevent the practice of sharing towels with others. Single-use towels are recommended as towels that are reused by the same or different personnel result in the accumulation of moisture reducing the capacity to dry hands effectively. Drying hands is prolonged if using electric devices that evaporate the water.

Practices, such as infrastructural and other elements, to enhance adherence to hand hygiene are:

1. Permanent supply of elements required for hand hygiene e.g., hand hygiene stations, soap, water, disposable towels.
2. Ensure a temperature adequate to the environmental thermal condition.
3. Locate hand hygiene stations as close as possible to the site where patient care is delivered
4. Hand hygiene stations should be stocked with appropriate supplies and located in a well-lit area.
5. If a sink connected to a sewer system or septic tank is not available, a container to collect used water should be large and deep enough to minimize splatter risk to personnel.

Hand washing technique – When washing hands, personnel should make sure that the entire surface of hands (e.g., palms, fingers, interdigital spaces, nail region) come into contact with the water and soap. Friction should be used when washing hands to eliminate any organic matter and dirt. Hands should be rinsed under running water to eliminate all the waste. Jewelry (e.g., rings, watches, bracelets) should be removed prior to performing hand hygiene, as they will impede thorough washing (Figure 3).

2.2.2 ALCOHOL-BASED SOLUTIONS (ALCOHOL-BASED HAND RUB – ABHR)

Alcohol-based hand rub (ABHR) is the principal method of hand hygiene recommended for hands that are not visibly soiled with dirt or organic material. The use of alcohol-based solutions for hand hygiene ensures that, through its germicidal effect, transient skin flora is eliminated but will not be effective if hands are dirty/soiled.

The most effective ABHR has alcohol concentrations between 60% and 95%. Lesser concentrations are not as effective in their bacterial control action because the proteins in the cell membrane are not denatured (mechanism that fosters that action) as efficiently in the absence of water. Solutions of low viscosity are generally fast acting, dry quickly and are less costly.

The following actions should be considered to achieve correct use and better adherence when cleaning hands with ABHR:

1. ABHR hand hygiene dispensers should be placed next to, or as close as possible, to places where patient care is performed. In ideal conditions, dispensers should be installed by each intensive care unit bed.

2. Dispensers can be used in replaceable holders with a device that makes it possible to attach them to the wall or placed in mobile holders.

3. Do not refill the holders until they are cleaned, dried and visual inspection verifies there is no left-over product.

Hand rubbing technique with alcohol-based solutions – With dry hands, without visible dirt, deposit solution in the palm of the hand in sufficient quantity to cover the whole hand. Using friction, make sure that all the surfaces of the hands meet the solution. Continue rubbing until hands are dry. Just as important as good technique is performing hand hygiene at the proper time—namely, when the likelihood of contamination and carrying infectious agents to a portal of entry on a susceptible host is highest. Several situations, or "moments," have been identified as important times to disinfect the hands. The World Health Organization (WHO) promotes five widely recognized key moments for hand hygiene **(Error! Reference source not found.)**

Note: When hands are visibly soiled with dirt or have been in contact with body fluids, HCW should wash hands with soap and water. ABHR is not necessary after hand washing.

Figure 3 –
Hand washing technique

2.3 RESPIRATORY HYGIENE AND COUGH ETIQUETTE

To prevent the transmission of all respiratory infections in healthcare settings, including influenza and Coronaviruses, the following infection control measures should be implemented at the first point of contact with a potentially infected person. They should be incorporated into infection control practices as one component of Standard Precautions.

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

1. When sneezing or coughing cover the nose and mouth with a disposable tissue. Discard immediately into a waste bucket. Do not put the tissue into a pocket.
2. If disposable tissue is not available cough / sneeze into bent elbow.
3. Always face away from others when coughing or sneezing.
4. Wash hands immediately after coughing, sneezing, handling tissues or after contact with respiratory secretions or contaminated objects/surfaces.

Healthcare facilities should ensure the availability of materials for adhering to Respiratory Hygiene/Cough Etiquette in waiting areas for patients and visitors.

Provide tissues and no-touch receptacles for used tissue disposal.

Provide conveniently located dispensers of ABHR and hand hygiene stations where sinks are available. Ensure that supplies for hand washing (i.e., soap, disposable towels) are consistently available. If needed, standard surgical masks can be placed on patients who are coughing or sneezing for source control.

2.4 PERSONAL PROTECTIVE EQUIPMENT

PPE includes different articles and elements of clothing that can be used by HCWs to create a barrier between the patient, the environment or an object. Appropriate use of PPE (as much or as little as needed) will prevent/reduce risk for HCWs from exposure to, and potential transmission of, infectious agents when delivering patient care. PPE should be used jointly with other prevention and control measures such as, hand hygiene and specific isolation measures according to the mode of transmission of the infectious agent.

General measures related to the use of PPE include:

Administrative Measures

- **Ensure the permanent provision of all the required PPE.**
- **Include HCWs in the PPE selection process, particularly Infection Prevention and Control Staff.**
- **Standardize PPE to limit variability.**
- **Regularly supervise the addition of new, and discontinuation of older products.**
- **Discuss with HCWs if any health issues were detected when wearing PPE.**
- **Ensure PPE is worn safely and correctly.**

PPE includes (Table 4):

1. Gloves
2. Gowns
3. Waterproof aprons;
4. Goggles or facial shield (eye, nose mouth protection)
5. Masks and respirators with particle filter (nasal and mouth protection)

Table 4 – Personal Protective Equipment

Personal protective equipment
Fluid-resistant Gown Protect clothes and skin from contamination with infectious germs or blood/body fluids.
Waterproof apron Adds an extra layer of protection over a gown to prevent fluids from seeping in. orn alone if healthcare worker anticipates minor splash to the clothing.
Eye protection (goggles) Protection of the eyes. Should always be worn with a mask in order to protect the mouth if splash or spray is anticipated.
Eye and facial protection (facial shield) Protects eyes, nose, mouth. Should cover forehead, extend below the chin and wrap around the side of the face.
Gloves Most common type of PPE. Protects hands from contamination with infectious germs.
Respirators Protect HCWs from inhaling very small infectious germs (e.g., TB)
Masks Protects nose and mouth from organisms spread by large droplets (e.g., influenza).

2.4.1 GLOVES

Gloves protect the patient and healthcare worker from infectious germs that may be transmitted by the hands. Gloves are made from various materials, such as, latex, vinyl and nitrile. Nitrile is preferred if HCW has a known allergy to latex.

Recommendations:

- When use of long-sleeve gowns is indicated, place gloves on top of the cuff of the gown.
  - Some procedures may require use of double gloves or 2 gloves. I this case the inner glove should go under the cuff on the long sleeve of the gown.
- Always change gloves between patients.
- Use gloves only when necessary; excessive use can cause certain types of dermatitis and increase sensitivity to latex.
- Perform hand hygiene immediately before and, even more important, after using gloves. Under no circum-stance should glove use replace hand hygiene.
- It may be necessary to change gloves while caring for the same patient when different activities are required, and the gloves become contaminated.
- Change gloves whenever they develop breaks or tears

2.4.2 GOWN AND APRON

1. The gown makes it possible to cover HCWs from the neck to the knees and from the arms to the fists with a system of closing in the back (closing of clasp and curl-type Velcro, with ties or snaps, etc.). This closure prevents HCWs from contaminating their clothes with infectious organisms and/or blood and body fluids generated during certain procedures.

2. Gowns can be disposable or reusable. Gowns should be fluid resistant. If fluid-resistant gowns are not available, the gown should be covered with a plastic waterproof apron to prevent strike-through.

3. The apron is placed over the front of the gown, covering the HCW from neck to knees.

4. Aprons should be made of waterproof material and used in procedures that can generate large volumes of blood or bodily fluids.

5. Aprons can also be used without a gown if there is low risk of contamination or large splash.

2.4.3 FACIAL MUCOUS MEMBRANE PROTECTORS (MOUTH, NOSE, CONJUNCTIVA)

Surgical masks and goggles provide a barrier and protect the nose, mouth and eyes from splashes of blood/body fluids or other infective microorganisms generated by droplets when a patient coughs or sneezes. A **respirator mask and goggles may also be needed during procedures that generate aerosols** (e.g., dental procedures, intubation, suctioning).

PROTECTION OF MOUTH AND NOSE:

Surgical Masks, which cover nose and mouth of the HCWs should not be occlusive. Masks should be replaced whenever they are visibly soiled/wet (e.g., compromises the effect of the protective barrier).

Respirators filter small particles: N95 or FFP2 masks filter particles of <5 μ m in diameter and diminishes/protects HCWs from inhaling infectious pathogens that are transmitted through the air (e.g., tuberculosis, varicella zoster). **According to restricted studies, an HCW can use a respirator up to five times before filtration capacity is notably altered.** Replace the respirator if wet or dirty. A respirator requires a fit test and training on appropriate and safe use.

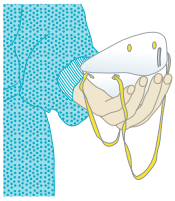
Training in the use of respirators should include ensuring that personnel are able to perform the following:

Adjustment test. The purpose is to find out if air is leaking or the respirator is not filtering properly. This test must be performed in order to select the most appropriate type and size of respirator for the individual being fitted. There are several types of adjustment tests, usually divided into two broad categories [23]:

- Qualitative tests. Following one of several standardized protocols, the tester exposes the user wearing the respirator to aerosols with characteristic scents to determine whether he or she can smell them. If the scent can be detected, it means that the respirator is not properly adjusted on the user's face and needs to be switched to a different size or more appropriate model.
- Quantitative tests. The device's effectiveness is evaluated with special equipment that measures the number of particles inside and outside the respirator when it is in use.

Seal check. The seal should be checked before each use of the respirator to ensure that it is working correctly before it touches the patient. If this is not done, there is no assurance that the respirator is properly filtering the inhaled air and therefore has the protective effect equivalent to that of a mask (Figure 5).

Figure 5 – Seal check for respirators



Step 1

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

Step 2

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

Step 3

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

Step 4

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

Step 5

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

Step 5a: Positive seal check

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

Step 5b: Negative seal check

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

Reproduced from "Infection prevention and control of epidemic- and pandemic-prone acute respiratory diseases in health care - WHO Interim Guidelines" available at *http://www.who.int/csr/resources/publications/WHO_CD_EPR_2007_6/en/index.html*

Long term use and re-use of respirators:

Long-term use of respirators. **A respirator can be used continuously for up to about eight hours (the length of time may vary depending on the manufacturer's specifications), as long as users do not touch its surface with their hands and seal checks are performed repeatedly to make sure it is working properly.** Additional protective measures (face shields) should also be used if it is expected that exposure to droplets will be high. Respirators should be discarded after use in the following circumstances: when they have been worn during a procedure highly likely to generate aerosols, when they are visibly contaminated with anybody fluid, when the seal check is unsatisfactory, or when the user experiences a significant increase in resistance to respiratory effort.

Reuse of respirators. There is no consensus on the effectiveness of respirators in real conditions, nor are there any studies on the subject in the literature. Some authors, based on the results of a study conducted under controlled laboratory conditions [24],b suggest that **if the same person reuses a respirator, it should not be used more than five times.** After that, its filtration efficiency will decline significantly [25].

