Infection Prevention
Student Orientation
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Community Hospital
Chain of Transmission of Infection

- Infectious Agent
- Reservoir
- Susceptible Host
- Portal of Entry
- Portal of Exit
- Means of Transmission
- Getting Around
Link #1: Infectious Agent

- This is the disease-causing organism.
- For many illnesses and diseases this is a virus or bacterium.
- In order to break this link, various methods can be used, including education, disinfection, and sterilization.
Link #2: Reservoir

• This is the natural environment that the pathogen requires for survival.
• Reservoirs can be a person, an animal or an environmental component, such as soil or water.
• This link can be broken through medical treatment and testing, insect and rodent eradication or quarantine.
Link #3: Portal of Exit

• This link is needed for the pathogen to leave the reservoir.
• If the reservoir is a human, then the portal of exit may be saliva, mucous membranes, feces, blood, or nose or throat discharges.
• By using barrier methods, such as masks, gloves, isolation precautions or covering the mouth while coughing, this link can be broken.
Link #4: Means of Transmission

- The pathogen can be transmitted either directly or indirectly.
- Direct transmission requires close association with the infected host, but not necessarily physical contact.
- Indirect transmission requires a vector, such as an animal or insect.
- The link can be broken through hand hygiene or avoiding contact with infected individuals.
• Entry of the pathogen can take place in one of 3 ways: penetration, inhalation or ingestion.
• The level and severity of an infection may depend on the depth of penetration,
• Similar to the portal of exit, barrier methods, such as masks, can be used to break this link, along with other methods, such as insect repellants.
Once in the new host, various factors influence the severity of infection, including the strength of the immune system and the reproductive rate of the pathogen. Immunization, health promotion, and medical treatment can be used to break this link in the chain.
Clean Care is Safer Care

HAND HYGIENE
When and How
Hand Hygiene

- The single most important method to prevent the spread of infection.
- Hand hygiene must be done upon entry and exit (in and out) of the patient room/environment even if you do not touch anything in the patient room/environment.

Handwashing
Alcohol-based handrub
Additional Indications for Handwashing

- When hands are visibly dirty
- Before eating
- After using the restroom
- After contact with a patient or patient’s environment under certain conditions
Additional Indications for Alcohol-based Hand Rub

If hands are *not visibly soiled*, use an alcohol-based hand rub:

• Before having direct contact with patients
• Before inserting patient care devices.
• After contact with patient’s intact skin (e.g., when taking a pulse or blood pressure or lifting a patient
• After contact with patient’s environment (e.g., medical equipment, bedside table, bed)
• After removing gloves
Hand Hygiene

**How to handrub?**

1a. Apply a palmful of the product in a cupped hand, covering all surfaces.
1b. Rub hands palm to palm, right palm over left dorsum with interlaced fingers and vice versa.
2. Rub hands palm to palm, palm to palm with fingers interlaced, rotational rubbing of left thumb clasped in right palm and vice versa.
3. Backs of fingers to opposing palms with fingers interlocked, rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa.
4. Once dry, your hands are safe.

**How to handwash?**

1. Wet hands with water, apply enough soap to cover all hand surfaces.
2. Rub hands palm to palm, rotational rubbing of left thumb clasped in right palm and vice versa.
3. Right palm over left dorsum with interlaced fingers and vice versa, rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa.
4. Palm to palm with fingers interlaced, rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa.
5. Backs of fingers to opposing palms with fingers interlocked, rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa.
6. Rinse hands with water.
7. Dry hands thoroughly with a single use towel, use towel to turn off faucet.
8. Your hands are now safe.
Bloodborne Pathogens
Bloodborne Pathogens

• Healthcare workers are at risk of exposure to bloodborne pathogens at work. These include hepatitis B, hepatitis C, HIV and others.

• Blood-borne pathogens are viruses, bacteria & other organisms that are carried in a person’s bloodstream and cause disease. Other body fluids carry pathogens as well.
Hepatitis B and C

- Hepatitis B and C are liver diseases that result from infection with the hepatitis B and C virus.
- Hepatitis B and hepatitis C can range in severity from a mild illness lasting a few weeks to a serious, lifelong illness.
- People who are infected with hepatitis B or C may not have any symptoms at all for years (but can still spread hepatitis B or C).
- The only way to know if a person is infected is to be tested.
- The best way to prevent Hepatitis B is by getting vaccinated (a series of 3 vaccinations). There is no vaccine for Hepatitis C.
Hepatitis B and Hepatitis C
Signs and Symptoms

