HENRY FORD HEALTH

HENRY FORD HEALTH + MICHIGAN STATE UNIVERSITY Health Sciences

International Vaccine Institute

Integrated Activity and Tools for Antimicrobial Stewardship, Infection Prevention & Diagnostic Stewardship

Infection Prevention & Control, Hospital Epidemiology

CAPTURA
Capturing data on Antimicrobial resistance Patterns and Trends in Use in Regions of Asia

TACE ASIA
Technical Assistance for Clinical Engagement

MOTT MACDONALD

UKaid from the British people

The Fleming Fund Regional Grants

Overview

1. Reducing hospital acquired infections
2. Hand hygiene
3. Central line infection
4. Indwelling catheter infection
5. Ventilator associated events
6. Surgical antimicrobial prophylaxis
7. Isolation
8. Outbreak investigation

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Reducing Hospital-acquired Infections (HAIs)

Hospital-acquired Infections (HAIs)

- An infection acquired as a result of or related to care provided in the healthcare setting
- HAIs cause increased morbidity, mortality, length of stay, and hospital cost
  - 1 in 31 patients and 1 in 43 nursing home residents contract at least 1 HAI daily
  - Over 99,000 people die annually from complications of HAIs
- Most HAIs are preventable

FY 2025 Hospital Value-Based Purchasing Program Quick Reference Guide

Payment adjustment effective for discharges from October 1, 2024, to September 30, 2025

Clinical Outcomes — 25%

Mortality Measures

Baseline Period: July 1, 2015–June 30, 2018
Performance Period: July 1, 2020–June 30, 2023

Measure ID	Measure Name	Achievement Threshold	Benchmark
MORT-30-AMI	Acute Myocardial Infarction 30-Day Mortality	0.872624	0.889994
MORT-30-CABG	Coronary Artery Bypass Graft Surgery 30-Day Mortality	0.970100	0.979775
MORT-30-COPD	Chronic Obstructive Pulmonary Disease 30-Day Mortality	0.915127	0.932236
MORT-30-HF	Heart Failure 30-Day Mortality	0.883990	0.910344
MORT-30-PN	Pneumonia 30-Day Mortality	0.841475	0.874425

Complication Measure

Baseline Period: April 1, 2015–March 31, 2018
Performance Period: April 1, 2020–March 31, 2023*

Measure ID	Measure Name	Achievement Threshold	Benchmark
COMP-HIP-	Total Hip Arthroplasty/Total		

Person and Community Engagement — 25%

Safety — 25%

Healthcare-Associated Infections

Baseline Period: Jan. 1, 2019–Dec. 31, 2019
Performance Period: Jan. 1, 2023–Dec. 31, 2023

	Measure ID	Measure Name	Achievement Threshold	Benchmark
⬇	CAUTI	Catheter-Associated Urinary Tract Infection	0.735	0.000
⬇	CDI	Clostridium *difficile* Infection	0.427	0.047
⬇	CLABSI	Central Line-Associated Bloodstream Infection	0.918	0.013
⬇	MRSA	Methicillin-Resistant Staphylococcus *aureus*	0.969	0.026
⬇	SSI	Colon Surgery	0.716	0.000
		Abdominal Hysterectomy	0.824	0.000

Efficiency and Cost Reduction — 25%

Baseline Period: Jan. 1, 2021–Dec. 31, 2021
Performance Period: Jan. 1, 2023–Dec. 31, 2023

	Measure ID	Measure Name	Achievement Threshold	Benchmark
⬇	MSPB	Medicare Spending per Beneficiary	Median MSPB ratio across all hospitals during the performance period	Mean of lowest decile of MSPB ratios across all hospitals during the performance period

Table 3.

Attributed Costs of Healthcare-Associated Infection in Southeast Asian Countries, 2000–2012

Study	Country	Setting	Type	Mean Hospital Costs, US$	Mean Antibiotic Costs, US$	Excess Cost, US$
Ng et al, 2012 [60]	Singapore	2 hospitals	MDR vs non-MDR bacteremia			4959
Pada et al, 2011 [56]	Singapore	2 hospitals	MRSA vs noninfected			13 000
Ha et al, 2012 [57]	Vietnam	1 NICU	HAI			865
Kasatpibal et al, 2005 [37]	Thailand	1 hospital	SSI			1091
Pancharti et al, 2005 [58]						
1 episode				1028	110	
2 episodes				2377	383	
≥3 episodes				4004	595	

Abbreviations: HAI, healthcare-associated infection; MDR, multidrug resistant; MRSA, methicillin-resistant *Staphylococcus aureus*; NICU, neonatal intensive care unit; SSI, surgical site infection.

Moi Lin Ling, Anucha Apisarnthanarak, Gilbert Madriaga, The Burden of Healthcare-Associated Infections in Southeast Asia: A Systematic Literature Review and Meta-analysis, *Clinical Infectious Diseases*, Volume 60, Issue 11, 1 June 2015, Pages 1690–1699, https://doi.org/10.1093/cid/civ095

Hand Hygiene

BEFORE...

- Immediate contact with a patient or their surroundings
- Performing a clean or sterile procedure

AFTER...

- Contact with a patient or their surroundings
- Possible exposure to blood or body fluid

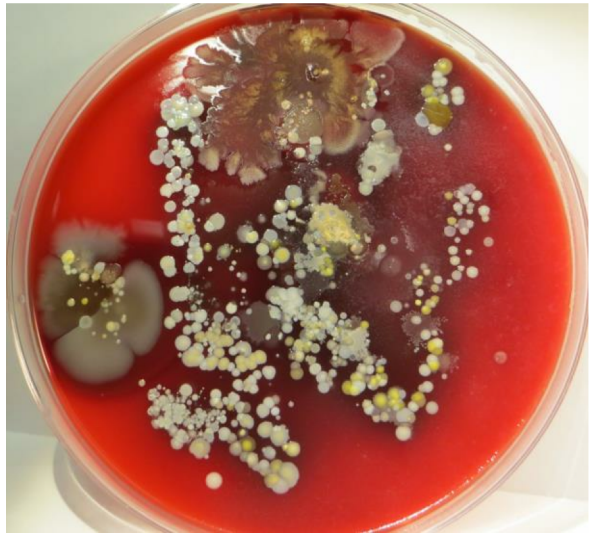
All of these indications for Hand Hygiene should be followed, regardless of glove use

Hand Hygiene and Glove Use

- Use of gloves does not substitute the need for Hand Hygiene
  - Performing hand hygiene ***before*** putting on gloves decreases contamination for the patient and environment
  - Performing hand hygiene ***after*** taking off gloves ensures that you remove any contaminants transferred to your hands during glove removal or through imperfect gloves

Importance of Hand Hygiene

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



Survival times of nosocomial pathogens

Organisms	Types of environmental surfaces	Duration of persistence
Staphylococcus aureus	Dry inanimate surfaces	7 days to 5 years
***Enterococcus* spp.**	Dry inanimate surfaces	5 days up to 5 years
E. coli	Dry inanimate surfaces	1.5 hours to 16 months
***Klebsiella* spp.**	Dry inanimate surfaces	2 hours to >30 months
Serratia marcescens	Dry inanimate surfaces	3 days to 2 months
Pseudomonas aeruginosa	Dry inanimate surfaces	6 hours to 16 months
Clostridioides difficile	Dry inanimate surfaces (spores)	>5 months
***Acinetobacter* spp.**	Dry inanimate surfaces	3 days to 11 months
***Candida* spp**	Dry inanimate surfaces	3 days to 5 months
Norovirus	Dry inanimate surfaces	8 hours to 2 weeks

Central Line-associated Bloodstream Infections– Background

Central Line-Associated Bloodstream Infections (CLABSIs)

Approximately 23,500 CLABSIs were reported to (NHSN) by U.S. hospitals in 2016

- 44% decrease in CLABSI between 2008-2016

CLABSI Impact

CLABSIs are associated with prolonged length of stay, increased cost and mortality

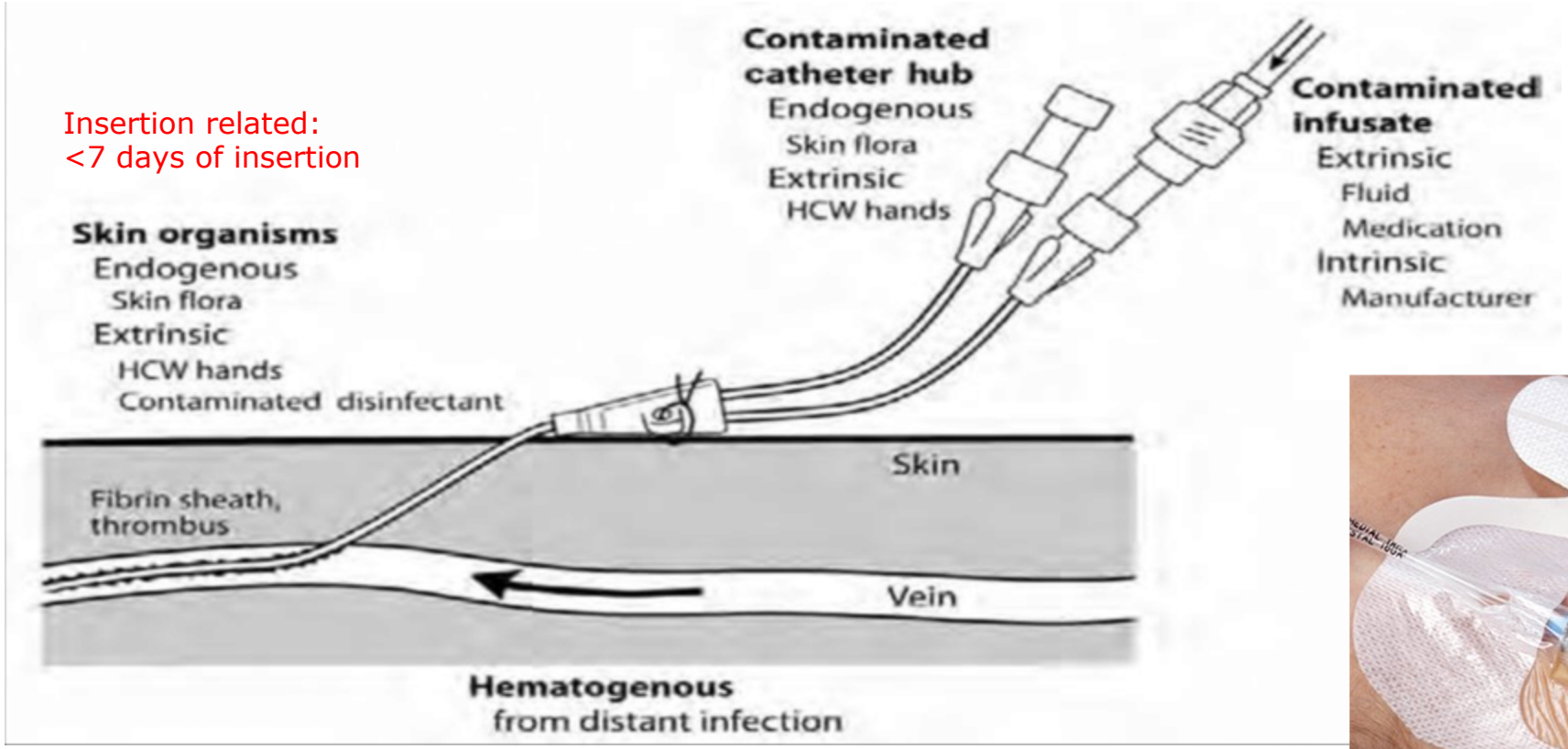
- On average, a CLABSI costs $55,646 and prolonged LOS by 19 days

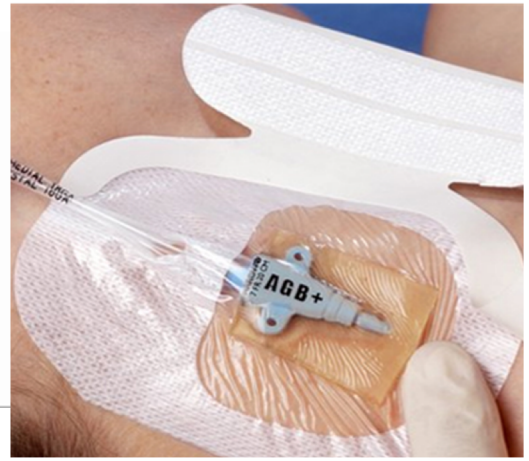
65%−70% of CLABSIs can be prevented by implementing and following evidence-based insertion and maintenance practices

- **Duration of catheterization** is one of the more important risk factor in the development of CLABSIs

How CLABSIs Happen

Maintenance related:
>7 days of insertion





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What is Considered a Central Line?