2.4.4 EYE PROTECTION

Goggles cannot be replaced by regular glasses. Goggles are designed to cover the contour of the eyes in order to prevent contact of the conjunctival mucous membrane with infectious agents. For better adherence and to reduce risks to the HCW, the goggles should meet the following requirements:

1. Must adjust well to the nose and the front parietal region
2. Must be adjustable to fit the HCW
3. Design that minimizes the possibility of fogging

Face shield covers the whole face from the hair line to the chin. **Face shield can replace goggles and mask (e.g., in irrigation of wounds or aspirate of copious secretions).** Permit its use over prescription glasses

The type of protective barrier to be used will depend on the risk of exposure to HCWs, according to the procedure to be performed, the type of infection that patient is carrying and the mode of transmission (Isolation) (Table 5).

Table 5 – PPE use according to procedure involved (Examples) and Risk Assessment for exposure potential

PROCEDURES	PERSONAL PROTECTIVE EQUIPMENT						
	Gloves	Gown	Apron	Goggles	Facial shield	Mask	Respirator
Bath of patient in the bed	yes	no	yes	no	no	no	no
Aspiration of oropharyngeal secretions	yes	no	no	yes	alternative	yes	airborne transmission
Transport of patient in wheelchair	yes (contact precautions)	yes (contact precautions)	no	no	no	no	no
Emergency with blood splatter	yes	yes	yes	yes	alternative	yes	no
Extraction of blood sample	yes	no	no	no	no	no	no
Cleaning of incontinent patient with diarrhea	yes	yes	splatter risk	splatter risk	no	splatter risk	no
Wound irrigation	yes	yes	no	yes	alternative	yes	no
Intubation	yes	no	no	yes	alternative	no	yes
Insertion of urinary catheter	yes	no	no	no	alternative	no	no

2.4.5 DONNING AND DOFFING PPE

Donning of PPE follows a sequence that ensures adequate utilization and does not affect patient care.

Prior to donning PPE, HCWs should assess risks of contamination depending on the procedure to be performed and/or type of isolation precautions the patient may be on (e.g., gloves, gown, apron, mask, respirator goggles, or face-shield).

[1] *Face shield may be used as an alternative to goggles*

Donning sequence, after the hand hygiene, is as follows (Figure 6):

1. Hand Hygiene
2. Gown or apron placement
3. Mask or respirator placement
4. Placement of goggles or facial shield
5. Placement of gloves ensuring that they remain over the gown sleeve.
6. If an employee wears glasses this can be donned after donning the mask or respirator

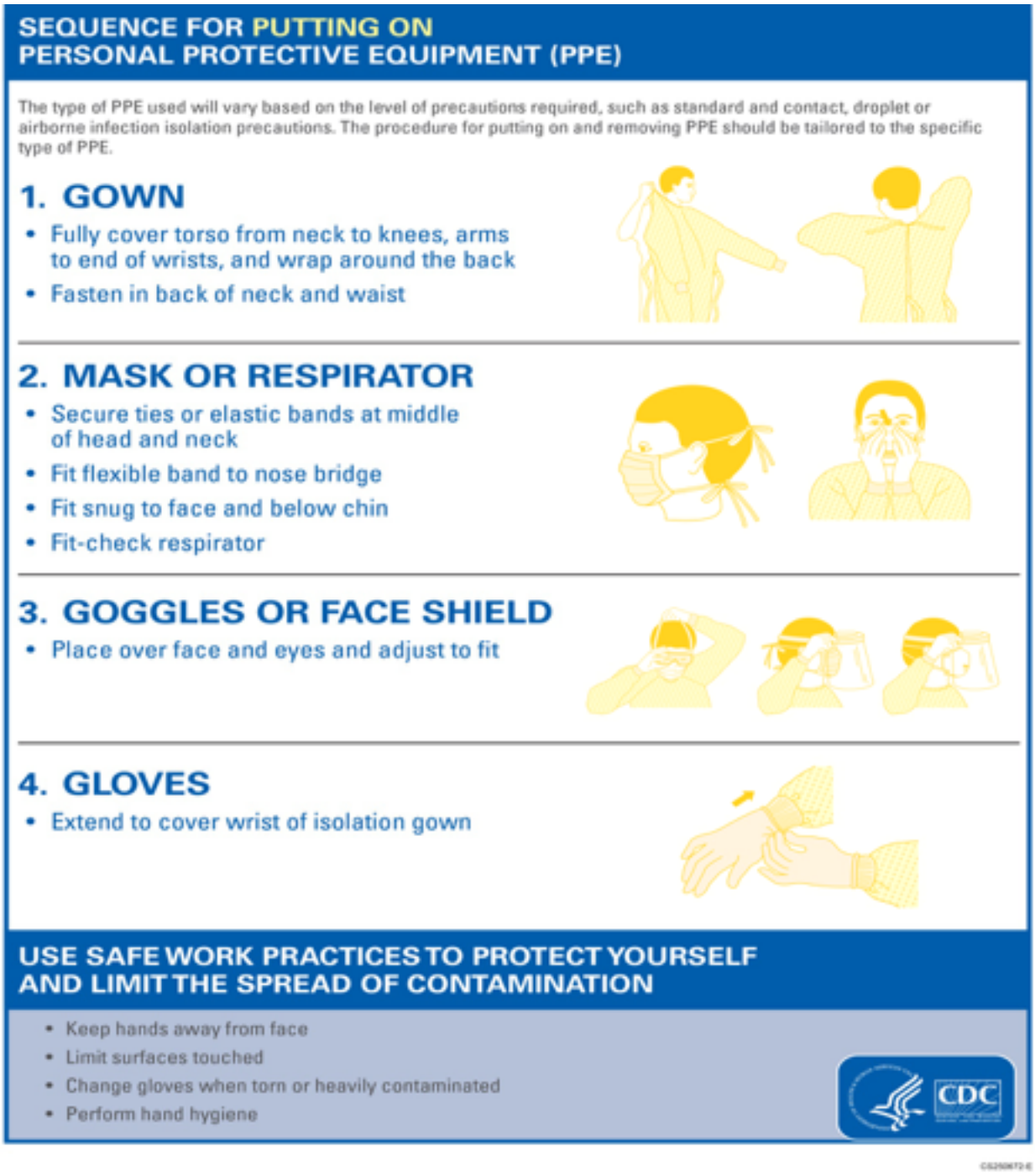
The moment of greater risk of contamination is the doffing process. Some general rules include:

1. PPE is more contaminated after contact with the patient e.g., front of the PPE including arms,
2. The face has the most ports of entry (e.g., oral mucosa, nasal and conjunctival), and considered the greater risk.
3. Removal of the facial protection should be carried out in the final phase of PPE doffing after performing hand hygiene.
4. It is necessary to conduct periodic training on PPE donning and doffing processes to ensure the correct sequence is being followed.
5. Trainers should document and correct any deficiencies in the donning and doffing process in order to minimize any risk of exposure to an infectious organism.
6. Hand rubbing with ABHR can occur between each step

Elements of the PPE **doffing sequence** is the following (Figure 7):

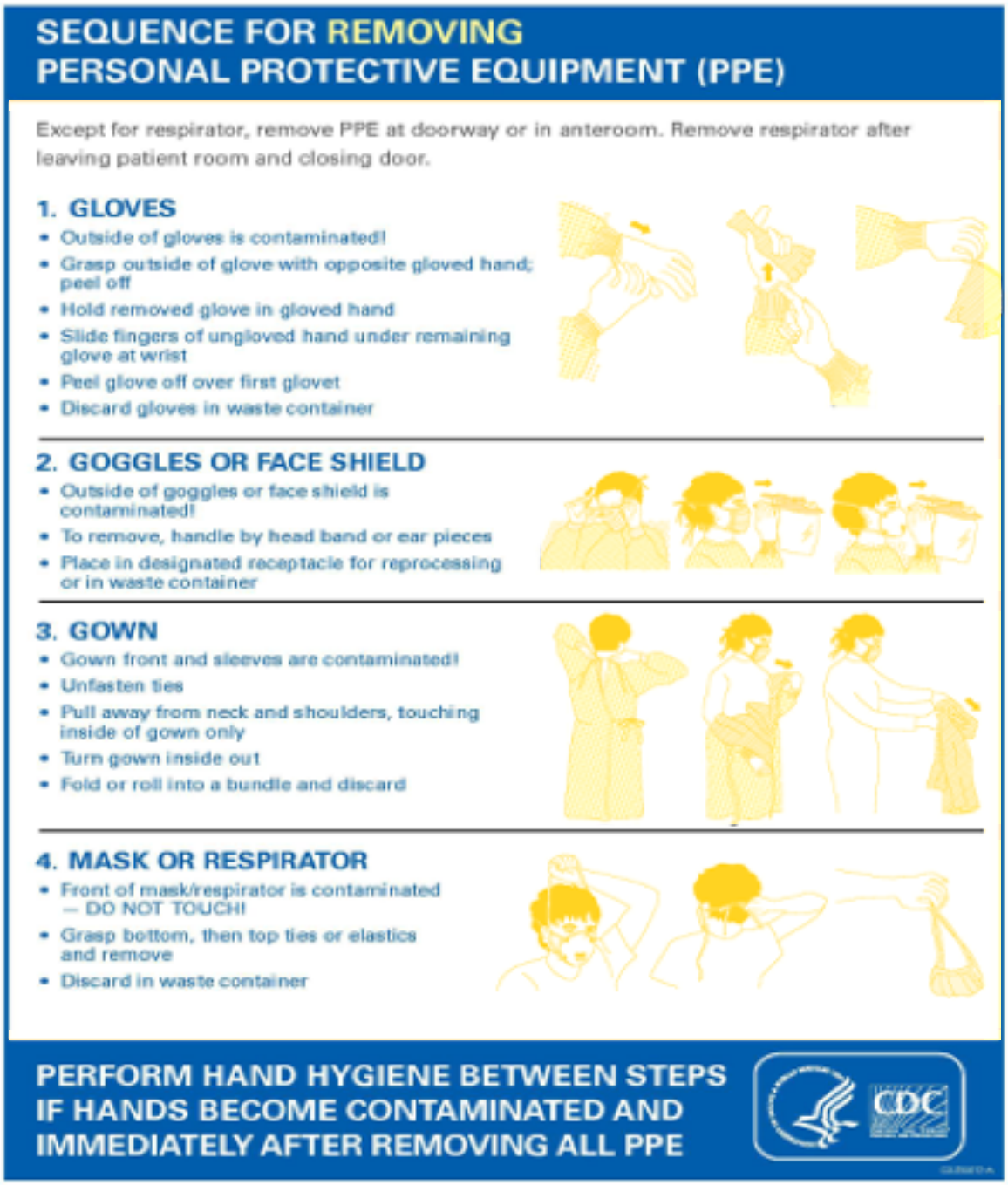
1. Gloves
2. Gown or apron (Eyeglasses or facial shield may be doffed before gown or Apron, as illustrated below)
3. Eyeglasses or facial shield
4. Mask or respirator
5. Proceed with hand hygiene
6. If an employee must wear glasses this is doffed prior to removing the respirator or mask and cleaned.

Figure 6 – Sequence of Donning PPE



Available from:
https://i.pinimg.com/236x/59/65/f4/5965f44f08ca6d361be72533a9423290--nursing-party-nursing-notes.jpg

Figure 7 – Sequence of Doffing PPE



Available from:
https://i.pinimg.com/originals/d6/96/71/d69671c8ae16057f5c8863e6f73ade5f.jpg

2.5 NEEDLESTICK AND OTHER SHARPS-RELATED INJURIES

The risks of infection through contact with contaminated sharps (with blood or body fluid), during patient care (e.g., giving an injection, performing a procedure) are directly related to the infectious status of the patient, nature of the exposure, frequency, duration, and the immunity status of the HCW.

