Addressing The Burden of Hospital-Onset Bacteremia: A Focus on Risk Factor Mitigation Strategies Webinar Toolkit

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I. Webinar Presentation

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Addressing The Burden of Hospital-Onset Bacteremia (HOB): A Focus on Risk Factor Mitigation Strategies

July 30, 2025

BD

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Objective of this presentation is to review:

01

Patient safety risks and cost of care for HOB, including CLABSI

02

Urine as a source of HOB

(i.e., CAUTI, non-CAUTI hospital-onset UTI)

03

Surgical site infections outcomes and association with HOB

HAIs increase costs and mortality rates



HAIs are in the **top ten** leading cause of death in the US[1]



They result in about **99,000 deaths** each year[1]



HAIs cause **$28–33 billion** in excess healthcare costs[1]



Approximately **1 in 31 patients** contract at least one HAI daily[1]

1. Agency for Healthcare Research and Quality. Healthcare Associated Infections. https://www.ahrq.gov/professionals/quality-patient-safety/patient-safety-resources/resources/hais/index.html

What is Hospital Onset Bacteremia and Fungemia (HOB)?

According to the National Quality Forum (NQF):

Hospital-onset bacteremia and fungemia (HOB) is any bloodstream infection where bacterial or fungal pathogens are detected from a blood culture specimen collected on day four or later of hospital admission.[2]

- HOB is a subset of Hospital Acquired Infections
- HOB includes bloodstream infections from all sources, regardless of procedure or device[2]
- It covers a wider range of infections than the traditional targets of infection prevention and control[2]
- To address existing patient safety risks, growing costs, and reporting challenges, the Centers for Disease Control and Prevention (CDC) is actively refining a new quality measure addressing HOB[2]

2. National Quality Forum (NQF). Hospital Onset Bacteremia and Fungemia Playbook. Washington, DC: NQF, 2024.

HOB as a metric

2024 NHSN Annual Training[3]

Measure	Numerator	Denominator
Primary Metric: HOB Event		
HOB Event	Pathogenic bacteria or fungi from blood culture on hospital day ≥ *(excluding patients with prior matching cultures and HOB events*	Total no. of inpatient admissions
Complementary Metrics: For Quality Improvement, NHSN Risk Adjustment		
Blood Culture Utilization	Testing Prevalence: Admissions with at least 1 blood culture Testing Intensity: Total blood cultures among patients with at least 1 blood culture	
Blood Culture Contamination	Skin commensal organism in 1 of 2 blood culture sets	Total no. of blood culture sets
Community-Onset Bacteremia & Fungemia Event	Pathogenic bacteria or fungi from blood culture prior to hospital c 4 *(excluding patients with prior matching cultures and COB events)*	Total no. of inpatient admissions
Matching Commensal HOB Event	Skin commensal from ⩾2 blood cultures, AND ⩾4 days of antibiotic treatment	Total no. of inpatient admissions
Non-Measure HOB Event	HOB events among patients with conditions that highly predict non-preventability	Total no. of inpatient admissions

3. Betz K, Dantes R, Shehab N, Student L. Center for Disease Control and Infection. National Healthcare Safety Network: NHSN's New Digital Quality Measures and Introduction Overview; 2024 NHSN Annual Training

HOB Perceptions

AHA Survey, March 2023:
"HOB: Hospital leaders' attitudes on HOB Sources, prevention and treatment"

- 45% of respondents already were tracking HOB and another 20% planned to do so as soon as possible. The rest were waiting for CMS Mandate.
- 73% believe future reporting metrics should consider patient demographics that may have predisposing clinical risk factors for HOB.
- Best practices should include visibility to HOB sources and prevention measures, timely pathogen identification, and improvement in definitive therapy.

