
Integrated Activities and Tools for Antimicrobial Stewardship



Hospital Acquired Infections

Anita Shallal, MD

Infectious Diseases

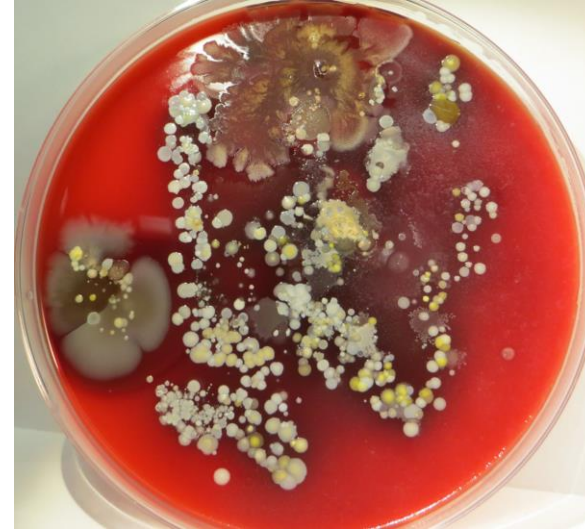
Henry Ford Hospital – Detroit, MI

Hospital Acquired Infections

- An infection acquired as a result of or related to care provided in a healthcare setting
- Affect 1 in 20 patients in the US
 - Increases morbidity, mortality, length of stay, and hospital costs
- Most are preventable...

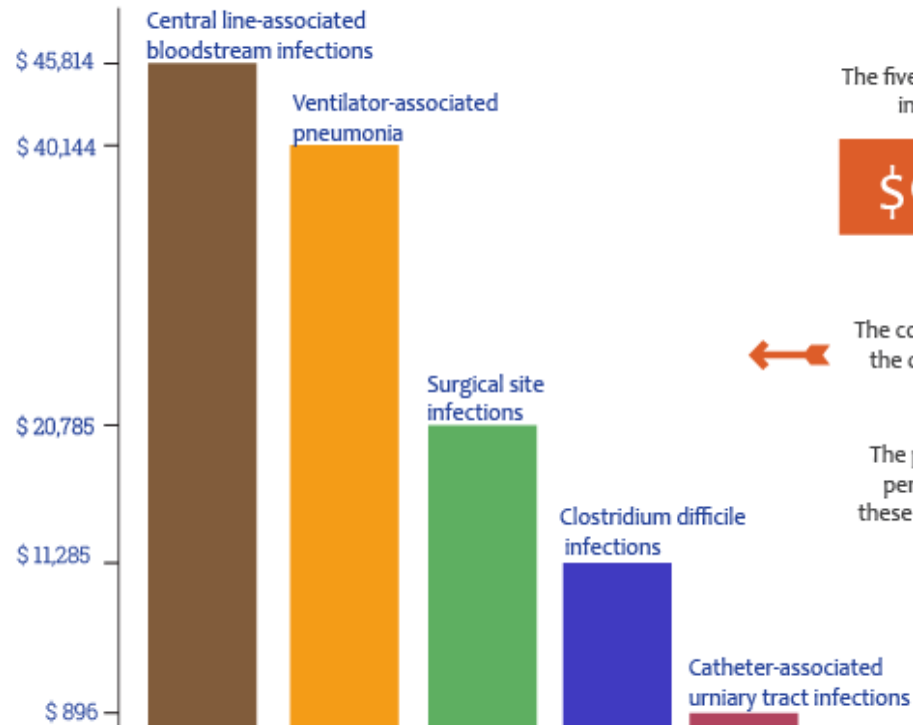
Patient Safety: It's In Your Hands!

- Germs may survive on surfaces anywhere from hours to months
- Multiple studies show that poor Hand Hygiene has led to HAIs and outbreaks



Costs of the five most common hospital-acquired infections (HAIs) in the US

Costs per case



The five most common hospital-acquired infections (HAIs) cost the US

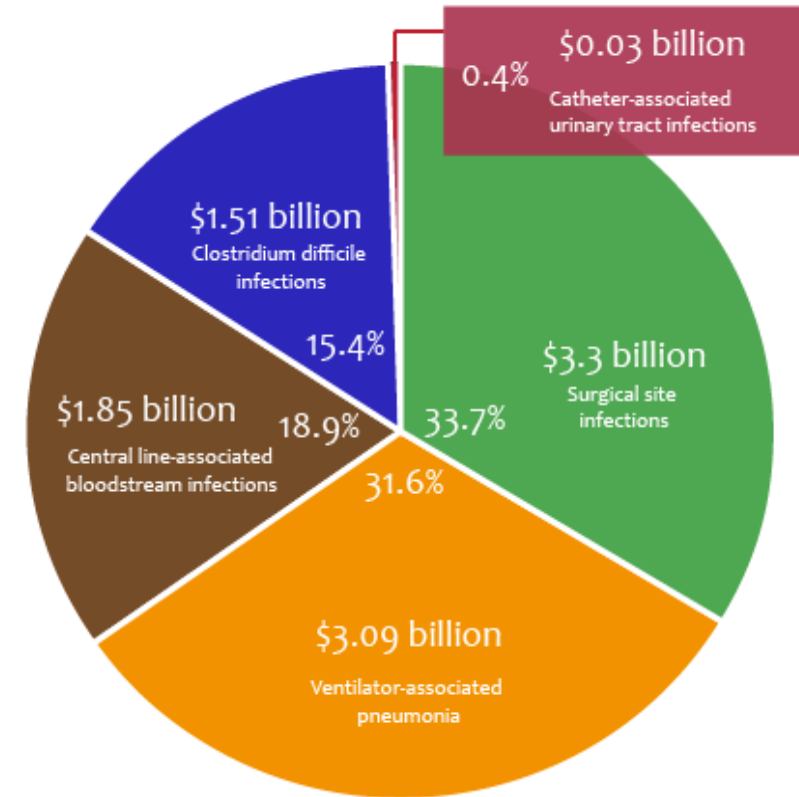
\$9.8 billion

annually.