• Fever
• Fatigue
• Loss of appetite
• Nausea
• Vomiting
• Abdominal pain
• Dark urine
• Clay-colored bowel movements
• Joint pain
• Jaundice (yellow color in the skin or eyes)
Human Immunodeficiency Virus (HIV)

- HIV is a virus spread through body fluids that affects specific cells of the immune system, called CD4 cells or T cells.
- Over time, HIV can destroy so many of these cells that the body can’t fight off infections and disease.
- When this happens, HIV infection leads acquired immunodeficiency syndrome (AIDS).
- Once a person has HIV, they have it for life.
HIV Signs and Symptoms

• The only way to know if a person is infected is to be tested.
• A person cannot rely on symptoms to know whether they have HIV.
• Many people who are infected with HIV do not have any symptoms at all for 10 years or more (but can still spread HIV).
• Some people who are infected with HIV report have flu-like symptoms 2-4 weeks after exposure.
Examples of Blood and Other Potentially Infected Materials (OPIM)

- Blood
- Saliva in dental procedures
- Cerebrospinal fluid
- Urine
- Stool
- Any body fluid visibly contaminated with blood
- Any unfixed tissue or organs from a human
- Lab specimens
- Amniotic fluid
- Synovial fluid
- Pleural fluid
- Pericardial fluid
- Peritoneal fluid
OSHA Bloodborne Pathogen Standard
1910.1030

• Mandated by the Needlestick Safety and Prevention Act.
• Applies to all occupational exposures to blood or other potentially infectious materials (OPIM).
• Engineering and work practices controls are utilized to eliminate or minimize employee exposures.
• Personal Protective Equipment (PPE) utilized for protection against a hazard.
Engineering Controls

Engineering controls (e.g., sharps disposal containers, self-sheathing needles, sharps with engineered sharps injury protections and needleless systems) isolate or remove the bloodborne pathogens hazard from the workplace.
Work Practice Controls

Controls that reduce the likelihood of exposure by altering the manner in which a task is performed

- **Never** re-cap needles by a two-handed technique
- Always use a sharps container to dispose of sharps
- Never reach inside a sharps container
- Do not over-fill sharps containers
Work Practice Controls

Regulated waste

- Liquid or semi-liquid blood or other potentially infectious materials (OPIM).
- Contaminated items that would release blood or OPIM in a liquid or semi-liquid state if compressed.
- Items that are caked with dried blood or OPIM and are capable of releasing these materials during handling.
- Contaminated sharps.
- Pathological and microbiological waste containing blood or OPIM.
- Regulated waste will be disposed of in containers marked by the biohazard symbol.
Personal Protective Equipment (PPE)

Specialized clothing or equipment worn by healthcare workers for protection against a hazard. PPE includes, *but is not limited to:*

- Gloves
- Gowns
- Masks
- Eye protection
What is Considered an Blood or Body Fluid Exposure Incident?

• Parenteral means piercing mucous membranes or the skin barrier through such events such as
  – Needlesticks
  – Human bites
  – Cuts
  – abrasions
• Mucous membranes means contact with
  – Eyes
  – Nose
  – Mouth
  – Nonintact skin
Steps to Take if You are Exposed to Blood or a Body Fluid

*Immediately...*

– Wash wound with soap and water
– Flush mucous membranes with water
– Report to your supervisor/instructor
– Seek medical evaluation
Standard Precautions and Transmission-based (isolation) Precautions
Basic concept: Treat all blood and body fluids as if they are infectious material
Standard Precautions: Infection Prevention Practices

- **Hand Hygiene**
- **Safer injection practices**
- **Personal Protective Equipment (PPE): Gloves, gowns, masks, eye protection**
- **Respiratory Hygiene and Cough Etiquette**
- **Patient placement**
- **Special lumbar procedures: Use face mask during spinal procedures**
- **Environmental cleaning**
Transmission-based Precautions

Prevents transmission of infectious agents which are spread by direct or indirect contact with the patient or patient’s environment

NOTE: These are in addition to Standard Precautions
Transmission-based Precautions

- Contact Precautions
- Droplet Precautions
- Airborne Precautions
- Surveillance Precautions
- Reverse Precautions
- Enhanced Precautions
Appendix A provides recommendations for Airborne, Droplet or Contact Precautions for infections/conditions.

Appendix A includes the specific infection/condition, type of precaution, and duration of precaution.

Additional information relevant to use of precautions is located in the comments column to assist the caregiver in decision-making.