Figure 4:

HOB sources ranked by source & preventability

Source	Rank as contributor to HOB	Rank as preventable source of HOB
Central-line catheters	1	1
Urinary-source infections	2	4
Respiratory/pneumonia	3	7
Wounds	4	6
Surgical-site/post-invasive procedure complications	5	3
Mechanical ventilation	6	N/A
Skin and soft tissue	7	5
Peripheral IVs	8	2

4. American Hospital Association (AHA). Hospital Onset Bacteremia, Hospital leaders' attitudes on HOB sources, prevention and treatment. AHA/BD 2023

CLABSI & HOB: Clinical & Economic Outcom[5]


Infection Control & Hospital Epidemiology (2023), 44, 1920–1926
doi:10.1017/ice.2023.132

SHEA

Original Article

Characteristics, costs, and outcomes associated with central-line–associated bloodstream infection and hospital-onset bacteremia and fungemia in US hospitals

Kalvin C. Yu MD, Molly Jung PhD and ChinEn Ai MPH

Sample size

- 41 acute care hospitals
- 403 CLABSI, 1574 non-CLABSI HOB, 1745 control group
- Main sources of HOB (respiratory, urine, SSTI, other HAIs)

In-Hospital Mortality

- 31.3% CLABSI, 28.3% non-CLABSI HOB, 8.3% controls

LOS (days)– HOB vs control

- 12.1–17.4 days added LOS depending on ICU status

Relative Mortality Risk

- 3.77 CLABSI, 3.2 non-CLABSI HOB

Hospital Costs ($)– HOB vs Control

- $25,207–$55,001 added incremental cost per HOB event

30-day Readmission Rates

- 1.41 CLABSI, 1.28 non-CLABSI HOB

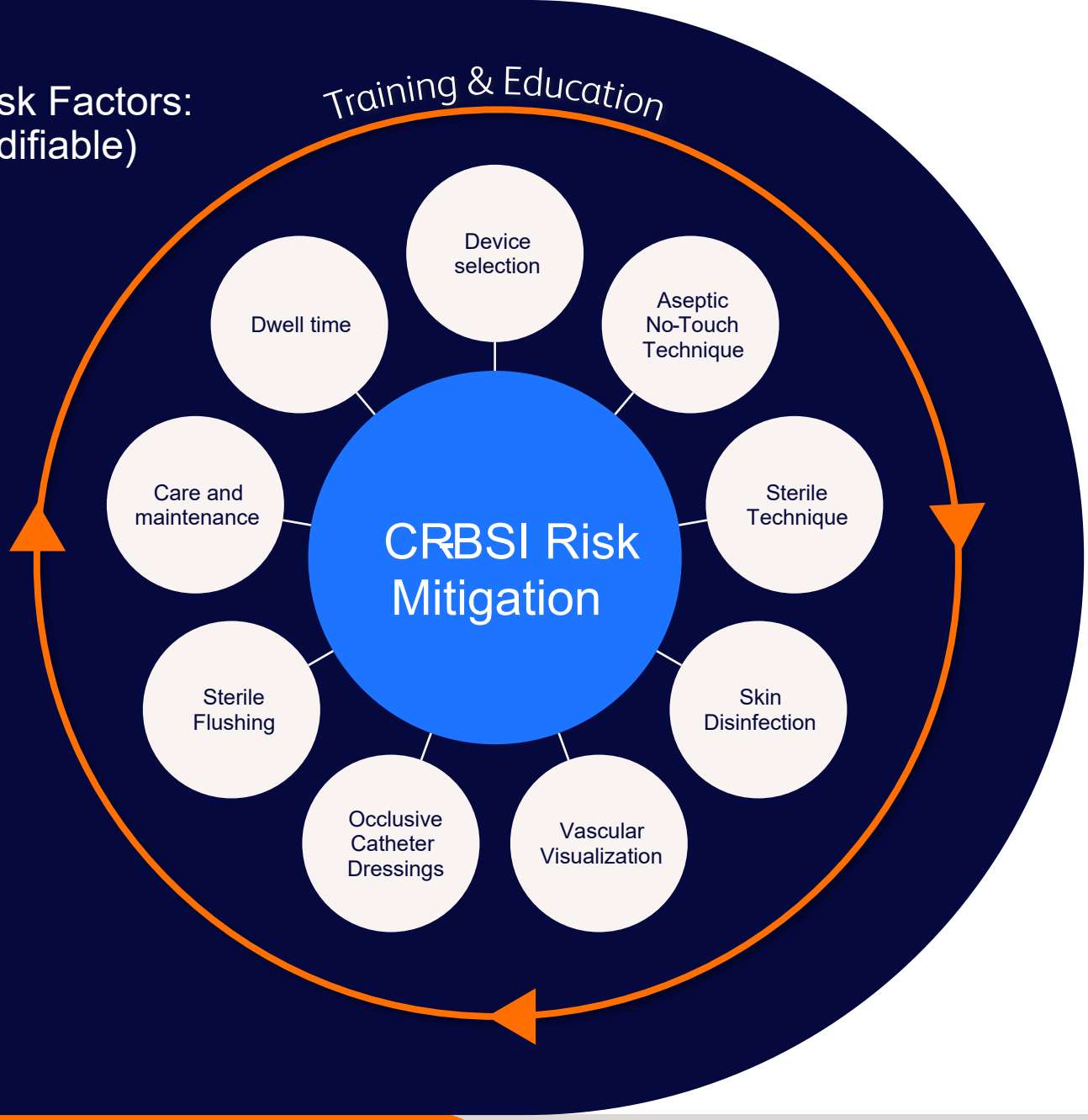
HOB incidence > 4x CLABSI at the facility level

