Healthcare Associated Infections and the Prevention and Control of Multi-Drug Resistant Organisms (MDRO)

Introduction

- The CDC estimates that healthcare-associated infections (HAI) account for an estimated 1.7 million infections and 99,000 associated deaths each year in the US.
  - ✓ Cost: $17 - 29 billion a year.
  - ✓ One of the top ten leading causes of death.
- HAIs are infections that patients acquire during the course of receiving treatment for other conditions within a healthcare setting.
  - ✓ HAIs are not present or incubating at the time of admission.
  - ✓ HAIs lead to:
    - ➢ increased length of stay
    - ➢ more diagnostic tests
    - ➢ more treatment
    - ➢ more antibiotics
    - ➢ more antibiotic resistance

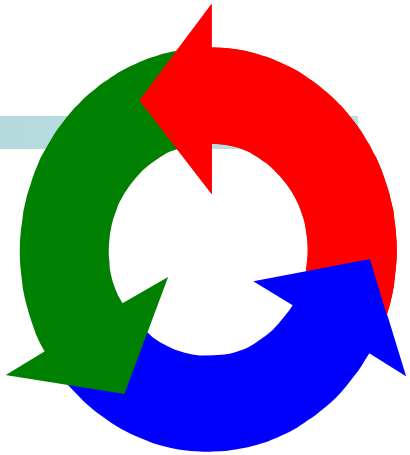
Introduction

- HAIs are more likely to be caused by multi-drug resistant organisms (MDRO) than community acquired infections.
  - ✓ MDROs are bacteria resistant to first line therapies.
  - ✓ MDROs are often difficult to treat due to their innate or acquired resistance to multiple classes of antimicrobial agents.
    - ➢ In some cases, there are few, if any, options for patient treatment.
  - ✓ Examples of MDROs:
    - ➢ Vancomycin resistant enterococcus (VRE)
    - ➢ Methicillin resistant *Staphylococcus aureus* (MRSA)
    - ➢ Gram negative bacteria (e.g., E. coli, Pseudomonas, Klebsiella, Enterobacter, Acinetobacter) resistant to first line antibiotic agents and/or carrying certain resistance traits (e.g., ESBL = extended spectrum beta-lactamase, KPC = *Klebsiella pneumoniae* carbepenemase)

Introduction

- MDRO infections are particularly difficult and problematic to treat in certain patient populations such as:
  - ✓ Immunosuppression
  - ✓ Prosthetic devices
  - ✓ Device related infections (e.g., central line infection, Foley catheter related infection, ventilator associated pneumonia)
- Although *C. difficile* (C. diff) is not technically an MDRO, it poses similar challenges for prevention of transmission and treatment.
  - ✓ Outbreaks of a particularly virulent strain of C. diff are being increasingly reported in the US.

The Chain of Transmission



HAIs don't occur spontaneously. They are the result of a number of steps in a process that allows an organism to colonize and/or infect a susceptible host.

These steps are linked and are commonly referred to as the *"Chain of Transmission"*.