Table 6 shows the risks of infection for HIV, HBV, and HCV after percutaneous exposures. They are expressed in infections per every 100 punctures or cuts with instruments contaminated with blood.

Table 6 – Risk of infections after percutaneous exposures

Type of infections	HIV	HBV		HCV
Risk of infection	0.3%	Ag HBe (-)	AgHB (+)	1.8%
		< 6%	≥ 3%	

Instruments with prick or cut risk include: solid needles (suture); hollow needles (injections); scalpels, scissors, biopsy forceps, glass ampoules with infective material (blood, fluid that comes from sterile cavity or any fluid with visible blood) and dental instruments (high speed hand pieces, ultrasonic scalers and drills).

Accident hazard is greater in the following circumstances:

1. Surgical interventions (e.g., hand to hand transfer of contaminated sharps).
2. Upon attempting to dispose of used needles after a procedure.
3. Perforation of safety box if they are not puncture proof.
4. Overfilled safety sharp box.
5. Safety sharp box without a protective cover.

Accident prevention measures involving sharp devices

1. Safe manipulation of instruments includes:
2. Asking for additional support during procedures that require manipulating needles/syringes for specimen collection (e.g., collecting arterial gases).
3. Asking for additional support when working with agitated patients or young children.
4. Do not recap the needles. If recapping is unavoidable use one handed technique.
5. Avoid handling or removing a sharp (e.g., scalpel, suturing) directly with the fingers. If necessary, use tweezers.
6. Do not point the sharp toward another person.
7. Place sharps container on a stable surface and within arm's reach or as close as possible where sharps are being used.
8. Avoid direct hand to hand transfer of sharps. Place the sharp in a tray prior to transfer.
9. Communicate verbally (out loud) when a sharp object is passed.
10. Segregation and safe elimination of sharp objects
11. Sharps containers should be puncture resistant, leak proof and sealable when full.
12. Collect and dispose containers when ¾ full.
13. Never attempt to empty, shake or compact sharps containers in order to increase storage capacity.

[2] *Adapted from Beltrami E, Williamscraig I et al.*
Risk and Management of Blood-Borne Infections in Health Care Workers CLINICAL MICROBIOLOGY REVIEWS, July 2000, p. 385–407 Vol. 13, No. 3

Transmission prevention from the health workers: All HCWs, including physicians, should be immunized against vaccine-preventable diseases (measles, `rubella`, mumps, hepatitis B, polio, varicella, tetanus and diphtheria) and receive annual vaccination for the prevention of influenza.

NOTE: In the event of sharp or other occupational related injuries please refer Guideline 2: Occupational Health and Dentistry – Guidelines For Infection Prevention and Control.

3. TRANSMISSION-BASED PRECAUTIONS

Isolation is the creation of a barrier, mechanical or spatial, to prevent the transmission of infectious diseases to or from a patient, and to reduce the risk of transmission to other patients, health care workers, and visitors. The purpose of isolation is to prevent the transmission of infectious diseases that are spread by both contact and airborne routes (droplets and aerosol).

3.1 TRANSMISSION-BASED PRECAUTIONS

Transmission-based precautions are used when standard precautions do not interrupt the infection transmission cycle. Transmission-based precautions are used for patients who are known or suspected to be infected or colonized with infectious agents that require control measures (in addition to standard precautions) to effectively prevent transmission of infectious agents in health care facilities. Transmission-Based Precautions are always used ***in addition to*** Standard Precautions.

Transmission-based precautions can be applied empirically, by establishing a possible route of transmission based on clinical signs and symptoms and then modifying the precautions based on the final diagnosis.

Transmission-based precautions include Contact Precautions, Droplet Precautions, and Airborne Precautions

1. Contact precautions are implemented to prevent transmission of diseases that are spread via contact with infectious material or organisms
2. Droplet precautions are used to prevent transmission of diseases that are spread via contaminated respiratory droplets.
3. Airborne precautions are implemented to prevent transmission of diseases that can spread through the air and in aerosolized particles.

The following guidelines serve as the minimum requirements that should be enforced in all health care settings to protect patients, HCWs, and visitors. (Siegel et al. 2007). These interventions are specific to the mode of transmission of the disease.

1. Practice Standards Precautions for all patients at all times.
2. Use transmission-based precautions in addition to standard precautions when standard precautions alone are not enough to prevent transmission of infection.
3. Follow risk assessment findings and use appropriate personal protective equipment (PPE) based on route of transmission, clinical symptoms/signs and laboratory results (if available).
4. Limit visitors and non-essential staff contact with patients based on the clinical diagnosis, experience (empiric), or presence of a set of signs and symptoms (syndrome) until the final diagnosis (including laboratory investigations) is made available.
5. Limit patient movements outside of designated areas, based on their empiric/syndromic symptoms, following appropriate guidelines.
6. Clean and disinfect patient care environment and reusable equipment between each patient.
7. Make every effort to diagnose the microorganism responsible for infection if access to laboratory services is possible.
8. At a minimum, apply transmission-based precautions when the clinical symptoms and signs suggest additional precautions may be necessary.
9. Apply multiple precautions if the microorganism in question is transmitted by multiple routes.

Policies and Standard Operating Procedures covering all these areas should be implemented always to minimize the risk of transmission of infection from an unrecognized source, be it an individual, contaminated equipment, linen or waste. Every person working within a healthcare facility should be trained on, and familiarize themselves with, standard and transmission-based precautions and ensure they are compliant always.

Training should include:

1. Importance of why HCWs should adhere to standard and transmission-based precautions.
2. Scientific rationale for the precautions to enhance staff knowledge on why to apply the precautions correctly.
3. How to establish a program to monitor and evaluate practices with timely feedback to correct unsafe practices.
4. The need to provide **clear information to the patient and family on type of isolation and PPE requirements when visiting the patient.**
5. Known or suspected diagnosis of infection of the patient.
6. The pathogen and its mode of transmission.
7. The natural history of infectious disease and its period of communicability.
8. Measures to avoid the transmission of the infectious agent.
9. The need to restrict access of persons entering the isolation area.

3.1.1 CONTACT PRECAUTIONS

It is the most frequent form of transmission.

1. Direct contact: when the infective microorganisms travel from the reservoir to the susceptible person.
2. Indirect contact: the susceptible person (host) acquires the infective microorganism through an intermediary (e.g., environment (inanimate), healthcare workers or another patient (animated). The infective agent should have the capacity to survive in the environment, however the detection of this in the environment does not necessarily explain the transmission of the infection. An analysis should be completed to determine if the organism is contributing to the infection.

Microorganisms transmitted through contact transmission: ***Acinetobacter*** spp, ***Clostridium difficile***, `***Enterococcus***` spp (including vancomycin-resistant strains), ***Pseudomonas aeruginosa, Klebsiella*** spp, ***Staphylococcus aureus*** (includes methicillin-resistant strains), norovirus, `respiratory syncytial virus`, rotavirus, Gram-negative bacilli including Enterobacteriaceae resistant to the antimicrobial drugs (for example: producers of Extended Spectrum Beta Lactamases (ESBL) or carbapenemases).

3.1.1.1 PATIENT PLACEMENT

1. Preferably, patients should be placed in an individual room. If this option is not possible or more than one patient has the same type of infection (and no other infection) patients may be cohorted in the same room (useful during outbreak situations).
2. If there is only one case without possibility of having an individual room, the following should be considered:
   - (a) The patient can share a room with other uninfected patient(s). Beds should be spaced at least 1 meter apart, with sufficient space that permits comfort, adequate space for devices and equipment's used by the other patient (e.g., IV pole, bed side table etc.).
   - (b) The infectious patient should not share the room with immunocompromised patients or patients that have had invasive procedures (e.g., surgical procedure).

3.1.1.2 ROOM REQUIREMENTS

1. The room should have a sink with running water (with adjustable temperature), soap, disposable paper towels or cloth, single-use washable towels.
2. ABHR should be available to enhance adherence to hand hygiene practices.
3. Patients with an enteric infectious disease should have an exclusive bath inside the room. If a personal-use bath is not possible, other measures should be made available in order to prevent the transmission of infection by contact (e.g., personal bedpan/commode and wash basin). Items should be cleaned and disinfected prior to use by another patient
4. Appropriate PPE should be available outside of the room (antechamber or corridor) or next to the patient bed.
5. Used PPE should be deposited in a trash can inside the room (preferably located near the door) before leaving the room or in a trash can at the patient bedside.
6. Place visible and easily understandable signage at the entrance to the room indicating precautions needed (e.g., PPE –gowns/gloves and hand hygiene requirements)

3.1.1.3 PPE TO BE USED AND PROCEDURES TO FOLLOW

Gowns and gloves should be worn upon entry into the room. Don long-sleeved gown and gloves prior to entering the room. Hand hygiene should precede donning gloves and after glove removal (Figure 8).

1. If disposable gowns are not available, gowns can be reused on the same patient if care is taken not to contaminate the inside of the gown during donning and doffing.
    a. Gowns should be washed at least daily.

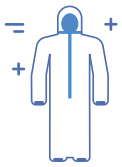
2. If there is an anticipated risk of splash or contact with bodily fluids, or exposure to facial mucous membranes a waterproof apron may be needed (following standard precautions) and facial protection (goggles and surgical mask or face shield). Use as much or as little PPE to care for the patient safely **based on the risk assessment.**

Limit transport of such patients to essential purposes (e.g. diagnostic and therapeutic procedures that cannot be performed in the patient's room).

- When transport is necessary, use appropriate barriers on the patient (e.g., gown, wrapping in sheets or use of impervious dressings to cover the affected area(s) when infectious skin lesions or drainage are present, consistent with the route and risk of transmission.

- Notify HCWs in the receiving area of the impending arrival of the patient and precautions necessary to prevent transmission.

Figure 8 – Contact isolation

CONTACT ISOLATION	
To prevent transmission of	✓ *Clostridium difficile* ✓ respiratory syncytial virus (RSV) ✓ Rotavirus ✓ multi-drug resistant bacteria (MDR)
	✓ hand hygiene before and after having contact with the patient ✓ soap and water hand wash required after patient contact
	✓ disposable gloves ✓ don gloves before entering the room ✓ remove gloves in the room at the end of patient care
	✓ individual room if possible ✓ cohort in shared room with separation of 1 meter between beds ✓ exclusive bath required (e.g., commode bucket if individual toilet not available)
	✓ avoid transfer of patient to other areas in the hospital ✓ limit transportation if medical care can be provided at bedside
	✓ follow standard precautions as risk of blood/ body fluid exposure is determined
	✓ use of individual disposable gown for each patient ✓ gown should be put on before entering patient room ✓ gown should be removed after patient care and before leaving the room and place in appropriate receptacle (e.g., laundry or waste) ✓ follow standard precautions as assessment of risk of exposure to blood/body fluids indicates ✓ eventual use of waterproof apron if there is risk of contamination by splatter of bodily fluids

3.2 DROPLET TRANSMISSION

Respiratory drops (droplets) that range between 5 and 100 μ m in diameter are released from the respiratory tract upon coughing, speaking or sneezing. These droplets carry microorganisms (infecting or colonizing patient's oral cavity) that can be transferred to a recipient person and contaminate surroundings within 1 to 2 meters from where they were expelled.

