Three Percent is for Wimps

ACHIEVING AND MAINTAINING BLOOD CULTURE CONTAMINATION RATES BELOW ONE PERCENT

Dennis Ernst, MT (ASCP), NCPT (NCCT)

2/25/2020

Learning Objectives

WEBINAR: ACHIEVING AND MAINTAINING A BLOOD CULTURE CONTAMINATION RATE UNDER 1%

I. Define the impact of blood culture contamination on patients and the facility

II. List the most common human errors that contaminate blood cultures

III. Discuss a new technique that significantly, immediately, and sustainably reduces contamination rates

Diagnosing the #1 cause of death and readmission in US Hospitals

Blood cultures remain the gold standard for diagnosing sepsis, with an *accepted* 3% contamination rate

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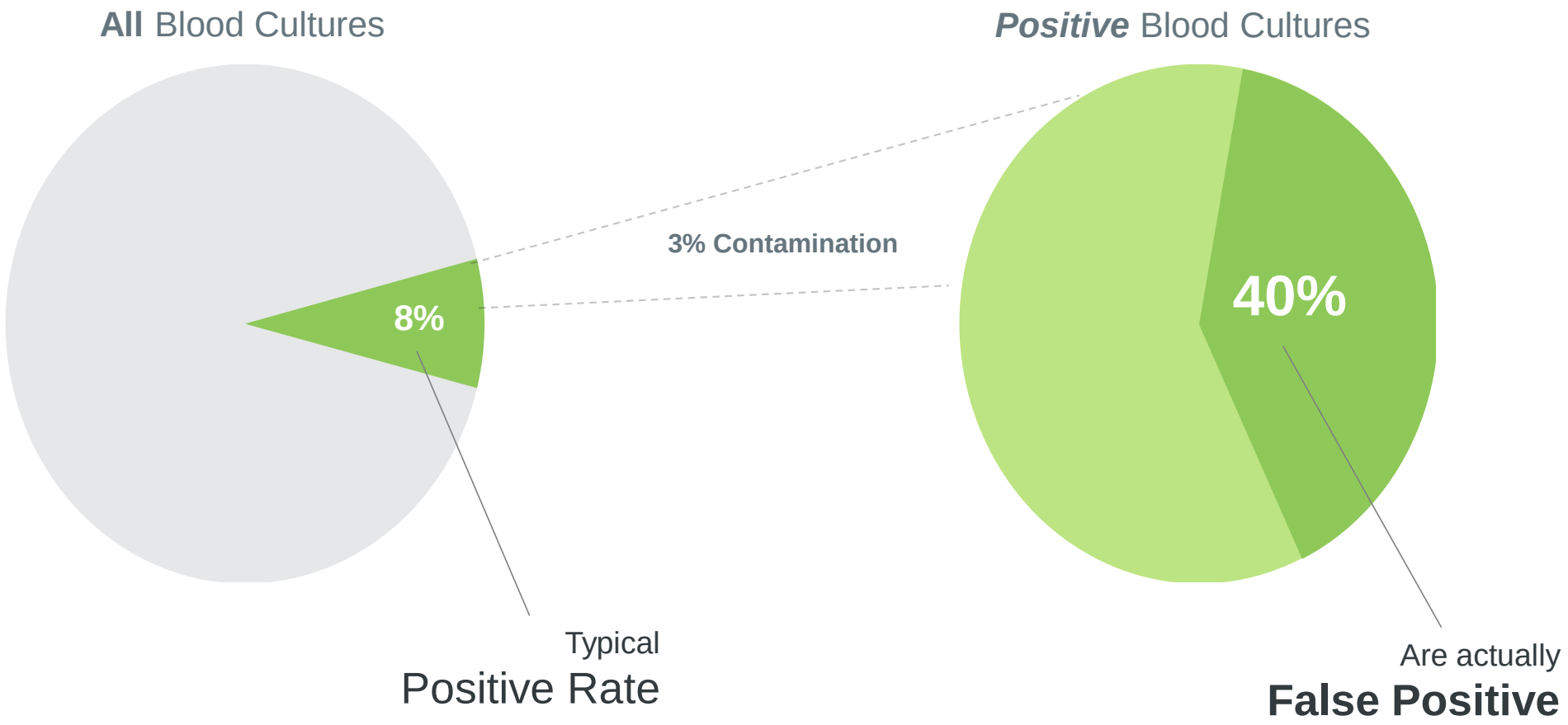
The (In)accuracy of Blood Culture Results



[1]Zwang O, Albert RK. Analysis of Strategies to Improve Cost Effectiveness of Blood Cultures. J Hosp Med. 2006 Sep;1(5):272-6.