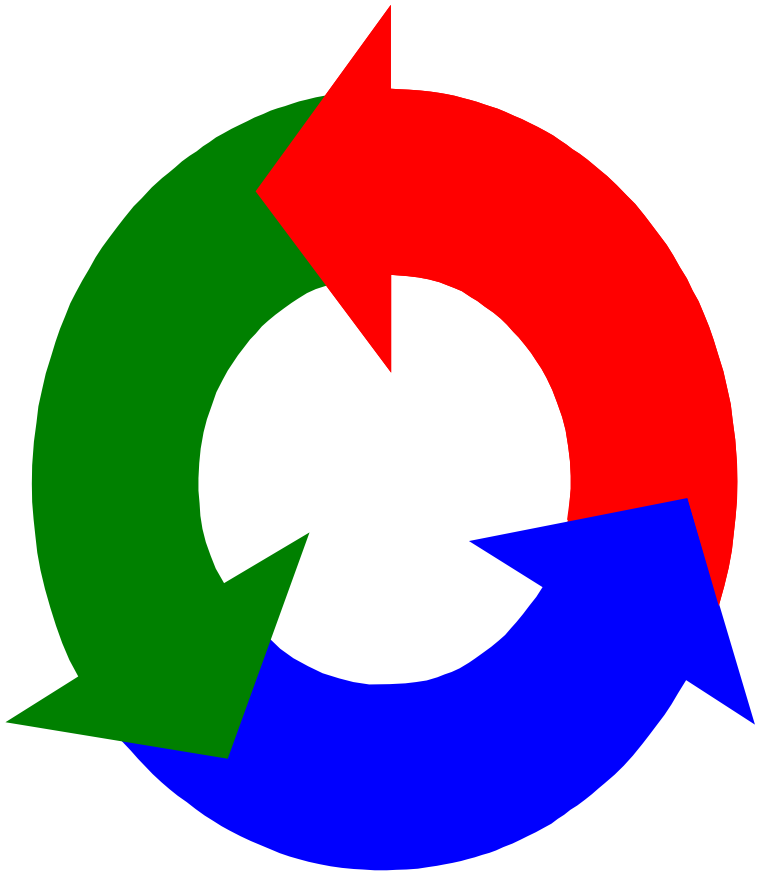
The transmission of infectious agents requires three elements:

1. A **source** (or reservoir) of infectious organisms
2. A **susceptible host** with a portal of entry for the organism
3. A **mode of transmission** for the organism

Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings , http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf

