1.0 Contact Hour

Understanding the Significance of Blood Culture Contamination: Impacts and Effective Solutions

Meet the Presenter

Disclosures: employed by Kurin Inc. (manufacture and distribute device that reduces blood culture contamination)

Sara E Owens

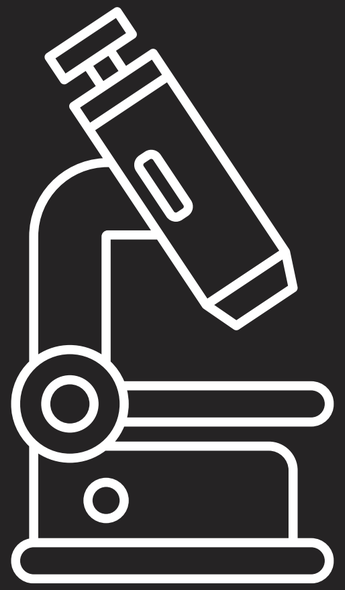
BSN, RN, VA-BC

Objectives

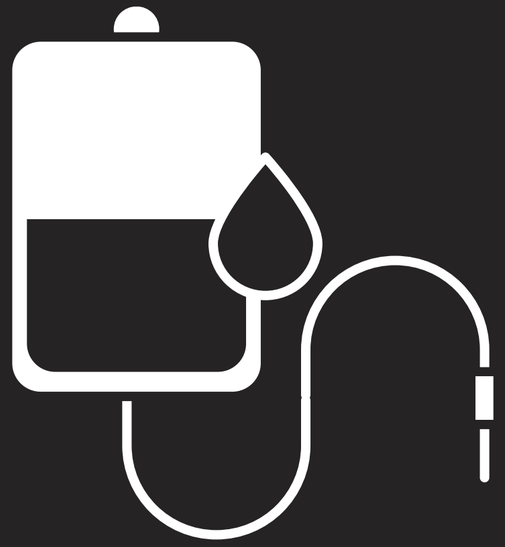
1. Define causes and impacts of blood culture contamination (BCC)
2. Describe relationship of accurate blood cultures, sepsis diagnosis, & antimicrobial stewardship
3. Identify solutions to reduce BCC, and the role of leadership to achieve long term, sustained outcomes
4. Outline the relationship and impact of BCC reduction and accurate quality metric reporting

Three Goals of Blood Culture Collection

Does the patient have an infection?



Identify the organism causing the infection



Determine the right antibiotic to treat the patient

Blood Culture Facts

Blood cultures remain the gold standard for diagnosing sepsis and sepsis is the leading cause of death and readmissions [1, 2]

There are over 1 million blood culture contaminations in the USA each year [4]

Virtually all contaminations occur during sample acquisition [3]

Blood culture contaminations are largely preventable

1 Sinha, M., Jupe, J, Mack, H, Coleman, TP, Lawrence, S.M, & Fraley, SI. Emerging technologies for molecular diagnosis of sepsis. *Clinical Microbiology Reviews. 2018;*31(2):e00089-17. doi: https://doi.org/10.1128/CMR.00089-17

2 Sepsis Alliance. What is Sepsis? Published January 13, 2022. Accessed February 9, 2024. https://www.sepsis.org/sepsis-basics/what-is-sepsis/

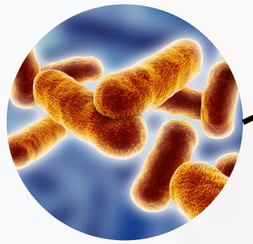
3 U.S. Department of Health and Human Services Centers for Disease Control and Prevention. *Blood Culture Contamination: An Overview for Infection Control and Antibiotic Stewardship Programs Working with the Clinical Laboratory*. 2022. Accessed February 9, 2024. https://www.cdc.gov/antibiotic-use/core-elements/pdfs/fs-bloodculture-508.pdf

4 American Hospital Association. The Impact and Prevention of False Positive CLABSIs. AHA. Published 2019. https://www.aha.org/education-events/impact-and-prevention-false-positive-clabsis

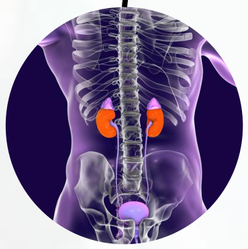
False Positive Blood Culture Impact

Patient Impact of a Blood Culture Contamination

Unnecessary Antibiotics



Increase risk of multi-drug resistant organisms (MDROs)



Risk of Acute Kidney Injury (AKI)

Increased risk of HACs

False Positive CLABSIs

Falls, Pressure Ulcers, PEs

Increased Mortality

Extended LOS

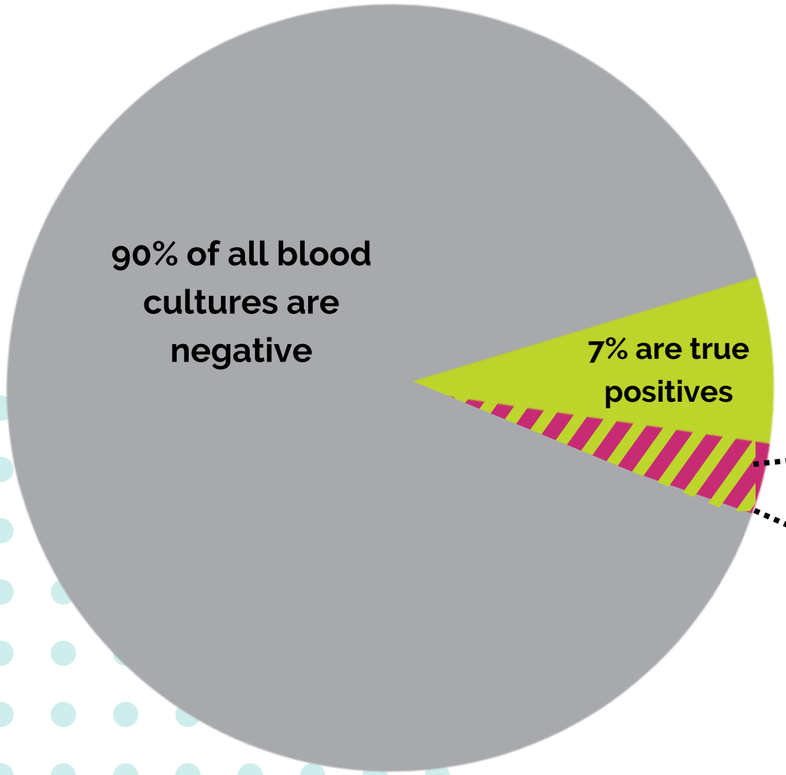
Decreased Patient Satisfaction

Cost of a Contamination?

	Facility/Location	Cost	Journal/Presentation
Garcia et al. [15]	Stonybrook, NY	$4500-10,000	Am J Infect Control 2015
Skoglund et al. [16]	University of Houston	$4538-$4739	J Clin Microbiol 2019
Gander et al. [17]	Parkland, TX	$3886	J Clin Microbiol 2009
Rupp et al. [18]	University of Nebraska	$4850	Clin Infect Dis. 2017
O' Sullivan & Steere [19]	Hartford, CT	$5000	Connecticut Med 2019
Dempsey et al. [20]	University of Houston	$2923-$5212	Am J Infect Control 2019
Allain [21]	Crouse, NY	$5200	CNS Conf 2018
Arnaout et al. [22]	University of Massachusetts	$7000	Open Forum Infect Dis 2021
Burnie & Vining [23]	TriHealth, OH	$5863	Clin Nurse Spec Dec. 2021

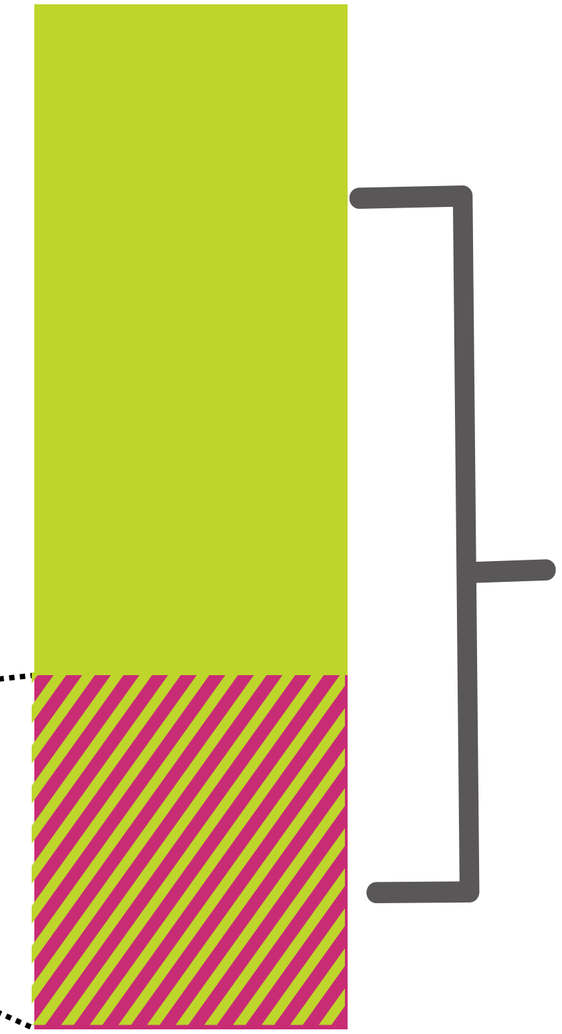
CDC AVERAGE CONTAMINATION COST ~$4538

Putting the 3% blood culture contamination rate benchmark to the test



All Blood Cultures

3% of all blood cultures are contaminated!



Positive Blood Cultures

Approximately one in three blood cultures is wrong. Why tolerate these rates from blood culture testing when false positives are a **preventable error?**

7 Zwang O, Albert RK. Analysis of strategies to improve cost effectiveness of blood cultures. *J Hosp Med.* 2006;1:272-6.

The 3% Problem

Outdated Benchmark

National 3% benchmark established by CLSI in 2007, as a result of a CAP Q-probe study from 1998 [5]

Unreliable Testing

3% sounds acceptable – but actually means 1/3 of positive tests are inaccurate

New Guidelines

2022 CLSI update: revised guidelines to state facilities should benchmark at 3% or less, but **with best practices, 1% is achievable and should be considered** [6]

5 CLSI. *Principles and Procedures for Blood Cultures; Approved Guideline.* CLSI document M47A. Clinical and Laboratory Standards Institute; 2007.