~8% of blood culture results indicated commensals

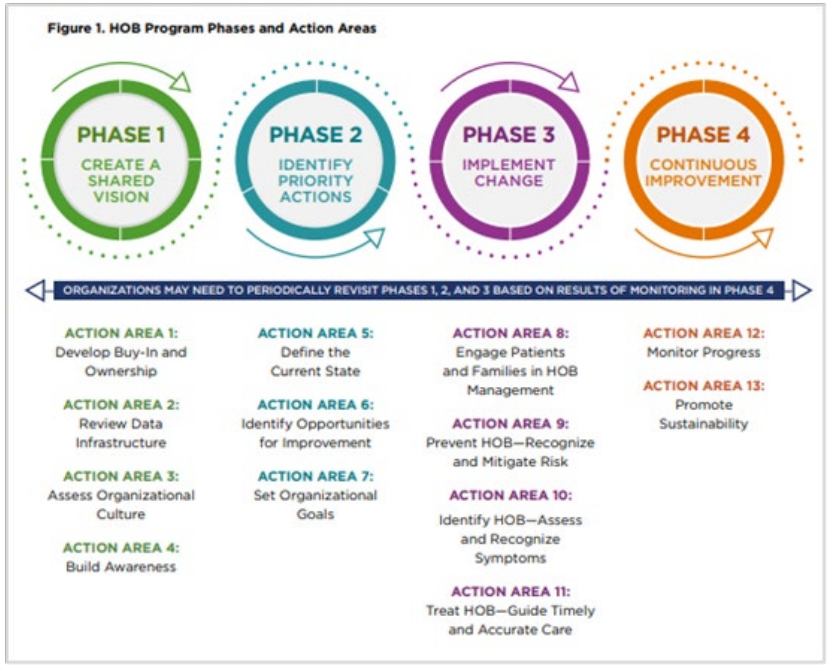
5. Yu KC, Jung M, Ai C. Characteristics, costs, and outcomes associated with central-line–associated bloodstream infection and hospital-onset bacteremia and fungemia in US hospitals Infection Control & Hospital Epidemiology. 2023;44(12):1920–1926. doi:10.1017/ice.2023.132

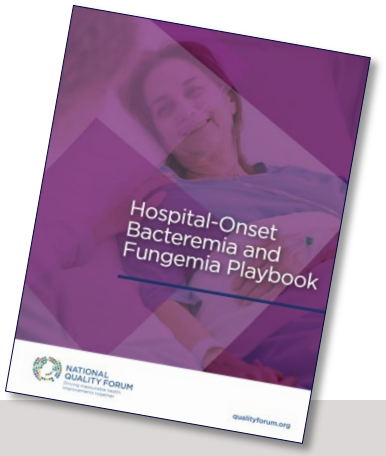
Mitigating Risk

Infection Risk Factors: CRBSI (Modifiable)



National Quality Forum Hospital Onset Bacteremia Playbook[6]