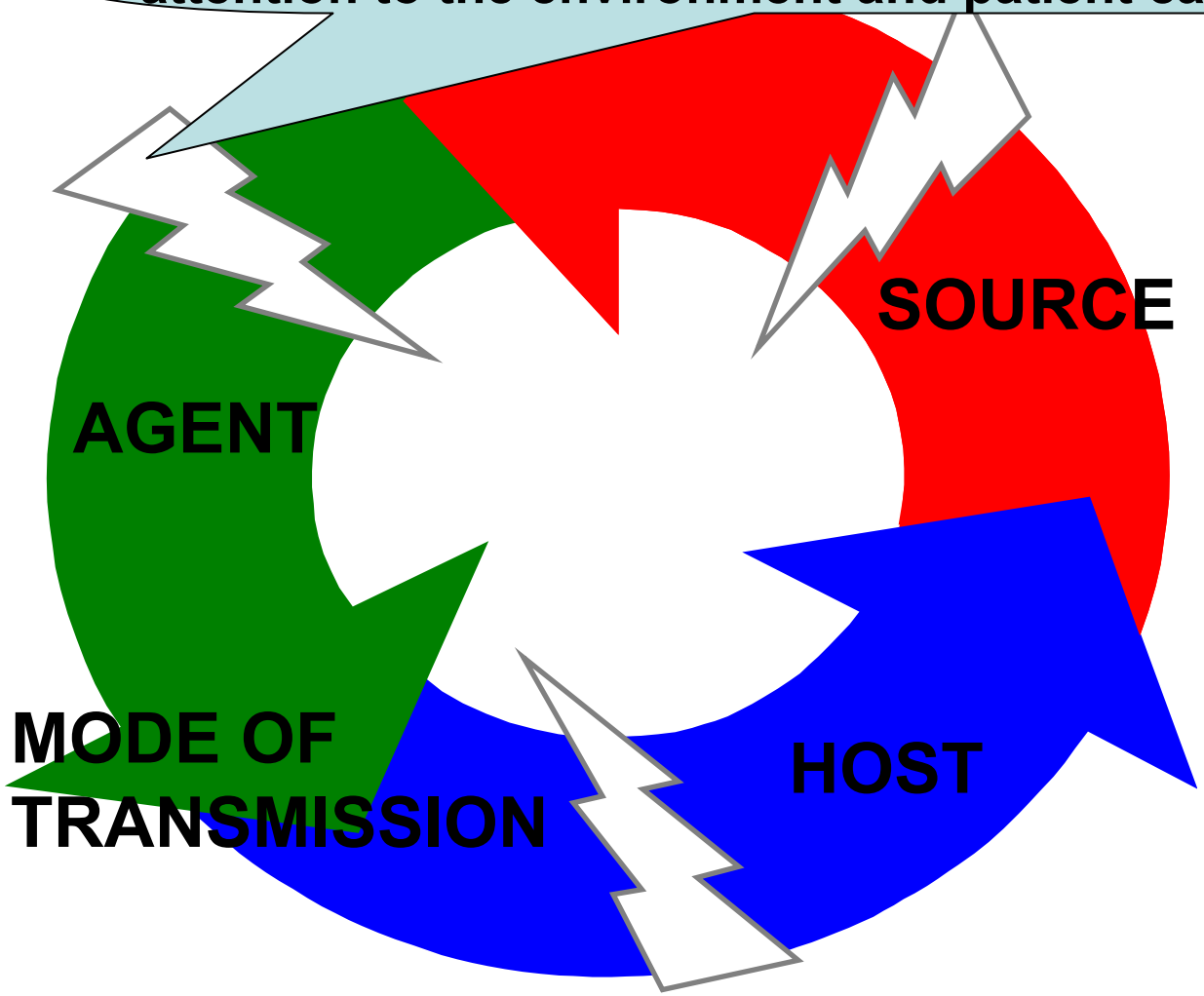
The Chain of Transmission

- ***A Source***
  Where the organism resides (patients, healthcare workers, visitors, environment, equipment).
- ***Means (modes) of Transportation***
  How the organism is picked up and taken to the host (contact, airborne, droplet).
- ***A Susceptible Host***
  A person who is capable of receiving the organism and playing host to the organism.



Breaking the Chain of Transmission

Hand hygiene, standard precautions, transmission-based precautions (contact, droplet, airborne), aseptic technique, attention to the environment and patient care equipment, etc.



HAI infection prevention strategies are targeted at breaking the chain of transmission.

These strategies make up the fundamentals of infection prevention.

Breaking the Chain of Transmission

- ***Hand hygiene*** is the cornerstone of all infection prevention measures and precautions.
  - ✓Proper hand hygiene is the most essential measure for breaking the chain of transmission of organisms, including multi-drug resistant bacteria, that can cause healthcare associated infections.

"When a doctor or nurse can reduce the spread of antibiotic-resistant bacteria by practicing simple hand hygiene, accountability should matter. True, the hospital and its leaders are accountable for establishing a system in which caregivers have the knowledge, competence, time, and tools to practice perfect hygiene. But each caregiver has the duty to perform hand hygiene – perfectly and every time. When this widely accepted, straightforward standard of care is violated, we cannot continue to blame the system."

Donald Goldmann, MD
New England Journal of Medicine, 355:2 July 13, 2006, 121-123

Hand Hygiene

An Often Forgotten Infection Prevention Strategy

What's On Your Hands?

A 24-year-old man who had quadriplegia due to a traumatic spinal cord injury was found on routine surveillance cultures to have methicillin-resistant *Staphylococcus aureus* (MRSA) colonization of his anterior nares. He had no history of MRSA infection or colonization. To assess the potential implications of the patient's MRSA carriage for infection control, an imprint of a health care worker's ungloved hand was obtained for culture after the worker had performed an abdominal examination of the patient. The MRSA colonies grown from this handprint on the plate…are pink and show the outline of the worker's fingers and thumb (Panel A). … After the worker's hand had been cleaned with alcohol foam, another hand imprint was obtained, and the resulting culture was negative for MRSA (Panel B). These images illustrate the critical importance of hand hygiene in caring for patients, including those not known to carry antibiotic-resistant pathogens.