6 CLSI. *Principles and Procedures for Blood Cultures.* 2nd ed. CLSI guideline M47. Clinical and Laboratory Standards Institute; 2022.

exposure and prolonged length of hospitalization. Microbiology laboratories typically track blood culture contamination rates and can provide data to assist in reducing contamination rates. Infection control programs and microbiology laboratories might participate in designing and implementing interventions to decrease contamination rates, and antibiotic stewardship programs could also be engaged to optimize multidisciplinary quality improvement efforts to decrease blood culture contamination and improve the collection of blood culture specimens.

Background

Blood cultures are important diagnostic tools for identifying the pathogen(s) responsible for a patient's infection. This is especially true of patients with suspected sepsis or septic shock and for patients with suspected infective endocarditis[1,2]. When indicated, blood cultures should be obtained prior to starting antimicrobial therapy[1,2]. A conventional blood culture set consists of an aerobic and an anaerobic bottle. For adults, 20-30 mL of blood per venipuncture (depending on the instrument manufacturer) is recommended and may require >2 bottles depending on the system[2]. At least two blood culture sets should be obtained within a few hours of each other via peripheral venipuncture when obtaining blood cultures for a total volume of 40-60 mL of blood to optimize detection of pathogens[2]. The College of American Pathologists laboratory accreditation program states that clinical laboratories have a written policy and procedure for monitoring blood cultures from adults for adequate volume and provide feedback on the results to the collectors[3]. Moreover, the monitoring and reporting of blood culture contamination rates is a laboratory quality best practice[4].

Example of a blood culture set consisting of an anaerobic and an aerobic bottle, with the latter after filling with an appropriate volume of blood.

Because blood is a normally sterile body site, positive blood cultures with a known pathogen have a generally overall high positive predictive value for infection. However, blood culture contamination is a significant problem. In the era of modern blood culturing techniques, virtually all blood culture contamination occurs during collection; the source of contaminants is usually the patient's skin or the hub or cannula of an indwelling catheter (i.e., when an existing catheter is used to obtain the specimen). Frequent causes include poor collection technique and insufficient skin disinfection. Typical organisms include coagulase-negative staphylococci, *Corynebacterium* spp., *Bacillus* spp. other than *Bacillus anthracis, Micrococcus* spp., and *Cutibacterium acnes* among others. Consequences include unnecessary antibiotic exposure with the potential for downstream unintended consequences (e.g., possible allergic reactions and *Clostridioides difficile* infection)[5]. Other possible consequences include the unnecessary removal of intravenous catheters or other devices, an increased length of stay, and increased costs[5]. One study found that the average length of stay was 2 days longer in patients with contaminated blood cultures compared to patients with negative cultures[6]. That same study found that direct and indirect hospital costs of a contaminated blood culture were $12,824 compared to $8,286 for a negative blood culture (savings of $4,538 for preventing a contaminated blood culture)[6].

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

CS 331454-B

CDC

Moving the target: 1%

VA | U.S. Department of Veterans Affairs

VA Medical Centers

CLINICAL AND LABORATORY STANDARDS INSTITUTE

2nd Edition

M47

Principles and Procedures for Blood Cultures

This guideline includes recommendations for collecting, transporting, and processing specimens for blood culture, as well as procedures for recovering pathogens from the blood of patients with suspected bacteremia or fungemia.

CLSI

"Savings of **$4,538** for preventing a contaminated blood culture"

3 U.S. Department of Health and Human Services Centers for Disease Control and Prevention. *Blood Culture Contamination: An Overview for Infection Control and Antibiotic Stewardship Programs Working with the Clinical Laboratory*. 2022. Accessed February 9, 2024. https://www.cdc.gov/antibiotic-use/core-elements/pdfs/fs-bloodculture-508.pdf

Diagnosing Sepsis & The Clinical Challenge

- Time crunch of sepsis bundles
- Patients are sicker requiring higher level, immediate care
- Diagnostic errors and delays are significant, but some are accepted as the norm

11 Centers for Disease Control and Prevention. *Hospital Sepsis Program Core Elements: 2023*. US Department of Health and Human Services; 2023. Accessed February 9, 2024. https://www.cdc.gov/sepsis/pdfs/sepsis-core-elements-H.pdf

Sepsis and Antimicrobial Stewardship

Possible Contamination Occurs

Continue Treatment?

De-escalate?

Delayed appropriate drug therapy
Redraw blood cultures. Are those accurate?
Unnecessary Antibiotics + associated adverse effects
Delays in diagnosis and Tx

A contamination can take a treatment plan in a completely different direction than what the patient actually needs!

Stewardship

Right Patient. Right Setting. Right Time.

Improve the reliability of blood culture testing to ensure blood stream infections are properly diagnosed while minimizing adverse events from antibiotic overuse.

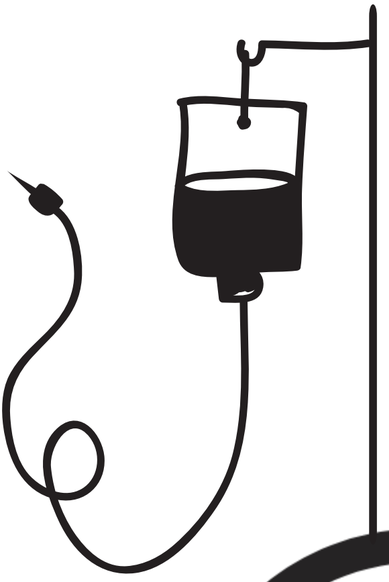
What are some adverse events associated with unnecessary antibiotics?

- Patient vulnerable to antibiotic-resistant infections
- Increased risk of AKI
- Increased risk of C. Diff

Blood culture sensitivity is significantly influenced by blood volume, both volume per bottle & total blood volume.

- In adults, up to 40% of blood cultures are single sets [12]
- Blood cultures are often improperly filled (under or overfilling).

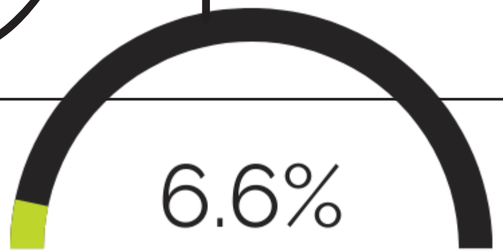
12 Fabre V, Carroll KC, Cosgrove SE. Blood culture utilization in the hospital setting: a call for diagnostic stewardship. *J Clin Microbiol*. 2022;60(3):e0100521. doi:10.1128/JCM.01005-21



What is the Impact of Contaminated Cultures on Vancomycin Use?

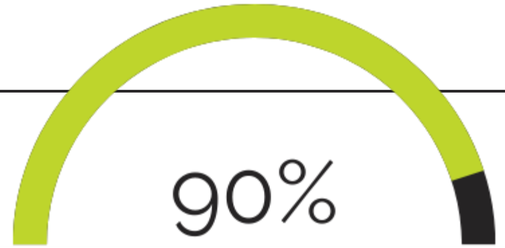
A total of 1816 blood samples were collected

- 44% collected with standard methods
- 56% collected using an initial specimen diversion device



There were 53 contamination events in the **Standard Method group** (6.6% BCC rate)

There were 7 contamination events in the **device group** (0.69% BCC rate)

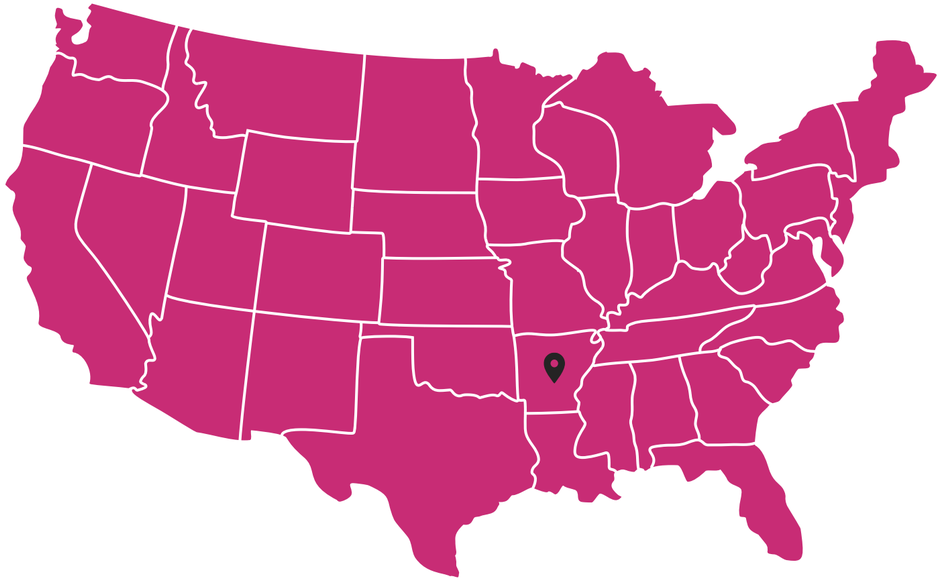


The device group had a 90% lower incidence of blood contamination vs the standard method

31.4% reduction in **V**ancomycin for ER sepsis patients over the following eight-month period after the device had been introduced.