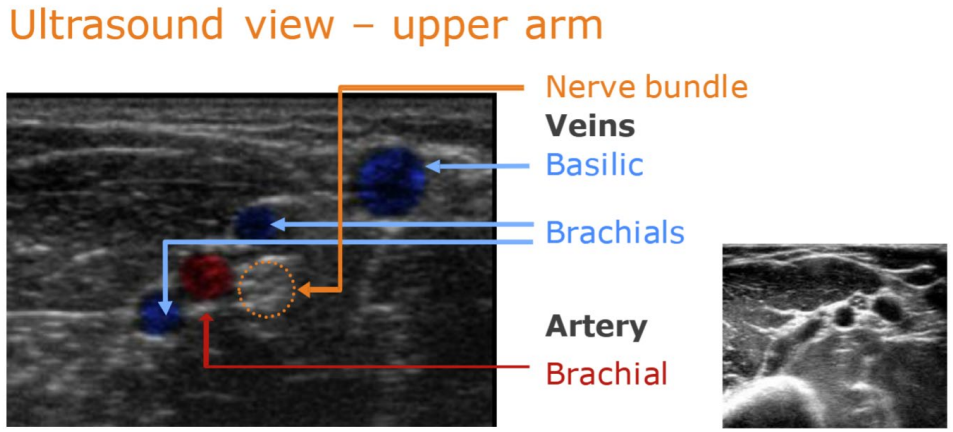
6. National Quality Forum (NQF). Hospital Onset Bacteremia and Fungemia Playbook. Washington, DC: NQF, 2024.

Infection Risk Factor Mitigation: CRBSI



Vascular Visualization

INS Standards: "Vascular visualization technology is used to increase insertion success of the most appropriate, least invasive vascular access device (VAD)…to reduce insertion-related complications."[7]



7. Infusion therapy standards of practice (9th ed.). Journal of Infusion Nursing, 47(1S), S224.

Infection Risk Factor Mitigation: CRBSI



Sterile Flushing

INS Standards: "Vascular access devices (VADs) should be assessed for patency (i.e., flushed and aspirated for a blood return) prior to each infusion to assess catheter function and prevent complications as well as flushed after each medication administration[9]."

WHO Guidance: "After product administration via a PIVC or PICC, the catheter should be flushed with a compatible sterile fluid[8]."



8. Guidelines for the prevention of bloodstream infections and other infections associated with the use of intravascular catheters. Geneva: World Health Organization; 2024

9. *Infusion therapy standards of practice* (8th ed.). *Journal of Infusion Nursing, 47*(1S), S1–S224.

Infection Risk Factor Mitigation: CRBSI



Care and maintenance

INS Standards: “Limit the use of add-on devices whenever possible to decrease excessive manipulations, accidental disconnections or misconnections, and risk of contamination and subsequent infection.”[10]