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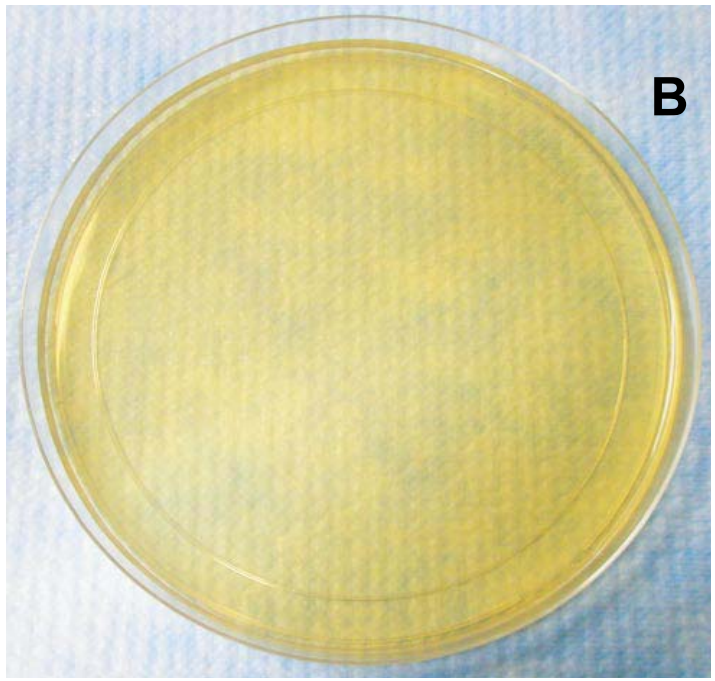


Donskey, Eckstein. N Engl J Med 360;3
January 15, 2009

When is hand hygiene required?

The main activities that require healthcare workers to perform hand hygiene include:

- ✓Before touching a patient
- ✓Before putting on gloves (sterile or non-sterile)
- ✓Before doing invasive procedures
- ✓Before handling clean equipment or supplies
- ✓After touching a patient
- ✓After handling dirty equipment or supplies
- ✓After removing gloves (sterile or non-sterile)
- ✓Before eating or drinking
- ✓After using the restroom

How to Properly Perform Hand Hygiene

Using Soap and Water

- ✓ Turn on faucet
- ✓ Wet hands
- ✓ Apply soap
- ✓ Rub hands together to form a lather for at least ***15*** seconds
  - ➢ Make sure to cleanse thumbs, areas in between fingers, and under fingernails
- ✓ Thoroughly rinse lather from hands
- ✓ Pat dry with clean paper towel
- ✓ Use paper towel to turn off faucet
- ✓ Dispose of paper towel in appropriate receptacle

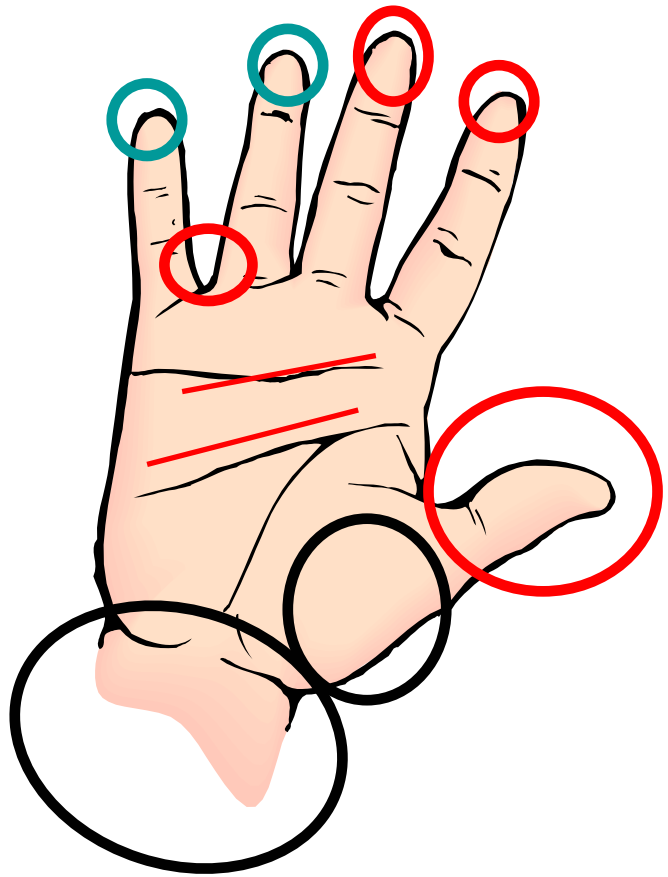
How to Properly Perform Hand Hygiene

Using Alcohol-based Hand Rub

- ✓Push the dispenser *once*
- ✓Coat all surfaces of your hands including:
  - ➢between fingers
  - ➢under fingernails
  - ➢back of hands and wrists
- ✓Rub hands together briskly until dry
- ✓No rinsing needed

Hand Hygiene

- Frequently missed areas:
  - ✓Thumbs
  - ✓In between fingers
  - ✓Under finger nails
  - ✓Wrists



The Palm

When should an alcohol-based hand rub not be used?