The column graph on the left shows the cost per infection for each of these infections.

The pie-chart on the right displays the percentage contribution of each of these infections to this total annual cost.

Percentage share of total annual costs



Data source: Eyal Zimlichman, Daniel Henderson, Orly Tamir, Calvin Franz, Peter Song, Cyrus K. Yamin, Carol Keohane, Charles R. Denham, & David W. Bates. Health Care-Associated Infections: A Meta-analysis of Costs and Financial Impact on the US Health Care System. *JAMA Internal Medicine*.

Hospital-Acquired Infections

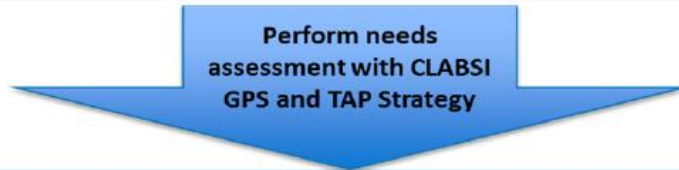
- **Central line-associated bloodstream infection (CLABSI)**
- Catheter-associated urinary tract infection (CAUTI)
- Ventilator associated pneumonia (VAP)
- *C. difficile* infection (CDI)
- Surgical site infections (SSI)

CLABSI

- Associated with prolonged hospital stay and increased cost and mortality
- Preventable!
 - Proper insertion & maintenance techniques
 - e.g.: Daily chlorhexidine bathing in ICU patients, avoid femoral access, use of ultrasound-guidance
 - **Duration of catheterization** is one of the most important risk factors in development of CLABSI