10. Infusion therapy standards of practice (9th ed.). Journal of Infusion Nursing, 47(1S), S1–S224.

Infection Risk Factor Mitigation: CRBSI

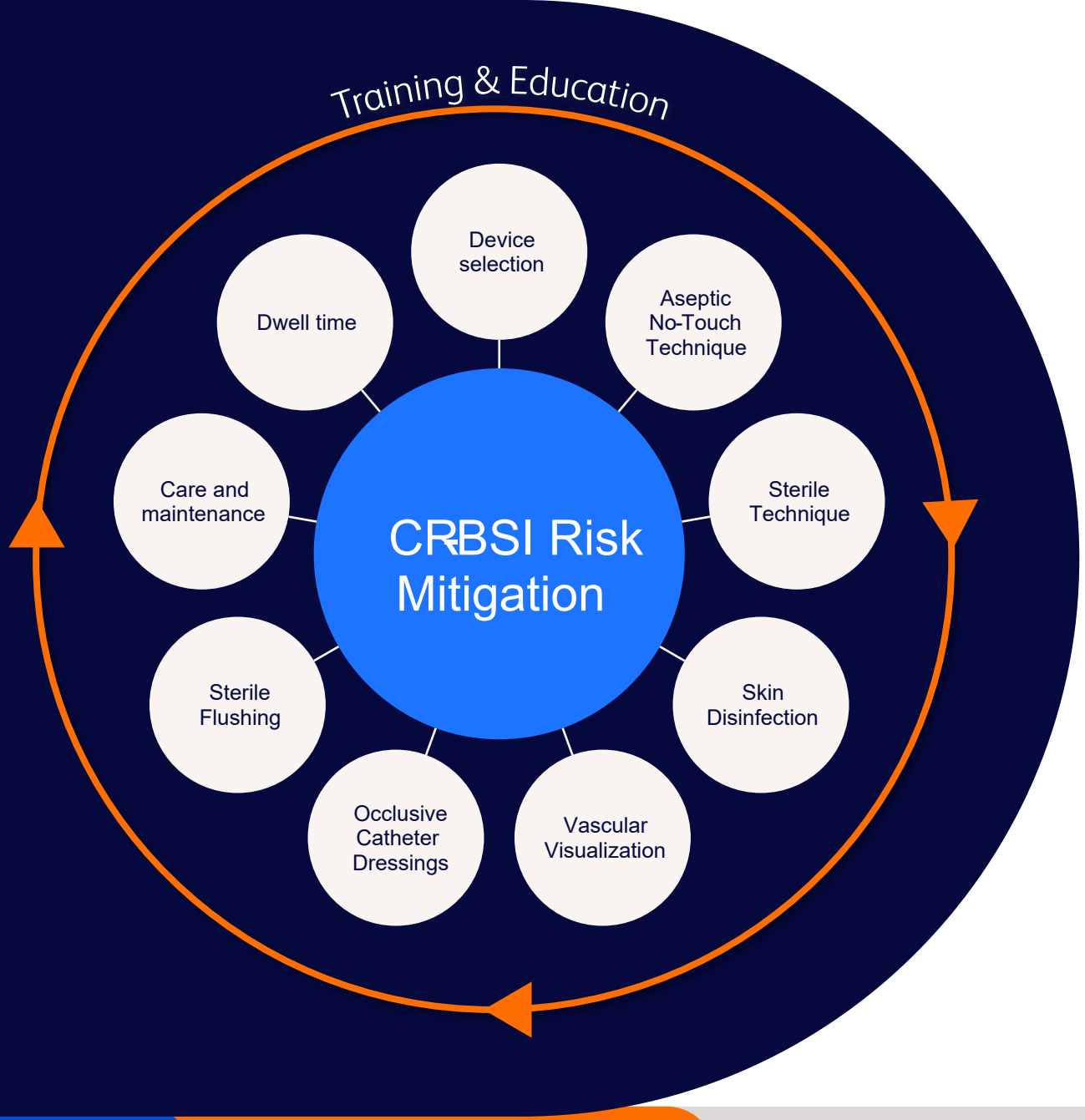


Longer dwell times

INS Standard 42. Vascular Access Device Removal

VADs are removed when clinically indicated (e.g., unresolved complication, discontinuation of infusion therapy, or when no longer necessary for the plan of care).[11]

11. *Infusion therapy standards of practice* (9th ed.). *Journal of Infusion Nursing, 47*(1S), S1–S224



Infection Risk Factors: CRBSI (Modifiable)

CRBSI

- Select proper site (avoiding areas of flexion)
- Disinfectskin properly and practice aseptic technique

Complications

(occlusions, dislodgement, phlebitis, infiltration/extravasation)

- Follow flushing and locking procedures
- Prevent catheter dislodgement (catheter securement)
- Select appropriate device for the intended therapy
- Use ultrasound guidance to visualize veins

6. National Quality Forum (NQF). Hospital Onset Bacteremia and Fungemia Playbook. Washington, DC: NQF, 2024.

CAUTI, HOUTI and HOB[12]



Retrospective observational study,
43 acute-care hospitals

CAUTI per NHSN definition,

non-CAUTI HOUTI defined as a positive, noncontaminated, non-commensal culture collected on day 3 or later with a new antimicrobial prescribed within 2 days of the first positive urine culture

- 8% of CAUTIs evolve into an HOB event
- For every 1 CAUTI that turns into HOB, 3 non-CAUTI HOUTIs do the same
- Approximately 32.8% of urine culture positives were excluded from this study (i.e., false + urine cultures)

	CAUTI (n=434)	Non-CAUTI HOUTI (n=3177)
Incremental Total Cost ($)	9,807	6,874
Incremental LOS Day (Days)	3.01	2.97
Readmission Relative Risk	0.82	1.17
Mortality Relative Risk	3.78	1.03

12. Kelly T, Ai C, Jung M, Yu K. Catheter-associated urinary tract infections (CAUTIs) and non-CAUTI hospital-onset urinary tract infections: Relative burden, cost, outcomes and related hospital-onset bacteremia and fungemia infections. Infect Control Hosp Epidemiol. 2024 Jul;45(7):864-871. doi: 10.1017/ice.2024.26. Epub 2024 Feb 20. PMID: 38374686; PMCID: PMC11439594.