- When hands are visibly soiled or dirty.
- When hands have been in direct contact with blood or body fluids.
- After contact with a patient, or their environment, who has *C. difficile*.

In these cases, hand hygiene should be performed using soap and water instead of an alcohol-based hand rub.

Gloves

Gloves are not a substitute for hand hygiene!

- In general, wear gloves when you anticipate contact with blood, body fluids, non-intact skin, mucous membranes.
- Perform hand hygiene before putting on gloves.
- Remove gloves after patient care and immediately perform hand hygiene.
- Wear a new, clean pair of gloves for each patient and never wash, disinfect or sterilize gloves for reuse.
- Remove gloves that are torn, cut or punctured.

Remember that all personal protective equipment (e.g., gloves, gowns, etc.) must be removed between patients and before leaving treatment areas.

Fingernails

- Fingernails have been shown to harbor a high number of bacteria and yeast.
- Healthcare personnel who wear artificial nails are more likely to harbor organisms on their fingertips or under their nails than those who have short natural nails.
  - ✓ Artificial nails have been implicated in outbreaks of hospital acquired infections.
  - ✓ Artificial nails, nail art or nail jewelry is not permitted for anyone who has contact with patients, medications or food in the healthcare setting.
- Fingernails of healthcare personnel must be clean, natural, and short (1/4 inch) to assure patient safety.

Patient Comments: We See You!

“The only thing that bothered me was the hand washing. I know in the medical field sanitizing your hands is very important and I didn't see that being done by the employees as often as I thought it should be done.”

“The only negative comment is that you guys need to be more aware and in control of the infections passed around the hospital and come up with a better way to keep it from happening.”

“The [unit] nursing assistant or PCA came into my room with full contact precautions on. When I asked her why, she said “because the person in the next room required it and she was trying to save time.” When I asked her if she would be changing her gloves and washing her hands in between pts, she said no…Finally, I asked to be discharged from the hospital 30 hours after surgery …in fear of contracting a hospital acquired infection…People wonder why MRSA and C. diff are rampant in the inpatient population but I don’t.”

"Methicillin-resistant Staphylococcus aureus (MRSA) is a versatile bacterial pathogen, combining virulence, antibiotic resistance and survival fitness. **Clonal spread is facilitated by cross-transmission via the hands of healthcare workers** and the selection pressure exerted by broad-spectrum antibiotic treatment."

Clin Microbiol Infect 2006;12:1154–1162

"Outbreaks of MRSA in hospitals are often attributed to a lapse in contact precautions, with **transmission from a colonized or infected patient to a non-colonized patient via healthcare worker hands or implements (e.g., stethoscopes)."**

Infect Control Hosp Epidemiol 2006;27:1267-1269

"The most common reason for sub-populations of MDRO to appear is not the development of de novo resistance by the patient's normal flora, but **the introduction of MDRO into the microflora of the patient. The introduction of MDRO is primarily due to inappropriate infection control practices**. The transfer of MDRO from healthcare workers to patients is facilitated by poor hand hygiene and non-compliance with isolation precautions."

Expert Opin Pharmacother 2006;7:11

Transmission-Based Precautions

- Used for patients known or suspected to be colonized and/or infected with epidemiologically significant organisms (e.g., MDROs)
- Efforts should be made to counteract possible adverse effects on patients (e.g., anxiety, depression and other mood disturbances, perceptions of stigma, reduced contact with clinical staff, and increases in preventable adverse events) in order to improve acceptance by the patients and adherence by healthcare personnel
- MDROs are most commonly transmitted via contact
  - ✓ *Direct contact transmission*: organisms are transferred from one person to another
  - ✓ *Indirect contact transmission:* transfer of an organism through a contaminated intermediate object or person (e.g., unwashed hands, improperly cleaned patient care devices, instruments, equipment, environment)

Contact Precautions

- Contact Precautions are intended to prevent transmission of organisms (such as MDROs) that are spread by direct or indirect contact with a patient or a patient's environment.