- Intravascular device that terminates at or close to the heart or one of the great vessels
  - –Temporary central line:
    a. **Peripherally inserted central catheters (PICCs)**
    b. Central venous catheters (CVC)
    c. Dialysis catheters
  - –Permanent central lines:
    a. Tunneled catheters, including tunneled dialysis catheters
    b. Implanted catheters, including ports
  - –Umbilical catheter:
    a. A vascular catheter inserted through the umbilical artery or vein

Central Lines: To Remove or Not to Remove?

- Long-term catheters
  - Severe sepsis
  - Suppurative phlebitis
  - Endocarditis
  - BC remain positive >72 hrs despite appropriate therapy
  - Certain pathogens
    - SA, Pseudomonas, fungi, Mycobacteria
- Short-term catheters
  - As above
  - GNB, SA, Enterococcus, fungi, Mycobacteria
- Remove central lines infected with Bacillus, Micrococcus, Cutibacterium

NHSN CLABSI Definition

A laboratory confirmed bloodstream infection (LCBI) that is not secondary to an infection at another body site

And

Central line is in place for >2 consecutive calendar days following its first access

Example of a CLABSI RCA

	2022
Total # of CLABSIs	**96**
Time to BSI <7days/Insertion Related?	32.3%
Time to BSI >7days/Maintenance Related?	66.7%
Multiple Lines?	20.8%
PICC Present?	54.2%
Femoral Line Present?	7.3%
Dialysis Line Present?	33.3%
Received Dialysis/SLED within 7 days?	33.3%
Subclavian Line Present?	17.7%
Emergently Placed Line?	0.0%
Checklist completed?	55.2%
Mechanical Problem with Line?	5.2%
TPA Used?	5.2%
Line exchange over guidewire?	4.2%
CHG Bathing Daily?	55.8%
Peripheral Collection?	95.8%
Pathogen?	88.5%
Common Commensal?	11.46%
End of Life/Comfort Care?	11.1%
Line Necessary?	69.79%

CDC Tiers of CLABSI Prevention Practices

Tier 1: Standardize Supplies, Procedures and Processes (complete all interventions: review and audit compliance with Tier 1 measures prior to moving to Tier 2)				
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 CVS
(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)				

Perform needs assessment with CLABSI GPS and TAP Strategy

Tier 2: Enhanced Practices				
Conduct multidisciplinary rounds to audit for necessity of continued CVC use	Feedback 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

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Evidence-based Bundles for CLABSI Prevention

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

Additional CDC Recommendations

- **Use a subclavian site in adult patients to minimize infection risk (Category 1B)**
- **Avoid using the femoral vein for central venous access (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 hrs (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)

Additional CDC Recommendations

- **Educate healthcare workers (IA) regarding:**
  - Indications for CVC use
  - Proper procedures for the insertion and maintenance of intravascular catheters
  - Appropriate infection control measures to prevent CLABSI
- **Use sterile, transparent, semipermeable dressing to cover the catheter site (IA)**
  - If the patient is diaphoretic or if the site is bleeding or oozing, use a gauze dressing until this is resolved (II)

Infection Control & Hospital Epidemiology (2022), **43**, 553–569
doi:10.1017/ice.2022.87

SHEA

SHEA/IDSA/APIC Practice Recommendation

Strategies to prevent central line-associated bloodstream infections in acute-care hospitals: 2022 Update

Niccolò Buetti MD, MSc, PhD[1,2,a], Jonas Marschall MD, MSc[3,4,a], Marci Drees MD, MS[5,6], Mohamad G. Fakih MD, MPH[7], Lynn Hadaway MEd, RN, NPD-BC, CRNI[8], Lisa L. Maragakis MD, MPH[9], Elizabeth Monsees PhD, MBA, RN, CIC[10,11], Shannon Novosad MD MPH[12], Naomi P. O'Grady MD[13], Mark E. Rupp MD[14], Joshua Wolf MBBS, PhD, FRACP[15,16], Deborah Yokoe MD, MPH[17] and Leonard A. Mermel DO, ScM[18,19]

Intravascular Complications of CVC by Insertion Site

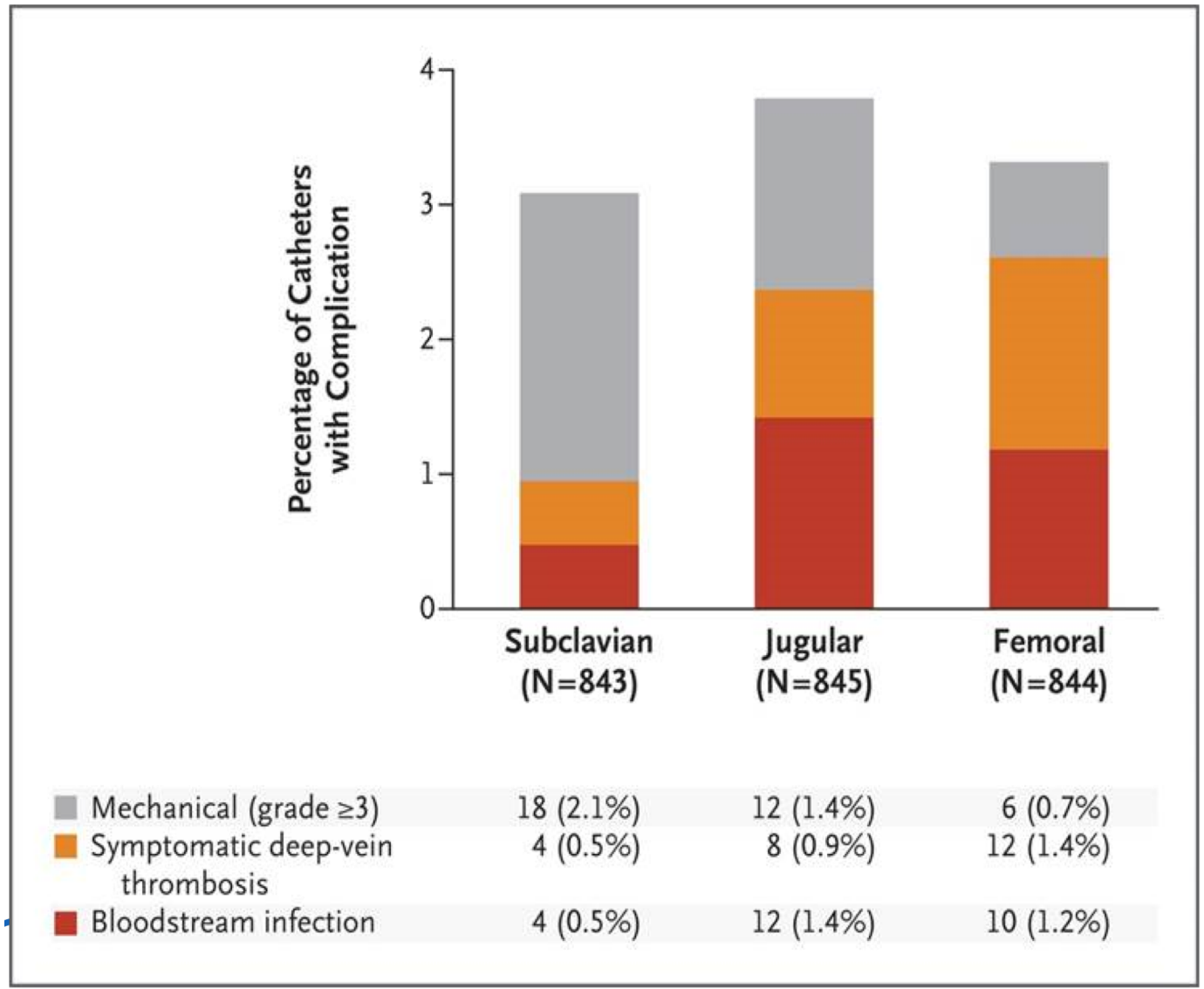


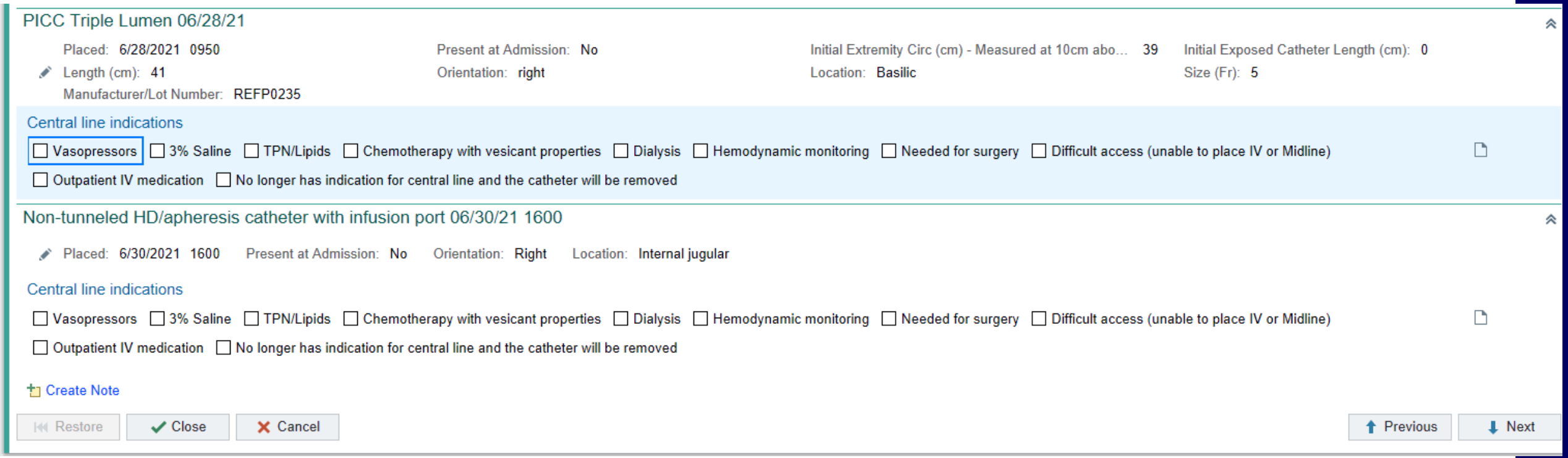
Table 2. Frequency of Mechanical Complications, According to the Route of Catheterization.*

Complication	Frequency		
	Internal Jugular	Subclavian	Femoral
		percent	
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.

