Welcome to the Infection Control: Prevention of Healthcare-Associated Infection (HAI) course. This course will help you understand how to control and prevent infections from occurring in the healthcare environment and reduce the risk of healthcare-associated infections for our patients, visitors and staff.

The course will cover the three primary types of HAIs identified in The Joint Commission’s National Patient Safety Goal number 7- Surgical Site Infections, Central Line-Associated Blood Stream Infections and Multi-Drug Resistant Organisms.
Upon completion of this course, you should be able to:
• Identify strategies that can reduce the risk of developing a surgical site infection,
• List the key elements in the Central Line Bundle, and
• Discuss key facts about specific multi-drug resistant organisms in the healthcare setting
What is a healthcare-associated infection? A healthcare-associated infection is an infection that a patient develops while receiving treatment for medical or surgical conditions. To be considered a healthcare-associated infection, the infection can not be present or incubating at the time of admission to the hospital. Healthcare-associated infections must be reported to the Patient Safety Authority and the Pennsylvania Department of Health.
Anyone who is a patient in a hospital is at risk for healthcare-associated infection. HAIs occur in all settings of care, including acute care within hospitals, same day surgical centers, home care, ambulatory outpatient care in health clinics, and long term care facilities. HAIs are associated with a variety of causes, including (but not limited to) the use of invasive medical devices such as catheters and ventilators, complications following surgery, and the transmission of microorganisms acquired in healthcare settings.
You may be surprised by some of the facts related to healthcare-associated infections. Do you know how many healthcare-associated infections occur in the United States each year? Do you know the leading types of healthcare-associated infections? What about the number of patient deaths that are caused by healthcare-associated infections each year? Or, how many extra days a patient must stay in the hospital due to getting a healthcare-associated infection?

Click each of the buttons to learn the facts.
How many healthcare-associated infections occur each year in the United States?

1.7 million healthcare-associated infections occur each year in the United States!
What are the leading types of healthcare-associated infections?

The most common type of healthcare-associated infections are urinary tract infections. Surgical site infections are the second most frequently occurring HAI in acute care hospitals.
How many patient deaths might be caused by healthcare-associated infections each year?

About 99,000 deaths result from infection that might have started after the patient was hospitalized.
How many extra days does a patient stay at the hospital due to getting an HAI?

A patient who gets an HAI while in the hospital, stays for an average of 6 extra days. If a patient develops a surgical site infection while in the hospital, on average their stay is extended 7 to 10 days. For central line-associated blood stream infections, the average stay increases by 7 days.
Hand Hygiene has long been recognized as the single most effective way to prevent the spread of infection. The prevention of HAI is also possible through the application of certain best practices. In the following three sections of this module, we will address the key practices to prevent Surgical Site Infections (SSIs), Central Line-Associated Blood Stream Infections (CLABSIs), and Multi-Drug Resistant Organisms (MDROs).
Surgical site infections are one of the most frequently occurring types of healthcare-associated infections. Preventative actions can reduce your patient's risk for developing a surgical site infection.

In this brief section, you will learn about the strategies to reduce your patient's risk for developing a surgical site infection.
What is a surgical site infection? A surgical site infection is an infection that occurs after surgery in the part of the body where the surgery took place. SSIs are classified as superficial incisional, deep incisional, or organ/space. Superficial incisional surgical site infections only involve the skin or subcutaneous tissue of the incision. Deep incisional surgical site infections involve fascia and/or muscle layers. Organ/space surgical site infections involve any part of the body that is opened or manipulated during the operative procedure.

Surgical site infections develop in about 1 to 3 out of every 100 patients who have surgery. Approximately 500,000 SSIs occur each year.
What can happen if a patient develops a surgical site infection? There are several possible negative outcomes that may result when a patient develops a surgical site infection.

Patients who develop surgical site infections CAN:
- Have an increased length of stay by 7 to 10 days,
- Have an increased rate of re-admission,
- Have a increased use of antibiotics and other medical treatments,
- Have increased medical costs, and
- Have an increased mortality rate.

Patients with a surgical site infection have a 2 to 11 times higher risk of death!
The likelihood of developing a surgical site infection relies on a combination of three factors – microbiological characteristics, patient characteristics, and surgical characteristics.

