

Infection Prevention and Control 101: Understanding Standard and Transmission-Based Isolation Precautions During COVID-19

Background

Personal protective equipment (PPE) and room pressurization recommendations to safely care for patients are developed based on transmission dynamics for each infectious disease pathogen. It is helpful to start with clear definitions as follows:

Definitions

Fomites: inanimate (non-living) objects that may serve as sources for pathogen transmission.

Standard Precautions: basic infection control practices that must be used for all patient care. They're based on a risk assessment and make use of common-sense practices and PPE use that protect healthcare providers from infection and prevent the spread of infection from patient to patient. Key elements of standard precautions include the following (**bolded sections directly apply to COVID-19**):

- **Hand Hygiene**
- **Use of appropriate PPE** whenever there is an expectation of possible exposure to infectious material (gloves, gowns, eye protection, etc. depending on patient interaction). Examples include:
 - Wearing gloves to draw blood
 - Using a gown and gloves while cleaning a patient after having a bowel movement in their bed.
 - Using eye protection during a procedure where there is a potential for blood or body fluid exposure to the eyes.
 - Placing a mask on a patient with infectious respiratory symptoms to provide source control while in an outpatient clinic or when exiting an inpatient room.
- **Respiratory hygiene/cough etiquette principles**
- **Appropriate patient placement** (i.e. single patient room for patients with open wounds)
- **Cleaning and disinfection**
 - **patient-care equipment and instruments/devices after every use**
 - **environmental cleaning**
 - **clean workspaces at the beginning of each shift**
- **Safe handling of textiles and laundry**
- Safe injection practices. Wear a surgical mask when performing a lumbar puncture.
- Safe handling of needles and other sharps (avoid recapping needles, don't overfill sharps containers, etc.)

Transmission-Based Precautions: these precautions offer a second tier to basic infection control and are to be used in addition to Standard Precautions for patients who may be infected or colonized with certain infectious agents for which additional precautions are needed to prevent infection transmission. These include the following groups:

- Droplet precautions (face mask)
- Contact precautions (gown and gloves)
- Contact enteric precautions (gown, gloves, soap and water for hand hygiene, bleach for environmental cleaning)
- Airborne precautions (N95 respirator or PAPR, negative room pressure or HEPA filter)
- Special airborne contact precautions (N95 respirator or PAPR, gown, gloves, face shield, negative room pressure or HEPA filter)
- Combinations of the above including: droplet/contact, airborne/contact, droplet/contact special enteric

The DUHS Acute Care (Hospital) Standard and Transmission-Based Precautions are pathogen specific and the DUHS policy can be found [here](#).

The DUHS Ambulatory Care (Outpatient) Standard and Transmission-Based Precautions are pathogen specific and the DUHS policy can be found [here](#).

Modes of Transmission:

- Direct transmission: Transfer of an infectious agent via direct contact with an infected individual or contaminated environment.
 - Endogenous: transmission occurs via direct spread from invasive devices (e.g. skin flora along central venous catheters or IVs, GI flora along urinary catheters, etc.) or surgical wounds.
 - Direct contact: transmission occurs via skin-to skin contact (touching) or contact with a contaminated environment harboring infectious organisms.
 - Droplet spread: transmission occurs via direct spray with relatively large (>5 μ m), short-range (3-6 feet) droplets produced by sneezing, coughing, or talking.
- Indirect transmission: Transfer of an infectious agent from a reservoir to a host by suspended air particles, inanimate objects (vehicles), or animate intermediaries (vectors).
 - Airborne: Small droplet nuclei (<5 μ m) can remain suspended in the air for periods of time (which are dependent on the number of air exchanges in a room, presence of negative pressure or a HEPA filter). Individuals who are not wearing adequate PPE (i.e. N95 or PAPR) can inhale infectious aerosol droplets.
 - Vehicle borne: Food, water, and fomites may passively carry a pathogen or serve as an environmental reservoir for transmission events.
 - Vector borne: mosquitoes, fleas, and ticks can mechanically carry a pathogen (e.g., flies – Shigella; fleas – Yersinia) or serve as an intermediate host that then infects humans.