Parienti et al. N Engl J Med 2015; 373:1220-1229

Central line justification checklist



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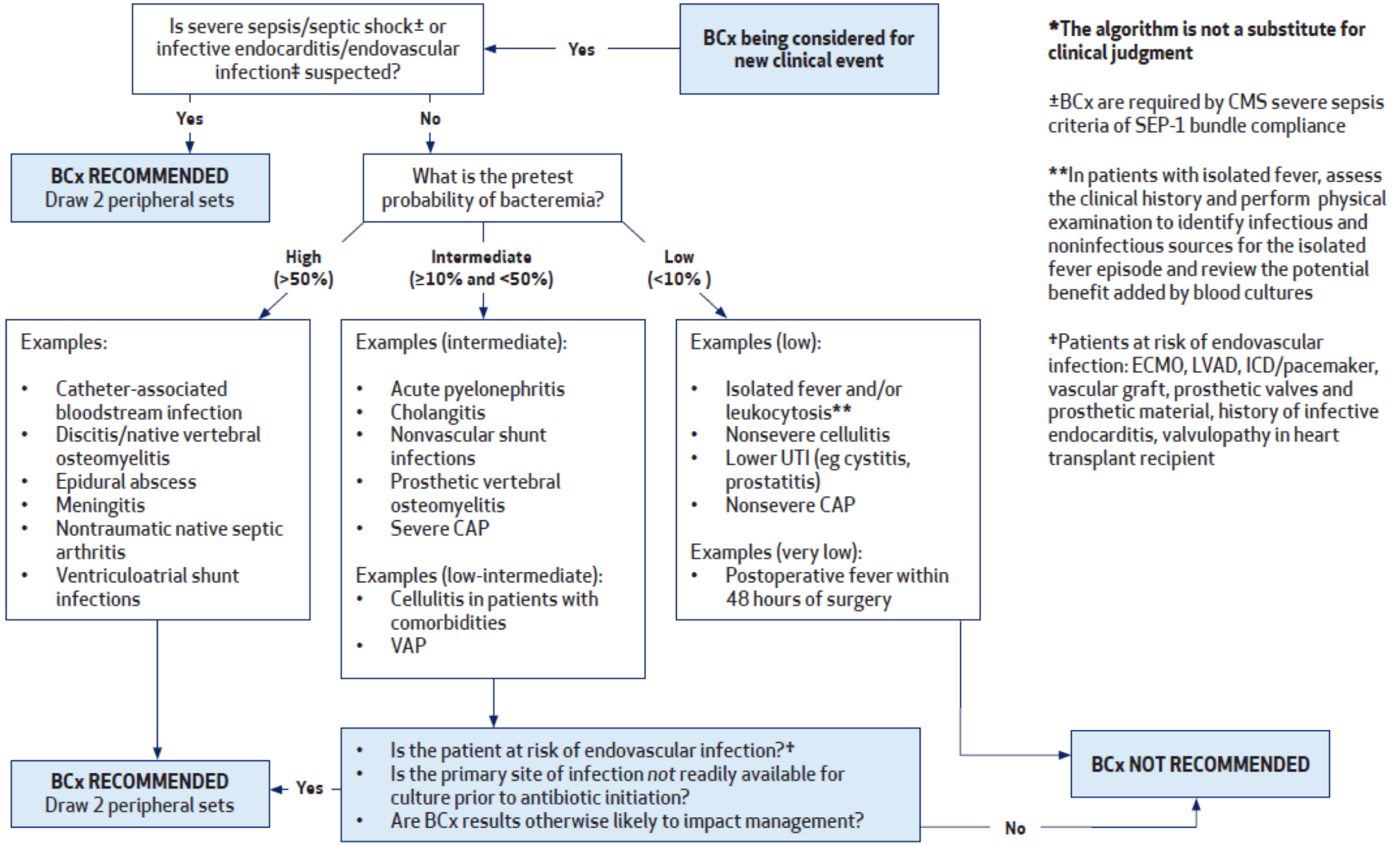
Diagnostic Stewardship and Blood Cultures

Diagnostic stewardship
the right test for the right patient

Antimicrobial stewardship (AMS)
the right antibiotic, dose & duration

Blood Culture Evaluation in Nonneutropenic Patients



***The algorithm is not a substitute for clinical judgment**

±BCx are required by CMS severe sepsis criteria of SEP-1 bundle compliance

**In patients with isolated fever, assess the clinical history and perform physical examination to identify infectious and noninfectious sources for the isolated fever episode and review the potential benefit added by blood cultures

†Patients at risk of endovascular infection: ECMO, LVAD, ICD/pacemaker, vascular graft, prosthetic valves and prosthetic material, history of infective endocarditis, valvulopathy in heart transplant recipient

‡Septic thrombophlebitis, infected endovascular thrombi, ICD/pacemaker lead infections, LVAD, ECMO or intravascular catheter infections, and vascular graft infections

152835

Key points – repeat blood cultures

"…physicians should wait 72 hours after preantibiotic cultures before considering additional blood cultures given the lack of additional information provided"

Linsenmeyer K et al. J Hosp Med 2016; Grace CJ et al. Clin Infect Dis 2001

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The incidence of bacteriuria each day of catheterization is?

ⓘ Start presenting to display the poll results on this slide.

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The greatest risk for CAUTI is?

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Catheter-associated Urinary Tract Infection– Background

Catheter-associated Urinary Tract Infections (CAUTIs)

UTIs are one of the most commonly reported HAIs to the NHSN

- Approximately 75% UTIs are CAUTIs
  - Decline in non-yeast CAUTIs from 2012 to 2016

Overall, 25% of patients admitted to an acute care hospital will have a urinary catheter placed

- This is higher in the ICU population
- However, 30-50% of catheters are unnecessary
  - **Prolonged catheterization is the most important risk factor for developing a CAUTI**

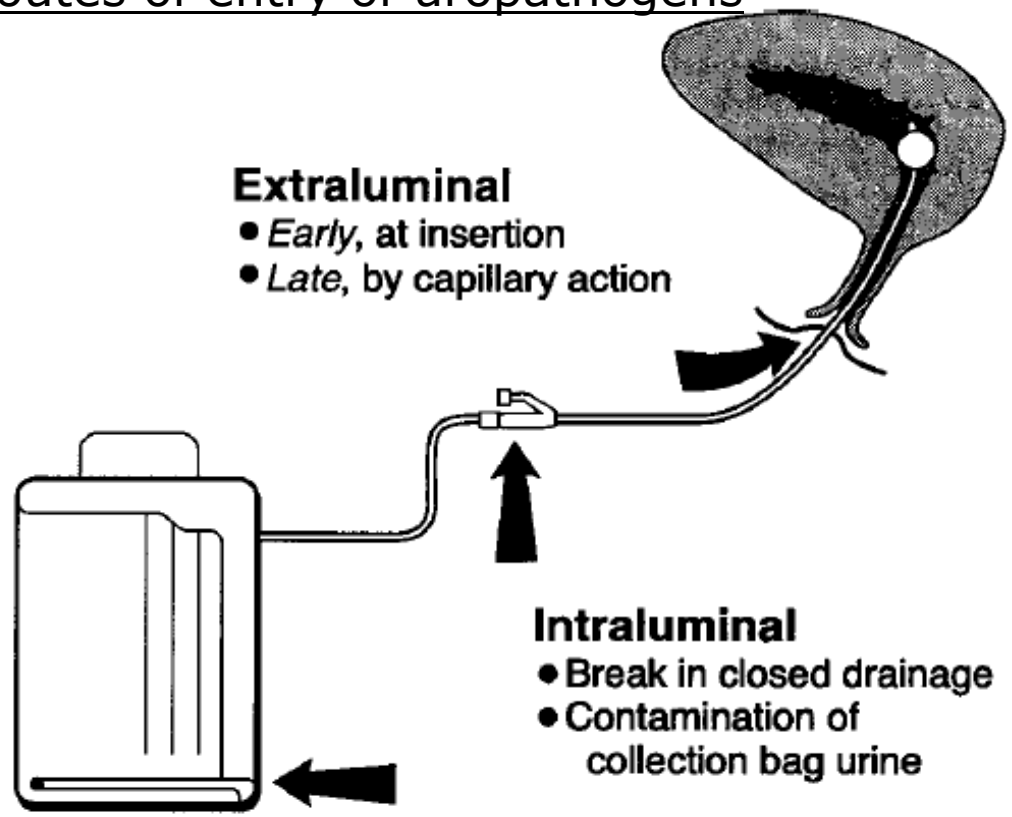
CAUTI Impact

CAUTIs are associated with increased cost, morbidity and mortality

- Up to 13,000 attributable deaths annually

Catheter and Bacteriuria

Routes of entry of uropathogens



Bacteriuria:
- At insertion: 8.7%
- Every day of catheterization: 3-7%

Bacteriuria is common!!

Population	Prevalence, %
Healthy, premenopausal women	1.0–5.0
Pregnant women	1.9–9.5
Postmenopausal women aged 50–70 years	2.8–8.6
Diabetic patients	
Women	9.0–27
Men	0.7–11
Elderly persons in the community[a]	
Women	10.8–16
Men	3.6–19
Elderly persons in a long-term care facility	
Women	25–50
Men	15–40
Patients with spinal cord injuries	
Intermittent catheter use	23–89
Sphincterotomy and condom catheter in place	57
Patients undergoing hemodialysis	28
Patients with indwelling catheter use	
Short-term	9–23
Long-term	100

Nicolle L et al. Clin Infect Dis 2005; 40: 1643-54

Pyuria and Bacteriuria

Table 3. Utility of Pyuria for the Diagnosis of CAUTI*

Variable	No. of Patients	No. (%) of Patients With Pyuria			Sensitivity	Specificity	Positive Predictive Value
		Mean	First Day of CAUTI	Highest Level			
No CAUTI	679	65 (9.6)	81 (11.9)†	172 (25.3)	. . .	. . .	. . .
CAUTI, CFUs/mL							
$>10^3$	101	37 (36.6)	25 (24.8)	66 (65.3)	0.37	0.90	0.36
$>10^5$	71	33 (46.5)	21 (29.6)	53 (74.6)	0.47	0.90	0.32

**Pyuria is indicated by a white blood cell count greater than 10 per microliter. The sensitivity, specificity, and positive predictive value were obtained using mean values. CAUTI indicates catheter-associated urinary tract infection; CFUs, colony-forming units; and ellipses, data not applicable.*

†First day of catheterization.

Pyuria cannot predict CAUTIs

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Tambyah, Arch Intern Med. 2000;160:673-677)

NHSN CAUTI Surveillance Definition

Indwelling urinary catheter for >2 calendar days

and

At least 1 of the following signs or symptoms:

fever (>38°C)

suprapubic tenderness

costovertebral angle pain or tenderness

and

A positive urine **culture** of ≥10^5 CFU/ml with no more than 2 species of organism

CDC Tiered Approach to CAUTI Prevention

Tier 1: Standardize Supplies, Procedures and Processes **(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 insertion: education and observed behavior	Perform root-cause analysis or focused review of infections

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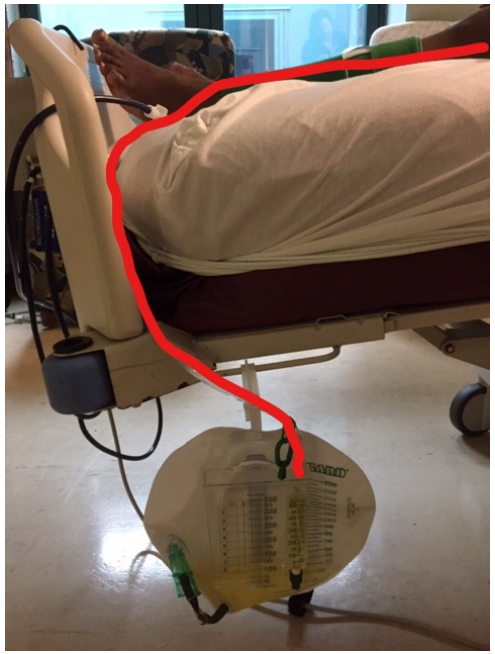
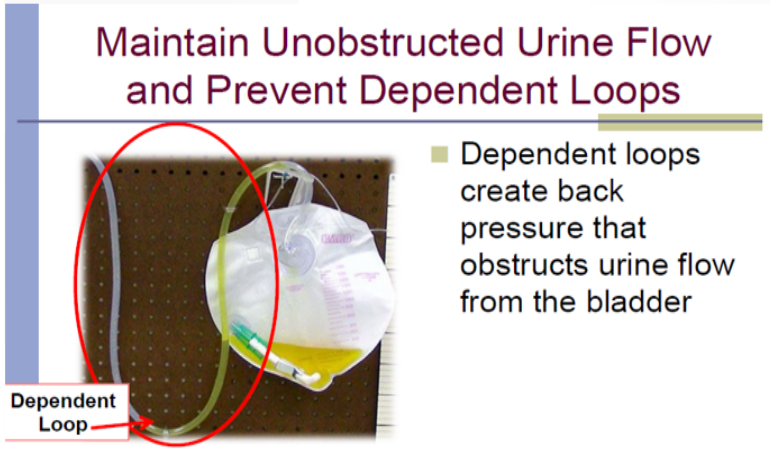
Indwelling Urinary Catheter Maintenance: The CAUTI Prevention Bundle



- ✓ Keep the catheter and collecting tube free from kinks and dependent loops
- ✓ Keep the collection bag ***below the level of the bladder at all times*** without allowing it to touch the floor
- ✓ Ensure tubing is secured to the patient with StatLock, leg strap, or tape
- ✓ Do not break the seal between the catheter and the tubing to maintain a closed system
- ✓ Before transporting the patient, empty the bag using a separate, clean collecting container for each patient; avoid splashing, and prevent contact of the drainage spigot with the container