Droplet Precautions apply to any patient known or suspected to be infected with epidemiologically important pathogens that can be transmitted by infectious droplets.

- Droplet transmission involves contact of the conjunctivae or the mucous membranes of the nose or mouth by large-particle droplets (larger than 5 μ m in size). Droplets can also be generated during certain procedures such as, suctioning and bronchoscopy.
- Depending on survival period of the organism, infections can spread to others by indirect contact if surfaces are not cleaned /disinfected appropriately.
- Special air handling and ventilation are not required to prevent droplet transmission because they do not remain suspended in the air.

> Microorganisms that are transmitted through droplet precaution: Diphtheria, whooping cough (***B. pertussis***), meningitis by ***N. meningitidis***, influenza, rhinovirus, adenovirus.

3.2.1 PATIENT PLACEMENT

1. Preferably place patient in an individual room. If this option is not possible, place patient in a room with other patients with the same (and no other infection) e.g., cohort patients. Cohorting is often used during an outbreak situation (e.g., influenza). Beds should be placed at least 1 meter apart.
2. If patient is the only infected person and an individual room is not available, consider the following option:
    a. The patient can share a room with other uninfected patients.
    b. Maintain a distance of 1-2 meters between beds with a barrier placed between the beds (screen/curtain if possible).
    c. In an outbreak situation do not include patients with compromised immune systems or patients who have had invasive procedures in shared isolation cohort room.

3.2.2 ROOM REQUIREMENTS

1. The room should have a sink with running water (with adjustable temperature), soap and disposable paper towels or single-use, washable cloth towels.
2. ABHR should be available to enhance adherence to hand hygiene practices
3. Appropriate PPE (surgical mask) should be available outside of the room (antechamber or corridor).
4. Mask should be removed and deposited in appropriate trash can (with the appropriate color coded bag) after leaving the room.
5. Place visible and easily understandable signage at the entrance to the room indicating precautions needed (e.g., PPE –regular surgical mask upon entry and adherence to hand hygiene requirements)
6. Keep the door closed and manage air flow through mechanical system of air injection and extraction or with the support of an open window that ensures an adequate change of air per hour.

3.2.3 PPE TO USE AND PROCEDURES TO FOLLOW

Staff should don a disposable surgical mask upon entry to the room to protect mucous membranes. Mouth and nose are among the most common portals of entry for germs spread by droplets. Additional PPE (other than a surgical mask) should be selected according to the type of patient care that is needed (e.g., assess contact with blood or body fluid). (Figure 9)

If care to be provided implies proximity less than a meter from the patient during aerosol producing procedures (respiratory therapy, intubation, or others) the following must be in place:

1. Protection of facial mucous membranes and conjunctiva with:
   - a. Disposable surgical mask and goggles.
   - b. Or disposable surgical mask and facial shield (If the face shield is long, covering chin and involving the face, disposable surgical mask may not be needed).

Normally use of face-shield and goggles are not necessary when caring for a patient on droplet precautions.
Use of extra PPE (when not needed) wastes resources and increases associated costs of patient care.

2. Follow standard precautions if there is risk of splash/spray with abundant secretions (e.g., blood or body fluids) Limit transport to essential purposes only (e.g., such as diagnostic and therapeutic procedures that cannot be performed in the patient's room). When transport is necessary, use appropriate barriers on the patient (e.g., disposable surgical mask)

3. Notify HCWs in the receiving area of the impending arrival of the patient and precautions necessary to prevent transmission of infection.

Because these pathogens do not remain infectious over long distances in a healthcare facility, special air handling and ventilation are not required to prevent droplet transmission.

Figure 9 – Droplet precaution

DROPLET PRECAUTIONS	
To prevent transmission of	✓ *Bordetella pertussis* (whooping cough) ✓ Influenza ✓ Adenovirus ✓ Coronavirus ✓ Meningitis by Meningococcus sp.
	✓ Hand hygiene before and after having contact with the patient
	✓ Gloves use only if given risk of splatters or contact with secretions ✓ Gloves should be placed before entering the room ✓ Remove gloves before exiting the room at the end of care (and wash your hands)
	✓ Surgical mask for direct care the patient (<1 meter in distance) or procedures that increase aerosols with infectious organisms (e.g., aspiration of secretions; intubation; resuscitation) ✓ Ensure the correct adjustment of mask to the face
	✓ Individual room if possible ✓ Cohort in shared room with separation of a meter between beds ✓ Keep door closed
	✓ Avoid transfer of patient to other precincts of the hospital ✓ If transfer is required, the patient should be placed surgical mask that will maintain at all times as long as is outside the room
	✓ Goggles for patient care in risk for aerolization of infectious organisms when providing care (e.g., aspiration of secretions; intubation; resuscitation) ✓ Can be replaced by face shield
	✓ Use of gown in risk of splatter and contact with secretions (aspiration of secretions; intubation; resuscitation) ✓ Additional use of waterproof aprons if extensive contact with secretions is anticipated

3.3 AIRBORNE TRANSMISSION

Airborne Precautions prevent transmission of infectious agents (particles of less than 5μm) that remain infectious over long distances when suspended in the air. Patients can inhale the infectious particles without being in close physical proximity with the infected patient.

Airborne particles can be transmitted when an infected patient coughs or sneezes and also when performing clinical procedures that include: tracheal intubation, tracheotomy, non-invasive respiratory ventilation with positive pressure, invasive mechanical ventilation of high frequency, aspiration of airway, respiratory therapy, bronchoscopy, induction of sputum, centrifugation of samples and procedures with air drills. The greater risk procedures are tracheal intubation, non-invasive mechanical ventilation, tracheotomy, and manual ventilation.

Microorganisms transmitted through airborne transmission: ***Mycobacterium tuberculosis*** (patients with TB bacilli); measles virus, varicella zoster (Chicken pox), herpes disseminated zoster, and coronavirus (SARS Co-V, MERsCOv, SARS-CoV- 2).
For SARS Co-V, MERsCOv and SARS-CoV- 2 the main risk of aeroslization is when doing specific procedures mentioned.

3.3.1 PATIENT PLACEMENT

Location will be defined according to analysis of risk of analysis regarding healthcare associated transmission of infection to other patients.

The following should be considered when selecting a room for the patient:

1. Room for individual use that has the following:
   - a. Restricted access.
   - b. System of negative pressure of air, with ventilation always toward the exterior of the establishment, and not toward interior or exterior hallways.
   - c. Closed door.
   - d. Natural ventilation can be used with the door closed and window open.
     (The air changes are shown in Appendix 3)
   - e. If the climatic conditions do not make it possible to use natural ventilation, an air system with air extraction toward the exterior of the room with 6 to 12 changes per hour can be implemented
   - f. Ventilation should not be directed toward areas of the hospital with closed spaces, or ventilation ducts. If this is not possible a high-efficiency particulate air (HEPA) filter should be used at the end of the ventilation line.
     Ultraviolet light filtration (UV) may also be considered.

2. Shared room
   - a. Is the last option, and can only be used with patients with same diagnosis, pathogen, and genotype (and no other infectious agent)
   - b. Due to the risk of development of resistance to antimicrobial drugs, patients with drug resistant TB should be hospitalized in individual rooms.
   - c. In outbreak situations patients who carry the same infection, can be put in the same room (cohorting) in an area of the hospital far from the other patients especially those which have greater risk of infection (e.g., immunocompromised patient).

The PPE to be worn is shown in Figure 10.

Figure 10 – Airborne precaution

AIRBORNE PRECAUTIONS (Droplet nuclei)	
To prevent transmission of	✓ Tuberculosis ✓ Measles ✓ Chickenpox ✓ Disseminated herpes zoster
	✓ Hand hygiene before and after having contact with the patient
	✓ Standard precautions indicated in all situations ✓ In case of patients with tuberculosis use of gloves is not required ✓ In case of patient with chickenpox, measles, or disseminated herpes zoster is recommended use of gloves is required (can have transmission by contact also) ✓ Gloves should be placed before entering the room ✓ Gloves should be removed inside the room at the end of care
	✓ Place high efficiency respirator (n95; pff2 or equivalent) before entering the room ✓ Ensure the correct adjustment of the respirator to the face
	✓ Individual room if possible ✓ Shared room in cohort with separation of 1 meter between beds ✓ Ventilation toward the exterior of the building ✓ Negative air pressure in the room compared to corridors ✓ Always maintain closed door
	✓ Avoid transfer of patient to other areas of the hospital ✓ If transfer is required, the patient should wear a surgical mask that will remain always if patient ✓ is outside the room ✓ Inform receiving department prior to arrival and alert as to necessary precautions and PPE

3.4 ESTABLISHING PRIORITIES FOR SINGLE ROOMS

Special considerations are needed for patients with the following:

- Infections that have more than one mode of transmission for example droplet and contact.
- Multiple patients with the same type of infection.

Patients with infections with more than one mode of transmission: Diseases such as `chickenpox` and respiratory syncytial virus (RSV) can be disseminated by multiple ways (e.g., airborne, droplet and through direct and indirect contact). In these situations, actions are necessary for initiating isolation with greater emphasis on all modes of transmission (e.g., use of PPE and room placement).

3.4.1 COHORT ISOLATION

The presence of multiple patients carrying the same type of infection and a single agent leads to the generation of this type of isolation.

- Cohort multiple patients carrying the same type of infection, with a single agent, to optimize resources and concentrate work efforts in a specific area. This will be more cost and resource effective when caring for patients.
- Cohorting is often used to control disease outbreaks or outbreaks that have been difficult to handle.

General cohort measures

1. Include only confirmed cases of infection/colonization by the same infectious agent (agent, strain or `clone`) based on the best available information at the time of making the decision.
2. Dedicate HCWs exclusive for patient care. HCWs should not care for other patients during the same shift.
3. The cohort is considered a closed zone, admitting only patients carrying the same disease by the same agent.
4. Dedicate physical space (room or sector) including nursing station, PPE donning/doffing stations and bathing areas.
5. The cohort sector should be restricted to patients and HCWs and opened after last patient is discharged, room cleaned and disinfected. If patients were cohorted with an airborne infection (e.g., TB), the area should remain closed until ventilation requirements are met to rid the infectious agent.

3.4.1.1 ROOM REQUIREMENTS

1. The room should have a sink with running water (with adjustable temperature), soap and disposable paper towels or single-use washable cloth towels.
2. ABHR should be available to enhance adherence to hand hygiene practices.
3. Place visible and easily understandable signage at the entrance to the room indicating precautions needed (e.g., PPE –respirator mask upon entry and adherence to hand hygiene requirements).