Infection Risk Factors: Hospital Onset UTI



Prolonged Indwell time



Contamination



Practice Variation

Urologic Drainage & Fecal Management Innovation

Product	Intended Use	Risk Mitigation
External Urinary Devices	Intended fornon-invasive urine management.	Indwelling catheters
Coated Indwelling Catheters	Intended to reduce the risk or prolong manifestation of biofilm.	Bacterial adherence and biofilm
Fecal Containment/Diversion	Intended to minimize overall exposure and skin contact with stoc	Exposure
Periurethral Cleaning Wipes	Intended to externally clean around the genitalia and perineum.	Device environment
Indwelling Catheter Trays	Intended to provide necessary materials to perform catheterizatic sometimes in sequence.	Procedural Variation
Closed System Trays	Intended to prevent ingress of pathogens.	External Contaminants

SSI & HOB: Clinical & Economic Outcomes[13]

Sample size

- 38 acute care hospitals
- 242 NHSN-reported SSI cases, 30 (12.4%) HOB co-occurrence

Relative Mortality Risk

- SSI vs Control: 3.4 RR
- SSI + HOB vs SSI Control: 3.4 RR

LOS (days) – added LOS per event

- SSI vs Control: 11.6 days
- SSI + HOB vs SSI Control: 6.3 days

30-day Readmission Rates

- SSI vs Control: 1.5 RR
- SSI + HOB vs SSI Control: 2.7 RR

Hospital Costs ($) – incremental cost per event

- SSI vs Control: $30,689
- SSI + HOB vs SSI Control: $24,586

Patients with SSI had 6-fold higher risk of HOB

HOB + SSI Co-occurrence = Increased Clinical & Economic Burden

13. ChinEin, A, Jung, M, Bastow, S, Adjaoute, G, Bostick, D, Yu, K. Clinical Outcomes and Hospital Cost Associated with Surgical Site Infections and the Co-occurrence of Hospital Onset Bacteremia and Fungemia Across US Hospitals. Infection Control & Hospital Epidemiology. Accepted January 4, 2025

Infection Risk Factors: Surgical Site Infections

Patient factors

- MRSA or MSSA nasal colonization
- Infection at another site
- Obesity
- Diabetes
- Smoking
- Immunosuppressive agents

Surgeon factors

- Use of drains
- Poor surgical technique
- Use of staples
- Lack of redosing of antibiotic

Work environment factors

- Poor staff levels
- Workload and shift patterns
- Design, availability and maintenance of equipment
- Environment and physical plant problems (e.g. air handling system)
- Lack of hand hygiene

Care delivery problems

- Lack of discontinuation of antibiotics at 24h
- Contamination of incision postop
- Contaminated environment
- Inadequate staffing for postop care
- Lack of Foley catheter removal within 48h
- Lack of hand hygiene

Surgical outcome

Preop factors

- Lack of hand hygiene
- Patient body colonization
- Lack of preop shower

Perioperative team factors

- Lack of traffic control (e.g. too many in room)
- Improper surgical hand antisepsis
- Improper surgical attire
- Unsterile instruments
- Insufficient skin antisepsis
- Contaminated environment
- Inadequate surgical prophylaxis
- Non-coated sutures
- Improper mixing of irrigation solutions

Organizational / management factors

- Financial constraints
- Poor team communication
- Poor leadership
- Increased hospital days

One factor could lead to failure

+ There are many different strategies that are required to **reduce SSI risk to the lowest extent possible**

+ The **most successful method of implementation** to prevent SSIs is the use of **bundles**, i.e, addressing multiple risk factors simultaneously

Perioperative

+ The time period of a patient's procedure, from preop to postop

14. Adapted from Spencer M. Working Toward Zero Healthcare Associated Infections. http://www.workingtowardzero.com/uploads/4/6/4/2/4642325/aorn1929_going_forward_-_preventing_ssis__dec_2014.pdf.13