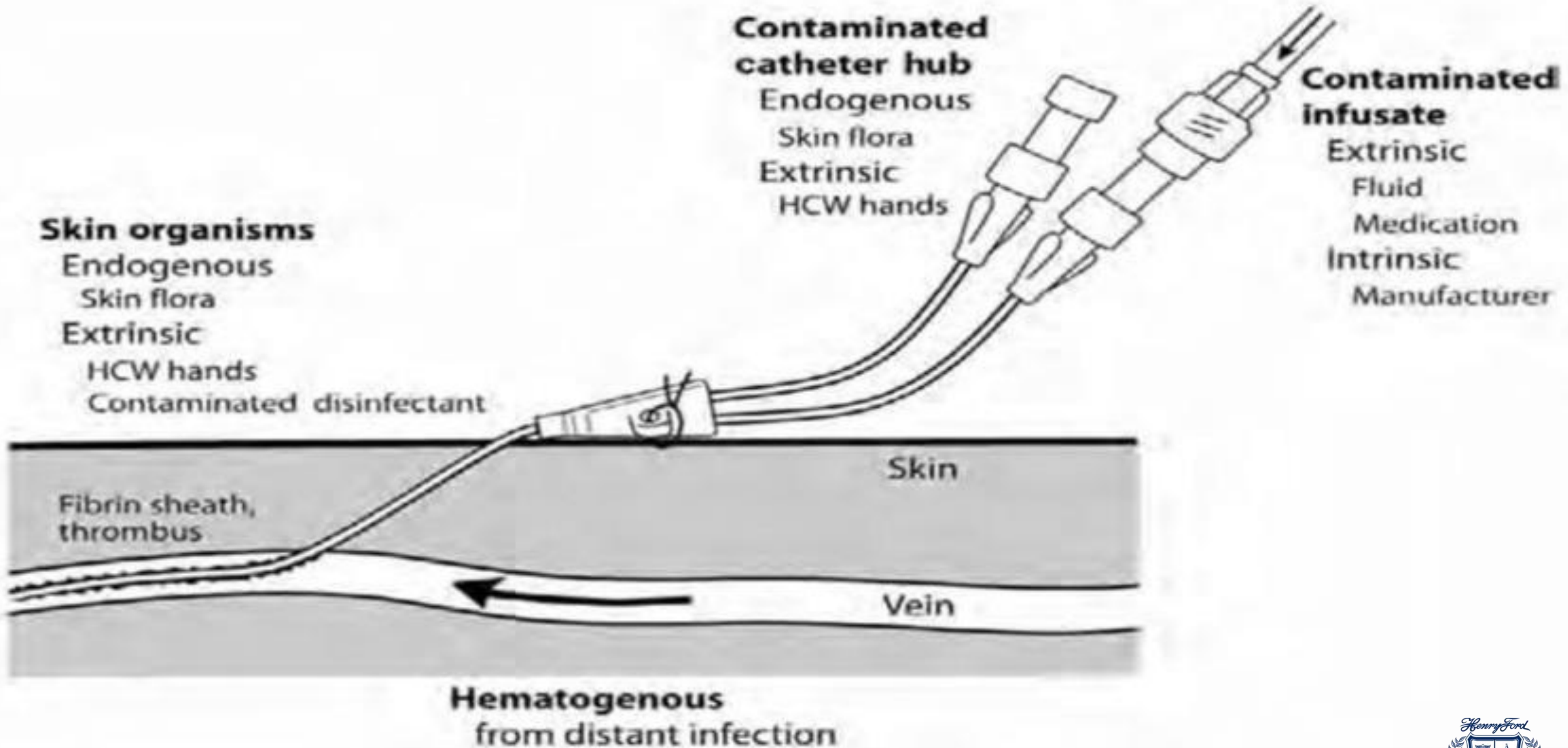
Tiers of CLABSI Prevention Practices*

TIER 1 Standardize Supplies, Procedures and Processes <i>(complete all interventions: review and audit compliance with Tier 1 measures prior to moving to Tier 2)</i>				
Assess appropriateness and need for Central Venous Catheter (CVC)	Select appropriate site of insertion; avoid use of femoral site	Ensure proper aseptic insertion using maximal sterile barriers and ultrasound guidance	Ensure proper care and maintenance of CVC; e.g. proper hand hygiene, adequate staffing, disinfection of connector, secure/intact dressing	Optimize prompt removal of clinically unnecessary CVCs
(If CLABSI rates remain elevated, start with CLABSI Guide to Patient Safety (GPS) and Target Assessment for Prevention (TAP) Strategy and then proceed with additional interventions)				



Tier 2 Enhanced Practices				
Conduct multidisciplinary rounds to audit for necessity of continued CVC use	Feed back CLABSI and CVC utilization metrics to frontline staff in "real time"	Observe and document competency and compliance with CVC insertion and maintenance	Use additional approaches as indicated by risk assessment (e.g., antimicrobial coated CVC)	Full or mini root cause analysis of CLABSI





Checklist for Prevention of Central Line Associated Blood Stream Infections

Based on 2011 CDC guideline for prevention of intravascular catheter-associated bloodstream infections:

<https://www.cdc.gov/infectioncontrol/guidelines/bsi/index.html>

Strategies to Prevent Central Line–Associated Bloodstream Infections in Acute Care Hospitals: 2014 Update

<http://www.jstor.org/stable/10.1086/676533>

For Clinicians:

Follow proper insertion practices

- Perform hand hygiene before insertion.
- Adhere to aseptic technique.
- Use maximal sterile barrier precautions (i.e., mask, cap, gown, sterile gloves, and sterile full body drape).
- Choose the best insertion site to minimize infections and noninfectious complications based on individual patient characteristics.
 - Avoid femoral site in obese adult patients.
- Prepare the insertion site with >0.5% chlorhexidine with alcohol.
- Place a sterile gauze dressing or a sterile, transparent, semipermeable dressing over the insertion site.
- For patients 18 years of age or older, use a chlorhexidine impregnated dressing with an FDA cleared label that specifies a clinical indication for reducing CLABSI for short term non-tunneled catheters unless the facility is demonstrating success at preventing CLABSI with baseline prevention practices.

Handle and maintain central lines appropriately

- Comply with hand hygiene requirements.
- Bathe ICU patients over 2 months of age with a chlorhexidine preparation on a daily basis.
- Scrub the access port or hub with friction immediately prior to each use with an appropriate antiseptic (chlorhexidine, povidone iodine, an iodophor, or 70% alcohol).
- Use only sterile devices to access catheters.
- Immediately replace dressings that are wet, soiled, or dislodged.
- Perform routine dressing changes using aseptic technique with clean or sterile gloves.
 - Change gauze dressings at least every two days or semipermeable dressings at least every seven days.
 - For patients 18 years of age or older, use a chlorhexidine impregnated dressing with an FDA cleared label that specifies a clinical indication for reducing CLABSI for short-term non-tunneled catheters unless the facility is demonstrating success at preventing CLABSI with baseline prevention practices.
- Change administrations sets for continuous infusions no more frequently than every 4 days, but at least every 7 days.
 - If blood or blood products or fat emulsions are administered change tubing every 24 hours.
 - If propofol is administered, change tubing every 6-12 hours or when the vial is changed.

Promptly remove unnecessary central lines

- Perform daily audits to assess whether each central line is still needed.