- A single patient room is preferred for patients who require Contact Precautions.
  - ✓When a single-patient room is not available, consultation with infection prevention personnel is recommended to assess the various risks associated with other patient placement options (e.g., cohorting, keeping the patient with an existing roommate).

Contact Precautions

- Requires putting on gown and gloves
  - ✓You must gown and glove even if…"I'm not going to touch anything".
  - ✓Perform hand hygiene *before* putting on gloves so gloves are not contaminated. This protects the patient and you.
  - ✓The gown must be tied at the waist and neck to keep it from opening and/or slipping off the shoulders to prevent contamination of your clothing.
- Remove gown and gloves before leaving the room.
- Perform hand hygiene immediately after removal of gown and gloves, before touching anything or anyone.

Contact Precautions

Examples of when contact precautions are required:

- VRE
- MRSA
- Resistant gram negative bacteria
- *C. difficile* colitis
- Zoster in a normal host
- RSV--Respiratory Syncytial Virus
- Parainfluenza virus
- Rotavirus

The Basics for Preventing Transmission of MDROs

- Promote compliance with CDC (or WHO) hand hygiene recommendations
- Use Contact Precautions for MDRO colonized and infected patients
- Educate health care personnel about MDROs
- Ensure cleaning and disinfection of equipment and environment
- Educate patients and their families about MDROs
  - ✓ Engage patients and families and encourage their participation in their care and encouraging healthcare workers and visitors to comply with hand hygiene and contact precautions
- Monitor compliance
  - ✓ Hold all healthcare providers accountable for compliance with all recommended infection prevention practices

Communication Among Healthcare Personnel

All healthcare personnel must take responsibility for infection prevention practices.

Anyone can stop someone or a procedure if infection prevention practices (e.g., hand hygiene, aseptic technique) are not properly adhered to.

It is important for healthcare personnel to follow standard patient safety protocols and to ensure that their peers and other healthcare personnel practice the same standards.

***Question*: Who is responsible for infection prevention measures at YNHH?**

***Answer*: Each and everyone one of us.**

- We are each responsible for maintaining a safe environment for our patients, staff and visitors at YNHH.

- We are each responsible for our own hands.

- We are each responsible to remind others to perform hand hygiene.

Hand Hygiene: Everywhere, Everyone, Every time

ROMILLY LOCKYER—GETTY

Wash Those Hands!

How doctors and nurses can make you sick—and what you can do about it

Final Thoughts

While conducting rounds with infection prevention specialists, Dr. Gawande observed less than optimal hand hygiene compliance by healthcare providers. When one of his patients acquired an MRSA infection while in the hospital, he was prompted to examine his own infection prevention practices.

"Until that moment, when I stood there looking at the sign on his door, it had not occurred to me that I might have given him that infection. But the truth is I may have. One of us certainly did."

Atul Gawasnde, MD, MPH
Notes of a Surgeon: On Washing Hands
New England Journal of Medicine, 350:13, March 25, 2004, 1283-1286

Performance improvement requires…[an] unshakeable belief in the idea that everyone in healthcare really has two jobs when they come to work every day: to do their work and to improve it.

Bataldenn, Davidoff
Qual Saf Health Care 2007;16:2-3.

The hardest thing about hand hygiene is remembering to do it!