3.4.2 PPE TO USE AND PROCEDURES TO FOLLOW

Based on the risk associated with the procedure to be carried out and the conditions of the patient the following are indicated:

1. HCWs should put on a **respirator (N-95 or FFP2 mask)** before entering the room (adjusting respirator per training provided). Doffing will be made outside the room after hand hygiene.
2. **Gown or apron** if there is risk of contamination with copious secretions of the patient or if procedures will be carried out that facilitate the dispersion of aerosols. **If disposable gowns are not available, reuse for the care of the same patient shared by different staff members can be done.** Consideration should be given to washing the reusable gown where applicable and daily change is necessary.
3. **Goggles** if risk of contamination with secretions is anticipated. They will be put on before entering the room and removed after leaving the room, having carried out hand hygiene previous to removal.
4. Use of disposable single-use **gloves**, after hand hygiene. They will be discarded in the room followed immediately by hand hygiene, to be repeated outside the room for doffing of respirator and reusable goggles or face shields.
5. In the case of patients with vaccine-preventable infections (chickenpox, measles) it is required that HCWs, entering the room, should have been previously immunized.
6. Limit transport of such patients to essential purposes (e.g., diagnostic and therapeutic procedures that cannot be performed in the patient's room). If transport is necessary, the patient should wear a surgical mask and skin lesions should be covered (e.g., patients with chickenpox). Notify HCWs in the receiving area of the impending arrival of the patient and precautions necessary to prevent transmission of infection.

Where single rooms are limited in number, the institution shall set priorities for their use, based on risk factors for transmission or adverse outcome inherent to the patient, microbe and institution.

3.5 ELEMENTS NECESSARY FOR DEFINING THE TERMINATION OF ADDITIONAL PRECAUTIONS

When decisions for termination of transmission-based precautions are to be defined, sound **scientific evidence is not always found.** Guiding these decisions is given by a **shared rationality from the knowledge available and regular practice.**

For most cases it is well known that these additional precautions remain in effect for limited periods of time, while the risk of transmission of the infectious agent persists or for the duration of the illness24. Examples Included in this decision are:

1. **Time since initial symptoms (e.g., influenza)**
2. **Number of days since starting antibiotic treatment (e.g., meningococcal meningitis)**
3. **Negative laboratory results (e.g., negative sputum-smear microscopy for TB)**

In other cases, the decision to end the additional precautions can be more complex and will be a local decision, irreproducible in other settings or circumstances. **It is always important to leave a registry of these indications for later evaluations.**

Ending additional precautions in a patient should not affect continuity of standard precautions.

4. SPECIAL CONSIDERATIONS

4.1 PRECAUTIONS TO PREVENT MULTI-DRUG RESISTANT AGENT INFECTIONS OF IMPORTANCE TO PUBLIC HEALTH

Antimicrobial resistance (AMR) has gradually increased because of the introduction and use of antibiotics. AMR is facilitated by various factors, increasing selective pressure in the microorganisms forced by the massive use of antimicrobial drugs (e.g., microorganisms become more selective and change (become resistant) when they are exposed to antimicrobial drugs, which in turn increases the need to use more and different antibiotics).

Multi-drug resistant organisms (MDROs) that cause healthcare-associated infections (HAIs) increase morbidity, mortality, and associated costs derived from prolonged hospitalizations and use of more costly antimicrobials. For this reason, guidelines have been developed that aim at more rigorous infection prevention control (IPC) practices that reduce the risks of transmitting MDROs in a healthcare facility.

The existing recommendations have been strongly guided to contain infections caused by the following organisms: methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant enterococcus (VRE), and multi-resistant gram-negative bacilli, including extended-spectrum betalactamases (ESBL), and cabapenemases, (includes Klebsiella pneumoniae, Pseudomonas aeruginosa and Acinetobacter baumanii). IPC interventions coincide with the need to adhere to standard and transmission-based precautions. The proposed measures can vary depending on situations of endemic disease or outbreaks. The following tables provide examples of the most effective measures.

Table 7 – Measures of containment of HAIs in endemic conditions for multi-resistant microorganisms

Microorganisms against which interventions have demonstrated effectiveness	Adopted or proposed measures
Multi-drug resistant MRSA, VRE, Enterobacteriaceae with ESBL, Klebsiella pneumoniae, Pseudomonas aeruginosa, and Acinetobacter baumanii	Better adherence to hand hygiene, including aspects of infrastructure (number and placement of hand hygiene stations/adequate supplies), HCW training, supervision, and feedback
MRSA, VRE, Acinetobacter baumanii multirresistant	Single use of non-critical articles (endoscopes, thermometers, blood pressure cuffs etc.) for infected or colonized patients. As an alternative to single use, ensure disinfection of equipment between every patient
Multi-drug resistant Enterobacteriaceae with ESBL, Klebsiella pneumoniae, Pseudomonas aeruginosa, and Acinetobacter baumanii	Systematic cleaning and disinfecting with intermediate or low-level solutions in areas and on surfaces with greater probability of contact with infected or colonized patient.
MRSA, VRE, Multi-drug resistant Enterobacteriaceae with ESBL (except for Escherichia coli), Klebsiella pneumoniae, Pseudomonas aeruginosa, and Acinetobacter baumanii	Initiate Contact precautions for patients colonized or infected by multi-drug resistant microorganisms. If available place patient in a single room.
MRSA, VRE, Enterobacteriaceae with ESBL	If patient is transferred to another ward or institution, notify the receiving department/institution of patient's infection/colonization status.
Multi-drug resistant MRSA, VRE, Enterobacteriaceae with ESBL, Klebsiella pneumoniae, Pseudomonas aeruginosa, and Acinetobacter baumanii	Educate and train HCWs on IPC measures that reduce the risk of transmitting the organism to others (e.g., HCWs, patients, visitors). Reinforce training, monitor practices and provide timely feedback to staff and supervisors
MRSA, VRE, Enterobacteriaceae with ESBL, Clostridium difficile	Develop guidelines on placement of patients readmitted to the facility with previous infection or colonization with a multi-drug resistant organism.

If implementation of the previous measures (Table 7) does not interrupt the transmission/increase of endemic infections or outbreaks, consider adding measures noted in Table 8.

Table 8 – Measures of containment of HAI against outbreaks of multi-drug resistant microorganisms

Microorganisms against which interventions have demonstrated effectiveness	Adopted or proposed measures
Multiresistant MRSA, VRE, Enterobacteriaceae with ESBL, Klebsiella pneumoniae, Pseudomonas aeruginosa, and Acinetobacter baumanii	Implement active culture monitoring to identify patients colonized or infected with a MDRO. Apply isolation precautions in patient risk groups, such as: intensive care units With prolonged antimicrobial treatment With immunosuppressive treatment Major burns With invasive procedures (e.g., dialysis, central venous lines, invasive mechanical ventilation) Other centers or units with outbreaks by multi- drug resistant microorganisms Share room with colonized or infected patients
MRSA, Enterobacteriaceae with ESBL	Perform cultures on health workers if there is a suspicion of implication of transmission of an infectious organism (e.g., to eradicate colonization and to exclude from direct patient care)
Enterobacteriaceae with ESBL, multiresistant Klebsiella pneumoniae	Install an alert system to inform HCWs of patients with a background of previous hospitalizations in units with colonized or infected patients. This may provide an early warning that isolation measures may be needed. Point Prevalence studies
MRSA, VRE, Enterobacteriaceae with ESBL, multiresistant Klebsiella pneumoniae	Isolation in cohort
Multiresistant VRE, Enterobacteriaceae with ESBL, Klebsiella pneumoniae, Pseudomonas aeruginos, and Acinetobacter baumanii	Isolation in individual room
MRSA, VRE	Daily patient bath in ICU with `chlorhexidine` in soap or cloths
MRSA	Eradication of nasal transport of MRSA in patients, with `mupirocin` or bathing the patient with `chlorhexidine` soap or impregnated cloths
Multiresistant Enterobacteriacea with ESBL, Klebsiella pneumoniae, Pseudomonas aeruginos, and Acinetobacter baumanii	Intensify permanent programs for supervision of cleaning and disinfection, including preparation of disinfectants and feedback of results to the HCWs

Conducting active surveillance by collecting/monitoring cultures to identify infected/ colonized patients should be consistent with the epidemiological context and existing recommendations based on expert opinions. If there are concerns for high numbers of infectious patients, consider collecting surveillance cultures on admission and weekly as a measurement of prevalence and HAI transmission. Active surveillance can be deferred to 15 days, monthly, twice monthly or semi-annually depending on whether the number of cases is diminishing.

Recommendations for sampling sites according to microorganism are:

1. MRSA: Culture in areas of the skin with injuries (wounds, cuts, punctures), or nasal and pharyngeal swab, groin and perirectal swab and peri- gastrostomies.
2. VRE: Culture perirectal area and stool
3. Multi-resistant Gram-negative bacilli: Swab perirectal area. Can be combined with culture of endotracheal aspirate, expectoration, nasal and pharyngeal, skin of axillary and inguinal region and wound discharge.

[3] Use of mupirocin for eradication of MRSA in all patients, without screening, has not had an impact on the reduction of HAI by this pathogen.

4.2 SPECIAL RECOMMENDATIONS FOR PAEDIATRICS

Healthcare facility paediatric services constitute an area particularly susceptible to infection transmission. Infants and preschool children who mainly enter these establishments can carry and transmit infectious microorganisms (e.g., respiratory and gastrointestinal viruses, often asymptomatic).

Susceptibility to acquire infections includes weakened or immature immune systems which are challenged by behaviors characteristic of the age such as: incontinence, hygiene practices (e.g., placing hands and objects into the mouth, salivation/drooling) and direct contact with other children.

Hospital environments and basic care provided by HCWs involves high instances of hand contact. The chance of infection transmission increases with the sharing of toys and playrooms, overcrowding (e.g., winter and rainy months) and shortage of HCWs.

Standard precautions, applicable for adult and child, should always be applied, independent of the diagnosis of the patient. Adaption of additional precautions, according to mode of transmission, may be necessary depending on certain situations and characteristics of younger children. Implementation of additional precautions should be based on the conditions and clinical symptoms of the child since the diagnostic confirmation may take longer than the transmission period.

4.2.1 TRANSMISSION BY CONTACT (CONTACT PRECAUTIONS)

Be certain that elements needed for hand hygiene are available, such as sink, tap water, soap, single-use disposable hand towels for drying hands and ABHR. These should be placed in an area large enough for comfort and safety during procedures.

Gloves, gown and apron should always be used when:

1. A low infecting dose microorganism infection is suspected, e.g., rotavirus.
2. High risk of contamination is anticipated, e.g., watery stools.
3. The child carries a respiratory disease with secretions or will need any procedure that generates aerosols, e.g., oropharyngeal aspiration or respiratory therapy.

When the child is not suspected of having any infection the use of gloves may not be compulsory, as in:

1. Routine changing of diapers if hand contact with urine and stool can be avoided
2. Feeding the child.
3. Cleaning a running nose

Perform hand hygiene before and after each intervention, if a sink, water, soap, and towels for drying hands are available in the room or close to the clinical patient care area. Alcohol-based hand rub (ABHR) solutions may also be used if hands are not soiled. ABHR can be placed beside the bed, cradle, or incubator. Persons with breaks in the skin of the hands, such as cuts or abrasions should use gloves.

HCWs, family/visitors should be instructed to avoid sharing of toys, objects or games between children.

Additional Precautions

PPE such as, gloves, gown, apron, mask, face shield, or goggles may be used **as needed when**:

1. One suspects infection with a microorganism with low infective dose e.g., rotavirus
2. HCW anticipates extensive contamination, such as watery diarrheal diseases
3. The child has respiratory infection with abundant secretions or who requires procedures that generate aerosol dispersion (e.g., oropharyngeal aspiration, respiratory therapy)

Additional precautions in **Pediatrics** need to be set immediately once an infectious disease is suspected. **Waiting for an accurate lab diagnosis and not implementing additional precautions, increases the risk for transmitting and spreading infection within the facility**. Once microbiological information is available initial measures will be adjusted. Initial clinical conditions to be approached immediately with contact precautions and the possible pathogens associated with them are described in Table 9.