Proper Insertion & Maintenance

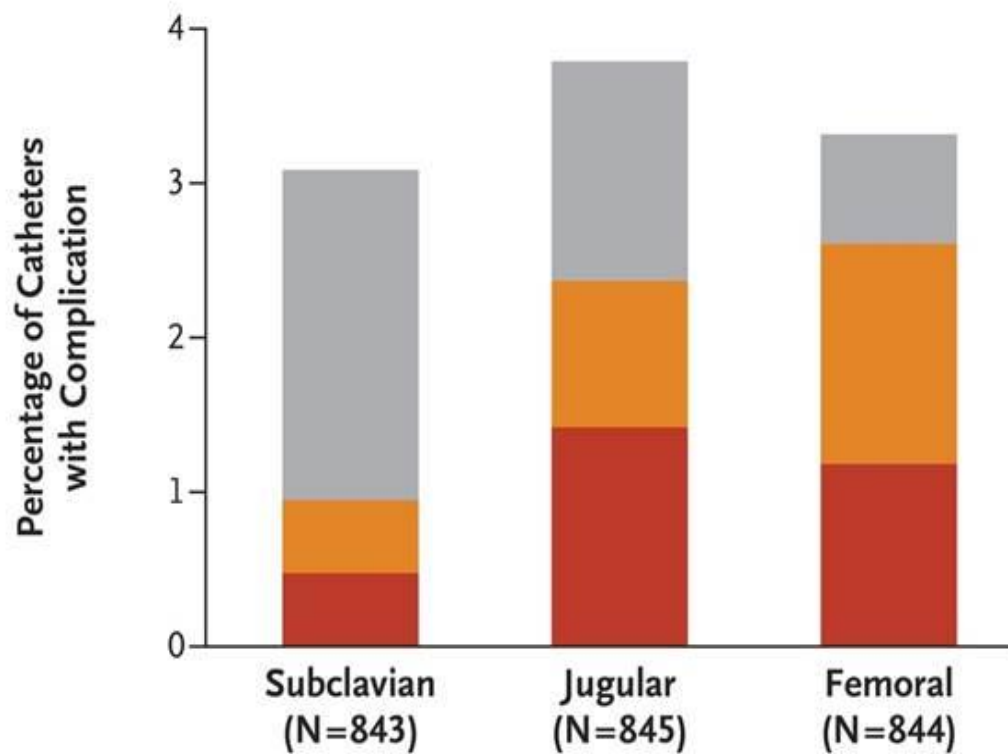
CLABSI Prevention

1. Optimal site selection
2. Maximal sterile barrier precautions upon insertion
3. Chlorhexidine skin antisepsis
4. CHG-impregnated dressing
5. Daily 2% chlorhexidine cleansing
6. Hand hygiene and aseptic technique
- 7. Daily review of central line necessity and prompt removal of unnecessary lines**



Additional CDC Recommendations

- Use a subclavian site in adult patients to minimize infection risk for non-tunneled CVC placement (**Category 1B**)
- Avoid using the femoral vein for central venous access in adult patients (**1A**)
 - No recommendation for preferred site of insertion to minimize infection risk for tunneled CV
 - However, KDOQI recommends the IJ
- Catheters inserted during a medical emergency should be replaced within 48 hours (1B)
- Use a CVC with the minimum number of ports or lumens (1B)
- Use a sutureless securement device to reduce the risk of infection (II)



■ Mechanical (grade ≥3)	18 (2.1%)	12 (1.4%)	6 (0.7%)
■ Symptomatic deep-vein thrombosis	4 (0.5%)	8 (0.9%)	12 (1.4%)
■ Bloodstream infection	4 (0.5%)	12 (1.4%)	10 (1.2%)

Table 2. Frequency of Mechanical Complications, According to the Route of Catheterization.*

Complication	Frequency		
	Internal Jugular	Subclavian	Femoral
Arterial puncture	6.3–9.4	3.1–4.9	9.0–15.0
Hematoma	<0.1–2.2	1.2–2.1	3.8–4.4
Hemothorax	NA	0.4–0.6	NA
Pneumothorax	<0.1–0.2	1.5–3.1	NA
Total	6.3–11.8	6.2–10.7	12.8–19.4

* Data are from Merrer et al.,⁵ Sznajder et al.,⁶ Mansfield et al.,⁸ Martin et al.,²² Durbec et al.,²³ and Timsit et al.²⁴ NA denotes not applicable.

CLABSI Prevention Goals

Maintenance

- Aseptic technique (“scrub the hub”)
- Daily evaluation of catheter insertion site
- Dressing change using sterile gloves, mask, Chloraprep
 - Transparent dressings are replaced weekly
 - Gauze dressings (diaphoresis, bleeding or oozing) are replaced every 2 days
 - However, replace either dressing if damp, loosened, or visibly soiled immediately
- Daily review of central line necessity and prompt removal of unnecessary lines
 - **Central line justification checklist**

Central Line Necessity

- Daily alert in electronic medical record for provider which ensures an indication for CVC or PICC has been met:
 - Vasopressors
 - Chemotherapy w/ vesicant
 - TPN/lipids
 - 3% saline
 - Hemodynamic monitoring
 - Dialysis
 - Difficult access (unable to place PIV or midline)
 - Outpatient IV medications

Central Line Necessity

PICC Triple Lumen 06/28/21

Placed: 6/28/2021 0950

Present at Admission: No

Initial Extremity Circ (cm) - Measured at 10cm abo... 39

Initial Exposed Catheter Length (cm): 0

✎ Length (cm): 41

Orientation: right

Location: Basilic

Size (Fr): 5

Manufacturer/Lot Number: REFP0235

Central line indications

- Vasopressors 3% Saline TPN/Lipids Chemotherapy with vesicant properties Dialysis Hemodynamic monitoring Needed for surgery Difficult access (unable to place IV or Midline)
- Outpatient IV medication No longer has indication for central line and the catheter will be removed



Non-tunneled HD/apheresis catheter with infusion port 06/30/21 1600

✎ Placed: 6/30/2021 1600 Present at Admission: No Orientation: Right Location: Internal jugular

Central line indications

- Vasopressors 3% Saline TPN/Lipids Chemotherapy with vesicant properties Dialysis Hemodynamic monitoring Needed for surgery Difficult access (unable to place IV or Midline)
- Outpatient IV medication No longer has indication for central line and the catheter will be removed



📝 Create Note

⏪ Restore

✓ Close

✗ Cancel

↑ Previous

↓ Next

Device Audit

* 4. Central Line (if line present, must fill in all columns)

Question Title	Insertion Site	Dressing intact?	Is date written on dressing?	Was dressing changed within 7 days? (if not written on dressing, check chart)	Chlorhexidine present and positioned over site?	Site without redness?	Site without drainage/blood?	If blood present, was dressing changed within 24 hrs?
Central 1	<input type="text"/> Central 1 Insertion Site menu	<input type="text"/> Central 1 Dressing intact? menu	<input type="text"/> Central 1 Is date written on dressing? menu	<input type="text"/> Central 1 Was dressing changed within 7 days? (if not written on dressing, check chart) menu	<input type="text"/> Central 1 Chlorhexidine present and positioned over site? menu	<input type="text"/> Central 1 Site without redness? menu	<input type="text"/> Central 1 Site without drainage/blood? menu	<input type="text"/> Central 1 If blood present, was dressing changed within 24 hrs? menu
Central 2	<input type="text"/> Central 2 Insertion Site menu	<input type="text"/> Central 2 Dressing intact? menu	<input type="text"/> Central 2 Is date written on dressing? menu	<input type="text"/> Central 2 Was dressing changed within 7 days? (if not written on dressing, check chart) menu	<input type="text"/> Central 2 Chlorhexidine present and positioned over site? menu	<input type="text"/> Central 2 Site without redness? menu	<input type="text"/> Central 2 Site without drainage/blood? menu	<input type="text"/> Central 2 If blood present, was dressing changed within 24 hrs? menu
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Question Title