Click on each button to learn more
Microbiological characteristics involve the presence of bacteria near the surgical site. The amount of bacteria and other microorganisms that are present near the surgical site is dependent upon the location of the procedure. For example, fewer microorganisms are encountered during a joint replacement surgery compared to surgeries that involve the gastrointestinal system.
Patient characteristics include factors such as diabetes, obesity, smoking, and weakened immune status. Patients with any of these characteristics are at a greater risk for developing a surgical site infection.
Surgical characteristics include the type of procedure, the duration of the procedure, and the amount of damage caused to the tissue.
Patients can reduce their risk for developing a surgical site infection. Encourage your patients to control their serum glucose levels, lose weight if they are obese, and stop smoking. Patients who smoke get more infections than patients who don’t. You should also identify and treat any infections that the patient may already have before they have elective surgery.
Reducing Surgical Related Risks

- Perform preoperative surgical scrub
- Wash and clean the skin around the patient’s incision site
- Handle tissue carefully to reduce trauma
- Minimize operative time as much as possible
- Minimize operating room traffic
- Control blood glucose level during and after the procedure
- Maintain perioperative normothermia

Procedure related risk factors can also be reduced. Follow these precautions to lower your patients’ risk of developing a surgical site infection:

- Perform preoperative surgical scrub with an alcohol-based surgical hand antisepsis product,
- Wash and clean the skin around the patient’s incision site with an appropriate antiseptic agent,
- Handle tissue carefully to reduce trauma,
- Minimize operative time as much as possible,
- Minimize operating room traffic,
- Control blood glucose level during and after the procedure, and
- Maintain perioperative normothermia.
Antibiotic prophylaxis
- Deliver antibiotics within 1 hour before incision
- 2 hours for vancomycin and fluoroquinolones
- Use the recommended antibiotic
- Discontinue antibiotics within 24 hours after surgery
- Discontinue antibiotics within 48 hours for cardiothoracic procedures in adult patients

Antibiotic treatments also have an impact on reducing your patients’ risk for developing a surgical site infection. Deliver antibiotics within one hour before the incision is to be made. Vancomycin and fluoroquinolones should be delivered within 2 hours. Only use the recommended antibiotic. Discontinue use of antibiotics within 24 hours after surgery. For adult patients undergoing cardiothoracic procedures, discontinue antibiotics within 48 hours.
Proper hair removal can also reduce your patients' risk for developing a surgical site infection. Only remove hair if it will interfere with the operation. If hair removal is necessary, remove by clipping and do not use razors.
The Joint Commission requires hospitals to provide patients and their families with education related to preventing adverse events in surgery. “Patient Safety Tips for the Surgical Patient” includes information on the prevention of surgical site infections. This document includes information on what hospitals are doing to prevent surgical site infections and what patients can do to prevent surgical site infections. This health sheet is intended for patients who are scheduled for surgery.
Use Krames On-Demand to document your patient’s understanding of the information provided in the “Patient Safety Tips for the Surgical Patient” health sheet.

For Outpatient departments who do not use Krames On-Demand, the “Patient Safety Tips for the Surgical Patient” can be found on the LVHN Intranet. Documentation and evaluation of the patient’s understanding should be done in the medical record.
In this section of the course, you will be introduced to key evidence-based practices to prevent the incidence of central line-associated blood stream infections.
A central venous catheter, also known as a central line is a flexible tube that is inserted through the skin and ends at or close to the heart or in one of the great vessels. Central lines can be used to administer infused solutions, withdrawal blood and/or for hemodynamic monitoring.
A central line-associated blood stream infection or (CLABSI) is a blood stream infection that is associated with the presence of a central line or an umbilical catheter in newborns. Central lines disrupt the integrity of the skin, making patients vulnerable to bacterial and fungal infections, that lead to a central line-associated blood stream infection. A blood steam infection can occur when bacteria or other germs travel down the central line and enter the blood.

Approximately 200,000 CLABSIs occur in U.S. hospitals each year, resulting in 14,000 to 28,000 deaths annually. CLABSIs are very serious infections, increasing mortality rates 4 to 20% and prolonging a patients hospital stay on average by 7 days. The reported range for patient care cost attributed to CLABSI is $3,700 to $45,000 per episode.
Central Line Bundle

CLABSIs Prevention

Step Text
A “bundle” is a set of evidence based practices that when implemented together, result in substantially greater outcomes than when implemented individually.