Understanding the “why” behind COVID-19 precautions:

To understand the “why” behind PPE recommended for caring for COVID-suspected or confirmed patients, it is helpful to understand how COVID-19 can be transmitted using the above definitions and principles.

Modes of Transmission for COVID-19:

- **Direct:**
 - Direct spray of infectious respiratory droplets (created when a patient talks, coughs, or sneezes) and droplet aerosols (created by invasive airway manipulation) into the eyes, noses, or mouths of healthcare providers.
 - Inhalation of infectious aerosol droplets while not wearing an N95 or PAPR.
- **Indirect:**
 - Transfer of COVID from contaminated environmental surfaces (fomites) to healthcare worker hands followed by auto-inoculation of eyes, nose, or mouth.

Transmission-based [PPE recommended for COVID-19:](#)

- **Universal Face masks:**
 - Face masks mainly serve to provide what is called “source control” for the mask wearer by providing a physical barrier to prevent the source, or mask wearer, from spreading potentially infectious droplets from their nose or mouth to others who are in close range (<6 feet) when physical distancing is not possible.
 - Face masks also provide some protection against mucous membrane (nose and mouth) exposure to infectious droplets from others but do not protect the wearer’s eyes or protect the wearer from inhaling tiny droplet aerosols. If everyone is masked, however, these risks are significantly reduced (since any coughing is contained behind the mask).
 - Face masks are intended to protect one another from transmission events between asymptomatic patients or team members.
 - Face masks do not prevent indirect transmission of infection that may occur when individuals touch a contaminated environmental surface and then touch their own eyes or face.
 - Some argue that face masks paradoxically lead people to touch their faces more often, potentially exposing themselves to the risk of self-inoculation with unclean hands, or exposing others through environmental contamination after touching their mask and high-touch surfaces around them. Therefore, strict education about best practices, such as the need to avoid touching your face and eyes, the need to wash your hands before and after touching your face and your mask, and the need to increase the frequency of environmental cleaning of all high-touch surfaces, must accompany universal application of face masks to prevent the spread of infection.

- **N95 respirator or PAPR:** protect healthcare workers by preventing inhalation of short range (<6 feet) aerosol droplets that are generated from [aerosol generating procedures](#). Long-range aerosol transmission, which is seen with measles, tuberculosis, and varicella (chicken pox or disseminated shingles) **has not** been a feature of COVID-19.
- **Gown and gloves:** protect healthcare workers' clothing and hands from direct spray of infectious respiratory droplets or environmental contamination. Hands may become contaminated in the doffing (removal) process so it is critical to perform hand hygiene **AFTER** this step.
- **Face shields:** protect healthcare workers' eyes and face from a direct spray of infectious respiratory droplets.
- **[Negative pressure/HEPA filtration:](#)**
 - Negative room pressurization and HEPA filtration remove aerosols from the environment, decrease environmental contamination of the room itself following aerosol-generating procedures, and decrease the time that a room must remain closed before it can be entered by individuals without respiratory protection. For non-negative inpatient rooms, the time period is 2 hours. For procedure rooms, please refer to your area-specific COVID plan.
 - If available, HEPA filters may be placed in non-negative pressure rooms prior to anticipated aerosol-generating procedures, but this is not required for safety of the staff in the room at the time of the procedure.
 - Please note that we are already using a higher level of PPE (i.e. N95 or PAPR) for all patients with confirmed or suspected COVID-19. In the case that negative pressure rooms or HEPA filters are not available, the team members entering the space will be adequately protected.
 - Note that many operating rooms and procedure rooms are equipped with HVAC systems that deliver a high number of air exchanges per hour (ACH). When the number of ACH exceeds 15, HEPA filtration does not provide additional benefit.
 - Examples of aerosol-generating procedures can be seen on page three of this document ([link](#)).

References:

1. <https://www.cdc.gov/infectioncontrol/basics/transmission-based-precautions.html>
2. <https://www.cdc.gov/infectioncontrol/basics/standard-precautions.html>
3. <https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html>
4. <https://covid-19.dukehealth.org>