* 5 HD/Arteriosic (if line present, must fill in all columns)



Diagnostic Stewardship and Blood Cultures



Diagnostic stewardship

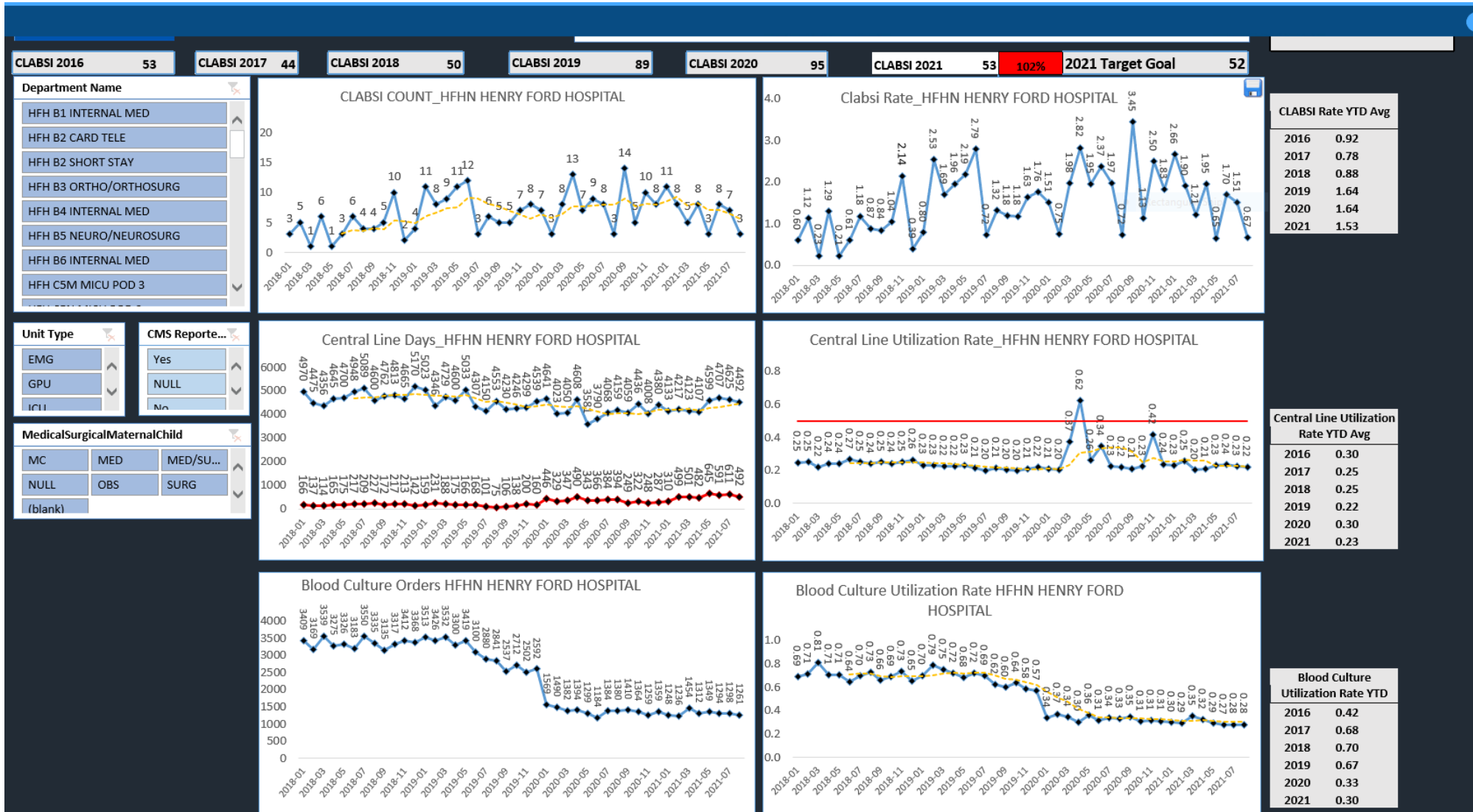
the right test for the right patient



Antimicrobial stewardship (AMS)

the right antibiotic, dose & duration

HFH Infection Control Dashboard



CLABSI Rate YTD Avg

2016	0.92
2017	0.78
2018	0.88
2019	1.64
2020	1.64
2021	1.53

Central Line Utilization Rate YTD Avg

2016	0.30
2017	0.25
2018	0.25
2019	0.22
2020	0.30
2021	0.23

Blood Culture Utilization Rate YTD

2016	0.42
2017	0.68
2018	0.70
2019	0.67
2020	0.33
2021	0.30



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Question 1

- The percentage of patients in acute care hospitals with a urinary catheter inserted is...?
 - 25%
 - 50%
 - 75%

Question 1

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 - **25%**
 - 50%
 - 75%

Question 2

- The greatest risk for CAUTI is?
 - Poor insertion technique
 - Broken seal between catheter and drainage system
 - Unsecured catheter
 - Bag above the bladder
 - Duration of catheterization