Institute for Healthcare Improvement (IHI) Central Line Bundle:
- Hand Hygiene
- Maximal Barrier Precautions Upon Insertion
- Chlorhexidine Skin Antisepsis
- Optimal Catheter Site Selection, with Avoidance of the Femoral Vein in Adult Patients
- Daily Review of Line Necessity with Prompt Removal of Unnecessary Lines

Click the numbers at the bottom of the screen to learn more about each element of the Central Line Bundle.
• Optimal Catheter Site Selection, with Avoidance of the Femoral Vein in Adult Patients

• Daily Review of Line Necessity with Prompt Removal of Unnecessary Lines
Hand Hygiene

Follow the CDC Guidelines for Hand Hygiene and the World Health Organization (WHO) 5 Moments for Hand Hygiene

• Proper hand hygiene before catheter insertion, even when wearing gloves, and during all care and maintenance is essential

CDC Guidelines:
• Wash hands with soap and water or use an alcohol-based hand sanitizer

(WHO) 5 Moments for Hand Hygiene:
1. When entering the room and/or before patient contact
2. Before clean/aseptic procedure
3. After body fluid exposure risk
4. After patient contact and/or when leaving the room
5. After contact with the patient’s surroundings

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Maximal Barrier Precautions

For Operator and Supervisor

- Full sterile attire including eye protection

For Assistants and All Others in the Room

- Hair cover and mask with face shield/eye protection

For the Patient

- Cover patient’s head and body with a large sterile drape (use more than one if needed for large patients)

Step Text

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- Full sterile attire including eye protection

For Assistants and All Others in the Room

- Hair cover and mask with face shield/eye protection

For the Patient
• Cover patient’s head and body with a large sterile drape (use more than one if needed for large patients)
Chlorhexidine Skin Antisepsis

**Step Text**
- Prepare skin with 2% Chlorhexidine Gluconate (CHG) in 70% isopropyl alcohol
- Apply CHG using a back and forth friction scrub for at least 30 seconds. Do not wipe or blot
- Allow antiseptic solution time to dry completely before puncturing the site (~30 seconds)
- CHG provides persistent bacterocidal activity
Optimal Catheter Site Selection

Step Text
Physicians must weigh risk-benefit of site selection for individual patient

Subclavian site:
- Preferred site for types of catheters used for short term therapy
- Lower risk of CLABSI than the internal jugular vein

Femoral site:
- Greatest risk of infection, especially in overweight patients
Daily Review of Line Necessity

Step Text

• Goal is to reduce the number of line days to reduce the risk of acquiring a CLABSI

• Include daily review of line necessity in multidisciplinary rounds

• Remove promptly when no longer needed
During a procedure involving insertion of a central line a multidisciplinary insertion procedure checklist is used. Utilize the Central Line Checklist to document compliance with the insertion criteria at the time of insertion. Using the Central Line Checklist during the procedure creates a culture of collaboration, patient safety, and prevention. The checklist increases awareness of the key components of proper insertion and improves accountability and compliance with standard of care.

Completion of the procedural checklist is a shared responsibility between the provider inserting the central line and the nurse or other professional recording and observing the procedure.
Proper care and maintenance of the central line is essential to prevent CLABSIs. When caring for a patient with a central line the preferred dressing is transparent and semi-permeable. The benefits of a transparent, semi-permeable dressing include the ability to evaluate the insertion site while the dressing is in place, the wicking of moisture away from the skin, and less frequent dressing changes compared with standard gauze and tape dressings.

The transparent dressing should be changed every 7 days and whenever the dressing is soiled or non-adherent. Avoid using antibiotic ointment at the catheter insertion site as it promotes fungal infections and antibiotic resistance (except when using dialysis catheters). Instead, utilize antimicrobial discs.

When caring for a patient with a central line always, clean your hands and wear gloves when changing the bandage that covers the area where the catheter enters the skin. Disinfect the catheter hub openings with an antiseptic solution before accessing the port.

In general, minimize the manipulation of the catheter.
Additional measures to prevent CLABSIs include:
• Educate and train providers who insert lines
• Use a standardized supply cart or kit
• Routine replacement of central lines is not necessary
• Replace central lines within 24 hours when adherence to aseptic technique was not followed during insertion