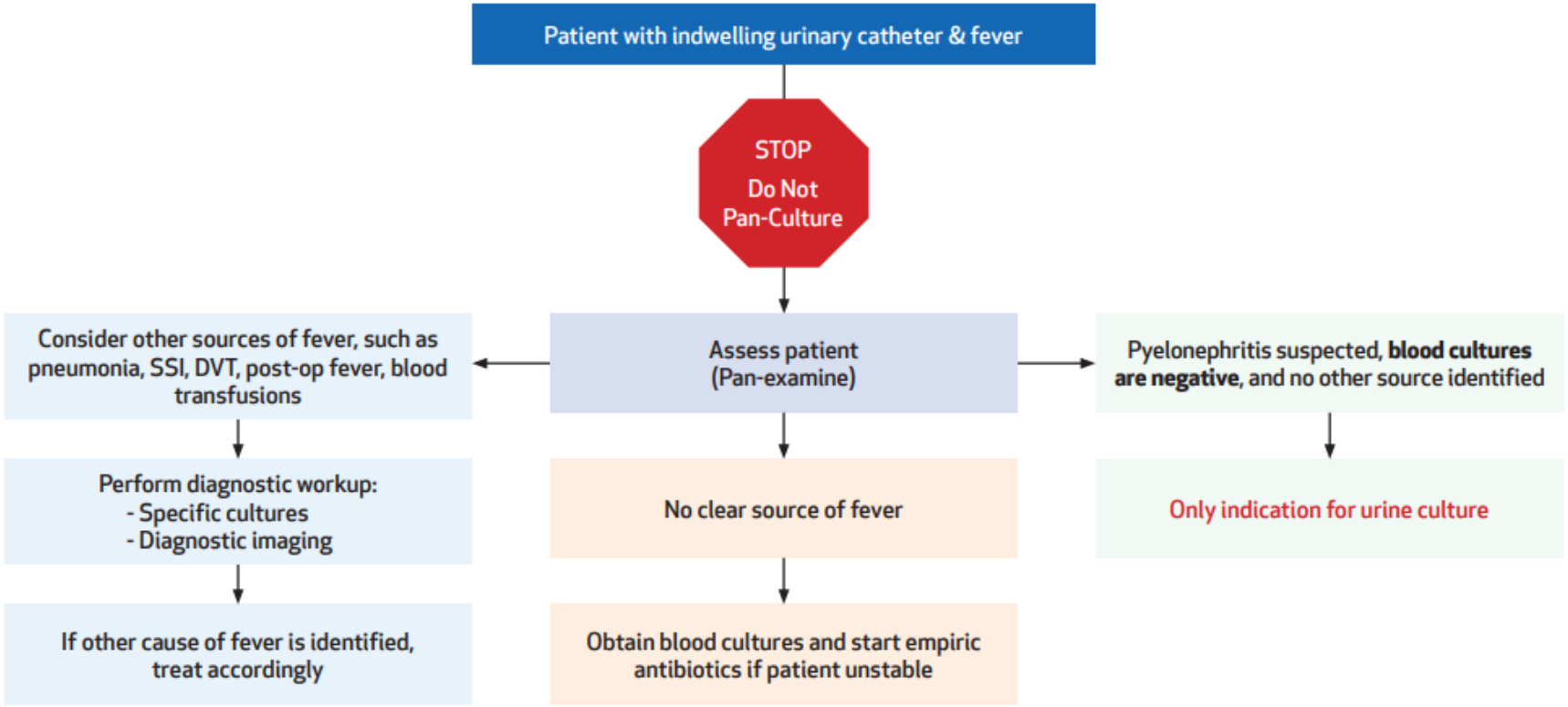
CAUTI Prevention Basics

- Avoid inserting an IUC. Use external collection devices such as condom catheter or PureWick.
- If IUC is clinically indicated per established guidelines, use aseptic insertion technique.
- Remove IUCs as soon as they are no longer needed.
- Follow appropriate urine culture collection techniques.
  - NEVER obtain a culture from an external urinary catheter device (such as a PureWick) or the urine collection bag.
  - If IUC is in place and the order is to obtain specimen via a straight catheter, the RN will remove IUC and straight catheter for a sample.
  - If patient has a chronic IUC or the IUC cannot be removed, the RN will receive an order from the Infection Control Medical Director with instructions on how to collect the specimen.
- Maintain all elements of the CAUTI prevention bundle while an IUC is in place

Urine Culture Stewardship

- Fever is the most common reason for ordering cultures
- Fever is prevalent in ICU patients (50%)
  - Etiology of fever in ICU patients is multifactorial
    - Acute pyelonephritis accounts for <5% of ICU infections
    - Cystitis does not cause fevers or leukocytosis
- Bacteriuria and pyuria are common in catheterized patients but are not specific for UTI

Fever Workup in Patient with Indwelling Urinary Catheter



Key reminders:

- **Fever is the most common reason for ordering urine cultures, however:**
  - Cystitis does not cause fevers
  - Pyelonephritis causes fevers but is rare in hospitalized patients
- **Bacteriuria and pyuria are common in catheterized patients due to presence of indwelling catheter**
  - They are not specific for the diagnosis of UTI
- **Positive urine cultures generally represent colonization in catheterized patients**

Ventilator-associated Pneumonia– Background

Hospital-acquired Pneumonia (HAP) and Ventilator-associated Pneumonia (VAP)

Most common nosocomial infection

- ~1 in 100 patients overall and up to 1 in 10 patients on invasive mechanical ventilation (IMV)
  - The true incidence of nosocomial pneumonia is difficult to estimate

Many hospitals have reported dramatic decreases in VAP rates over the past 20 years

- However, 5%–10% of ventilated patients continue to be treated for VAP

VAP Impact

Ventilator-associated events (VAEs) and VAP extend duration of IMV, prolong ICU and hospital LOS, and increase mortality risk

- The attributable mortality is estimated to be ~10% but varies considerably by type and severity of underlying illness
- Associated with greater use of antimicrobials and higher costs

VAE Diagnostic Criteria

- Patient on mechanical ventilation > 2 days with
- Baseline period of stability or improvement

VAC

- Worsening oxygenation as evidenced by one of the following:
- Increase in daily minimum FiO2 of ≥0.20 over the previous 2 days, sustained for 2 days
- Increase in daily minimum of PEEP values of ≥3 cm water, sustained for 2 days

IVAC

- Within 2 days before or after VAC criteria are met:
- Temperature >38^{0}C or <36^{0}C, **OR** WBC ≥12,000 or ≤4,000 cells/mm3
- **PLUS** a new antimicrobial agent(s) is started and is continued for ≥4 calendar days

PVAP

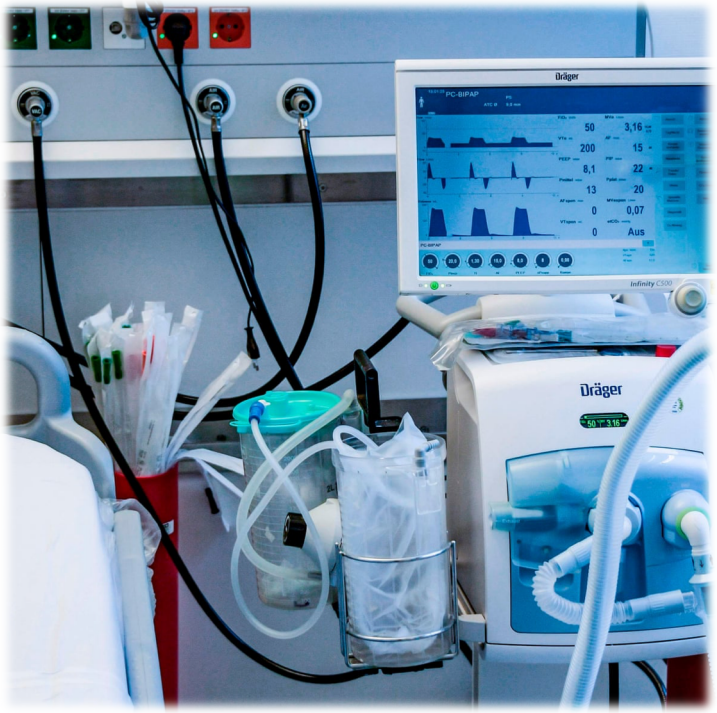
- Within 2 days before or after VAC criteria met, patient meets additional criteria:
- Positive results of microbial testing demonstrating pneumonia

Ventilator-Associated Events (VAE)

- 300,000 patients receive mechanical ventilation in the US each year
- Infection Control surveillance focuses on ventilator-associated events (VAE), which may or may not include pneumonia
- Ventilated patients are at risk for complications and poor outcomes, including sepsis, longer stays in ICU, more antibiotic use, and death
- The majority of VAEs are believed to be caused by pneumonia, atelectasis, fluid overload, or acute respiratory distress syndrome (ARDS)
- Prevention requires collaboration between Nursing, Respiratory Therapy, physicians, and Physical Therapy

VAE Prevention Strategies (Ventilator Bundle)

- Elevation of head of bed (typically 30-45°) to prevent aspiration
- Oral care every 4 hours (using CHG every 12 hours)
- Minimize sedation through
    - Daily SATs (spontaneous awakening trials), sometimes called “sedation vacations”
    - Daily SBTs (spontaneous breathing trials)
    - Delirium monitoring and management
- Early exercise and mobility
- Lung protective strategies
    - Low tidal volume ventilation
    - Conservative fluid management
- Early extubation when ready
- DVT prophylaxis



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Which of the following patient care measures is likely to be most effective for preventing the ventilator-associated infection complication of pneumonia (VAP)?

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Infection Control & Hospital Epidemiology (2022), 1–27
doi:10.1017/ice.2022.88

SHEA

SHEA/IDSA/APIC Practice Recommendation

Strategies to prevent ventilator-associated pneumonia, ventilator-associated events, and nonventilator hospital-acquired pneumonia in acute-care hospitals: 2022 Update

Michael Klompas MD, MPH[1,2], Richard Branson MSc, RRT[3], Kelly Cawcutt MD, MS[4], Matthew Crist MD[5], Eric C. Eichenwald MD[6,7], Linda R. Greene RN, MPS, CIC[8], Grace Lee MD[9], Lisa L. Maragakis MD, MPH[10], Krista Powell MD, MPH[5], Gregory P. Priebe MD[11], Kathleen Speck MPH[12], Deborah S. Yokoe MD, MPH[13] and Sean M. Berenholtz MD, MHS[12,14,15]

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Table 2. Summary of Recommendations to Prevent VAP and/or VAE in Adult Patients

Category	Rationale	Intervention	Quality of Evidence
Essential practices	Good evidence that the intervention decreases the average duration of mechanical ventilation, length of stay, mortality, and /or costs. Benefits likely outweigh risks.	Avoid intubation and prevent reintubation • Use high-flow nasal oxygen or noninvasive positive pressure ventilation (NIPPV) as appropriate whenever safe and feasible[91–93,96,99]	HIGH
		Minimize sedation[105,106] • Avoid benzodiazepines in favor of other agents[106] • Use a protocol to minimize sedation[110] • Implement a ventilator liberation protocol[113]	MODERATE
		Maintain and improve physical conditioning[113,120–123]	MODERATE
		Elevate the head of the bed to 30–45°[125,388–390]	LOW[a]
		Provide oral care with toothbrushing but *without* chlorhexidine[126,127]	MODERATE
		Provide early enteral vs. parenteral nutrition[131]	HIGH
		Change the ventilator circuit only if visibly soiled or malfunctioning (or per manufacturers' instructions)[391–394]	HIGH

Klompas M, Branson R, Cawcutt K, et al. Strategies to prevent ventilator-associated pneumonia, ventilator-associated events, and nonventilator hospital-acquired pneumonia in acute-care hospitals: 2022 Update. Infect Control Hosp Epidemiol. 2022;43(6):687-713. doi:10.1017/ice.2022.88