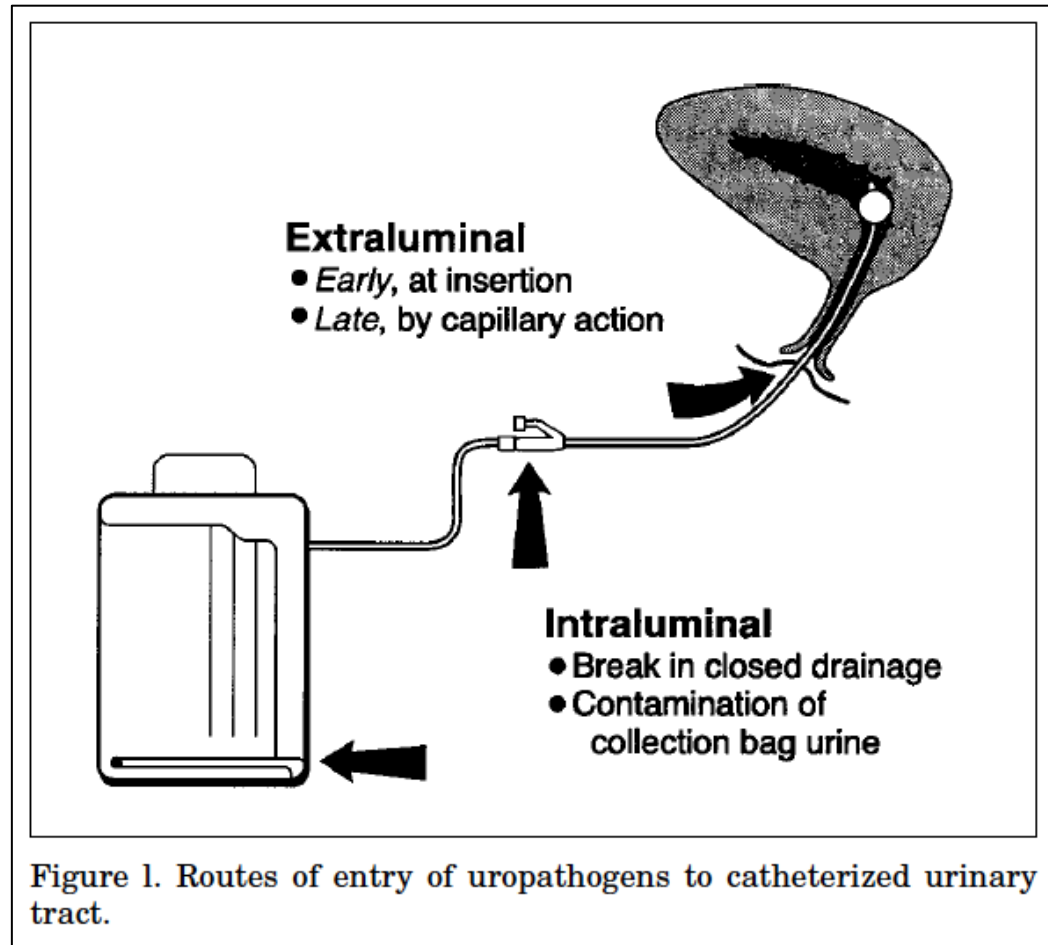
Question 2

- The greatest risk for CAUTI is?
 - Poor insertion technique
 - Broken seal between catheter and drainage system
 - Unsecured catheter
 - Bag above the bladder
 - **Duration of catheterization**

CAUTI

- CAUTI = catheter associated urinary tract infections
- Many of HAI are urinary tract infections, and 75% of them are associated with a catheter
- 25% of patients admitted to acute care hospitals will have a urinary catheter placed
 - Higher in critically ill patients
 - Up to 1/3 of the time, catheters are unnecessary
- Every day with a catheter increases incidence of bacteriuria
 - 3-7% increase per day

CAUTI: The Problem



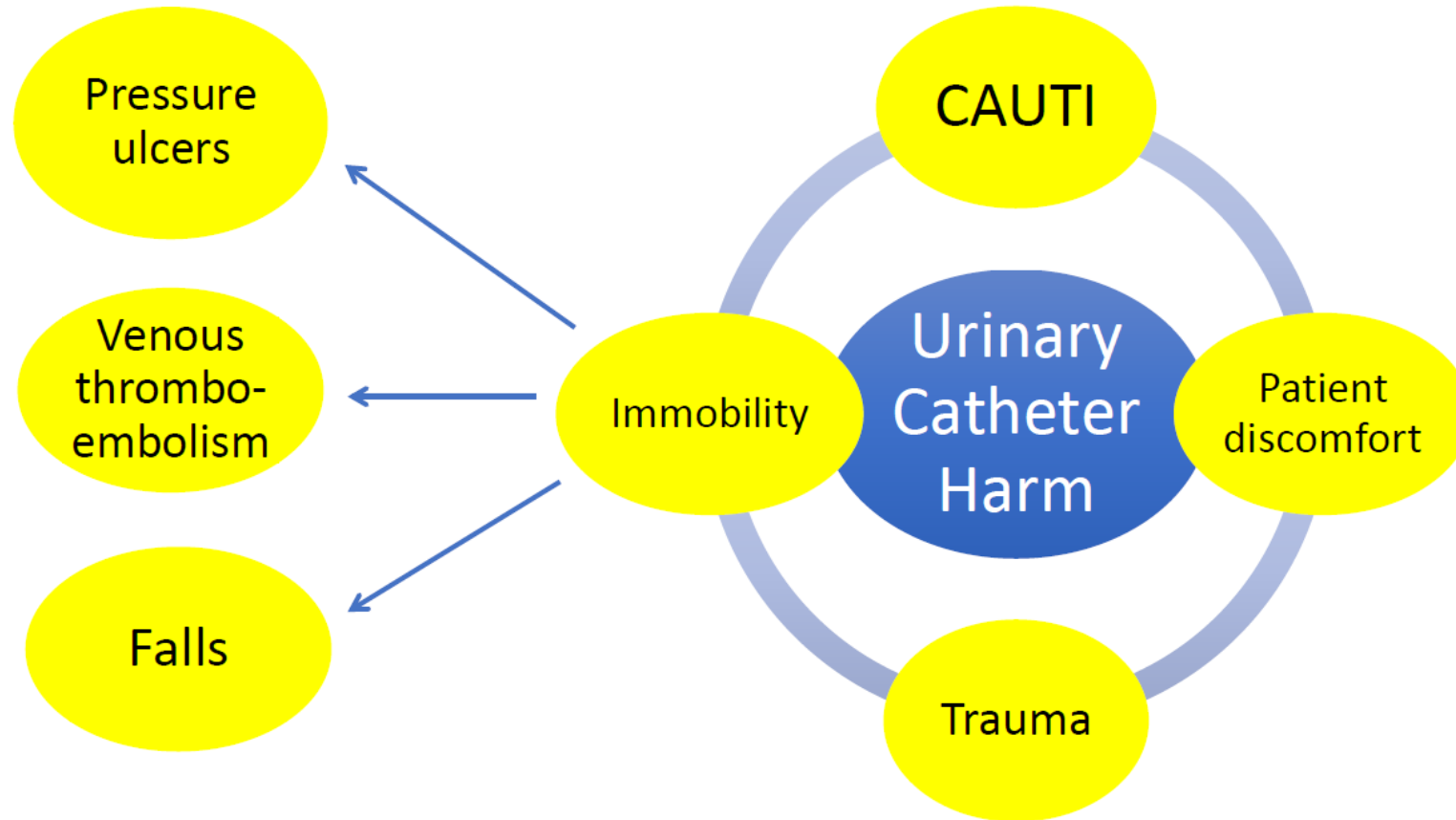
Bacteriuria:

- at insertion: 8.7%
- every day of catheterization: 3-7%

CAUTI: A Solution

Early removal of unnecessary catheters!

Indwelling Urinary Catheters Cause Harm



Tiered Approach to CAUTI Prevention

Tier 1 Standardize Supplies, Procedures and Process

(complete all interventions: review and audit compliance with Tier 1 measures prior to moving to Tier 2)

Place indwelling urinary catheter only for appropriate reasons

Encourage use of alternatives to indwelling urinary catheters

Ensure proper aseptic insertion technique and maintenance procedures

Optimize prompt removal of unneeded catheters

Urine culture stewardship: culture only if symptoms of UTI are present

(If CAUTI rates remain elevated, start with CAUTI Guide to Patient Safety (GPS) and Target Assessment for Prevention (TAP) Strategy and then proceed with additional interventions)

Perform needs assessment with CAUTI GPS and TAP Strategy

Tier 2 Enhanced Practices

Conduct catheter rounds with targeted education to optimize appropriate use

Feed back infection and catheter use to frontline staff in "real time"

Observe and document competency of catheter insertion: education and observed behavior

Perform root-cause analysis or focused review of infections



Indications for Urinary Catheter

Acute urinary retention

Accurate measurement of output in critically ill

Need during selected surgeries

Urological procedure / catheter placed by urology service

Assist healing of stage 3-4 sacral ulcers in incontinent patients

Prolonged immobilization

Hospice or palliative care

Insertion and maintenance of urinary catheter “Catheter Bundle”

1. Use aseptic technique during insertion
2. Use catheter securement device (STATLOCK)
3. Do not break seal between catheter and bag
4. Keep urinary bag below level of bladder
5. Avoid dependent loops or kinking of catheter
6. Maintain <400 cc urine in bag
7. Empty bag before patient is transported



Diagnostic Stewardship and Urine Cultures



Diagnostic stewardship

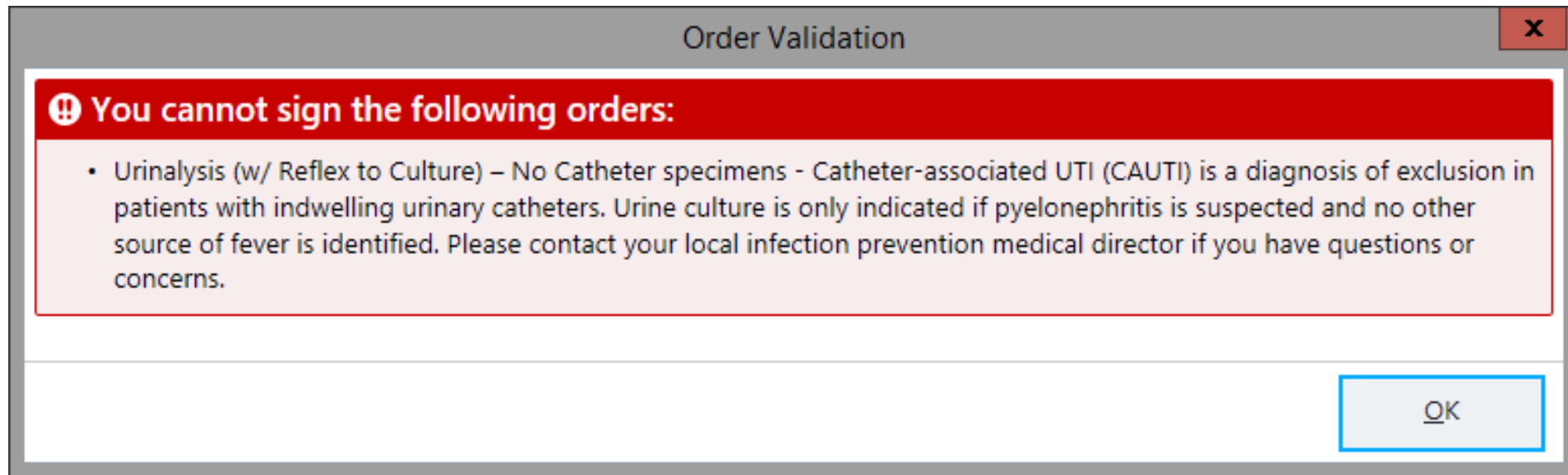
the right test for the right patient



Antimicrobial stewardship (AMS)