Surgery Innovations

	Product Selection/Intended Use	SSI Risk Factor Mitigation
Skin Antisepsis, Hair Removal	• Hair removal is indicated prior to procedure to better visualize the proc area. • Can be used with a vacuum assisted device to vacuum clipped hair and airborne contaminants generated from the clipping process. • Skin antisepsis is for the preparation of the patient's skin prior to surgical procedure. It helps to reduce the bacteria that potentially can cause skin infection.	• Adhesive tapes can damage skin, creating a portal for infection • Hair and airborne particles left behind from surgical clipping on the patient, linens, an floor can contaminate the surgical environment • Significantly less microbial contamination from airborne hair dispersal when using a vacuum-assist device • Ex: 2% CHG / 70% isopropyl Alcohol delivers a broad spectrum, rapid acting, and persistent antiseptic activity beyond your procedure.
Wound Irrigation	• Wound irrigation solution is used to mechanically loosen and remove from the wound • Should Meet guideline recommendations such as SHEA and CDC such as the use of PVP-I irrigation. • Ready and ease to use.	• The solution with PVP-I as a preservative provided 99.99% reduction against common organisms • Biofilm bacteria (4 log10) after a 1-minute contact time in the solution • Solutions should be terminally sterile. • Premixed antimicrobial irrigation system streamlines clinical workflow by requiri setup time
Hemostats & Sealants	• Hemostats and sealants are indicated in surgical procedures as an adjunctive hemostatic device to assist when control of capillary, venous, and other arteriolar bleeding by pressure, ligature, and other conventional procedures is ineffective or impractical.	• Hemostatic agents and sealants should not be a nidus for infection. • Completely absorbed with the body within 24-48 hours.
Hemodynamics	• Hemodynamic monitors are designed to help you detect hemodynamic instability	• Hemodynamic optimization through goal-directed hemodynamic therapy (GDHT) is demonstrated to reduce complications like acute kidney injury and SSI.

Key Takeaways: HOB

Outcomes & Sources

- HOB events have:
  - 12-17 days longer LOS,
  - $25k -$55k incremental cost of care
  - 3x higher risk of mortality
  - Higher readmission risk
- Common sources of HOB:
  - Urine
  - Respiratory
  - SSTI, CLABSI and other HAIs

Challenges

- Because HOB has so many sources, including other HAIs, prevention efforts alone will likely not result in "zero rate goals"
- Therefore, when an HOB event occurs, identification of the pathogen and timely definitive therapy (right "drug for the bug") will likely be important in mitigating morbidity & mortality of HOB events
- Clinically indicated use of invasive devices (ventilator, central lines, foleys) will likely be scrutinized in HAI prevention bundles

What can be done now?

- Policies and procedure to hardwire standardization of existing current HAI prevention bundles
- Reduce clinical confusion by adhering to best specimen practices for blood, urine and respiratory cultures
- Less contaminated cultures = less clinical and workflow churn for RNs, laboratory services, MDs, PharmDs
- Align microbiology lab workflow with ASP workflow and ASP committee goals

Covid Era: HAI Facts

A study by the CDC showed that U.S. hospitals saw significant increases in healthcare-associated infections (HAI SIRS) for CLABSI, CAUTI, VAE, MRSA bacteremia during the pandemic

The CMS ruling on ASP (Antimicrobial Stewardship Programs) in 2020 codified that ASPs were required as a condition of CMS participation, and ASP Committe required laboratory, ASP, ICP, Quality leads

https://arpsp.cdc.gov/profile/national-progress/united-states
Hospital-Acquired Condition Reduction Program | CMS
https://www.federalregister.gov/documents/2019/09/30/2019-20736/medicare-and-medicaid-programs-regulatory-provisions-to-promote-program-efficiency-transparency-and

Q&A



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BD

Q&A

MDS

- How might HOB initiatives impact vascular device selection? Do you think that we will see a shift in increased use of central lines?

UCC

- How do you think the link of urine as a source and HOB will impact the use of indwelling urine foley catheters?

Surgery

- What are the SSI risk factors that you perceive to be most controllable/preventable?