Additional approaches	Good evidence that the intervention improves outcomes in some populations, but may confer some risk in others.	Use selective oral or digestive decontamination in countries and ICUs with low prevalence of antibiotic-resistant organisms[128,134,135]	HIGH[a]
	May lower VAP rates but insufficient data to determine impact on duration of mechanical ventilation, length of stay, or mortality.	Utilize endotracheal tubes with subglottic secretion drainage ports for patients expected to require >48–72 hours of mechanical ventilation[395]	MODERATE
		Consider early tracheostomy[144]	MODERATE
		Consider postpyloric rather than gastric feeding for patients with gastric intolerance or at high risk for aspiration[131,147]	MODERATE
Generally not recommended	Inconsistently associated with lower VAP rates and no impact or negative impact on duration of mechanical ventilation, length of stay, or mortality.	Oral care with chlorhexidine[75,128–130,150]	MODERATE
		Probiotics[153–156]	MODERATE
		Ultrathin polyurethane endotracheal tube cuffs[165–167]	MODERATE
		Tapered endotracheal tube cuffs[169]	MODERATE
		Automated control of endotracheal tube cuff pressure[170,171,174,175]	MODERATE
		Frequent cuff-pressure monitoring[176]	MODERATE
		Silver-coated endotracheal tubes[178]	MODERATE
		Kinetic beds[180]	MODERATE
		Prone positioning[181,183,a]	MODERATE
		Chlorhexidine bathing[184–186,a]	MODERATE
	No impact on VAP rates, average duration of mechanical ventilation, length of stay, or mortality.[a]	Stress-ulcer prophylaxis[190,191,193]	MODERATE
		Monitoring residual gastric volumes[194]	MODERATE
		Early parenteral nutrition[195]	MODERATE
No recommendation	No impact on VAP rates or other patient outcomes, unclear impact on costs.	Closed endotracheal suctioning systems[197–199]	MODERATE

Surgical Site Infections – Background

Surgical Site Infections (SSI)

SSIs occur in 2%–5% of patients undergoing surgery

- About 160,000–300,000 SSIs occur each year in the United States
- SSIs account for 20% of all HAIs in hospitalized patients
- Up to 60% of SSIs have been estimated to be preventable by using evidence-based guidelines

SSI Impact

Associated with increased Length of Stay (LOS), cost and mortality

- Account for $3.5 billion to $10 billion annually in healthcare expenditures
- 77% of deaths in patients with SSI are directly attributable to SSI

Guidelines for the Prevention of SSIs

CDC Guideline for SSI Prevention, 2017

- Hair removal only as necessary
- *Staphylococcus aureus* nasal screening and decolonization
- Perioperative antibiotic prophylaxis before skin incision
- Alcohol-based skin preparation
- Perioperative glycemic control (<200mg/dL)
- Normothermia
- Supplemental oxygen

Berríos-Torres SI, Umscheid CA, Bratzler DW, et al. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017. JAMA Surg. 2017;152(8):784–791.

Surgical Site Infection Prevention: A Review

- Avoid razors for hair removal
- *Staphylococcus aureus* nasal and skin decolonization for high-risk procedures
- Perioperative antibiotic prophylaxis before skin incision
- ChloraPrep skin preparation (not Duraprep)
- Perioperative glucose control (110-150mg/dL)
- Maintain normothermia with active warming
- **Negative pressure wound therapy for certain procedures**

Seidelman JL, Mantyh CR, Anderson DJ. Surgical Site Infection Prevention: A Review. JAMA. 2023;329(3):244–252. doi:10.1001/jama.2022.24075.

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SHEA

SHEA/IDSA/APIC Practice Recommendation

Strategies to prevent surgical site infections in acute-care hospitals: 2022 Update

Michael S. Calderwood MD, MPH[1,a], Deverick J. Anderson MD, MPH[2,a], Dale W. Bratzler DO, MPH[3], E. Patchen Dellinger MD[4], Sylvia Garcia-Houchins RN, MBA, CIC[5], Lisa L. Maragakis MD, MPH[6], Ann-Christine Nyquist MD, MSPH[7], Kiran M. Perkins MD, MPH[8], Michael Anne Preas RN, MS, CIC[9], Lisa Saiman MD, MPH[10], Joshua K. Schaffzin MD, PhD[11], Marin Schweizer PhD[12], Deborah S. Yokoe MD, MPH[13] and Keith S. Kaye MD, MPH[14,b]

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Table 1. Summary of Recommendations to Prevent Surgical Site Infections (SSIs)

Essential practices
1. Administer antimicrobial prophylaxis according to evidence-based standards and guidelines.[73,75] (Quality of evidence: HIGH)
2. Use a combination of parenteral and oral antimicrobial prophylaxis prior to elective colorectal surgery to reduce the risk of SSI.[115,116] (Quality of evidence: HIGH)
3. Decolonize surgical patients with an anti-staphylococcal agent in the preoperative setting for orthopedic and cardiothoracic procedures. (Quality of evidence: HIGH) Decolonize surgical patients in other procedures at high risk of staphylococcal SSI, such as those involving prosthetic material. (Quality of evidence: LOW)
4. Use antiseptic-containing preoperative vaginal preparation agents for patients undergoing cesarean delivery or hysterectomy. (Quality of evidence: MODERATE)
5. Do not remove hair at the operative site unless the presence of hair will interfere with the surgical procedure. [4,119] (Quality of evidence: MODERATE)
6. Use alcohol-containing preoperative skin preparatory agents in combination with an antiseptic. (Quality of evidence: HIGH)
7. For procedures not requiring hypothermia, maintain normothermia (temperature > 35.5°C) during the perioperative period. (Quality of evidence: HIGH)
8. Use impervious plastic wound protectors for gastrointestinal and biliary tract surgery. (Quality of evidence: HIGH)
9. Perform intraoperative antiseptic wound lavage.[171] (Quality of evidence: MODERATE)
10. Control blood-glucose level during the immediate postoperative period for all patients.[94] (Quality of evidence: HIGH)
11. Use a checklist and/or bundle to ensure compliance with best practices to improve surgical patient safety. (Quality of evidence: HIGH)
12. Perform surveillance for SSI. (Quality of evidence: MODERATE)
13. Increase the efficiency of surveillance by utilizing automated data. (Quality of evidence: MODERATE)
14. Provide ongoing SSI rate feedback to surgical and perioperative personnel and leadership. (Quality of evidence: MODERATE).
15. Measure and provide feedback to HCP regarding rates of compliance with process measures.[94] (Quality of evidence: LOW)
16. Educate surgeons and perioperative personnel about SSI prevention measures. (Quality of evidence: LOW)
17. Educate patients and their families about SSI prevention as appropriate. (Quality of evidence: LOW)
18. Implement policies and practices to reduce the risk of SSI for patients that align with applicable evidence-based standards, rules and regulations, and medical device manufacturer instructions for use.[4,94] (Quality of evidence: MODERATE)
19. Observe and review operating room personnel and the environment of care in the operating room and in central sterile reprocessing. (Quality of evidence: LOW)

Additional approaches
1. Perform an SSI risk assessment. (Quality of evidence: LOW)
2. Consider use of negative pressure dressings in patients who may benefit. (Quality of evidence: MODERATE)
3. Observe and review practices in the preoperative clinic, postanesthesia care unit, surgical intensive care unit and/or surgical ward. (Quality of evidence: MODERATE)
4. Use antiseptic-impregnated sutures as a strategy to prevent SSI. (Quality of evidence: MODERATE)
Approaches that should not be considered a routine part of SSI prevention
1. Do not routinely use vancomycin for antimicrobial prophylaxis.[73] (Quality of evidence: MODERATE)
2. Do not routinely delay surgery to provide parenteral nutrition. (Quality of evidence: HIGH)
3. Do not routinely use antiseptic drapes as a strategy to prevent SSI. (Quality of evidence: HIGH)
Unresolved issues
1. Optimize tissue oxygenation at the incision site
2. Preoperative intranasal and pharyngeal CHG treatment for patients undergoing cardiothoracic procedures
3. Use of gentamicin-collagen sponges
4. Use of antimicrobial powder
5. Use of surgical attire

Selection of surgical prophylactic regimen

CEFAZOLIN

Long half life

Low cost

Drug of choice for most clean procedures

High risk for MRSA is defined according to the presence of any the following risk factors:

- Intravenous antibiotic therapy within 90 days
- Chronic wound care
- Hemodialysis patients
- History of MRSA infection or colonization within 1 year

Among patients who are high risk for MRSA, vancomycin should be prescribed **in addition** to the recommended antibiotic prophylaxis.

Vancomycin Disadvantages

- narrow spectrum, costly, infused slowly, increased VRE
- Limit its use to cases with severe β-lactam allergy or institutions with high rates of MRSA or MRSE.

History of penicillin or cephalosporin allergy

True (IgE mediated) allergy is characterized by

- urticaria, pruritius
- angioedema, bronchospasm
- hypotension, or arrhythmia

“Cefazolin for All” surgical prophylaxis

Cefazolin is safe and can be administered to persons with penicillin allergy

Cefazolin is superior to alternative antibiotics for prevention of surgical site infection

Use Alternative antibiotic(s): Only for life-threatening delayed-onset immune reactions (drug fever, toxic epidermal necrolysis or Stevens-Johnson Syndrome)

History of penicillin or cephalosporin allergy

- Patients with a history suggestive of true allergy or an unknown allergy, consider outpatient referral to allergy/immunology for penicillin skin testing prior to surgery.
- Serious adverse drug reactions may include drug-induced hypersensitivity syndrome, drug fever, toxic epidermal necrolysis, or Stevens-Johnson Syndrome. Lifelong beta-lactam avoidance is generally necessary for these serious adverse drug reactions.

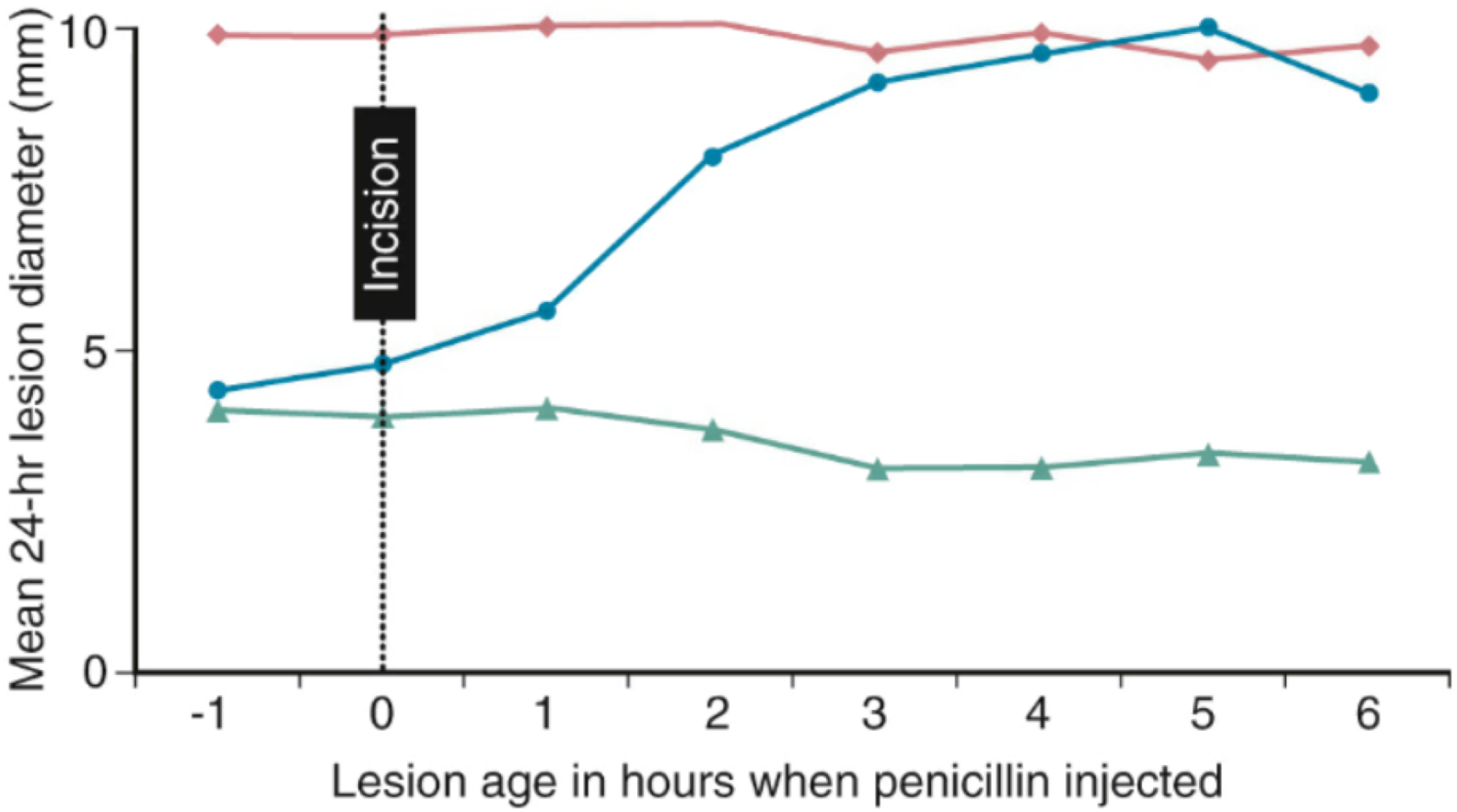
Timing Surgical Prophylaxis

Infusion of the first antimicrobial dose should begin within 60 minutes and be completed before incision to allow for adequate tissue distribution.