13 Nielsen LE, Nguyen K, Wahl CK, et al. Initial Specimen Diversion Device® reduces blood culture contamination and vancomycin use in academic medical centre. *J Hosp Infect*. 2022;120:127-133. doi:10.1016/j.jhin.2021.10.017

University of Arkansas



- Focuses on the impact of blood culture contamination
- Published in ICHE
- Over 13,000 blood cultures analyzed

For those patients with a false positive versus a true negative, the study found:

24%
increase in LOS

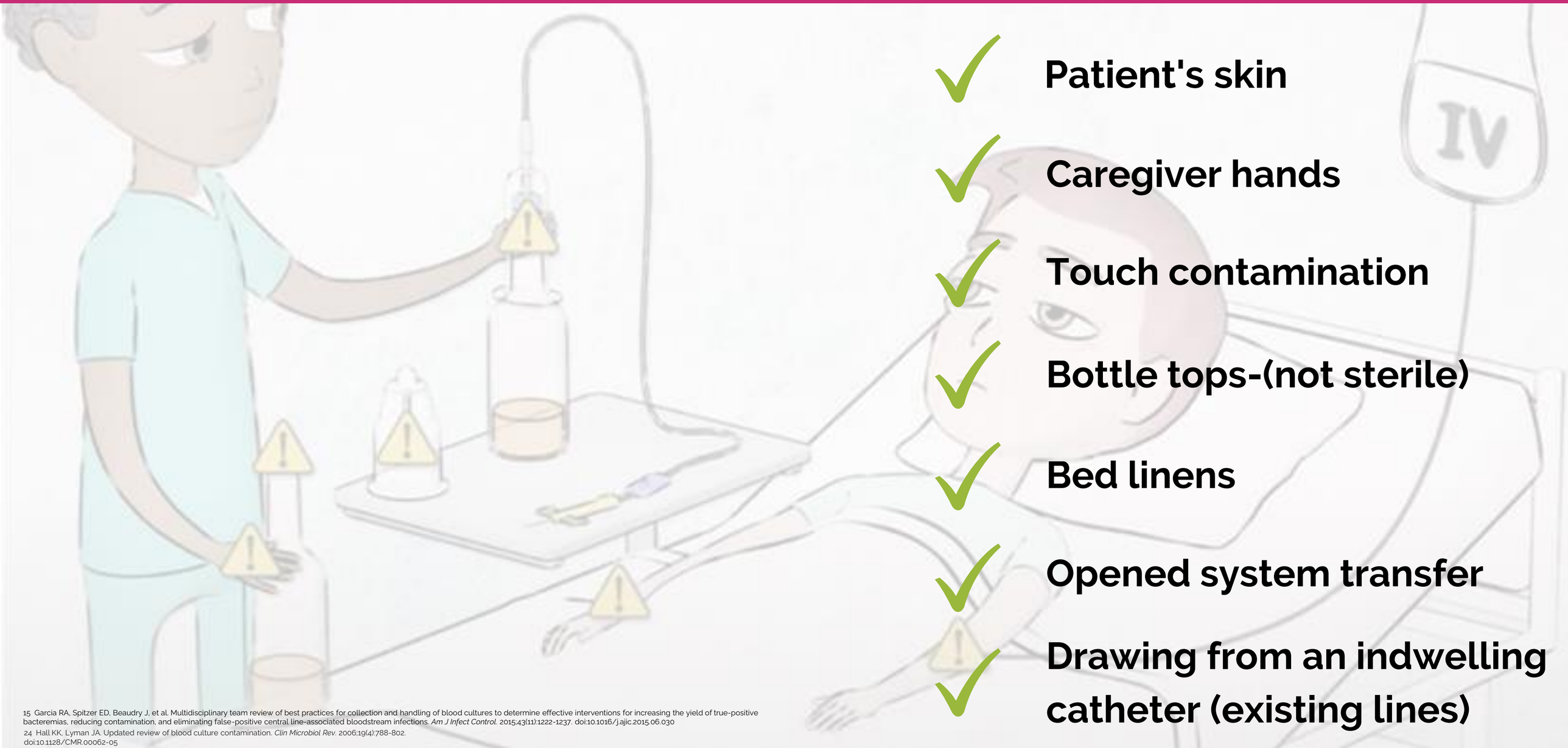
24%
increase in hospital charges

25%
increase in Vancomycin orders

Overall
increase in rate of in-hospital mortality

14 Klucher JM, Davis K, Lakkad M, Painter JT, Dare RK. Risk factors and clinical outcomes associated with blood culture contamination. *Infect Control Hosp Epidemiol*. 2022;43(3):291-297. doi:10.1017/ice.2021.111

Causes of Blood Culture Contamination



- ✓ Patient's skin
- ✓ Caregiver hands
- ✓ Touch contamination
- ✓ Bottle tops-(not sterile)
- ✓ Bed linens
- ✓ Opened system transfer
- ✓ Drawing from an indwelling catheter (existing lines)

15 Garcia RA, Spitzer ED, Beaudry J, et al. Multidisciplinary team review of best practices for collection and handling of blood cultures to determine effective interventions for increasing the yield of true-positive bacteremias, reducing contamination, and eliminating false-positive central line-associated bloodstream infections. *Am J Infect Control.* 2015;43(11):1222-1237. doi:10.1016/j.ajic.2015.06.030

24 Hall KK, Lyman JA. Updated review of blood culture contamination. *Clin Microbiol Rev.* 2006;19(4):788-802. doi:10.1128/CMR.00062-05

Blood Culture Best Practices

Dedicated Collection Team

Facilities with dedicated collection teams do better

Proper Bottle Antisepsis

Bottle antisepsis is maintained throughout collection process

Closed System Collection

Fresh sticks, 2 sites. Direct vein to bottle collection leads to less risk of contamination

Appropriate Fill Volumes

Bottles should not be under or over filled

Proper Skin Antisepsis

Right solution for the right time

Diversion Devices

Controlling for human error and the inability to fully sterilize skin

3 U.S. Department of Health and Human Services Centers for Disease Control and Prevention. *Blood Culture Contamination: An Overview for Infection Control and Antibiotic Stewardship Programs Working with the Clinical Laboratory*. 2022. Accessed February 9, 2024. https://www.cdc.gov/antibiotic-use/core-elements/pdfs/fs-bloodculture-508.pdf

6 CLSI. *Principles and Procedures for Blood Cultures*. 2nd ed. CLSI guideline M47. Clinical and Laboratory Standards Institute; 2022.

25 ENA Clinical Practice Guideline: Prevention of Blood Culture Contamination. *J Emerg Nurs*. 2018;44(3):285.e1-285.e24. doi:10.1016/j.jen.2018.03.019

CDC OVERVIEW: Blood Culture Contamination

The CDC outlines 8 “prevention / action” items to reduce contaminations:

Diagnostic Stewardship

- Right patient, right location, right time
- Right volume & right duration

Blood Culture Collection Site

- Peripheral venipuncture preferred vs. draws collected through existing central venous catheters

Blood Culture Contamination: An Overview for Infection Control and Antibiotic Stewardship Programs Working with the Clinical Laboratory

Purpose

Blood culture contamination can compromise quality of care and lead to unnecessary antibiotic exposure and prolonged length of hospitalization. Microbiology laboratories typically track blood culture contamination rates and can provide data to assist in reducing contamination rates. Infection control programs and microbiology laboratories might participate in designing and implementing interventions to decrease contamination rates, and antibiotic stewardship programs could also be engaged to optimize multidisciplinary quality improvement efforts to decrease blood culture contamination and improve the collection of blood culture specimens.

Background

Blood cultures are important diagnostic tools for identifying the pathogen(s) responsible for a patient's infection. This is especially true of patients with suspected sepsis or septic shock and for patients with suspected infective endocarditis[1,2]. When indicated, blood cultures should be obtained prior to starting antimicrobial therapy[1,2]. A conventional blood culture set consists of an aerobic and an anaerobic bottle. For adults, 20-30 mL of blood per venipuncture (depending on the instrument manufacturer) is recommended and may require >2 bottles depending on the system[2]. At least two blood culture sets should be obtained within a few hours of each other via peripheral venipuncture when obtaining blood cultures for a total volume of 40-60 mL of blood to optimize detection of pathogens[2]. The College of American Pathologists laboratory accreditation program states that clinical laboratories have a written policy and procedure for monitoring blood cultures from adults for adequate volume and provide feedback on the results to the collectors[3]. Moreover, the monitoring and reporting of blood culture contamination rates is a laboratory quality best practice[4].

Example of a blood culture set consisting of an anaerobic and an aerobic bottle, with the latter after filling with an appropriate volume of blood.

Because blood is a normally sterile body site, positive blood cultures with a known pathogen have a generally overall high positive predictive value for infection. However, blood culture contamination is a significant problem. In the era of modern blood culturing techniques, virtually all blood culture contamination occurs during collection; the source of contaminants is usually the patient's skin or the hub or cannula of an indwelling catheter (i.e., when an existing catheter is used to obtain the specimen). Frequent causes include poor collection technique and insufficient skin disinfection. Typical organisms include coagulase-negative staphylococci, *Corynebacterium* spp., *Bacillus* spp. other than *Bacillus anthracis*, *Micrococcus* spp., and *Cutibacterium acnes* among others. Consequences include unnecessary antibiotic exposure with the potential for downstream unintended consequences (e.g., possible allergic reactions and *Clostridioides difficile* infection)[5]. Other possible consequences include the unnecessary removal of intravenous catheters or other devices, an increased length of stay, and increased costs[5]. One study found that the average length of stay was 2 days longer in patients with contaminated blood cultures compared to patients with negative cultures[6]. That same study found that direct and indirect hospital costs of a contaminated blood culture were $12,824 compared to $8,286 for a negative blood culture (savings of $4,538 for preventing a contaminated blood culture)[6].

CDC U.S. Department of Health and Human Services Centers for Disease Control and Prevention

Proper Skin Antisepsis

- CLSI – 2 step process
- Alcohol, and then CHG
- Right solution, right scrub time, right dry time

Hand Hygiene

- Hand hygiene recommended prior to interacting with patients and donning gloves prior to drawing blood cultures

Surveillance & Feedback

- Providing feedback to dept. leadership & clinicians drawing cultures
- Track impact of BCCs on unnecessary Vancomycin use

Blood Culture Bottle Disinfection

- Scrub tops to disinfect
- Keep bottles out of beds

Phlebotomy Teams + Education on Proper Technique

- BC practice and policy review
- Dedicated staff and/or superusers
- Annual competency and observations

Diversion Devices

- Diversion devices “have shown promise in further reducing contamination rates.”

3 U.S. Department of Health and Human Services Centers for Disease Control and Prevention. *Blood Culture Contamination: An Overview for Infection Control and Antibiotic Stewardship Programs Working with the Clinical Laboratory*. 2022. Accessed February 9, 2024. https://www.cdc.gov/antibiotic-use/core-elements/pdfs/fs-bloodculture-508.pdf

Advancements in Clinical Microbiology: Overcoming Blood Culture Contamination Challenges

Blood culture collection is better through venipuncture than existing intravascular catheters, as the latter has a **2.69-fold highe**r contamination risk [26]

Catheter-hub colonization can cause false-positive cultures from skin commensals and/or pathogens (e.g., enterococci, S. aureus, Gram-negative bacilli).