Table 9 – Principal clinical conditions and aetiologies that require additional contact precautions

Clinical symptoms	Specific aetiology
Diarrhoea until an infectious cause has been ruled out	Diarrhoea (*Campylobacter, Clostridium difficile, pathogenic strains of Escherichia coli, Giardia, `Salmonella`, Shigella, Yersinia, rotavirus and other viruses*) Enteroviral infections Hepatitis A, E
Infected major burns	Infections caused by multi-drug resistant germs (MRSA, carbapenemase producing Enterobacteriaceae, Enterobacteriaceae with ESBL, vancomycin-resistant `Enterococcus`)
Drainage of infected wounds or copious abscess	
Extensive skin desquamation with known or suspected infection	Virus Herpes simplex (neonatal or mucocutaneous dissemination)
Vesicular rash compatible with chickenpox	Chickenpox
Cutaneous rash without or without fever (e.g., compatible with Scabiosis (scabies)	Pediculosis / Scabies
All the respiratory infections which are confirmed or with suspicion up to aetiology confirmation (bronchiolitis, colds, pharyngitis, croup, pneumonia)	Adenovirus, influenza, parainfluenza virus, rhinovirus, SRV

4.2.2 DROPLET TRANSMISSION

Droplet transmission is an important mode of transmission in paediatrics. The same precautionary droplet measures should be applied as described previously (see droplet transmission).

Initial clinical conditions and specific infectious aetiologies detected that require precautions by droplets are outlined in Table 9 below.

Table 9 – Principal clinical conditions and aetiologies that require additional droplets precautions

Clinical suspicion table	Specific aetiology
Every possible or confirmed infection of the respiratory tract until is ruled out or confirmed viral aetiology (bronchiolitis, common cold, laryngitis, pneumonia)	
Pharyngitis or asthma with fever	
Whooping cough	Bordetella pertussis (until 5 days after antibiotic therapy started)
Cellulitis or periorbital cellulitis in children under 5 without portal of entry	Invasive infections by Haemophilus influenzae type b (until 24 hours after antimicrobial therapy was started)
Septic arthritis in child under 5 without portal of entry	Pharyngitis by Streptococcus group A, pneumonia, scarlet fever (until 24 hours after antimicrobial therapy was started)
Epiglottitis	
Meningitis	Invasive infections by Neisseria meningitidis (until 24 hours after antimicrobial therapy was started)
Rash with fever, runny nose and headache	Parvovirus B19 (infection in chronic patient with immunodeficiency or with transitory aplastic crisis)
Pharyngeal diphtheria	Corynebacterium diphtheriae
Mumps	
Rubella	

4.2.3 AIRBORNE TRANSMISSION

Measures to implement and pathogens involved do not differ from the general and specific measures previously established. Initial clinical conditions and specific infectious aetiologies detected that require airborne precautions are outlined in Table 10.

Table 10 – Principal clinical conditions and aetiologies that require additional precautions by droplets

Clinical suspicion table	Specific aetiology
Vesicular rash until chickenpox is ruled out Or Herpes Zoster, disseminated or with extensive injury that does not make it possible to be covered with dressings	Chickenpox
Maculopapular rash with running nose and fever until measles is ruled out	Measles
Suspected pulmonary tuberculosis	Mycobacterium spp., predominantly M. tuberculosis

4.3 INFECTION PREVENTION AND CONTROL IN HEMODIALYSIS

The increased risk for contracting health-care-associated infections (HAIs) among HEMODIALYSIS (HD)patients are mainly due to (a) immune compromised status, (b) frequent and prolonged blood exposure during HD treatments through the vascular access and extra-corporeal circuit (with many ports and connections), (c) close proximity to other patients during treatment in the HD facility, (d) frequent contact with health-care workers, who frequently move between patients and between machines, (e) frequent hospitalization and surgery, and most importantly, (f) non-adherence or a break in implementation of recommended practices. Therefore, stricter measures are specifically recommended in this setting in addition to standard precautions, which include but are not restricted to, the following:

4.3.1 HAND HYGIENE

Based on hand hygiene indications as per recommendations from the Association for Professionals in Infection Control and Epidemiology (APIC), Center for Disease Control and Prevention (CDC) and World Health Organization (WHO), we estimated the number of times a single dialysis staff is required to perform hand hygiene per HD session per patient. The estimated number is a minimum of 60-100-times when multiplied by the number of patients assigned per staff (e.g., two to three patients). The large number of times an HD staff is required to perform hand hygiene could be a reason for lack of compliance.

1. However, compliance can be improved by continuous education and supervision, and by providing, in convenient locations, a sufficient number of sinks with soap dispensers, paper towels, hand lotions (e.g., one for every two to four dialysis stations) and alcohol-based hand rubs (ABHRs) placed at each patient station.
2. Because of the proven superior efficacy in decontamination, better skin tolerability and ease of use, ABHR is recommended to be used in all clinical situations if hands are not visibly soiled.
3. If exposure to bacterial spores (i.e., Bacillus anthracis and/or Clostridium difficile) is suspected or proven, hand washing with soap and water is recommended because spores are resistant to most antiseptic agents and require physical removal by washing and rinsing.
4. Other preventive measures include restriction of having long nails and wearing of artificial fingernails or extenders by health-care personnel who provide direct patient care, as artificial nails could harbor Gram negative bacilli and yeasts.
5. Monitoring hand hygiene compliance is crucial, and direct observation is the current gold standard method.

4.3.2 PERSONAL PROTECTIVE EQUIPMENT

In the Haemo Dialysis setting, gloves are recommended to be worn whenever caring for a dialysis patient, whether touching patient's intact skin (e.g., taking blood pressure) or patient's equipment at the dialysis station. Gloves should be removed and followed by hand hygiene between patients or stations. when visible soiling is present and/or contact precautions are indicated, wearing gloves is a must. Sterile gloves must be used during procedures requiring a sterile aseptic technique, such as during catheter insertion or at any time a dialysis catheter is handled/manipulated.

Wearing gowns (fluid-resistant with full coverage of the arms and body front and preferably disposable ones) over the uniform and use of a face mask and eye goggles or face shield is recommended when performing procedures wherein splashes of blood can be anticipated, especially during initiation and discontinuation of dialysis. If a face shield is used during catheter handling, a surgical mask should be worn underneath to protect the patient from the HCW's respiratory droplets.

Equally important is the fact that the patient should also wear a mask and be asked to turn his/her face away from the catheter site to reduce contamination from infectious droplets. Furthermore, wearing a mask is important when a staff member, a patient or a visitor is experiencing cold or cough.

A **respirator** should be used by HCWs only when taking care of a patient with an **airborne infection.**

HCWs uniforms can be colonized with potentially pathogenic bacteria in up to 60% of the situations, and, therefore, should be washed and changed daily in order to decrease the bacterial load.

4.3.3 CLEANING AND DISINFECTION OF ENVIRONMENTAL SURFACES

The environment in Hemodialysis (HD) units is particularly prone for contamination with blood-borne pathogens such as HBV, HCV and HIV, and other infectious agents such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant Enterococci (VRE) and *Clostridium difficile*. Microorganisms can survive on environmental surfaces for varying periods of time, ranging from few hours to days and months.

1. Cleaning and disinfection of the external surfaces of equipment (i.e., HD machine, dialysis chair or bed, procedure trolley) and other environmental surfaces inside the HD units, especially those that are frequently touched by patients and staff, should be performed between all patient treatments (irrespective of the patient diagnosis).

2. The application of *friction* during cleaning is emphasized as some organisms like *C. difficile* are not easily inactivated by most surface disinfectants (except bleach) and require removal by friction.

Cleaning and disinfection of external surfaces of HD machines

1. It is recommended to clean and disinfect the external surfaces of the HD machine after each dialysis session. A low-level disinfectant or any EPA-registered disinfectant (United States of America) solution labeled for use in a health-care setting is recommended to be used on non-critical items (including HD machines) and should also be in accordance with the machine manufacturer's recommendations.
2. If visible blood spills or other infectious material is present on the external surface of an HD machine, it should be cleaned separately (not to spread) before applying the disinfectant solution. In such cases, it is recommended to use an intermediate-level disinfectant or tuberculocidal agent (with specific label claims for HBV and HIV) or a 1:100 dilution of a hypochlorite solution (500-600 ppm free chlorine).
3. If using disinfectant wipes, one wipe should be used to exclusively clean the blood stain followed by another wipe(s) for disinfection. All external surfaces of the machine, especially the frequently touched front panel, including the intravenous pole, the side, back and base, should be thoroughly cleaned and disinfected using friction and be allowed to air dry.
4. All used towels or wipes and gloves that are contaminated with blood should be discarded in a biohazard waste container, and hand hygiene performed after glove removal.

4.3.4 DISINFECTION OF THE INTERNAL FLUID PATHWAY OF HEMODIALYSIS MACHINES

1. Routine disinfection and rinsing are recommended at the beginning or end of the day (or as recommended by the machine's manufacturer).
2. Chemical disinfection prior to patient use is recommended for standby machines, which could be inactive for variable periods of time and potentially develop bacterial growth.
3. The chemical disinfection protocol should be according to the machine manufacturer's recommendation, including the concentration and dwell time

4.3.5 HANDLING OF DISPOSABLE SUPPLIES AND REUSABLE ITEMS IN HD UNITS

1. Items taken into an individual patient's HD station should be used only for that patient and be disposed of after use.
2. Unused item(s) should be cleaned and disinfected before returning to a common clean area or used on another patient or be disposed of if it cannot be disinfected.
3. Non-disposable items that cannot be comprehensively cleaned and disinfected (e.g., adhesive tape, cloth-covered blood pressure cuffs) should be dedicated for use on a single patient.

4.3.6 WATER TREATMENT: PURITY AND TESTING

1. A sterile, single-use filter must be used for the final filtration step, which is according to the definition in pharmacopoeias.
2. Frequent heat disinfection of the distribution loop is the preferable method to prevent formation of biofilm.
3. Testing of product water of in-center reverse osmosis (RO) for bacteria and endotoxin assay are required at least monthly, and on a quarterly basis for portable RO.