Citations were added to the guideline as needed to support a change in or provide additional evidence for recommendations for a specific disease and for new infectious agents (e.g., SARS-CoV, avian influenza) that have been added to Appendix A.

# Type and Duration of Precautions Recommended for Selected Infections and Conditions

<table>
<thead>
<tr>
<th>Infection/Condition</th>
<th>Type of Precaution</th>
<th>Duration of Precaution</th>
<th>Precautions/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>M. tuberculosis</em></td>
<td>Airborne</td>
<td></td>
<td>Discontinue precautions only when patient on effective therapy is improving clinically and has three consecutive sputum smears negative for acid-fast bacilli collected on separate days (MMWR 2005; 54:RR-17 Guidelines for Preventing the Transmission of <em>Mycobacterium tuberculosis</em> in Health-Care Settings, 2005, <a href="https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5417a1.htm?_s_cid=rr5417a1_e2">https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5417a1.htm?s_cid=rr5417a1_e2</a>).</td>
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<td>Pulmonary or laryngeal disease, confirmed</td>
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<td></td>
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<tr>
<td><em>M. tuberculosis</em></td>
<td>Airborne</td>
<td></td>
<td>Discontinue precautions only when the likelihood of infectious TB disease is deemed negligible, and either 1. there is another diagnosis that explains the clinical syndrome or 2. the results of three sputum smears for AFB are negative. Each of the three sputum specimens should be collected 8-24 hours apart, and at least one should be an early morning specimen</td>
</tr>
<tr>
<td>Pulmonary or laryngeal disease, suspected</td>
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<tr>
<td><em>M. tuberculosis</em></td>
<td>Standard</td>
<td></td>
<td>Not transmitted from person to person</td>
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<tr>
<td>Skin-test positive with no evidence of current active disease</td>
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<td></td>
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<tr>
<td>Tularemia</td>
<td>Standard</td>
<td></td>
<td>Not transmitted from person to person</td>
</tr>
<tr>
<td>Draining lesion</td>
<td>Standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulmonary</td>
<td>Standard</td>
<td></td>
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</tbody>
</table>
Contact Precautions for patients with a suspected or confirmed infection/condition such as MRSA infection or *Clostridium difficile* infection

**Brown dot = C. difficile**
Wash hands with soap and water (do not use alcohol-based hand rubs) and disinfect patient room with bleach.

**Red dot = MRSA**
MRSA Bundle EVS detailed cleaning of patient room.

**Note:** Colored-coded dot placed in upper left or right corner of poster
Droplet Precautions for patients with a suspected or confirmed infection/condition such as influenza and pertussis
Airborne Precautions for patients with a suspected or confirmed infection/condition such as *Mycobacterium tuberculosis* and Measles
Surveillance Precautions for patients being tested for or confirmed positive for MRSA colonization

1. PATIENT PLACEMENT - Place the patient in a single-patient room.
2. GLOVES - All persons must wear gloves upon each entry to the room. Remove and discard gloves before leaving patient's room.
3. HAND HYGIENE - Perform hand hygiene before patient contact. Assist patient with hand hygiene as needed. Perform hand hygiene after glove removal and before leaving the patient's room.
4. TRANSPORT - Limit the transport and movement of patients outside of room for medically necessary purposes. When transport is necessary, place a clean patient gown on the patient prior to transport. Assist patient with hand hygiene before leaving the room. Remove contaminated gloves and perform hand hygiene prior to transporting patient. Put on clean gloves to handle patient when the transport destination has been reached.
5. NONCRITICAL PATIENT-CARE EQUIPMENT (e.g., blood pressure cuffs, stethoscopes, etc.) - When possible, dedicate the use of noncritical patient-care equipment to a single patient. If common equipment is used, clean and disinfect between patients.
Reverse Isolation for immunocompromised patients

1. PATIENT PLACEMENT - Place the patient in a single-patient room. DO NOT place patient in an Airborne Infection Isolation Room (negative air pressure room).

2. RESPIRATORY PROTECTION - All persons must put on a medical procedure mask upon each entry to the patient's room. Remove and discard mask before leaving the patient's room.

3. HAND HYGIENE - Perform hand hygiene before and after contact with patient and/or patient's environment. Assist patient with hand hygiene as needed. Perform hand hygiene before leaving the room.

4. TRANSPORT - Limit transport and movement of patients outside of the room for medically-necessary purposes. When transport or movement is necessary, instruct patient to wear a medical procedure mask. Place a clean patient gown on the patient prior to transport. Assist the patient with hand hygiene before leaving the room. A mask is not required for healthcare personnel transporting patients on Reverse Isolation if the patient is wearing a medical procedure mask during transport.