When azithromycin, vancomycin, or ciprofloxacin is indicated, infusion should begin within 120 minutes before incision to allow for adequate tissue distribution.

When a proximal tourniquet is required, the entire antimicrobial dose should be administered before the tourniquet is inflated. Azithromycin, vancomycin, and ciprofloxacin should be infused over at least 60 minutes.

Importance of the timing of antimicrobial administration



Burke JF: The effective period of preventive antibiotic action in experimental incisions and dermal lesions. Surgery 1961; 50: pp. 161-168.

Delayed surgery start time

If the surgery start time has been delayed and the pre-operative antibiotic agent has not been given within 60 minutes, redosing is required for ampicillin-sulbactam, cefoxitin, cefazolin, cefepime, or piperacillin-tazobactam before the surgery begins.

Adult Preoperative Antibiotic Guide

Drug & Adult Dosing	When to Start	Infusion Time	Incision Time	If Case Delayed	Re-dose
Ampicillin-sulbactam (Unasyn)* 3gm	**40 mins** prior to incision	10 mins	30 mins after infusion is completed	Redose if >60 mins from end of infusion**	2 hours after last dose
Aztreonam* 2gm	**35 mins** prior to incision	5 mins	30 mins after infusion is completed	Redose if >60 mins from end of infusion**	4 hours after last dose
Cefazolin (Ancef) * <120kgs: 2gm ≥120kgs: 3gm	**35 mins** prior to incision	5 mins	30 mins after infusion is completed	Redose if >60 mins from end of infusion**	4 hours after last dose Or 1500ml blood loss
Cefepime* 2gm	**35 mins** prior to incision	5 mins	30 mins after infusion is completed	Redose if >60 mins from end of infusion**	3 hours after last dose
Cefoxitin* <120 kg: 2gm >120 kg: 3gm	**35 mins** prior to incision	5 mins	30 mins after infusion is completed	Redose if >60 mins from end of infusion**	2 hours after last dose
Ceftriaxone* 2gm	**35 mins** prior to incision	5 mins	30 mins after infusion is completed	No redosing needed	Do not re-dose
Clindamycin+ 900mg	**45-60 mins** prior to incision	30 mins	15-30 mins after infusion is completed	No redosing needed	6 hours after last dose
Gentamicin+ 5mg/kg if Cr Cl > 20 ml/min 2 mg/kg if Cr Cl < 20 ml/min	**60 mins** prior to incision	30 mins	30 mins after infusion is completed	No redosing needed	Do not re-dose
Metronidazole (Flagyl)+ 500mg	**60 mins** prior to incision	30 mins	30 mins after infusion is completed	No redosing needed	6 hours after last dose
Piperacillin/Tazobactam (Zosyn)+ 4.5gm	**60 mins** prior to incision	30 mins	30 mins after infusion is completed	If >60 mins from end of infusion, redose**	6 hours after last dose
Azithromycin+ 500mg	**120 mins** prior to incision	60 mins	60 mins after infusion is completed	No redosing needed	Do not re-dose
Ciprofloxacin (IV)+ 400mg	**120 mins** prior to incision	60 mins	60 mins after infusion is completed	No redosing needed	Do not re-dose
Vancomycin+ ≤59kg: 750mg 60-89kg: 1000mg ≥ 90kg: 1500mg	**120-150 mins** prior to incision	750mg-1000mg: 60 mins 1500mg: 90 mins	60 mins after infusion is completed	No redosing needed	Consult pharmacist if case is >8 hours

*Administered by anesthesia. All others will be administered in preop.
**Wait, preferably 15 mins, until infusion is completed to incise after redosing.
+For transplant patients, start antibiotics only after case is confirmed to proceed and notify staff anesthesiologist of start time.

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Evaluation of PCN +/- Cephalosporin Allergy in Preoperative Patient

Step 1. Identify patients with documented penicillin and/or cephalosporin allergy via running the "HFH OR schedule next 30 days with allergies"
Step 2. Review chart for past penicillin and/or cephalosporin antibiotic administration
Step 3. Update allergy label with any new information regarding tolerance/intolerance of β-lactam antibiotic

Adverse effect reaction	**Mild reaction WITHOUT features of IgE-mediated reaction OR mucosal involvement***	**IgE-mediated reaction (type I)**	**Life threatening, non-IgE-mediated reaction**
GI intolerance (nausea, vomit, diarrhea, Headache, yeast infection)	Mild Rash/pruritis NOT HIVES	Anaphylaxis	Type II cytotoxic (hemolytic anemia, thrombocytopenia, interstitial nephritis)
OR	Itching without rash	Hives/urticaria	**OR**
Family history of allergy	Patient denies allergy on record	Angioedema	Blistering disorder (DRESS, SJS-TEN, AGEP)
OR	**OR**	Facial/throat/lip swelling	**OR**
Syncope	Unknown reaction	Difficultly breathing/wheezing	Organ damage (kidney, liver)
OR		Chest tightness	**OR**
Has recieved a penicillin, aminopenicillin, and/or cephalosporin antibiotic		Hypotension	Any mucosal involvement
Pharmacy personnel updates the allergy field "Cefazolin is safe to use, first line to reduce SSI"	Pharmacy personnel updates the allergy field "Cefazolin is safe to use, first line to reduce SSI"	OR pharmacist to place ambulatory referral to allergy/ immunology	No intervention by the OR pharmacist

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*If there is any question or uncertainty about allergy, further evaluation by allergy referral is warranted

Abbreviations: DRESS=drug rash eosinophilia and systemic symptoms, SJS=Steven Johnson's Syndrome, TEN=Toxic epidermal necrolysis, AGEP= Acute generalized exanthematous pustulosis

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Methicillin-resistant *Staphylococcus aureus* Bacteremia

Methicillin-resistant *Staphylococcus aureus* (MRSA) Infection

Hospital-acquired infections (HAIs) caused by MRSA are common in acute-care facilities

- In North America, an estimated 23% of ICU infections are caused by, and nearly half of those (44%) are due to MRSA
- In the United States, *S. aureus* is one of the most common pathogens associated with HAIs
  - Between 2015-2017, *S. aureus* was the 1st and 2nd most common pathogen associated with device-associated infections and surgical site infections (SSIs) in pediatric and adult infections
- Over half of the cases are preventable

MRSA Impact

The CDC estimated 323,700 cases of invasive MRSA infection and over 10,600 deaths in 2017

- Mortality among those with MRSA bacteremia ranges between 15-50%
- Annual attributable healthcare cost was $1.7 billion in 2017

MRSA Bacteremia

- Approximately 30% of people are colonized with *S. aureus* in their nose
- Most cases of MRSA bacteremia develop secondary to another site of infection
  - However, in up to 25% of cases, no initial site of infection is not identified
- Most commonly transmitted to patients via contaminated hands of health care personnel
  - Contaminated environmental surfaces play a role

MRSA Bacteremia Surveillance Definition

- Positive MRSA blood culture >3 days after admission to the facility
  - Specifically, on or after calendar day 4

CDC Tiers of MRSA Bacteremia Prevention Practices

Tier 1: Standardize Supplies, Procedures and Processes (complete all interventions: review and audit compliance with Tier 1 measures prior to moving to Tier 2)					
Conduct basic MRSA Risk Assessment for facility infection burden and transmission risk	Conduct case reviews of NHSN HO MRSA bacteremia LabID events (cases) to guide source-specific interventions	Monitor and alert staff of patients with MRSA	Promote and monitor hand hygiene compliance	Initiate Contact Precautions for both colonized and infected patients and monitor adherence	Assess effectiveness of cleaning and disinfection of environment of care and reusable patient care equipment
(If MRSA bacteremia rates remain elevated, start with MRSA Guide to Patient Safety (GPS) and then proceed with additional interventions					

Perform needs assessment with CAUTI GPS and TAP Strategy

Tier 2: Enhanced Practices			
Implement daily chlorhexidine bathing for populations at risk for developing MRSA bacteremia	Consider decolonization for those patients colonized with MRSA and at high risk of infection	Active Surveillance Testing (AST) for high-risk patient populations	Consider gowning and gloving for all intensive care unit (ICU) patients

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CDC

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SHEA

SHEA/IDSA/APIC Practice Recommendation

SHEA/IDSA/APIC Practice Recommendation: Strategies to prevent methicillin-resistant *Staphylococcus aureus* transmission and infection in acute-care hospitals: 2022 Update

Kyle J. Popovich MD, MS[1], Kathy Aureden MS, MT, CIC[2], D. Cal Ham MD, MPH[3], Anthony D. Harris MD, MPH[4], Amanda J. Hessels PhD, MPH, RN, CIC[5,6], Susan S. Huang MD, MPH[7], Lisa L. Maragakis MD, MPH[8], Aaron M. Milstone MD, MHS[9], Julia Moody MS[10], Deborah Yokoe MD, MPH[11,12] and David P. Calfee MD, MS[13,14]

[1]Department of Internal Medicine, RUSH Medical College, Chicago, Illinois, [2]Infection Prevention, Advocate Aurora Health, Downers Grove, Illinois, [3]Centers for Disease Control and Prevention, Atlanta, Georgia, [4]Health Care Outcomes Research, University of Maryland School of Medicine, Baltimore, Maryland, [5]Columbia School of Nursing, New York, New York, [6]Hackensack Meridian Health, Edison, New Jersey, [7]Division of Infectious Diseases, University of California Irvine School of Medicine, Irvine, California, [8]Johns Hopkins University School of Medicine, The Johns Hopkins Hospital, Baltimore, Maryland, [9]Division of Pediatric Infectious Diseases, Johns Hopkins University School of Medicine, Baltimore, Maryland, [10]Infection Prevention, HCA Healthcare, Nashville, Tennessee, [11]Department of Medicine, University of California San Francisco School of Medicine, San Francisco, California, [12]Transplant Infectious Diseases, UCSF Medical Center, San Francisco, California, [13]Department of Medicine, Weill Cornell Medicine, New York, New York and [14]Department of Population Health Sciences, Weill Cornell Medicine, New York, New York

Table 1. Summary of Recommendations to Prevent MRSA Infection and Transmission

Essential practices	
1	Implement a MRSA monitoring program. (Quality of evidence: LOW)
2	Conduct a MRSA risk assessment. (Quality of evidence: LOW)
3	Promote compliance with the CDC or WHO hand hygiene recommendations. (Quality of evidence: MODERATE)
4	Use contact precautions for MRSA-colonized and MRSA-infected patients. A facility that chooses or has already chosen to modify the use of contact precautions for some or all of these patients should conduct a MRSA-specific risk assessment to evaluate the facility for transmission risks and to assess the effectiveness of other MRSA risk mitigation strategies (eg, hand hygiene, cleaning and disinfection of the environment, single occupancy patient rooms), and establish a process for ongoing monitoring, oversight, and risk assessment. (Quality of evidence: MODERATE)
5	Ensure cleaning and disinfection of equipment and the environment. (Quality of evidence: MODERATE)
6	Implement a laboratory-based alert system that notifies HCP of new MRSA-colonized or MRSA-infected patients in a timely manner. (Quality of evidence: LOW)
7	Implement an alert system that identifies readmitted or transferred MRSA-colonized or MRSA-infected patients. (Quality of evidence: LOW)
8	Provide MRSA data and outcome measures to key stakeholders, including senior leadership, physicians, nursing staff, and others. (Quality of evidence: LOW)
9	Educate healthcare personnel about MRSA. (Quality of evidence: LOW)
10	Educate patients and families about MRSA. (Quality of evidence: LOW)
11	Implement an antimicrobial stewardship program. (Quality of evidence: LOW)