4.3.7 SCREENING/ROUTINE SEROLOGIC TESTING AND PATIENT PLACEMENT

Table 11 – Recommendations on hepatitis B virus, hepatitis C virus and Human Immunodeficiency Virus (HIV) screening/testing and patient placement:

CDC 2001[31]	EBPG 2002/ERBP 2009[34,72]	KDIGO 2008[71]	APIC 2010[22]
Hepatitis B virus (HBV)			
Screening/testing • All patients on admission: HBsAg, Anti-HBc (total), anti-HBs • HBV-susceptible, including non-responders to vaccine: Monthly HBsAg • Anti-HBs positive (10mlU/ ml), anti-HBc negative: Annual anti-HBs • Anti-HBs and anti-HBc positive: No additional testing needed	**Screening/testing** • "Screening for HBV markers should be performed in all patients starting HD or transferring from another unit whether they received anti-HBV vaccination or not" • "Screening should be repeated every 3-6 months once on HD depending on the prevalence of HBV infection" • Serological tests for HBV markers include: HBsAg, HBeAg, anti-HBe, anti-HBc and anti-HBs	**Screening/testing** Not addressed	**Screening/testing** Not addressed
Patient placement Recommended isolation of HBsAg-positive patients with dedicated room, machine, other equipment, supplies and staff members	**Patient placement** "Dialyzed HBsAg-positive patients should be treated in separate rooms with dedicated machines"	**Patient placement** Not addressed	**Patient placement** "Patients are placed in a private room or segregated area. Dedicated dialysis machine is used for HBV positive patients"
Hepatitis c virus (HCV)			
Screening/testing • All patients on admission: Anti-HCV, ALT • Anti-HCV-negative patients: Monthly ALT Semi-annual anti-HCV	**Screening/testing** • "Screening for HCV antibodies should be performed in all patients starting HD or transferring from another unit" • "Screening should be replaced at least every 6 months once on HD" • "HCV screening should include an ELISA assay and a confirmatory testing eith a more specific assay (RIBA)" "Detection of HCV RNA by PCR assay is acknowledged by the ERBP Work Group to be the best strategy because of false negative results in patients tested by EIA 72	**Screening/testing** • "Patients on HD should be tested when they first start HD or when they transfer from another HD facility • "In HD units with a low prevalence of HCV, initial testing with EIA (if positive, followed by NAT) should be considered" • "In HD units with a high prevalence of HCV, initial testing with NAT should be considered" • "For patients on HD who test negative for HCV, retesting every 6-12 months with EIA shuld be considered" • "Testing for HCV with NAT should be performed for HD patients with unexplained abnormal aminotrans-ferase(s) levels"	**Screening/testing** "The CDC and KDOOI recommend screening HD patients for anti-HCV at 6-month intervals..."
Patient placement "Patients who are anti-HCV positive (or HCV RNA positive) do not have to be isolated from other patients or dialyzed separately on dedicated machines"	**Patient placement** "In addition to universal precautions, which are the most efficacious preventative measures, treatment of anti-HCV patients in spearate sreas with dedicated staff is recommended in units with a high prevalence of HCV infection"	**Patient placement** • "The isolation of HCV-infected patients is not recommended as an alternative to strict infection-control procedures for preventing transmission of blood-bone pathogens" • "The use of dedicated dialysis machines for HCV-infected patients is not recommended"	**Patient placement** "Patients who are anti-HCV positive (or HCV RNA positive) do not have to be isolated from other patients or dialyzed separately on dedicated machines.
Human immunodeficiency virus (HIV)			
Screening/testing • Routine testing for infection control purposes not recommended • Patients with risk factors should be tested so that if infected, can receive medical care and counseling	**Screening/testing** "Screening for HIV infection should be done in all patients starting HD or transferring from another unit after getting informed consent. Once on routine HD, screening is not recommended"	**Screening/testing** Not addressed	**Screening/testing** Not addressed
Patient placement "HIV-infected patients do not have to be isolated from other patients or dialyzed separately on dedicated machines"	**Patient placement** "Isolation of patients with AIDS and asymptomatic carriers of HIV and the use of separate machines are not recommended"	**Patient placement** Not addressed	**Patient placement** "HIV-infected patients do not have to be isolated from other patients or dialyzed separately on dedicated machines"

CDC: Centers for Disease Control and Prevention, EBPG/ERBP: European Best Practice Guidelines/European Renal Best Practice, KDIGO: Kidney Disease: Improving Global Outcomes, APIC: Association for PRofessionals in Infection Control and Epidemiology.

Surveillance for infections (outcome measures) and monitoring adherence to recommended infection prevention practices (process measures) are important components of an infection prevention program.

A standardized and validated surveillance protocol be used uniformly by all dialysis facilities. A centralized surveillance system for health-care-associated infections which requires all participating facilities to strictly follow every specific surveillance criterion, can provide accurate and reliable data that can be used to identify problem areas as well as measure progress of prevention efforts.

4.4 INFECTION PREVENTION IN POST-MORTEM CARE

The conduct of autopsies can pose a risk to exposure to communicable diseases to the pathologist and assistants. The application of Standard Precautions is necessary to minimize the exposure to bloodborne pathogens. The application of additional precautions may be warranted depending on the medical history that is available at the time of the autopsy. Patients who present with no known medical history may present a greater risk. The following infection prevention interventions have been suggested.

Interventions:

1. Perform all procedures with minimal distractions, adequate assistance, and alert staff.
2. Operate as though the entire autopsy suite and its contents is a biohazardous area.
3. Precautions include standard use of personal protective equipment, engineering devices to minimize exposure, and work practices that delineate which tasks or conditions of employment require protective equipment and engineering devices, where the employee may safely consume food and beverages, and how the employee would clean up a blood spill and report an exposure. These precautions are regulated by the U.S. Occupational Safety and Health Administration (OSHA), this can be used as guidance. The Occupational Safety and Health Act. Act 1 of 2004 Amended by 3 of 2006 should be used in Trinidad and Tobago for Occupational considerations.
4. All persons performing or assisting in post-mortem procedures should wear double layers of disposable gloves, protective eyewear and face wear, respiratory protection, fluid-resistant gowns or jumpsuits, waterproof aprons, and protective shoe covers and caps. Evidence suggests that metal and mesh gloves worn underneath surgical gloves may prevent against injury from scalpels and sharp objects other than needles.
5. Performance of an autopsy on a known or suspected case of TB is considered to be a high-hazard procedure requiring personnel to use approved respiratory protection. In areas where TB is prevalent and the health history is unknown, respirators should be worn, especially for medical examiner's cases.
6. Instruments and surfaces contaminated during post-mortem procedures should be reprocessed according to standard procedures to remove all vegetative organisms. Enzymatic cleaners, intermediate-level disinfectants, and instrument washer-sterilizers may all be included in the processing. Autopsy tables must be flushed of gross material with water followed by disinfectant and detergent scrub of all surfaces and rinsing.
7. Safer engineering designs are available for cutting and aspirating, for ventilation of procedure rooms, and for autopsy equipment, including protective guards, vacuum attachments fitted to bone saws to prevent dispersion of bone dust, and drains or disposal units to facilitate evacuation and disposal of solid wastes produced during autopsy (e.g., drain or disposal unit).
8. Autopsy rooms should be at negative pressure with respect to adjacent areas, with room air exhausted directly outside. The American Society of Healthcare Engineers recommends 12 air changes per hour.
9. In-duct, high-efficiency particulate air (HEPA) filters used prior to recirculation or ultraviolet germicidal irradiation may supplement recommended ventilation.
10. Sharps hazards are minimized for prosectors (those performing post-mortem tissue dissection) by the following: using gloves made with "cut resistant fabric" under the outer glove, limiting scalpel use by blunt dissection with blunt-tipped scissors, having careful tabletop instrument control, minimizing the presence of sharp instruments on the autopsy field to one scalpel, taping or covering with towels cut bone and jagged rib edges, limiting blind evisceration, sawing skull with head and saw enclosed in plastic bag or box taped at the portals to avoid aerosolization of dust, announcing in advance any repositioning of sharp devices, and avoiding hand holding of bottles when injecting body fluids or passing of devices during the procedure.

11. Work practice controls include treating all specimens as infectious, retaining all tissues on the autopsy table until fixed unless transported on a tray or in a container, cutting frozen sections only on fixed tissue, and appointing a designated employee/circulator who will facilitate adherence to infection prevention precautions by preparing the room, assisting with photography, handling communications, or having personnel gather all the necessary supplies before the procedure begins.
12. At the completion of the autopsy, incisions are sutured with needle and forceps, the body is washed with detergent followed by 1:10 solution of 5.25 percent sodium hypochlorite and is enclosed in a leak-proof body bag.
13. Special tissue precautions: Creutzfeldt-Jakob Disease (CJD) tissue fixatives should be prepared by soaking small blocks of tissue in 95 to 100 percent formic acid for 1 hour, followed by soaking in fresh 4 percent formaldehyde for at least 48 hours. When M. tuberculosis is known or suspected, tissue fixatives should be prepared with 10 percent formalin in 50 percent ethyl alcohol (one-part 3.7 percent formaldehyde plus nine parts 10 percent ethanol in saline).
14. Instruments used on suspected CJD patients should be steam autoclaved for 1 hour at 132^{o}C (270^{o}F) or immersed in 1 N sodium hydroxide for 1 hour at room temperature.
15. Surveillance of autopsy reports may suggest information on previously undiagnosed infections, though some investigators question the utility of reviewing necropsy reports. One report reviewed 15 months of reports, or 155 cases, finding an 8 percent discrepancy between clinical observation and autopsy findings, with none of these having an infection prevention impact on patients or employees. Screening of these cases by the pathology department (e.g., only reports indicating TB or communicable disease) may increase the efficiency of this process.

4.5 TUBERCULOSIS

Transmission of Tuberculosis (TB) is through airborne route. Persons with untreated smear positive TB are an overwhelming source of infection. The infection decreases with the initiation of treatment.

Any patient suspected of TB must be given an appointment for the Chest Clinic, where a Tuberculin (Mantoux) test will be done. If the result is positive >10mm, a chest X-ray will be performed. Sputum sample for Acid Fast Bacilli (AFB) for three (3) consecutive sputum specimens are required. Disposable sputum cups with lids should be used for specimen collection.

Respiratory Hygiene/Cough Etiquette Precautions must be observed in the clinic. Signs illustrating precautions for coughing or sneezing must be prominently displayed.

Patients who are coughing persistently and are in the outpatient clinic or in casualty should cover mouth. They should be reminded about precautions and be encouraged to use tissues when coughing. TB suspects should be examined in a well-ventilated area.

Only well-fitted N-95 offers protection against TB infection. These are usually expensive and should only be worn in high-risk situations such as performing or assisting with:

- Caring or examination of active TB patient
- Endotracheal incubation
- Open abscess irrigation
- Bronchoscopes
- Suctioning
- Autopsy

NOTIFICATION OF TB

- Every diagnosed TB patient should be notified.
- It is a public health requirement under national Public Health Ordinance, that every form of TB diagnosed case should be notified to the Trinidad Public Health Laboratory using the relevant TB notification form(s).
- Action to be taken after Notification
- Contact tracing for screening.
- Monitor and prevent spread of disease
- Use appropriate forms for TB contact tracing.

STAFF HEALTH

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

Before entering the health service, all doctors, nurses, ward staff, radiographers, and laboratory staff should be screened using a chest X-ray in addition to a clinical history. Sputum specimens should be taken if necessary.

Every health care worker should report a persistent cough. Sputum specimens must then be examined. This is the only effective way of detecting TB early. Tuberculin test of >10mm, clear chest X-ray; prophylactic treatment is offered for three (3) months. Rotate staff out of Medical Wards according to schedules as stipulated by national authorities.

References

- Aronson, M. D., and D. H. Bor.. Blood cultures. Ann. Intern. Med. 1987;106:246–253.
  Arpi M, Bentzon MW, Jensen J, Frederiksen W. Importance of blood volume cultured in the detection of bacteriemia. Fur. J. Clin. Microbiol. Infect. Dis. 1989; 8:838-842.

- Broaddus C, Dake MD, Stulburg MS, et al. Bronchoalveolar lavage and thransbronchial biopsy for the diagnosis of pulmonary infections in the acquired immunodeficiency syndrome. Am Intern Med. 1986; 102:742-752.

- **CDC Guideline for isolation precautions in hospitals**. Available at http://www.cdc.gov/ncidod/dhqp/gl_isolation.html (accessed July 23 2006).