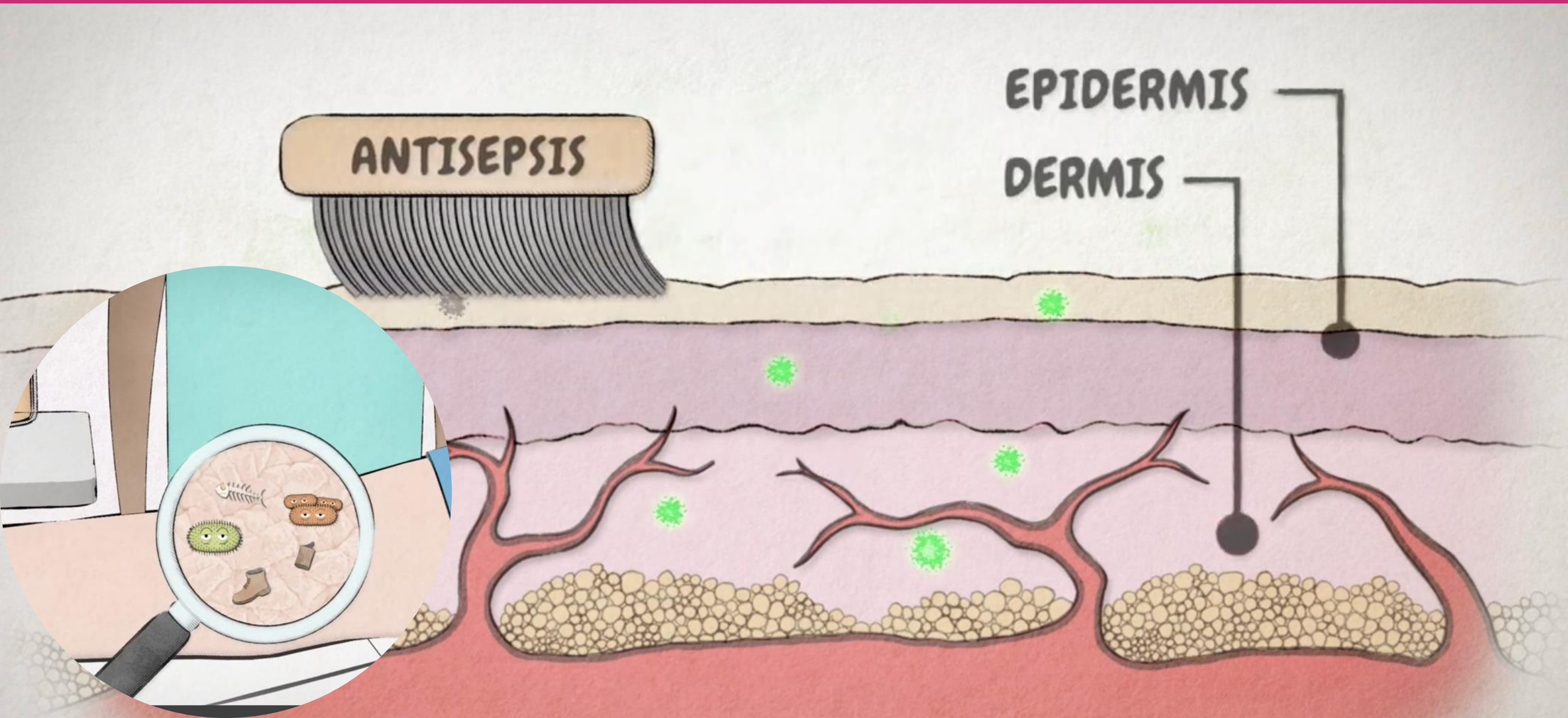
Contaminations may falsely elevate a facility's CLABSI rate. Surpassing NHSN thresholds for CLABSI rates can negatively impact patient care, hospital finances, and an institution's reputation for quality care [26]

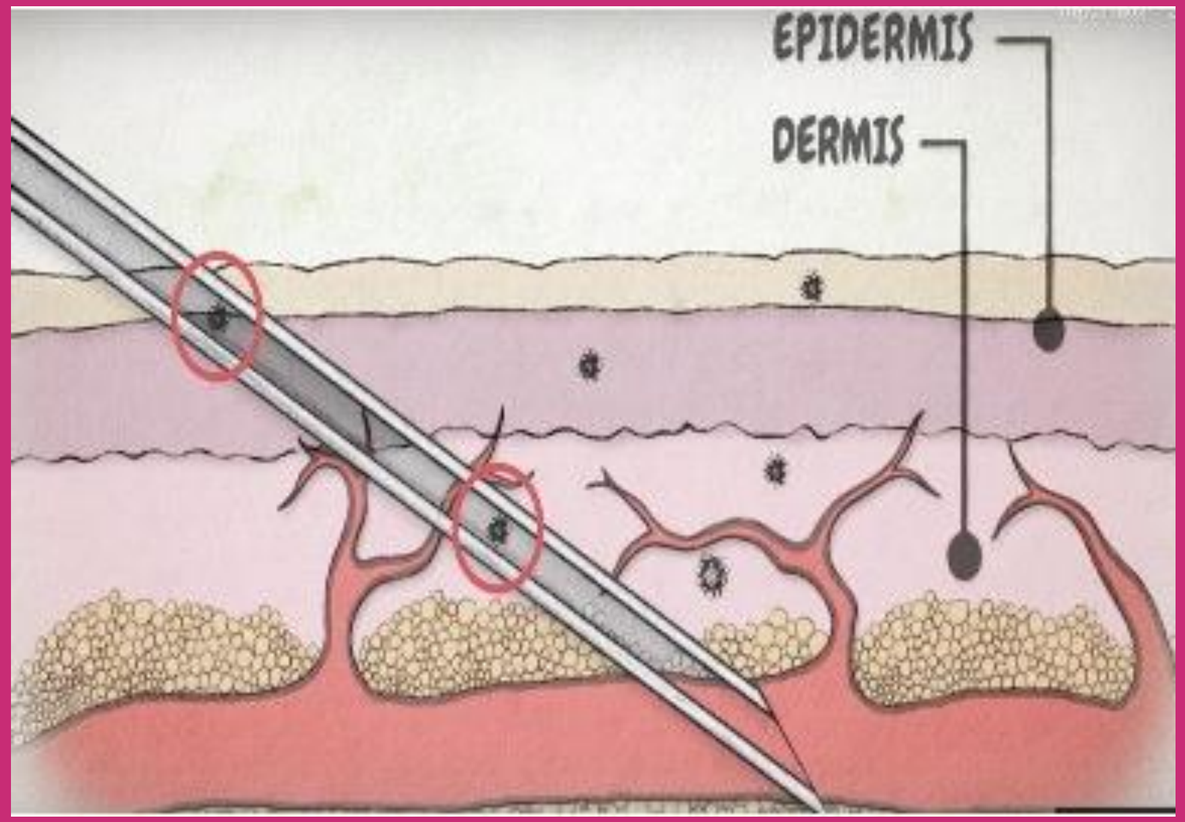
Diverting the initial blood sample, likely containing skin bacteria, may reduce contamination. Research on this method indicates lower than 1% rates are achievable

26 Doern GV, Carroll KC, Diekema DJ, et al. Practical guidance for clinical microbiology laboratories: a comprehensive update on the problem of blood culture contamination and a discussion of methods for addressing the problem. *Clin Microbiol Rev*. 2019;33(1):e00009-19. Published 2019 Oct 30. doi:10.1128/CMR.00009-19

MY TEAM USES BEST PRACTICE... WHY ARE WE STILL HAVING CONTAMINATIONS?

The Skin Plug Problem



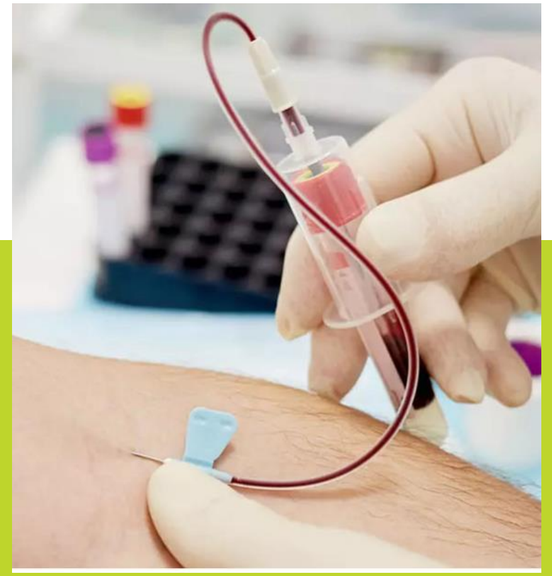


20% of the microbes are below the surface of the skin and may not be impacted by disinfecting [15]

15 Garcia RA, Spitzer ED, Beaudry J, et al. Multidisciplinary team review of best practices for collection and handling of blood cultures to determine effective interventions for increasing the yield of true-positive bacteremias, reducing contamination, and eliminating false-positive central line-associated bloodstream infections. *Am J Infect Control*. 2015;43(11):1222-1237. doi:10.1016/j.ajic.2015.06.030

Solutions to Address the Skin Plug

A look into the market of Diversion Devices.



Waste Tubes

1 ml-3 ml

Mechanical Diversion

0.5 ml-2 ml

Passive Sideline

0.15 ml

Comparing Methods - All of them work!

A look into the market of Diversion Devices.

Waste Tubes

Mechanical Diversion

Passive Sideline

	Waste Tubes	Mechanical Diversion	Passive Sideline
Cost	$	$$$	$$$
Volume of Diversion	1.5 ml-3 ml	0.5 ml-2 ml	0.15 ml
Mechanism of Action	Active	Active	Passive

The Challenge with Waste Tubes (Manual Method)

Lowest published contamination rates achieved 1.7% with 7ml waste drawn [27]

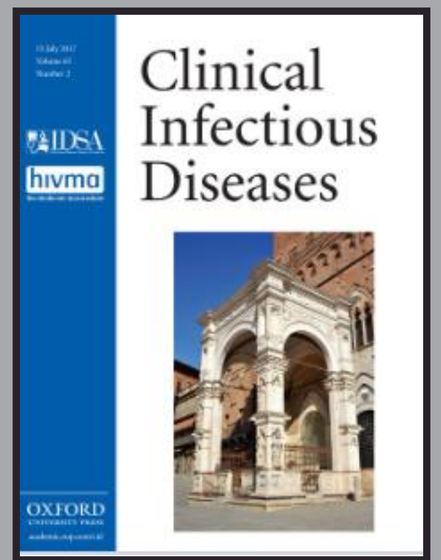
- Concave top is not sterile and difficult to disinfect
- More steps = increased contamination risk
- Additional steps that are often overlooked - sustained compliance is difficult to achieve
- Wastes more blood than necessary
- Cross contamination - risk of contamination for both bottles, which could lead to a "true positive"
- Susceptible to touch contamination

27 Syed S, Liss DT, Costas CO, Atkinson JM. Diversion principle reduces skin flora contamination rates in a community hospital. *Arch Pathol Lab Med*. 2020;144(2):215-220. doi:10.5858/arpa.2018-0524-OA

28 Sutton, J, Fritsch, P, Moody, M, Dinaro, K, Holder, C,. Preventing blood culture contamination using novel engineered passive blood diversion device. Abstract presented at: Association for Professionals in Infection Control; June 2018; Minneapolis, MN [Abstract Ei – 101].