5. NONCRITICAL PATIENT-CARE EQUIPMENT (e.g., blood pressure cuffs) - Use disposable noncritical patient-care equipment or implement patient-dedicated use of such equipment. If common use of equipment for multiple patients is unavoidable, clean and disinfect such equipment before use on another patient.
Enhanced Precautions for patient with suspected or confirmed Middle East Respiratory Syndrome (MERS)
A Powered Air Purifying Respirator (PAPR) is a hood that filters the air for the person wearing it. PAPRs must be worn in Airborne Precautions rooms by individuals who cannot be fitted for an N-95 respirator.
Mycobacterium tuberculosis
Mycobacterium tuberculosis (TB)

• Tuberculosis (TB) is a disease caused by germs that are spread from person to person through the air.

• TB usually affects the lungs, but it can also affect other parts of the body, such as the brain, the kidneys, or the spine.

• A person with TB can die if they do not get treatment.
**Mycobacterium tuberculosis (TB)**

- TB germs are put into the air when a person with TB disease of the lungs or throat coughs, sneezes, speaks, or sings.
- These germs can stay in the air for several hours, depending on the environment.
- Persons who breathe in the air containing these TB germs can become infected; this is called latent TB infection.
Mycobacterium tuberculosis (TB) Symptoms

• A bad cough that lasts 3 weeks or longer
• Pain in the chest
• Coughing up blood or sputum
• Weakness or fatigue
• Weight loss
• No appetite
• Chills
• Fever
• Sweating at night
• Symptoms of TB disease in other parts of the body depend on the area affected.
Latent TB Infection

- People with *latent TB infection* have TB germs in their bodies, but they are not sick because the germs are not active.
- These people do not have symptoms of TB disease, and they cannot spread the germs to others. However, they may develop TB disease in the future.
- They are often prescribed treatment to prevent them from developing TB disease.
TB Disease

- People with TB disease are sick from TB germs that are active, meaning that they are multiplying and destroying tissue in their body.
- They usually have symptoms of TB disease.
- People with TB disease of the lungs or throat are capable of spreading germs to others.
- They are prescribed drugs that can treat TB disease.
TB Infection Prevention Measures

- Administrative controls
  - Risk assessment
  - TB Exposure Control Plan
  - Work practices
  - Lab testing
  - Cleaning, disinfection and sterilization,
  - Education and screening of healthcare workers
  - Signage

- Environmental controls
  - Local exhaust ventilation (hoods, booths, or tents)
  - Airborne infection isolation rooms
  - Use of respiratory protective equipment
  - N-95 respirators and PAPRs
  - Respiratory hygiene and cough etiquette
Influenza
Contagious disease which is caused by the influenza virus.

Symptoms include fever/chills, cough, sore throat, headache, muscle aches, runny/stuffy nose, fatigue.

The influenza virus is contagious 1 day before symptoms develop and up to 5-7 days after becoming sick.

Spread by coughing, sneezing, or nasal secretions.
The single best way to prevent influenza is by getting a influenza vaccination each year.
Droplet Precautions for patient with suspected or confirmed influenza

1. PATIENT PLACEMENT - Place the patient in a single-patient room. Special air handling and ventilation are not necessary and the door may remain open.

2. RESPIRATORY PROTECTION - All persons must put on a medical procedure mask upon each entry to the patient’s room. Remove and discard mask before leaving the patient’s room.

3. HAND HYGIENE - Perform hand hygiene before and after contact with patient and/or patient's environment. Assist patient with hand hygiene as needed. Perform hand hygiene before leaving the room.

4. TRANSPORT - Limit transport and movement of patients outside of the room for medically-necessary purposes. When transport or movement is necessary, instruct patient to wear a medical procedure mask and follow Respiratory Hygiene/Cough Etiquette. Place a clean patient gown on the patient prior to transport. Assist the patient with hand hygiene before leaving the room. Mask is not required for healthcare personnel transporting patients on Droplet Precautions if the patient is wearing a medical procedure mask during transport.

5. NONCRITICAL PATIENT-CARE EQUIPMENT (e.g., blood pressure cuffs) - Use disposable noncritical patient-care equipment or implement patient-dedicated use of such equipment. If common use of equipment for multiple patients is unavoidable, clean and disinfect such equipment before use on another patient.
Clostridium difficile
• *Clostridium difficile* (*C. difficile*) is a bacterium that causes inflammation of the colon, known as colitis.