Additional approaches	
Active surveillance testing (AST)	
1	Implement a MRSA AST program for select patient populations as part of a multifaceted strategy to control and prevent MRSA. (Quality of evidence: MODERATE). Note: Specific populations may have different evidence ratings.
2	Active surveillance for MRSA in conjunction with decolonization can be performed in targeted populations prior to surgery to prevent post-surgical MRSA infection. (Quality of evidence: MODERATE)
3	Active surveillance with contact precautions is inferior to universal decolonization for reduction of MRSA clinical isolates in adult ICUs. (Quality of evidence: HIGH)
4	Hospital-wide active surveillance for MRSA can be used in conjunction with contact precautions to reduce the incidence of MRSA infection. (Quality of evidence: MODERATE)
5	Active surveillance can be performed in the setting of a MRSA outbreak or evidence of ongoing transmission of MRSA within a unit as part of a multifaceted strategy to halt transmission. (Quality of evidence: MODERATE)
Screen healthcare personnel (HCP) for MRSA infection or colonization	
1	Screen HCP for MRSA infection or colonization if they are epidemiologically linked to a cluster of MRSA infections. (Quality of evidence: LOW)
MRSA decolonization therapy	
1	Use universal decolonization (daily CHG bathing plus 5 days of nasal decolonization) for all patients in adult ICUs to reduce endemic MRSA clinical cultures. (Quality of evidence: HIGH)
2	Perform preoperative nares screening with targeted use of CHG and nasal decolonization in MRSA carriers to reduce MRSA SSI, in surgical procedures involving implantation of hardware. (Quality of evidence: MODERATE)
3	Screen for MRSA and provide targeted decolonization with CHG bathing and nasal decolonization to MRSA carriers in surgical units to reduce postoperative MRSA inpatient infections. (Quality of evidence: MODERATE)
4	Provide CHG bathing plus nasal decolonization to known MRSA carriers outside the ICU with medical devices, specifically central lines, midline catheters, and lumbar drains, to reduce MRSA clinical cultures. (Quality of evidence: MODERATE)
5	Consider postdischarge decolonization of MRSA carriers to reduce postdischarge MRSA infection and readmission. (Quality of evidence: HIGH)
6	Neonatal ICUs should consider targeted or universal decolonization during times of above-average MRSA infection rates or targeted decolonization for patients at high risk of MRSA infection (eg, low birthweight, indwelling devices, or prior to high-risk surgeries). (Quality of evidence: MODERATE)
7	Burn units should consider targeted or universal decolonization during times of above average MRSA infection rates. (Quality of evidence: MODERATE)
8	Consider targeted or universal decolonization of hemodialysis patients. (Quality of evidence: MODERATE)
9	Decolonization should be strongly considered as part of a multimodal approach to control MRSA outbreaks. (Quality of evidence: MODERATE)
Universal use of gowns and gloves	
1	Use gowns and gloves when providing care to or entering the room of all adult ICU patients, regardless of MRSA colonization status. (Quality of evidence: MODERATE)

MRSA Interventions

1. Ongoing CLABSI initiatives that impact MRSA rates
   - Expanding nasal decolonization to all patients with central lines in GPU
   - Monitoring CHG compliance
   - Daily central line necessity rounds to ensure unnecessary lines are removed
   - Twice weekly device audits
   - Ongoing nursing and physician education
2. Monitoring for any potential environmental spread
   - Monitoring environmental cleaning through blacklight audits
3. Ensuring hand hygiene compliance through multiple initiatives

Isolation

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Please download and install the Slido app on all computers you use

A 50 y/o previously healthy F developed a urinary tract infection after a 3-month trip to India. Symptoms persisted despite empiric antibiotic therapy. The most likely antimicrobial-resistant pathogen is:

ⓘ Start presenting to display the poll results on this slide.

Modes of Transmission of Infectious Agents

- Contact
  - Direct
  - Indirect
- Droplet (>5 µl, travels 3-6 feet)
- Airborne (≤5 µl, remains aloft)
- Common source
  - Outbreak potential
- Vectorborne
- Endogenous
  - Auto-inoculation & device-related

STANDARD PRECAUTIONS +

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Contact Precautions

All family and friends, please see a care team member before entering.

Todos los familiares y amigos deben ver a un miembro del equipo de atención antes de entrar.

إلى جميع أفراد العائلة والأصدقاء، يُرجى مقابلة أحد أعضاء فريق الرعاية قبل الدخول.

REQUIRED:

GOWN

GLOVES

HAND HYGIENE

Before entering patient room:

1. Perform hand hygiene
2. Put on gown and tie in the back
3. Put on gloves

Upon leaving patient room:

1. Remove gown and gloves and place in trash inside room
2. Perform hand hygiene

Staff Contact Precautions Policy

Guidelines for Visitors

149150_contact 06/22

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Please download and install the Slido app on all computers you use

A 55 y.o. is admitted with fever and pneumonia. He recalls lawn mowing over a dead rabbit a few days ago. Blood cultures grow gram-negative coccobacilli aerobically. The appropriate patient placement and specimen lab containment are:

ⓘ Start presenting to display the poll results on this slide.

Incubation Periods for Selected Pathogens

• Influenza	1-4 days
• Parainfluenza	2-7 days
• Norovirus	12-48 hrs
• Rotavirus	<2 days
• RSV	2-8 days
• SARS-CoV-2	mean 5-6 (up to 14) days
• Wound Infection	
• Clostridia	24-48 hrs
• Group A Strep	24-48 hrs
• *S. aureus*	5-7 days
• Gram-negative bacilli	>7 days (variable)

STANDARD PRECAUTIONS +

HENRY FORD HEALTH

Droplet Precautions

STOP

All family and friends, please see a care team member before entering.

Todos los familiares y amigos deben ver a un miembro del equipo de atención antes de entrar.

إلى جميع أفراد العائلة والأصدقاء، يُرجى مقابلة أحد أعضاء فريق الرعاية قبل الدخول.

REQUIRED:

MASK

HAND HYGIENE

Before entering patient room:

1. Perform hand hygiene
2. Put on mask
3. Perform hand hygiene

Upon leaving patient room:

1. Exit patient room and perform hand hygiene
2. Remove mask
3. Perform hand hygiene

Staff Droplet Precautions Policy

Guidelines for Visitors

149150_droplet 06/22

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STANDARD PRECAUTIONS +

HENRY FORD HEALTH

Droplet PLUS Precautions

All family and friends, please see a care team member before entering.

Todos los familiares y amigos deben ver a un miembro del equipo de atención antes de entrar.

إلى جميع أفراد العائلة والأصدقاء، يُرجى مقابلة أحد أعضاء فريق الرعاية قبل الدخول.

REQUIRED:

N95 OR HIGHER RESPIRATOR

EYE PROTECTION

GOWN

GLOVES

HAND HYGIENE

DOOR CLOSED

Before entering patient room:

1. Perform hand hygiene
2. Put on gown and tie in the back
3. Put on respirator and perform fit check
4. Put on eye protection
5. Perform hand hygiene
6. Put on gloves

Upon leaving patient room:

1. Remove gown and gloves and place in trash inside room
2. Perform hand hygiene
3. Remove disposable eye protection (if applicable) and place in trash inside room
4. Exit patient room and perform hand hygiene
5. Remove and disinfect reusable eye protection (if applicable)
6. Perform hand hygiene
7. Remove respirator
8. Perform hand hygiene

Staff Droplet PLUS Precautions Policy

Guidelines for Visitors

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STANDARD PRECAUTIONS +

HENRY FORD HEALTH

Airborne Precautions

All family and friends, please see a care team member before entering.

Todos los familiares y amigos deben ver a un miembro del equipo de atención antes de entrar.

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DOOR CLOSED + NEGATIVE PRESSURE ROOM

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Approaches to Outbreak Investigation

HENRY FORD HEALTH®

Pathogens Implicated in Outbreaks

- *Listeria*
  - –Foodborne →soft cheese, dairy, cabbage
    - Miscarriages
  - –Psychrophile
- *Yersinia*
  - –Blood products, pork, hot dogs
    - Post-infectious reactive arthritis
  - –Psychrophile
- *Candida auris*
  - –Multiple nosocomial outbreaks worldwide
- *Mycobacteria chimaera*
  - –Contaminated heater-cooler devices

Pathogens Implicated in Outbreaks

- *Cronobacter sakazakii*
  - –Yellow pigment, powdered infant formula
- *Pseudomonas* spp
  - –Contaminated iodophors
- *Enterobacter agglomerans, Pseudomonas, Flavobacterium*
  - –Intrinsic or extrinsic contamination of IV fluids and medications
- BSI with unusual species
  - –Common-source contamination

slido

Please download and install the Slido app on all computers you use

Over a 1-week period in early September 2015, 2 patients on a unit are diagnosed with ESBL Salmonella Isangi infection. You are the physician taking care of the patient and are consulted to manage the patients. What do you do next?

ⓘ Start presenting to display the poll results on this slide.

Steps in Outbreak Investigation

1. Establish the existence of an outbreak
2. Verify the diagnosis
3. Construct a working case definition
   - Describe and orient the data in terms of person, place and time
4. Determine size of population at risk
5. Perform descriptive epidemiology
   - Epidemic curve
   - Outbreak is characterized by person, place and time

Steps in Outbreak Investigation

6. Develop and evaluate hypotheses regarding source and mode of transmission
   - –As necessary, reconsider, refine, and re-evaluate hypotheses
   - –Compare and reconcile with lab and/or environmental studies
   - –Cohort or case-control study
7. Implement control and prevention measures
8. Initiate or maintain surveillance
9. Communicate findings

Remember……

- Outbreak investigations are neither linear nor orderly!
- Multiple steps happen simultaneously
- Steps often have to be repeated several times
- Notify the health department

Literature Review

- An important place to start
- There are more than 60,000 published outbreak investigations
  - Over the years, many outbreaks of infectious diseases have occurred and spread across the United States and internationally
    - CDC Outbreaks
- Clues on where and how to start your investigation

Initial Case Findings

- Index patient:
  - 44 y/o M born in the Middle-East, resident of Venezuela, traveled to Mexico, Colombia, Spain
  - Underwent lung transplantation on Aug 9, 2015
  - Developed worsening diarrhea and abd pain on 9/2/2015 but had it since admission
- In the next two weeks, you identify a total of 8 cases
  - Everyone had surgery
  - Most develop symptoms on unit but not everyone

What are the possible modes of transmission?