- **CDC Severe acute respiratory syndrome (SARS)**. Available at http://www.cdc.gov/ncidod/SARS/guidance/c/app2.htm (accessed July 23 2006).

- CDC. **Interim recommendations for infection control in health care facilities caring for patients with known or suspected Avian Influenza.** Available at http://www.cdc.gov/flu/avian/professional/infect-control.htm (accessed July 20 2006).

- Chastre J, Fagon J Y, Bornet-Lesco M et al. Evaluation of bronchoscopic techniques for the diagnosis of nosocomial pneumonia. Am J Respir Crit Care Med 1995; 152: 231-240.

- Chastre J, Viau F, Brun P, et al. Prospective evaluation of the protected specimen brush for the diagnosis of pulmonary infections in ventilated patients. Am Rev Respir Dis 1984; 130:924–929.

- Clarridge JE, Pezzlo MT, Vosti KL. Laboratory diagnosis of urinary tract infections. In Weissfeld AS, coordinating editor. 1987 Cumitech 2A. American Society for Microbiology, Washington,D.C.

- Corley D E, Kirtland S H, Winterbauer R H et al. Reproducibility of the histologic diagnosis of pneumonia among a panel of four pathologists. Chest 1997; 112: 458-465.

- Dunne, J., F. Nolte, and M. Wilson.. Blood cultures III. In J. Hindler (ed.), Cumitech 1B. 1997. American Society for Microbiology, Washington, DC.

- El-Ebiary M, Torres A, González J et al. Quantitative cultures of endotracheal aspirates for the diagnosis of ventilator-associated pneumonia. Am Rev Respir Dis 1993; 148: 1552-1557.

- Fernando Otaíza, Carmem Pessoa-Silva Ed. Core components for infection prevention and control programmes Infection Prevention and Control in Healthcare Informal Network Report of the Second Meeting, 26–27 June 2008, Geneva, Switzerland. World Health Organization 2009.

- Gibb AP Hill B, Chorel B et al. Reduction in blood culture contamination rate by feedback to phlebotomists. Arch. Pathol. Lab. Med .1997; 121:503-507.

- Gross PA, Harkavy LM, Barden GE, et al. The fallacy of cultures of the tips of Foley catheters. Surg Gynecol Obstet. 1974;139:597
- Grupo Panamericano de Evaluación de la Infección Hospitalaria. Evaluación de la infección hospitalaria en siete países latinoamericanos. Rev Panam Infectol 2008;10 (4 Supl 1):S112-122.
- Guía de evaluación rápida de programas de infecciones intrahospitalarias. Washington, D.C. Julio de 2005. Área de prevención y control de enfermedades unidad de enfermedades transmisibles. Organización Panamericana de la Salud.
- Hall, M. M., D. M. Ilstrup, and J. A. Washington II. Effect of volume of blood cultured on detection of bacteremia. J. Clin. Microbiol.1976; 3:643–645.
- Horan, Andrus, and Dudeck. CDC/NHSN Surveillance Definition of Healthcare-Associated Infection and Criteria for Specific Types of Infections in the Acute Care Setting. Am J Infect Control 2008,36:309-32.
- ICT. **Hand hygiene. Best practices for 2006**. Available at http://www.infectioncontroltoday.com/articles/400/400_621cover.html (accessed July 23 2006).
- Ilstrup, D. M., and J. A. Washington II. The importance of volume of blood cultured in the detection of bacteremia and fungemia. Diagn. Microbiol. Infect. Dis. 1983;1:107–110.
- Improving Food Safety Through a One Health Approach: Workshop Summary.
- Institute of Medicine (US).Washington (DC): National Academies Press (US); 2012.
- Joint ILO/WHO guidelines on health services and HIV/AIDS: Fact Sheet No. 10. Summary outline for the management of occupational exposure to blood-borne pathogen.
- Joint WHO/ILO guidelines on post-exposure prophylaxis (PEP) to prevent HIV infection, 2007
- Jourdain B, Joly-Guillou ML, Dombret MC, et al. Usefulness of quantitative cultures of BAL fluid for diagnosing nosocomial pneumonia in ventilated patients. Chest. 1997;111:411-418
- Jourdain B, Novara A, Joly-Guillou M L, Dombret M C, Calvat S, Trouillet J L et al. Role of quantitative cultures of endotracheal aspirates in the diagnosis of nosocomial pneumonia. Am J Respir Crit Care Med 1995; 152: 241-246.
- Kanamori H, Weber DJ and Rutala WA. Healthcare Outbreaks Associated with a Water Reservoir and Infection Prevention Strategies. Clin Infect Dis. Vol. 62, No. 11. Pp. 1423-1435. June 2016.
- Kunin CM. Detection, Prevention and management of urinary tract infections. 1987. 4th ed. Lea and Febiger.. Philadelphia.
- Li, J., J. J. Plorde, and L. G. Carlson. Effects of volume and periodicity on blood cultures. J. Clin. Microbiol. 1994; 32:2829–2831.

- Lipsky BA, Ireton RC, Fihn SD et al. Diagnosis of bacteriuria in men: specimen collection and culture interpretation. 1987 J. Infect Dis 155:847

- Madeo M, Barlow G. Reducing blood-culture contamination rates using a 2% chlorhexidine solution applicator in acute admission units. J Hosp Infect 2008; 69:307–309.

- Manual de orientações e critérios diagnósticos sistema de vigilância epidemiológica das infecções hospitalares do estado de São Paulo. Março 2009. Secretaria de estado da saúde de São Paulo. Coordenadoria de Controle de Doenças – CCD. Centro de vigilância epidemiológica "prof. Alexandre Vranjac". Divisão de Infecção Hospitalar.

- Marquette C H, Copin M C, Wallet F et al. Diagnostic test for pneumonia in ventilated patients: Prospective evaluation of diagnostic accuracy using histology as a diagnostic gold standard. Am J Respir Crit Care Med 1995; 151: 1878-1888.

- Marquette C H, Georges H, Wallet F et al. Diagnostic efficiency of endotracheal aspirates with quantitative bacterial cultures in intubated patients with suspected pneumonia. Comparison with the protected specimen brush. Am Rev Respir 1993; 148: 138-144.

- Mass.Gov. **General Infection control measures.**
  Available at http://www.mass.gov/dph/cdc/epii/sars/infosheets/infection_control.htm (accessed July 18 2006).

- Mensa, J., M. Almela, C. Casals, J. A. Martínez, F. Marco, R. Tomás, F. Vidal, E. Soriano, and T. Jiménez de Anta. Yield of blood cultures in relation to the cultured blood volume in Bactec 6A bottles. Med. Clin. (Barcelona) 1997; 108:521–523.

- Mermel LA, Maki DG. Detection of bacteremia in adults: consequences of culturing an inadequate volume of blood. Ann. Intern. Med. 1993;119:270-272.

- Nagassar RP, Bridgelal-Nagassar RJ, Daniel K, Harper L. The impact of interventions to improve compliance in hand hygiene – a prospective study from Sangre Grande Hospital. Caribbean Medical Journal. 2019.
  Available from: http://www.caribbeanmedicaljournal.org/2018/10/05/the-impact-of-interventions-to-improve-compliance-in-hand-hygiene/. Accessed April 24, 2020.

- Plorde, J. J., F. C. Tenover, and L. G. Carlson. Specimen volume versus yield in the BACTEC blood culture system. J. Clin. Microbiol. 1985;22:292–295.

- Preparación de los establecimientos de salud ante caso inusitado o imprevisto o conglomerado de infección respiratoria aguda grave – IRAG. Versión ABRIL/2009. Organización Panamericana de la Salud.

- Raad I, Costerton W, et al. Ultraestructural analysis of indwelling vascular catheters: a quantitative relationship between luminal colonization and duration of placement. J Infec Dis 1993; 168:400- 407.

- Reid Una V./WHO/AFRO/PEPFAR/JSI (2005). Do No Harm.
  Injection safety in the context of infection prevention and control. JSI: Washington, DC.

- Reimer LG, Carroll KC: Role of the microbiology laboratory in the diagnosis of lower respiratory tract infections. Clin Infect Dis 1998; 26:742–748.

- Rouby J J, Rossignon M D, Nicolás M H et al. A prospective study of protected broncho-alveolar lavage in the diagnosis of nosocomial pneumonia. Anesthesiology 1989; 71: 679-685.

- Rumbak MJ, Bass RL. Tracheal aspirate correlates with protected specimen brush in long term ventilated patients who have clinical pneumonia. Chest 1994: 106(2) 531-534

- Spitalnic SJ, Woolard RH, Mermel LA. The significance of changing needles when inoculating blood culture: a meta-analysis. Clin. Infect. Dis. 1995; 21:1103-1106.

- Torres A, El-Ebiary M. Diagnostic approaches and hospital-acquired pneumonia. Sem Respir Crit Care Med 1997; 18: 149-161.

- Torres A, El-Ebiary M. Diagnostic approaches and hospital-acquired pneumonia. Sem Respir Crit Care Med 1997; 18: 149-161.

- Weinstein MP. Evaluation of liquid and lyophilized preservatives for urine culture. J. Clin Microbiol 1983;18: 912.

- Weinstein MP; Joho KL; Quartey SM. Assessment of the third blood culture bottle: Does it increase detection of bacteremia? 94thGeneral Meeting of the American Society for Microbiolgy. Las Vegas Mayo 23-28, 1994.

- Weinstein MP; Reller LB; Murphy JR Lichtenstein KA. The clinical significance of positive blood culture: A comprehensive analysis of 500 episodes of bacteremia and fungemia in adults. Rev. Infect. Dis. 1983;5:35-53.

- WHO (2006). Management of waste from injection activities at district level. Guidelines for district health managers. WHO: Geneva.

- WHO. A global brief on vector-borne diseases. Accessed online from Error! Hyperlink reference not valid.

- WHO. A global brief on vector-borne diseases. https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases. (Accessed online May 1, 2020).

- WHO. Global vector control response (GVCR) 2017–2030" was approved by the World Health Assembly in 2017. https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases (Accessed online May 1, 2020)

- WHO. Infection control for Avian influenza in health care facilities.
  Available at http://www.who.int/csr/disease/avian_influenza/guidelines/EPR_AM_final1.pdf (accessed July 20 2006).

- Wild Iris Medical Education. Nursing Continuing Education. Personal protective equipment (PPE). Available at http://www.nursingceu.com/courses/116/index_nceu.html (accessed July 23 2006).

- Wilmberly NW, Bass JB, Boyd BW, et al. Use of bronchoscopic protected catheter brush for the diagnosis of pulmonary infections. Chest. 1982;81:556-582

- Wimberly N. Faling LJ, Bartlett JG. A fiberoptic bronchoscopy technique to obtain uncontaminated lower airway secretions for bacterial culture. Am Rev Respir Dis.1979;119:337- 342.

Ministry of Health Trinidad and Tobago

63 Park Street, Port of Spain
(868) 627-0012/ 627-1047
www.health.gov.tt

Facebook
Ministry of Health Trinidad and Tobago
(https://www.facebook.com/MinistryofHealthTT)

YouTube Channel
TrinidadHealth
(https://www.youtube.com/channel/UCqXrUlsLAsXJbPszQoNikeA)

Instagram
minhealthtt
(https://www.instagram.com/minhealthtt/)

Twitter
@moh_tt
(https://twitter.com/moh_tt)