• People who have other illnesses or conditions requiring prolonged use of antibiotics, and the elderly, are at greater risk of acquiring this disease.

• The bacteria are found in the feces. People can become infected if they touch items or surfaces that are contaminated with feces and then touch their mouth or mucous membranes.

• Healthcare workers can spread the bacteria to patients or contaminate surfaces through hand contact.
Symptoms of *Clostridium difficile*

- Watery diarrhea (at least three bowel movements per day for two or more days)
- Fever
- Loss of appetite
- Nausea
- Abdominal pain/tenderness
Transmission of *Clostridium difficile*

- *Clostridium difficile* is shed in feces.
- Any surface, device, or material (e.g., toilets, bed, siderails) that becomes contaminated with feces may serve as a reservoir for the *Clostridium difficile* spores.
- *Clostridium difficile* spores are transferred to patients mainly via the hands of healthcare personnel who have touched a contaminated surface or item.
- *Clostridium difficile* can live for long periods on surfaces.
Brown dot = \textit{C. difficile}

Wash hands with soap and water (do not use alcohol-based hand rubs) and disinfect patient room with bleach.

**Note:**
- Alcohol does not kill \textit{Clostridium difficile} spores.
- Standard EPA-registered hospital disinfectants are not effective against \textit{Clostridium difficile} spores. Utilize a hypochlorite-based disinfectant (bleach) to prevent \textit{Clostridium difficile} transmission.
Watery or loose stools are the preferred specimen (stool specimen should conform to the shape of the specimen container).

Positive results in a normal stool sample may demonstrate *Clostridium difficile* colonization, but not necessarily clostridium infection.
PCR testing methodology (DNA method):
Testing method for all patients.

NOTE: PCR test is not recommended to be used for children < 2 years of age because it is common for children < 2 years of age to be carriers of *C. difficile*. Per guidelines/recommendations: Strictly treat clinical symptoms rather than PCR results for children in this age group.
Patients who test positive for *Clostridium difficile* may have the Contact Precautions discontinued if the patient meets **ALL** of the following criteria:

1. The patient has not had a diarrhea or loose stool for **72 hours**, **AND**
2. The patient is continent of stool, **AND**
3. The patient performs hand hygiene with soap and water (handwashing).
Multi Drug Resistant Organisms (MDROs)
What is a MDRO?

Bacteria (excluding *Mycobacterium tuberculosis*) that are resistant to one or more classes of antimicrobial agents (e.g., B-lactams, fluoroquinolones) and usually are resistant to all but one or two commercially available antimicrobial agents.
Examples of MDROs

MRSA – Methicillin Resistant *Staphylococcus aureus*

VRE – Vancomycin Resistant *Enterococcus*

CRE - Carbapenem-resistant Enterobacteriaceae (e.g., *Klebsiella* species, *E. coli*)

*Streptococcus pneumoniae*

*ESBL* - Extended Spectrum-Beta Lactamase (e.g., *Serratia marcescens, E. coli*)
Contact Precautions for patients with suspected or confirmed MDROs

1. **PATIENT PLACEMENT** - Place the patient in a single-patient room.

2. **GLOVES AND GOWN** - All persons must wear gloves and gown upon each entry to the room. Remove and discard gloves and gown before leaving patient’s room.

3. **HAND HYGIENE** - Perform hand hygiene before patient contact. Assist patient with hand hygiene as needed. Perform hand hygiene after glove and gown removal before leaving the patient’s room.

4. **TRANSPORT** - Limit transport and movement of patients outside of the room for medically-necessary purposes. When transport or movement is necessary, ensure that infected areas of the patient’s body are contained and covered. Place a clean patient gown on the patient prior to transport. Assist the patient with hand hygiene before leaving the room. Remove and dispose of contaminated PPE (gloves and gown) and perform hand hygiene prior to transporting patients. Put on clean isolation gown and gloves to handle the patient at the transport destination.

5. **NONCRITICAL PATIENT-CARE EQUIPMENT** (e.g., blood pressure cuffs) - Use disposable non-critical patient-care equipment or implement patient-dedicated use of such equipment. If common use of equipment for multiple patients is unavoidable, clean and disinfect such equipment before use on another patient.
References

• Centers for Disease Control and Prevention http://www.cdc.gov/
• Association for Professionals in Infection Control and Epidemiology (APIC) http://www.apic.org/
• Occupational Safety and Health Administration https://www.osha.gov/
Infection prevention is for everyone...all the time, every time!