So, keep in mind…

Every where
Every patient
Every time

Hand Hygiene and MDRO

Review Questions

Question 1

The three elements necessary for the transmission of infectious agents in the healthcare setting are:

1. Source of an infectious agent
2. Host for the infectious agent
3. Means of transmission from the source to the susceptible host

a) True
b) False

Question 1 - Answer

The three elements necessary for the transmission of infectious agents in the healthcare setting are:

1. Source of an infectious agent
2. Host for the infectious agent
3. Means of transmission from the source to the susceptible host

✓ True

b) False

Question 2

When using soap and water for hand hygiene, hands should be rubbed together for:

a. 30 seconds
b. 5 seconds
c. 15 seconds
d. 60 seconds

Question 2 - Answer

When using soap and water for hand hygiene, hands should be rubbed together for:

a. 30 seconds
b. 5 seconds
✓ 15 seconds
d. 60 seconds

(C): 15 seconds is the time it takes to sing the “Happy Birthday” song twice.

Question 3

Which of the following is correct:

a. Gloves are an acceptable substitute for hand hygiene.

b. Hand hygiene must be performed before putting on gloves and after removing gloves.

c. Only gowns are necessary when going into the room of a patient on contact precautions.

d. Hand hygiene using an alcohol based hand rub is acceptable after caring for a patient with *C. difficile*.

Question 3 - Answer

Which of the following is correct:

a. Gloves are an acceptable substitute for hand hygiene.

✓ Hand hygiene must be performed before putting on gloves and after removing gloves.

c. Only gowns are necessary when going into the room of a patient on contact precautions.

d. Hand hygiene using an alcohol based hand rub is acceptable after caring for a patient with *C. difficile*.

(B) Explanation: Gloves are not a substitute for performing hand hygiene. Hand hygiene must be performed before putting on gloves and immediately after removing gloves as hands can be contaminated when removing gloves. Contact precautions requires hand hygiene, gloves and a gown to enter the patient's room. After caring for a patient with *C. difficile*, soap and water hand hygiene should be performed instead of using an alcohol-based hand rub (e.g., Purell^{R}).

Question 4

Multi-drug resistant organisms (MDROs), such as VRE and MRSA, are resistant to first line antibiotic therapies.

a. True
b. False

Question 4 - Answer

Multi-drug resistant organisms (MDROs), such as VRE and MRSA, are resistant to first line antibiotic therapies.

- ✓ True
- b. False

Question 5

Contact transmission, most commonly via hands, is the main mode of transmission of multi-drug resistant organisms that cause healthcare acquired infections.

a. True
b. False

Question 5 - Answer

Contact transmission, most commonly via hands, is the main mode of transmission of multi-drug resistant organisms that cause healthcare acquired infections.

✓True

b. False

Question 6

Which of the following is correct?

a. Hand hygiene does not need to be performed after removal of gloves.

b. Contact precautions does not require performing hand hygiene, putting on gloves and a gown if one is not expecting to touch the patient when in the room.

c. Artificial fingernails pose no infection hazard to patients and are acceptable for clinical staff.

d. Hand hygiene is the cornerstone of all infection prevention measures and precautions.

Question 6 - Answer

Which of the following is correct?

a. Hand hygiene does not need to be performed after removal of gloves.

b. Contact precautions does not require performing hand hygiene, putting on gloves and a gown if one is not expecting to touch the patient when in the room.

c. Artificial fingernails pose no infection hazard to patients and are acceptable for clinical staff.

✓ Hand hygiene is the cornerstone of all infection prevention measures and precautions.

(D) Explanation:

- Hands may be contaminated when removing gloves so hand hygiene should be performed immediately after removing gloves.
- You don't know what will happen when you are in a patient's room, so you should always perform hand hygiene before entering and glove/gown for patients on contact precautions.
- Artificial fingernails pose a risk of transmitting organisms to patients and are not permitted for YNHH clinical staff.

Question 7

If you see someone not performing hand hygiene or following contact precautions as required, you have no responsibility to remind that person to follow infection prevention measures: “It’s not my job.”

a. True
b. False

Question 7 - Answer

If you see someone not performing hand hygiene or following contact precautions as required, you have no responsibility to remind that person to follow infection prevention measures: “It’s not my job.”

a. True
✓ False

(False) Explanation: Yale-New Haven Hospital Pledges

- ✓ Service Excellence Pledge:
  - ➢ *“I will maintain a clean and safe environment”*
- ✓ The I Am New-Haven Pledge:
  - ➢ “I will take action when things go wrong”