Clinical Data

Rupp et al. [18]



2017

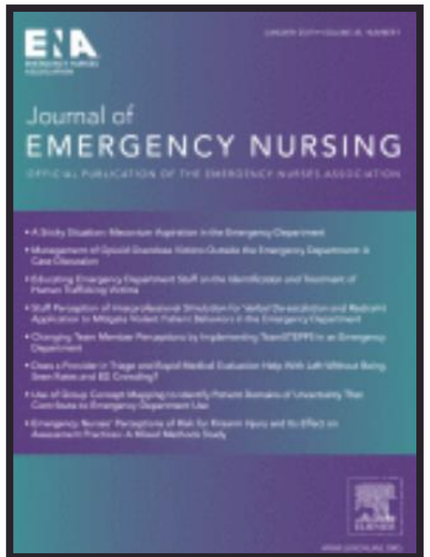
- University of Nebraska
- Mechanical (Steripath) peer-reviewed article
- 88% reduction when using a device

O' Sullivan & Steere [19]

2019

- Hartford Hospital
- Passive (Kurin) peer-reviewed article
- 74% overall reduction

Arenas et al. [29]



2019

> **Compared both Kurin and Steripath - concluded that both products drastically reduced contamination "irrespective of the volume of the initial diversion"**

18 Rupp ME, Cavalieri RJ, Marolf C, Lyden E. Reduction in blood culture contamination through use of Initial Specimen Diversion Device. *Clin Infect Dis.* 2017;65(2):201-205. doi:10.1093/cid/cix304

19 O'Sullivan DM, Steere, L. Reducing false-positive blood cultures: Using a blood diversion device. *Connecticut Medicine.* 2019;83(2):53-56.

29 Arenas, M, Boseman, GM, Coppin, JD, Lukey, J, Jinadatha, C, Navarathna, DH. Asynchronous testing of 2 specimen-diversion devices to reduce blood culture contamination: a single-site product supply quality improvement project. *J Emerg Nurs.*. 2021;47(2):256-264.e6. https://doi.org/10.1016/j.jen.2020.11.008

Financial Summary Average Hospital

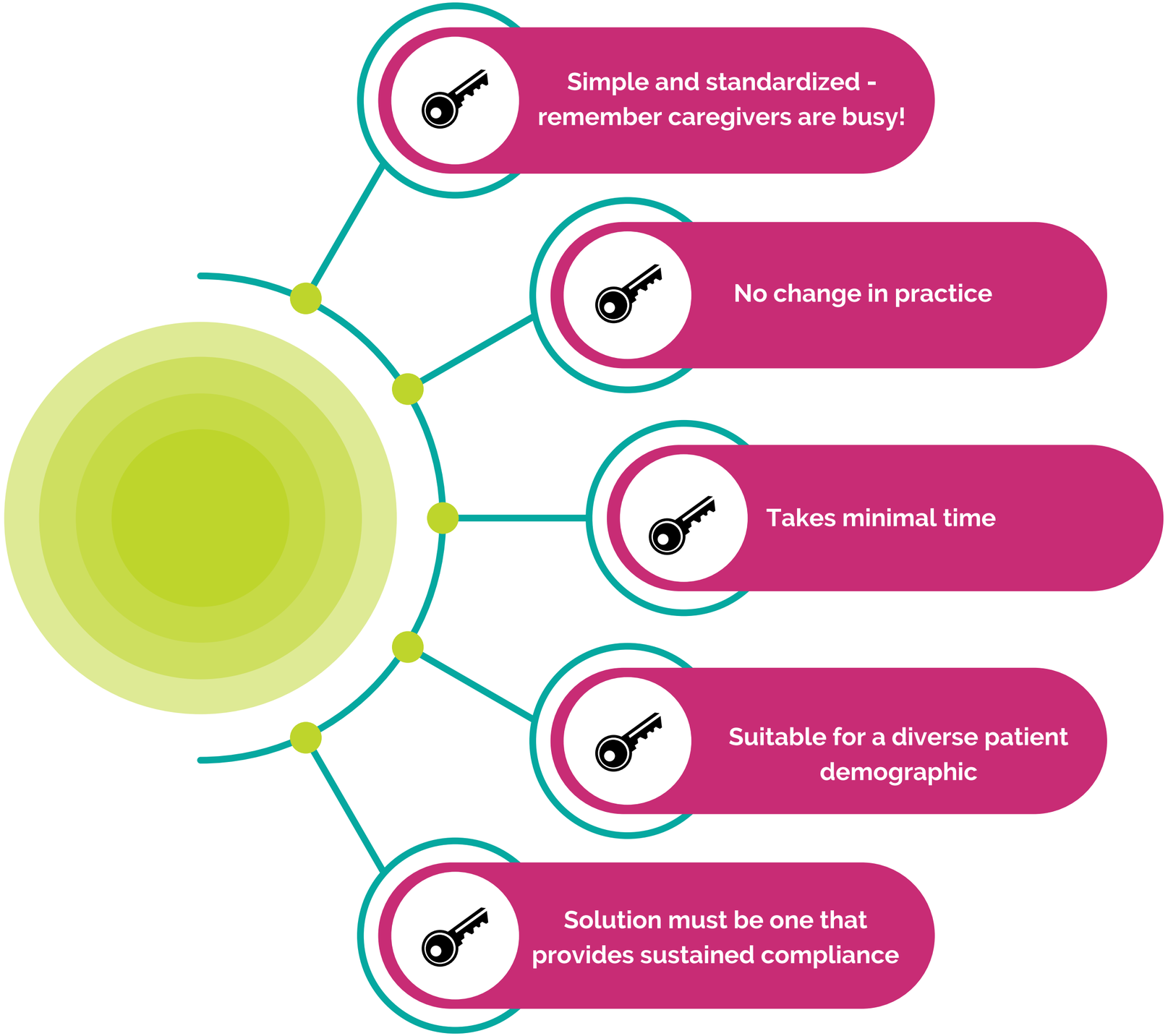
3% Baseline at 1000 cultures/month	
Patients impacted/month:	30
AVG Cost of FPBC event:	$4,538 [3]
AVG Cost/ Month:	$136,140
AVG Cost/ Year:	$1.63 Million

50% Reduction- 1.5% BCC Rate	
Patients impacted/month:	15
AVG Cost of FPBC event:	$4,538 [3]
AVG Cost/ Month:	$68,070
AVG Cost/ Year:	$816,840

50% Reduction saves ~ $586,000 after product cost

3 U.S. Department of Health and Human Services Centers for Disease Control and Prevention. *Blood Culture Contamination: An Overview for Infection Control and Antibiotic Stewardship Programs Working with the Clinical Laboratory*. 2022. Accessed February 9, 2024. https://www.cdc.gov/antibiotic-use/core-elements/pdfs/fs-bloodculture-508.pdf

Keys to Achieving Optimal Outcomes



Leadership Will Dictate Outcomes

Buy In

If it is important to leadership, it will be important to staff

Tracking

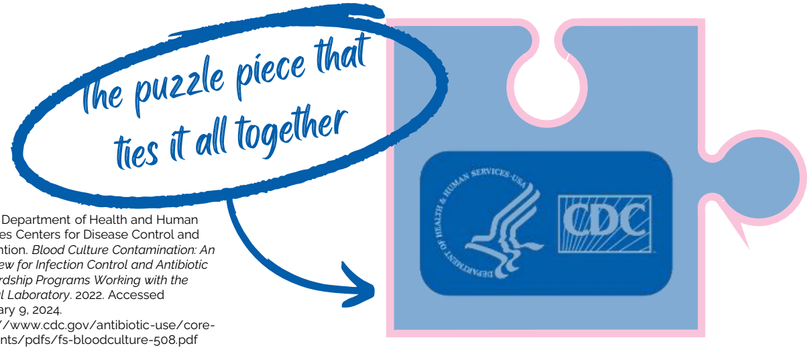
Measure and report on blood culture contamination and reductions possible with technology

Accountability

Drill down on blood culture contamination to identify gaps in best practices and repeat offenders

Sustained Outcomes

Select and implement methods that will lead to sustained compliance and long-term success



> There are devices that are commercially available that have shown promise in further reducing blood culture contamination rates. These devices initially divert a small amount of potentially contaminated blood and then collect blood for the blood culture. [3]

3 U.S. Department of Health and Human Services Centers for Disease Control and Prevention. *Blood Culture Contamination: An Overview for Infection Control and Antibiotic Stewardship Programs Working with the Clinical Laboratory*. 2022. Accessed February 9, 2024. https://www.cdc.gov/antibiotic-use/core-elements/pdfs/fs-bloodculture-508.pdf

Have you heard the chatter about potential future expansion of bloodstream infection surveillance to move beyond only Central Line-Associated Bloodstream infections (CLABSI) and expand to include all hospital onset bacteremia (HOB)?

30 Betz, K. Stutler, E. The Future is Here! NHSN on FHIR: Modernizing HAI Surveillance. Presented at: Association for Professionals in Infection Control and Epidemiology Conference (APIC); June 2023; Orlando, FL.
38 Centers for Medicare & Medicaid Services. *Frequently Asked Questions: DRA HAC Reporting*.; 2019. Accessed February 9, 2024. https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/Downloads/FAQ-DRA-HAC-PSI.pdf
39 QualityNet. Hospital-Acquired Condition Reduction Program (HACRP). qualitynet.cms.gov. Published 2023. Accessed February 9, 2024. https://qualitynet.cms.gov/inpatient/hac
40 Partnership for Quality Measurement. Adult Blood Culture Contamination Rate: A national measure and standard for clinical laboratories and antibiotic stewardship programs | Partnership for Quality Measurement. p4qm.org. Published December 12, 2022. Accessed February 9, 2024. https://p4qm.org/measures/3658
41 Centers for Medicare & Medicaid Services. FY 2024 IPPS Final Rule Home Page. www.CMS.gov. Published January 11, 2024. Accessed February 9, 2024. https://www.cms.gov/medicare/payment/prospective-payment-systems/acute-inpatient-pps/fy-2024-ipps-final-rule-home-page

Policy Evolution

The Deficit Reduction Act in **2005** started the trajectory of CMS policy and subsequent quality measure regulatory reporting. In **July 2008**, CMS selected 10 categories of conditions for application of the DRA HAC payment provision in the IPPS FY 2009 Final Rule. [38]

Financial Angle

In **October 2008,** hospitals no longer received additional payment for cases in which 1 of the selected conditions occurred but was not POA. Hospitals were not reimbursed fully and paid as though the condition(s) were not present. CMS expanded DRA HAC categories in FY2013 IPPS Final Rule to include 14 categories of HACs. [38]

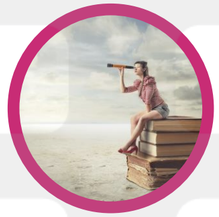
HAC Reduction Program: October 2014, CMS began reducing Medicare fee-for-service payments to hospitals based on HAC measure performance. Program supports long-standing efforts of CMS to provide incentives to improve quality of care in the inpatient setting. [39]

Recent Policy Updates & Endorsements

NQF/PQM: championed by CDC, endorsement of blood culture collection quality metric [40] (supports HOB initiative)

NHSN: CDC's Data Modernization Initiative [30]
digital Quality Metrics (dQM)
HOB & 2 blood culture measures

CMS: SEP-1 [41]



Future Impact?