Possible hypotheses for transmission

1. Contaminated shared equipment (e.g., intraoperative TEE probes, gels)
2. Contaminated environment (e.g., patient rooms)
3. Contaminated food or water
4. Infected or colonized healthcare worker (HCW)

Line List

- **Arguably the single most important part of the investigation since it drives all investigative efforts**
  - Most resource intensive part of the investigation
- What to look for:
  - Signs and symptoms
  - Host factors
  - Medications
  - Procedures
  - Location
  - Staff contact

Observations

- Who and what to observe is generally driven by the line list
- Initial observations and review of procedures can be very informative and can help with the creation of a standard observation tool, if needed

Case Definition

- Initial case definition should be narrow enough to focus efforts, but broad enough to catch all possible cases
  - How narrow to make it often depends on the pathogen
  - Confirmed, probable, and possible/suspect
- For example:
  - Patient or HCW with S. Isangi isolated from any culture during outbreak period from Aug 9-Oct 22, 2015, at HFH

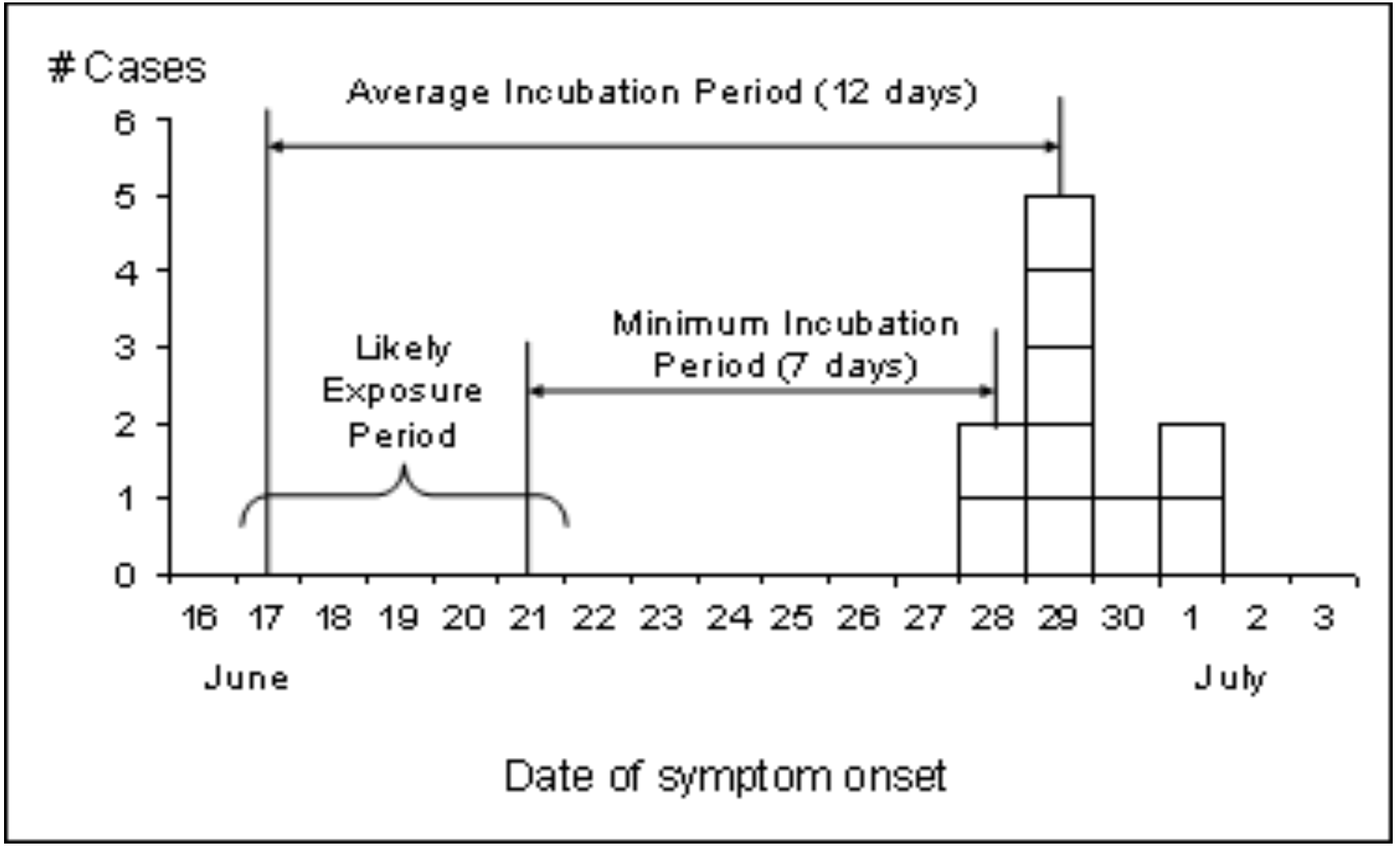
Case Findings

- Goal is to **stop** the **outbreak**, not to uncover every case
- More exhaustive case findings efforts may not be needed up front, but might become important to control an outbreak
  - Active vs passive surveillance
    - Microbiology data
      - Easiest and most reliable method
      - Pathogen-specific
        - Miss subclinical cases
  - Infection control or surveillance records
  - Discussions with clinicians

Investigation

- Active surveillance of patients potentially exposed during the outbreak
  - All patients in the unit
  - All patients who underwent solid organ transplantation (SOT) from Aug 9, 2015 - Oct 14, 2015
- Patients with diarrhea: screened for *S*. Isangi using stool samples
- Asymptomatic patients: screened for *S*. Isangi using perirectal swabs cultured in enriched broth media

Epidemic Curve



Environmental Sampling

- Can be the most powerful and definitive aspect of an investigation
- But can also be expensive, misleading and frustrating
  - Does a negative culture mean the bug was never there or just is not there right now?
- Methodologies can be tricky and may not be standardized
  - Some environmental pathogens have adapted to low nutrition environments and need special media to grow
  - Even using the best methods, the yield can still be low

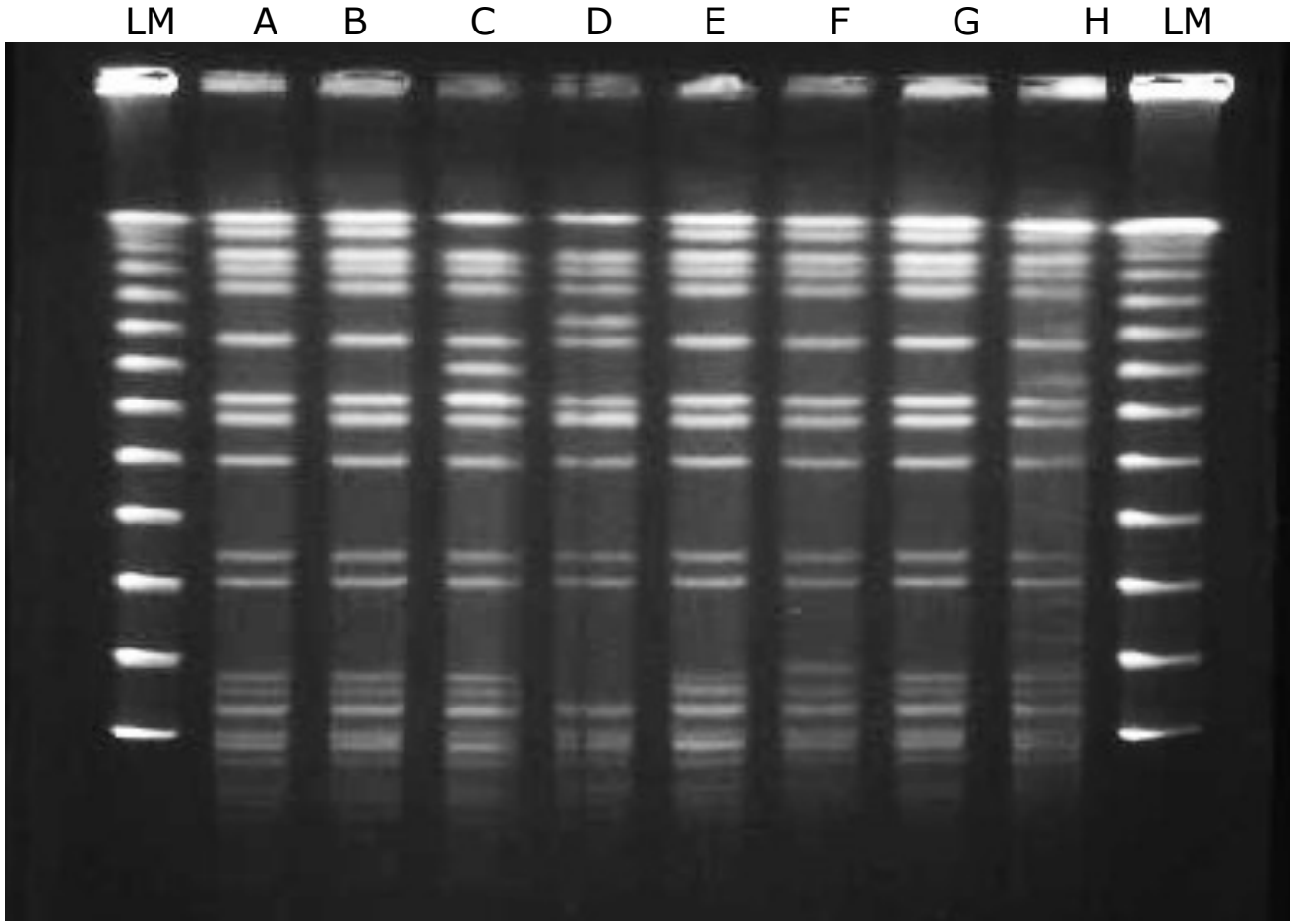
Environmental Cultures

- All 109 environmental cultures were negative for *Salmonella*
  - TEE probes
  - Glidescopes
  - Gel samples (multiuse and single use packs)
  - Environmental surfaces (OR and Units)
  - Water samples
  - Slush machines and coolers

Strain or Molecular Typing

- Strain typing technology has been used for decades in support of outbreak identification and monitoring
  - –Strain typing data can provide useful data for outbreak investigations
  - –Answers the question, “Are these isolates related?”
- Typing data is **NOT** a substitute for a sound epidemiologic investigation
- The two data sets should be used together to provide complementary information

PFGE of *Salmonella enterica* serotype Isangi clinical isolates



- PFGE showed 89.5% similarity
- Isolates with resistant-phenotypes possessed plasmid-mediated CTX-M15 ESBL

Strain relatedness using PFGE of all isolates was determined (8 representative isolates shown in lanes A-H).
14 of isolate patterns were identical and the remaining isolates differed by ≤ 3 bands for an overall relatedness of 89.5%.
Lanes A to H are patient isolates, and lanes LM are the lambda marker

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Multivariate Regression Analysis of Variables Associated with *Salmonella* Isangi Infection

	Adjusted	
Variable	Odds Ratio (95% CI)	P-value
Intra-operative TEE	9.0 (1.12-72.60)	0.02
Anesthesiologist A*	6.45 (1.00-41.52)	0.05
TTE	1.72 (0.47-6.29)	0.41
CTU stay	0.87 (0.22-3.43)	0.97

*Anesthesiologist A was involved in the care of only 4 (21%) case-patients, was asymptomatic and tested negative for salmonella

Implementing Control Measures

- Ultimately, the primary goal is to stop transmission, not necessarily find the source
  - Removing source or agent, blocking transmission
- May implement a variety of control measures targeting various possibilities based on the initial observations
  - Isolation or cohorting of case patients
  - Sterilization of equipment

Infection Control Assessment and Control Measures (1)

Operating room (OR)
OR processes assessed for lapses in infection control
Intra-operative transesophageal echocardiogram (TEE) practices reviewed
TEE and equipment reprocessing procedures evaluated and corrective measures implemented
TEE probes replaced and tracking procedures instituted for all TEE probes
Environmental surveillance cultures performed of TEE probes, gels, water, slush machines, environment
All multiuse gel containers replaced with single-patient use gels packs
Enhanced terminal cleaning of ORs using UV light disinfection
Temporary suspension of elective cardiothoracic surgical procedures
Perioperative prophylaxis switched to meropenem for cardiothoracic surgeries during outbreak
Multidisciplinary teams, including IC leadership and personnel from OR, anesthesia, and reprocessing, conducted weekly environmental rounds to monitor process improvement measures

Infection Control Assessment and Control Measures (2)

Cardiothoracic unit (CTU)
Case-patients placed in contact isolation until discharge
Infection Control teams placed in CTU to ensure adherence to infection control practices with emphasis on hand hygiene and disinfection of shared equipment
Daily huddles with unit staff to provide updates
Active surveillance with microbiological screening of all patients
Review of case-patient dietary records for any common food or water sources
Unit closed to new admissions
Enhanced terminal cleaning of patient rooms with UV light disinfection
Case-patients cohorted in single pod and all patient care equipment quarantined in pod
Temporary physical barriers placed between cohort pod and rest of CTU
Tracking of case-patients to ensure enhanced environmental cleaning of patient care areas outside the CTU

Definitive Investigation

- Refine the case definition based on the initial findings
  - Make it as focused as possible to detect real cases
- Continue surveillance efforts based on the refined case definition
- Continue to review control measures:
  - Compliance
  - Do they need to be enhanced or loosened?

Considerations

- Interested parties
  - Hospital administration
    - Educate
    - Update
  - Media
  - Lawyers

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Thank-you!
Questions?