the right antibiotic, dose & duration

Urine Culture Hard Stop at HFH



Hospital-Acquired Infections

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- **Ventilator associated pneumonia (VAP)**
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- Surgical site infections (SSI)

Ventilator Associated Pneumonia Prevention

Avoid intubation if possible

Minimize sedation

Spontaneous awakening trials daily

Assess readiness to extubate daily

Facilitate early mobility

Use subglottic suction ports

Avoid vent circuit changes

Elevate the head of bed to 30-45 degrees



Question #1

- Which of the following is the most common HAI in hospitalized patients?
 - VRE
 - MRSA
 - C difficile infection
 - Candida auris
 - Pseudomonas

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 - VRE
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 - **C difficile infection**
 - Candida auris
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Hospital-Acquired Infections

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- ***C. difficile* infection (CDI)**
- Surgical site infections (SSI)

Question #2

- Compared to hand sanitizer, soap and water will kill C difficile spores.
 - True
 - False

Question #2

- Compared to hand sanitizer, soap and water will kill C difficile spores.
 - True
 - **False**

Clostridioides difficile infection

- Most commonly reported HAI
 - Inappropriate antibiotic use
 - Inappropriate testing
- Associated with high morbidity and mortality
 - Also associated with high inpatient costs

C. difficile Testing Pearls



ONLY TEST FOR *C. difficile* IF:

- ≥ 3 loose/watery stools within 24 hours

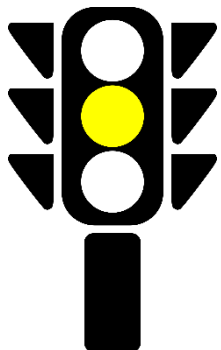
AND

- Diarrhea is not due to medications e.g. laxatives, tube feeds



DO NOT TEST FOR *C. difficile* IF:

- Formed stool
- Patients received laxatives, oral contrast, tube feeds
- Negative *C. difficile* test within last 7 days
- Positive during the same admission or test for cure



EXCEPTION TO TESTING FOR *C. difficile* IF:

- During first 3 days of admission and clinical suspicion for CDI is high, test immediately

Prevention of C diff Infection

- Reduce unnecessary antibiotic exposure
- Early detection
- Decrease inappropriate testing
 - Test only patients who have symptomatic diarrhea with no other alternative cause
 - However, we *should* test patients with diarrhea and clinical deterioration

Hospital-Acquired Infections

- Central line-associated bloodstream infection (CLABSI)
- Catheter-associated urinary tract infection (CAUTI)
- Ventilator associated pneumonia (VAP)
- *C. difficile* infection (CDI)
- **Surgical site infections (SSI)**

Surgical Site Infections

- SSIs occur in 2-5% of patients undergoing inpatient surgery
 - 60% of SSIs are preventable
 - Associated with increased LOS, cost, and mortality
- Prevention:
 - Appropriate peri-operative antibiotic prophylaxis
 - Hair removal should be avoided unless it interferes with surgery, otherwise should be performed as close to the time of surgery as possible
 - Use alcohol-containing pre-operative skin preparatory agents
 - Control blood glucose post-operatively

Surgical Site Infections

- Perioperative antibiotic prophylaxis should be discontinued after the surgical incision is closed for clean and clean-contaminated procedures
 - MRSA+ - Vancomycin PLUS cefazolin
 - 1 hour before incision
 - MSSA+ - Cefazolin
 - 15-30 min before incision
- Do not apply topical antimicrobials

MRSA Prevention Strategies

- Daily chlorhexidine gluconate (CHG) bathing in intensive care units
- MRSA decolonization for patients colonized with high risk of infection (ie: indwelling lines or catheters)
- Active surveillance testing for high-risk patient populations

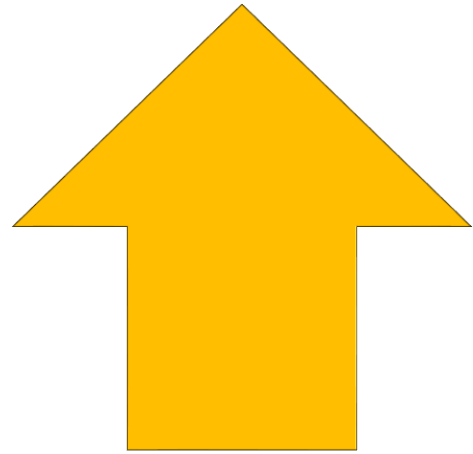
MRSA Decolonization Therapy

- Administration of antimicrobial or antiseptic agents to eradicate or suppress MRSA carriage
 - Intranasal antibiotic or antiseptic (mupirocin, povidone-iodine)
 - Topical antiseptic (chlorhexidine)
- Associated with reduction in MRSA carriage, transmission, and infection

Million \$ Question

What is the cheapest and most effective way to prevent an HAI?





20% increase in hand hygiene compliance



40% reduction in hospital acquired infections

Healthcare Associated Infections

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Integrated Activities and Tools for Antimicrobial Stewardship