A hospital that previously faced financial penalties due to high readmission rates for HAIs may now see additional scrutiny with the emerging measures like HOB, emphasizing the financial impact of quality care.

HEALTHCARE QUALITY REPORTING: THE EVOLVING LANDSCAPE

THE TRANSITIONS REFLECTS AN INCREASING PUSH FOR TRANSPARENCY AND QUALITY IN PATIENT CARE, WHERE INFECTION RATES ARE INDICATORS OF HOSPITAL PERFORMANCE

Introduction to Hospital-Onset Bacteremia (HOB)

What?

What is HOB? Defined as a bloodstream infection identified by blood cultures drawn on hospital day 4 or later with pathogenic bacteria or fungi. [30]

Why?

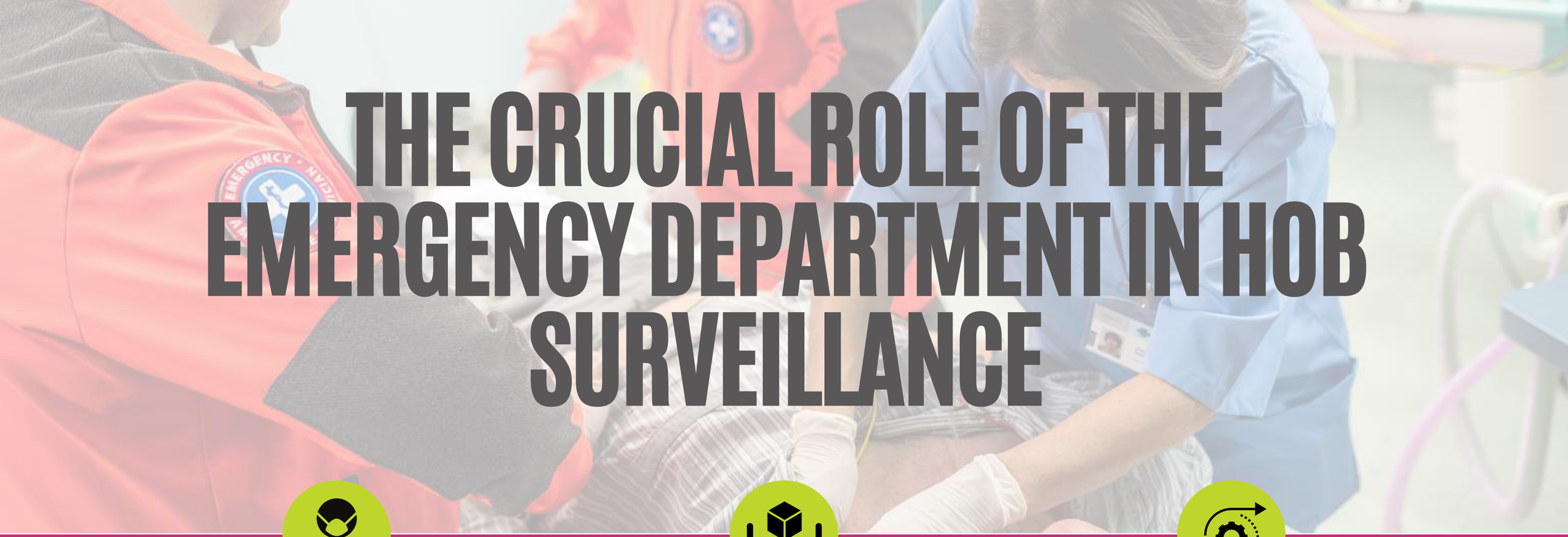
Why it Matters: Accurate detection and reporting of HOB are critical for patient safety, quality of care, and antibiotic stewardship. The goal is surveillance for broader reduction of bloodstream infection regardless of organism or association with device. [30, 41]

Who?

Expected in the Future: Facilities will be asked to report blood culture utilization rate and blood culture contamination rates via NHSN module. These complimentary metrics are expected to show correlation with HOB prevalence, making it necessary to improve BC testing accuracy to facilitate proper HOB reporting. [30, 41]

30 Betz, K, Stutler, E. The Future is Here! NHSN on FHIR: Modernizing HAI Surveillance. Presented at: Association for Professionals in Infection Control and Epidemiology Conference (APIC); June 2023; Orlando, FL.

41 Centers for Medicare & Medicaid Services. FY 2024 IPPS Final Rule Home Page. www.CMS.gov. Published January 11, 2024. Accessed February 9, 2024. https://www.cms.gov/medicare/payment/prospective-payment-systems/acute-inpatient-pps/fy-2024-ipps-final-rule-home-page



THE CRUCIAL ROLE OF THE EMERGENCY DEPARTMENT IN HOB SURVEILLANCE

FRONTLINE POSITION

As an initial point for patient care, the ED's blood culture collection practices are foundational for the hospital's HOB tracking.

SETTING THE STANDARD

Must ensure quality blood culture collection practices to prevent contamination, thus supporting accurate HOB surveillance.

PREPARING FOR CHANGE

With new NHSN measures tentatively on the horizon, EDs must align their practices and performance to accurately meet reporting requirements.

EDs serve as gatekeepers in infection surveillance. Quality blood culture practices here can inform and improve hospital-wide infection prevention and control strategies.

ALIGNING PRACTICES WITH EMERGING GUIDELINES

Upcoming Changes

Hospitals must anticipate CMS potentially requiring HOB rate reporting as part of quality metrics, which could influence reimbursement

Strategic Response

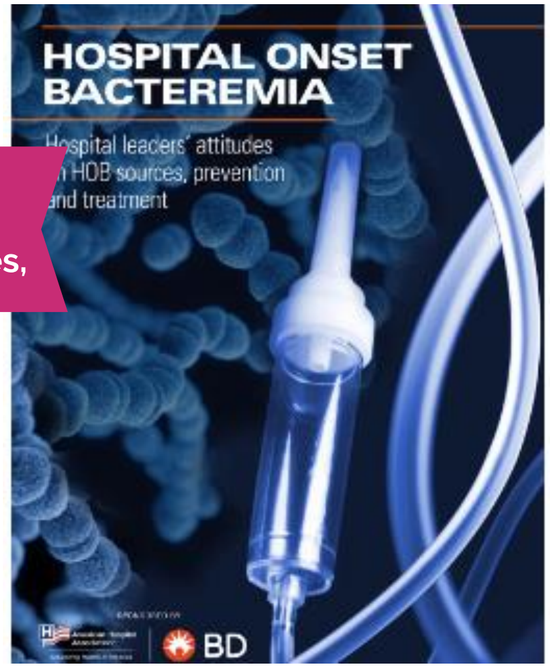
Clinicians must enhance blood culture accuracy and reduce contamination rates to meet these new standards and avoid financial penalties

Action Steps

Prioritize staff training, adopt the latest best guidelines in specimen collection, utilize technology, and prepare for automated quality metric reporting.

PQM Endorsed Measure: 3658
Adult Blood Culture Contamination Rate Measure

American Hospital Association's Executive Dialogue on HOB sources, prevention, and treatment



MORE INFO

CLABSI REPORTING

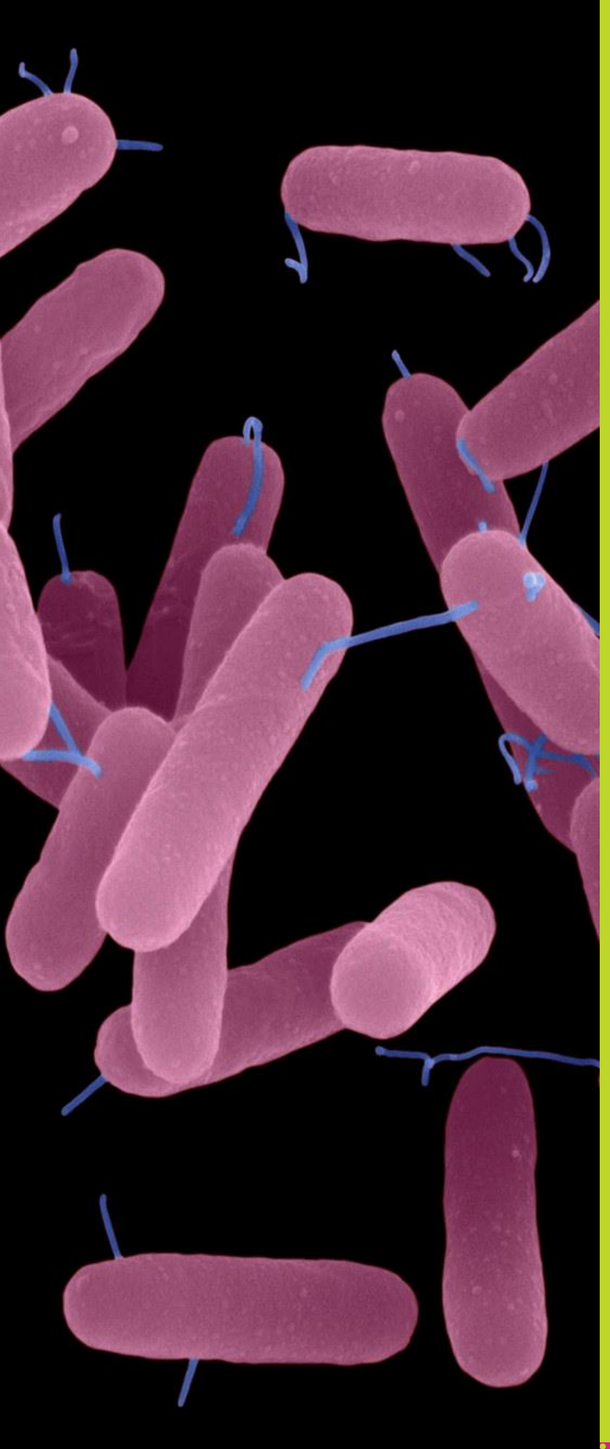
WHAT IS ALREADY HERE...