For more information please refer to the LVHN Patient Care Services Clinical Practice Guideline “Central Catheter: Venous or Arterial” and the LVHN Infection Control and Prevention policy “Requirements for Infection Control in Intravenous Therapy.” Both policies can be found on the LVHN Intranet. On the LVHN Intranet home page select the Resources menu, then highlight Employee, and click on Manuals. On the Manuals and Policies page, select the Patient Care Manual or the Infection Control and Prevention links.
In this section of the course, you will be introduced to the primary types of multi-drug resistant organisms and learn infection control precautions to prevent the transmission of MDROs in the healthcare environment.
Multi-Drug Resistant Organisms are microorganisms, mostly bacteria, that are resistant to one or more classes of antimicrobial agents, or antibiotics.
Types of resistant organisms include:
• Clostridium difficile - (C. Diff)
• Methicillin-resistant Staphylococcus aureus - MRSA
• Vancomycin-resistant enterococci - VRE
• MDR Acinetobacter baumannii
• Carbapenem-resistant Enterobacteriaceae (Carbapenemase-producing Enterobacteriaceae) - CRE
• Extended spectrum beta-lactamase producers - (ESBL)
Patients with severe disease and hospitalized patients are most at risk for contracting an infection with an MDRO. This includes patients with underlying medical conditions, patients who have recently had surgery, and patients with indwelling medical devices such as urinary catheters or endotracheal tubes or IVs.

Other factors that increase the risk for getting an infection with an MDRO include:
- Antibiotic use,
- A large number of colonized patients, and
- The contamination of healthcare worker’s hands and environmental surfaces.

The treatment of MDROs is extremely challenging because there are few antibiotics that can be used to eradicate these severely resistant organisms.

Severe cases of C. Diff and MDROs can result in death. Therefore, early implementation of prevention efforts is key in preventing the spread of Multi-drug resistant organisms. MDROs are spread by contaminated hands of healthcare providers, contaminated medical equipment and other environmental surfaces in the patient's surroundings.
To prevent the spread of MDRO infections, there are certain precautions that should be followed. There are a few special precautions that you should keep in mind when caring for a patient with Clostridium difficile (C. Diff) or Vancomycin-resistant enterococci (VRE).

When caring for a patient with C. Diff, it is important to follow strict hand hygiene practices. Wash your hands with antibacterial soap and water before and after patient contact. Washing with soap and water is preferred when caring for a patient with C. Diff. Use an alcohol-based waterless hand sanitizer as a second choice.

You should also clean medical equipment and the patient room with a hospital approved bleach solution. Clean C. Diff patient’s bathrooms more frequently.

When caring for patients with VRE, isolation precautions are not required unless the patient has an open draining wound, diarrhea, or are incontinent of urine or stool.
MDRO Precautions

Following precautions can help prevent the spread of infections.

Click on each of the numbered buttons above to learn more about the precautions that you should take when caring for a patient with a MDRO infection.

Now that you have learned the special precautions for C. Diff and VRE, let's learn more about the precautions that apply to all of the MDRO’s. Following these precautions can help to prevent the spread of infection to yourself and to others.

Click on each of the numbered buttons to learn more about the precautions that you should take when caring for a patient with an MDRO infection.
Utilize Standard Precautions plus Contact Precautions for known or suspected cases.
Patients with MDROs should be assigned a private room, or partnered with another patient who is infected with the same resistant organism.
Perform proper hand hygiene practices before and after all patient contact. It is preferred that you use an alcohol-based waterless hand sanitizer to disinfect your hands. The use of antibacterial soap and water is recommended if your hands are visibly dirty. Remember, for patients with C. Diff, washing with soap and water is preferred.
Use dedicated medical equipment or single use items if possible. It is important to disinfect items before using them with another patient.
Gloves should be worn for all patient contact. Gloves should also be worn if you will come into contact with environmental surfaces in the patient’s room, such as medical equipment, bed rails, or doorknobs. Remove your gloves and perform hand hygiene when you exit the patient’s room.
Wear a gown whenever there is a chance that your clothing will become contaminated through contact with the patient or the patient’s environment. You should also wear a gown if you will come into contact with a patient’s wound or other drainage containing a MDRO.
Carefully clean the patient's room and medical equipment with a hospital approved disinfectant solution*. Frequently touched surfaces should be cleaned more often.

* For patients with C. Diff, clean medical equipment and the patient room with hospital approved bleach solution.

Careful cleaning of the patient's room and other medical equipment with a hospital approved disinfectant solution will also help to prevent the spread of infections. Frequently touched surfaces, such as bed rails, over bed table, bedside commode, surfaces in the patient's bathroom, and doorknobs should be cleaned more often.
Patients and visitors should be educated on ways to prevent the spread of infection. Educational materials on hand hygiene practices, respiratory practices, and contact precautions can be found through Krames On-Demand.

This is an example of the handwashing tips for patients, family and friends.

This is an example of the education for preventing the spread of infection.