While we anticipate the introduction of Hospital Onset Bacteremia (HOB) measures, healthcare providers already face the tangible challenge of CLABSI reporting and associated penalties.

Intravascular catheter-related blood culture contaminations amplify the issue, creating a **2.69-fold increase in false-positive CLABSI rates compared to venipuncture**.[26] Over-reporting impacts patient care through misdiagnosis and unnecessary interventions.

What is the relationship between blood culture contamination and CLABSI, and how can better blood culture collection practices save facilities from steep financial penalties?

26 Doern GV, Carroll KC, Diekema DJ, et al. Practical guidance for clinical microbiology laboratories: a comprehensive update on the problem of blood culture contamination and a discussion of methods for addressing the problem. *Clin Microbiol Rev*. 2019;33(1):e00009-19. Published 2019 Oct 30. doi:10.1128/CMR.00009-19



Understanding CLABSI: Impact and Reporting

Definition of CLABSI:

- Laboratory-confirmed bloodstream infection (LCBSI)
- Occurs when there is no related infection at another site
- An eligible central line must be present on the event date or the day before

Central Line Criteria:

- Ends at/near heart or in a major vessel
- Used for infusion, blood draw, or hemodynamic monitoring
- In place for >2 consecutive calendar days, following first access (on/after central line day 3); inpatient location; current admission

CLABSI Impact:

- Increased healthcare costs
- Prolonged hospital stays
- Increased risk of mortality

CMS Reporting:

- Mandatory reporting to NHSN when definitions are met
- 42% of reported CLABSIs are contaminants [31]

31 Tompkins LS, Tien V, Madison AN. Getting to zero: Impact of a device to reduce blood culture contamination and false-positive central-line-associated bloodstream infections. *Infect Control Hosp Epidemiol*. 2023;44(9):1386-1390. doi:10.1017/ice.2022.284

CLABSIs are required to be reported to CMS through the NHSN when definitions are met

2011 IPPS Hospitals' Mandatory Enrollment in NHSN and CLABSI Reporting

2015 CLABSI HAC Penalties initiated

42% | of all reported CLABSIs are a result of contaminated cultures [31]

30,100 | CLABSIs/year [32]

30% | Of all HAIs are CLABSIs [33]

$48,000 | Estimated cost of a CLABSI [34]

31 Tompkins LS, Tien V, Madison AN. Getting to zero: Impact of a device to reduce blood culture contamination and false-positive central-line-associated bloodstream infections. *Infect Control Hosp Epidemiol.* 2023;44(9):1386-1390. doi:10.1017/ice.2022.284

32 Centers for Disease Control. NHSN: Bloodstream Infection Event (Central Line-Associated Bloodstream Infection and Non-Central Line Associated Bloodstream Infection). January 2024. Retrieved February 9, 2024, from https://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf

33 Boyce JM, Nadeau J, Dumigan D, et al. Obtaining blood cultures by venipuncture versus from central lines impact on blood culture contamination rates and potential effect on central line–associated bloodstream infection reporting. *Infection Control & Hospital Epidemiology.* 2013;34(10):1042-1047. doi:10.1086/673142

34 Results: Estimating the additional hospital inpatient cost and mortality associated with selected hospital-acquired conditions. November 2017. Agency for Healthcare Research and Quality, Rockville, MD. https://www.ahrq.gov/hai/pfp/haccost2017-results.html

Decoding Microbes: The Challenge of Identifying True CLABSIs for NHSN Reporting

Common Commensals → Microorganisms that naturally reside on body surfaces and mucosa without causing harm [36] → Example: Coagulase Negative Staph → Determining the true origin of the infection can be difficult [35]

Non-Common Commensals → Microorganisms not usually part of normal body flora, however, can become opportunistic pathogens [35] → Example: Enterococci → Positive blood cultures with enterococci can be contaminated up to 30% of the time [35]

Remember

Skin contaminations are the most common blood culture contamination source [35]

35 Freeman JT, Chen LF, Sexton DJ, Anderson DJ. Blood culture contamination with Enterococci and skin organisms: implications for surveillance definitions of primary bloodstream infections. *Am J Infect Control.* 2011;39(5):436-438. doi:10.1016/j.ajic.2010.07.014

36 Swaney MH, Kalan LR. Living in Your Skin: Microbes, Molecules, and Mechanisms. *Infect Immun.* 2021;89(4):e00695-20. Published 2021 Mar 17. doi:10.1128/IAI.00695-20

Understanding Common Commensals

1

What are common commensals?

Microorganisms that naturally reside on body surfaces and mucosa without causing harm. Skin, respiratory tract, intestinal tract, etc. [36]

2

Skin Common Commensals

- Coagulase Negative Staphylococci [3]
- Corynebacterium species [3]
- Bacillus species [3]

3

Prevalence in Cultures

Skin contaminants are most common culture contamination source [35]

4

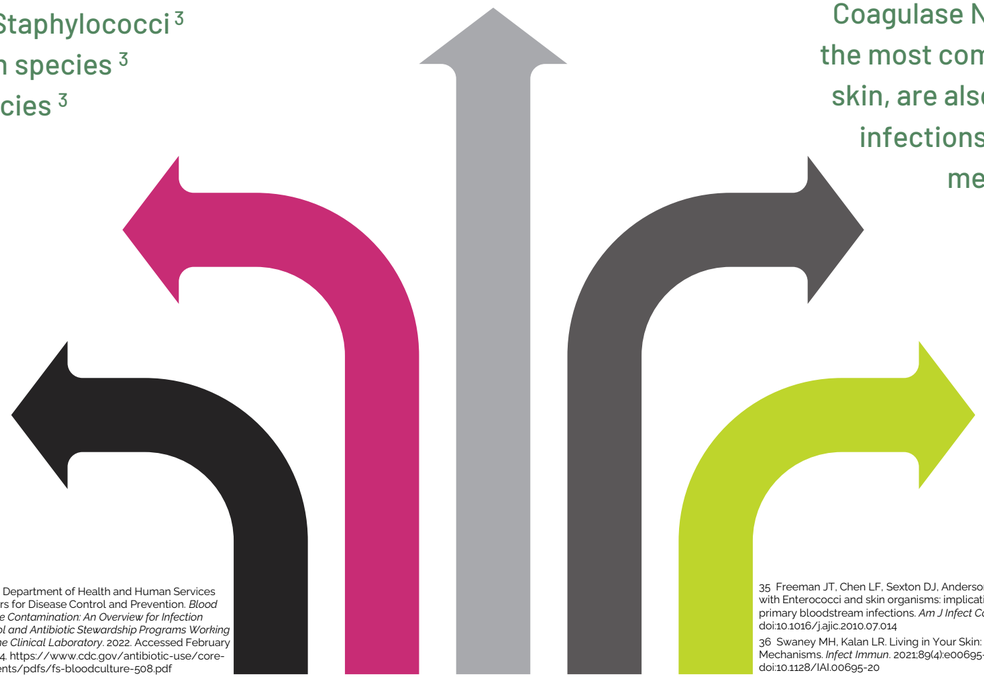
Example: CONs

Coagulase Negative Staphylococci, the most common bacteria on human skin, are also the primary culprits in infections related to indwelling medical device [36]

5

CLABSIs?

How are common commensal contaminations associated with CLABSIs?



3 U.S. Department of Health and Human Services Centers for Disease Control and Prevention. *Blood Culture Contamination: An Overview for Infection Control and Antibiotic Stewardship Programs Working with the Clinical Laboratory.* 2022. Accessed February 9, 2024. https://www.cdc.gov/antibiotic-use/core-elements/pdfs/fs-bloodculture-508.pdf

35 Freeman JT, Chen LF, Sexton DJ, Anderson DJ. Blood culture contamination with Enterococci and skin organisms: implications for surveillance definitions of primary bloodstream infections. *Am J Infect Control.* 2011;39(5):436-438. doi:10.1016/j.ajic.2010.07.014

36 Swaney MH, Kalan LR. Living in Your Skin: Microbes, Molecules, and Mechanisms. *Infect Immun.* 2021;89(4):e00695-20. Published 2021 Mar 17. doi:10.1128/IAI.00695-20

How are common commensal contaminations associated with CLABSIs?

60%

of reported CLABSIs could be linked to contaminated samples as per the 2017 AJIC survey [18]

A contaminated culture may result in the reporting of a CLABSI **by definition only**:

Patient has a CVC that meets date of placement/access criteria & shows signs/symptoms of infection	2 or more blood specimens drawn on separate occasions that grow same common commensal

↓

Facility will have to report as a CLABSI even if patient's symptoms resolve and it turns out there is NO infection

Reduction of just one contamination could have major implications on a facility's reportable CLABSIs!!

37 Garcia RA, Spitzer ED, Kranz B, Barnes S. A national survey of interventions and practices in the prevention of blood culture contamination and associated adverse health care events. *Am J Infect Control.* 2018;46(5):571-576. doi:10.1016/j.ajic.2017.11.009

Tackling Common Commensal Contaminations in CLABSI Reporting

EXAMPLE

Cultures contaminated by commensals like Coagulase-Negative Staphylococci (CoNS) may lead to a reported CLABSI, even without true infection confirmed.

FINANCIAL IMPACT

One less contamination event can have profound effects: improved patient care/outcomes and avoidance of financial penalties for the facility.

CRITICAL CARE

Focused efforts in ICUs, despite lower contamination rates, can significantly impact overall CLABSI reporting and patient outcomes.

REPORTING

Differentiating true infections from commensal presence is essential for accurate reporting and quality of care.

WHAT DOES THIS MEAN FOR US?

- A contaminated culture may result in the reporting of a CLABSI by definition only
- Even in departments like ICUs where contamination rates are not particularly high, we can make a huge impact
- Reduction of just one contamination in this patient population can have major positive consequences for a healthcare facility
- May help facility avoid penalty expense

Discussion

Conclusions

- Blood culture contamination is largely preventable with technology and best practice
- Peer-reviewed studies demonstrate rates below 0.5 using an evidence-based contamination reduction device
- Updated 1% Best Practice Benchmark
- Better clinical practice
- Ultimately: improved healthcare for patients, decreased costs for the hospital, & improved antimicrobial stewardship for the community

QUESTIONS?

References

1 Sinha, M., Jupe, J, Mack, H, Coleman, TP, Lawrence, S.M, & Fraley, SI. Emerging technologies for molecular diagnosis of sepsis. *Clinical Microbiology Reviews. 2018;*31(2):e00089-17. doi:https://doi.org/10.1128/CMR.00089-17

2 Sepsis Alliance. What is Sepsis? Published January 13, 2022. Accessed February 9, 2024. https://www.sepsis.org/sepsis-basics/what-is-sepsis/

3 U.S. Department of Health and Human Services Centers for Disease Control and Prevention. *Blood Culture Contamination: An Overview for Infection Control and Antibiotic Stewardship Programs Working with the Clinical Laboratory*. 2022. Accessed February 9, 2024. https://www.cdc.gov/antibiotic-use/core-elements/pdfs/fs-bloodculture-508.pdf

4 American Hospital Association. The Impact and Prevention of False Positive CLABSIs. AHA. Published 2019. https://www.aha.org/education-events/impact-and-prevention-false-positive-clabsis

5 CLSI. *Principles and Procedures for Blood Cultures; Approved Guideline*. CLSI document M47A. Clinical and Laboratory Standards Institute; 2007.

6 CLSI. *Principles and Procedures for Blood Cultures*. 2nd ed. CLSI guideline M47. Clinical and Laboratory Standards Institute; 2022.

7 Zwang O, Albert RK. Analysis of strategies to improve cost effectiveness of blood cultures. *J Hosp Med.* 2006;1:272-6.

8 Callado GY, Lin V, Thottacherry E, et al. Diagnostic stewardship: a systematic review and meta-analysis of blood collection diversion devices used to reduce blood culture contamination and improve the accuracy of diagnosis in clinical settings. *Open Forum Infectious Diseases*. 2023;10(9). doi:https://doi.org/10.1093/ofid/ofad433

References

9 Gilligan PH. Blood culture contamination: a clinical and financial burden. *Infect Control Hosp Epidemiol.* 2013;34:22-3.

10 Duncan CF, Youngstein T, Kirrane MD, Lonsdale DO. Diagnostic challenges in sepsis. *Curr Infect Dis Rep.* 2021;23(12):22. doi:10.1007/s11908-021-00765-y

11 Centers for Disease Control and Prevention. *Hospital Sepsis Program Core Elements: 2023*. US Department of Health and Human Services; 2023. Accessed February 9, 2024. https://www.cdc.gov/sepsis/pdfs/sepsis-core-elements-H.pdf

12 Fabre V, Carroll KC, Cosgrove SE. Blood culture utilization in the hospital setting: a call for diagnostic stewardship. *J Clin Microbiol.* 2022;60(3):e0100521. doi:10.1128/ JCM.01005-21

13 Nielsen LE, Nguyen K, Wahl CK, et al. Initial Specimen Diversion Device® reduces blood culture contamination and vancomycin use in academic medical centre. *J Hosp Infect.* 2022;120:127-133. doi:10.1016/j.jhin.2021.10.017

14 Klucher JM, Davis K, Lakkad M, Painter JT, Dare RK. Risk factors and clinical outcomes associated with blood culture contamination. *Infect Control Hosp Epidemiol.* 2022;43(3):291-297. doi:10.1017/ice.2021.111

15 Garcia RA, Spitzer ED, Beaudry J, et al. Multidisciplinary team review of best practices for collection and handling of blood cultures to determine effective interventions for increasing the yield of true-positive bacteremias, reducing contamination, and eliminating false-positive central line-associated bloodstream infections. *Am J Infect Control.* 2015;43(11):1222-1237. doi:10.1016/j.ajic.2015.06.030

References

16 Skoglund E, Dempsey CJ, Chen H, Garey KW. Estimated clinical and economic Impact through use of a novel blood collection device to reduce blood culture contamination in the emergency department: a cost-benefit analysis. *J Clin Microbiol*. 2019;57(1):e01015-18. doi:10.1128/JCM.01015-18

17 Gander RM, Byrd L, DeCrescenzo M, Hirany S, Bowen M, Baughman J. Impact of blood cultures drawn by phlebotomy on contamination rates and health care costs in a hospital emergency department. *J Clin Microbiol*. 2009;47(4):1021-1024. doi:10.1128/JCM.02162-08

18 Rupp ME, Cavalieri RJ, Marolf C, Lyden E. Reduction in blood culture contamination through use of Initial Specimen Diversion Device. *Clin Infect Dis*. 2017;65(2):201-205. doi:10.1093/cid/cix304

19 O'Sullivan DM, Steere, L. Reducing false-positive blood cultures: Using a blood diversion device. *Connecticut Medicine*. 2019;83(2):53-56.

20 Dempsey C, Skoglund E, Muldrew KL, Garey KW. Economic health care costs of blood culture contamination: a systematic review. *Am J Infect Control*. 2019;47(8):963-967. doi:10.1016/j.ajic.2018.12.020

21 Allain M. Not your "average" ED: a CNS-led project that reduced blood culture contaminations in one emergency department to below expected levels. Abstract presented at: National Association of Clinical Nurse Specialists Annual Conference; February/March 2018; Austin, TX.

22 Arnaout S, Ellison RT, Greenough TC, et al. 114. Prospective trial of passive diversion device to reduce blood culture contamination. *Open Forum Infect Dis*. 2021;8(Suppl 1):S70. Published 2021 Dec 4. doi:10.1093/ofid/ofab466.114

23 Burnie J, Vining S. Clinical nurse specialist practice: Impact on emergency department blood culture contamination. *Clin Nurse Spec*. 2021;35(6):314-317. doi:10.1097/NUR.0000000000000634

References

24 Hall KK, Lyman JA. Updated review of blood culture contamination. *Clin Microbiol Rev.* 2006;19(4):788-802. doi:10.1128/CMR.00062-05

25 ENA Clinical Practice Guideline: Prevention of Blood Culture Contamination. *J Emerg Nurs.* 2018;44(3):285.e1-285.e24. doi:10.1016/j.jen.2018.03.019

26 Doern GV, Carroll KC, Diekema DJ, et al. Practical guidance for clinical microbiology laboratories: a comprehensive update on the problem of blood culture contamination and a discussion of methods for addressing the problem. *Clin Microbiol Rev.* 2019;33(1):e00009-19. Published 2019 Oct 30. doi:10.1128/CMR.00009-19

27 Syed S, Liss DT, Costas CO, Atkinson JM. Diversion principle reduces skin flora contamination rates in a community hospital. *Arch Pathol Lab Med.* 2020;144(2):215-220. doi:10.5858/arpa.2018-0524-OA

28 Sutton, J, Fritsch, P, Moody, M, Dinaro, K, Holder, C,. Preventing blood culture contamination using novel engineered passive blood diversion device. Abstract presented at: Association for Professionals in Infection Control; June 2018; Minneapolis, MN [Abstract Ei – 101].

29 Arenas, M, Boseman, GM, Coppin, JD, Lukey, J, Jinadatha, C, Navarathna, DH. Asynchronous testing of 2 specimen-diversion devices to reduce blood culture contamination: a single-site product supply quality improvement project. *J Emerg Nurs.*. 2021;47(2):256-264.e6. https://doi.org/10.1016/j.jen.2020.11.008

30 Betz, K, Stutler, E. The Future is Here! NHSN on FHIR: Modernizing HAI Surveillance. Presented at: Association for Professionals in Infection Control and Epidemiology Conference (APIC); June 2023; Orlando, FL.

References

31 Tompkins LS, Tien V, Madison AN. Getting to zero: Impact of a device to reduce blood culture contamination and false-positive central-line-associated bloodstream infections. *Infect Control Hosp Epidemiol*. 2023;44(9):1386-1390. doi:10.1017/ice.2022.284

32 Centers for Disease Control. NHSN: Bloodstream Infection Event (Central Line-Associated Bloodstream Infection and Non-Central Line Associated Bloodstream Infection). January 2024. Retrieved February 9, 2024, from https://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf

33 Boyce JM, Nadeau J, Dumigan D, et al. Obtaining blood cultures by venipuncture versus from central lines impact on blood culture contamination rates and potential effect on central line–associated bloodstream infection reporting. *Infection Control & Hospital Epidemiology*. 2013;34(10):1042-1047. doi:10.1086/673142

34 Results: Estimating the additional hospital inpatient cost and mortality associated with selected hospital-acquired conditions. November 2017. Agency for Healthcare Research and Quality, Rockville, MD. https://www.ahrq.gov/hai/pfp/haccost2017-results.html

35 Freeman JT, Chen LF, Sexton DJ, Anderson DJ. Blood culture contamination with Enterococci and skin organisms: implications for surveillance definitions of primary bloodstream infections. *Am J Infect Control*. 2011;39(5):436-438. doi:10.1016/j.ajic.2010.07.014

36 Swaney MH, Kalan LR. Living in Your Skin: Microbes, Molecules, and Mechanisms. *Infect Immun*. 2021;89(4):e00695-20. Published 2021 Mar 17. doi:10.1128/IAI.00695-20

37 Garcia RA, Spitzer ED, Kranz B, Barnes S. A national survey of interventions and practices in the prevention of blood culture contamination and associated adverse health care events. *Am J Infect Control*. 2018;46(5):571-576. doi:10.1016/j.ajic.2017.11.009

References

38 Centers for Medicare & Medicaid Services. *Frequently Asked Questions: DRA HAC Reporting.*; 2019. Accessed February 9, 2024. https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/Downloads/FAQ-DRA-HAC-PSI.pdf

39 QualityNet. Hospital-Acquired Condition Reduction Program (HACRP). qualitynet.cms.gov. Published 2023. Accessed February 9, 2024. https://qualitynet.cms.gov/inpatient/hac

40 Partnership for Quality Measurement. Adult Blood Culture Contamination Rate; A national measure and standard for clinical laboratories and antibiotic stewardship programs | Partnership for Quality Measurement. p4qm.org. Published December 12, 2022. Accessed February 9, 2024. https://p4qm.org/measures/3658

41 Centers for Medicare & Medicaid Services. FY 2024 IPPS Final Rule Home Page. www.CMS.gov. Published January 11, 2024. Accessed February 9, 2024. https://www.cms.gov/medicare/payment/prospective-payment-systems/acute-inpatient-pps/fy-2024-ipps-final-rule-home-page