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ED Blood Culture Contamination Rates by Personnel

Lab staff	ED staff
Study A: 1.1%	Study A: 5.0%
Study B: 3.1%	Study B: 7.4%

Contamination Rates

Centralized settings	Decentralized settings
1.0-3.1	4.2-8.4

The Cost of Contamination

Inpatient cost to treat:
$2,083 – 8, 720

Increased LOS:
Up to 3.3 days

Outpatient: Follow-up testing & treatment:
$152/false positive

26% of pediatric outpatients unnecessarily hospitalized

What this means at a typical hospital

3% BLOOD CULTURE CONTAMINATION RATE IN AN EMERGENCY DEPARTMENT

Patient Safety

Cultures / month:		833
Contamination Rate:	x	3.0%
Patients impacted by false positives / month:	=	**25**

Hospital Economics

Patients / year		**300**
Avg. cost per incident[1,2]	x	$4,200
Avoidable costs:	=	**$1,260,000**

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What this means at a typical hospital

2% BLOOD CULTURE CONTAMINATION RATE IN AN EMERGENCY DEPARTMENT

Patient Safety

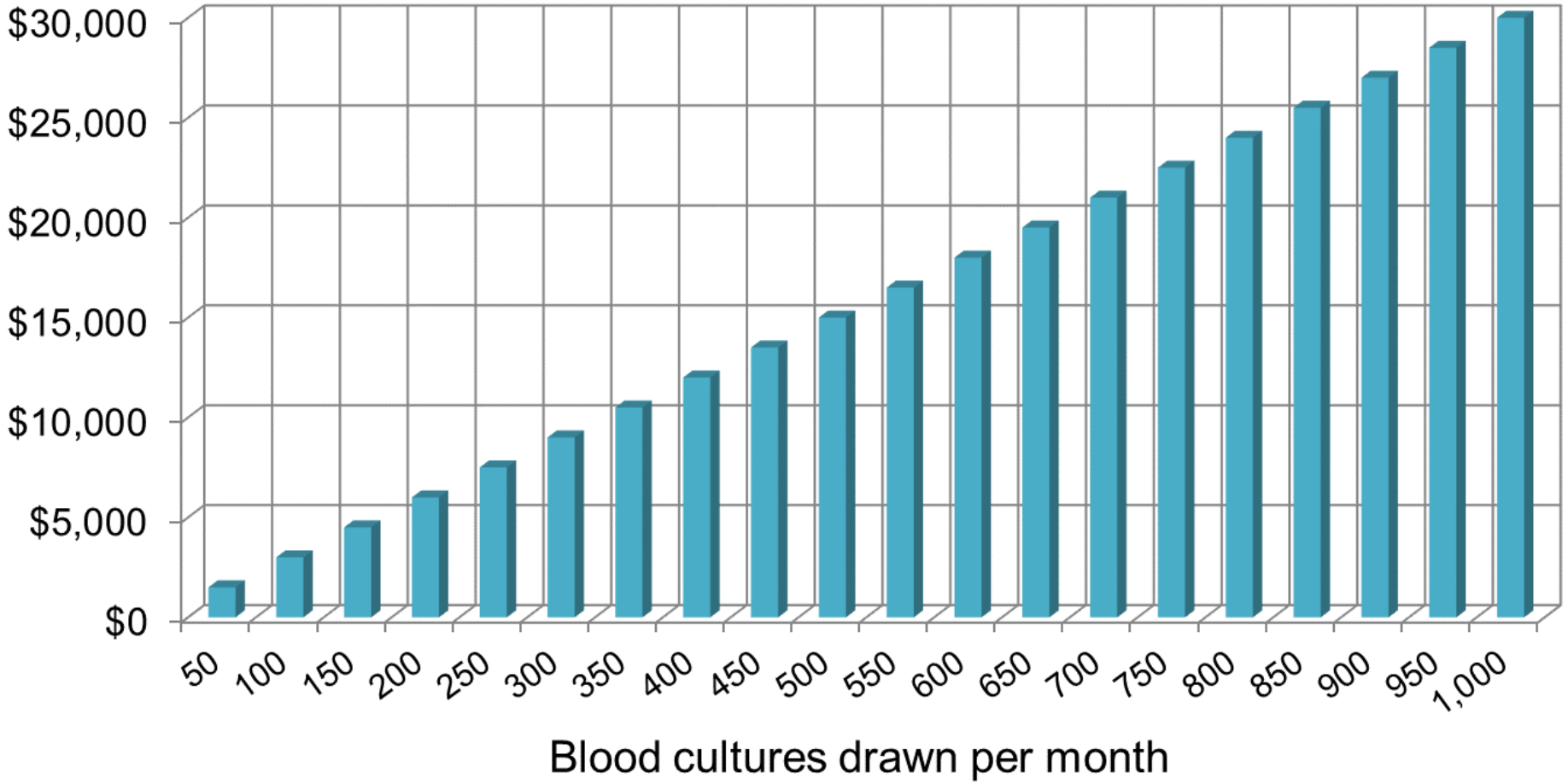
Cultures / month:		833
Contamination Rate:	x	2.0%
Patients impacted by false positives / month:	=	**17**

Hospital Economics

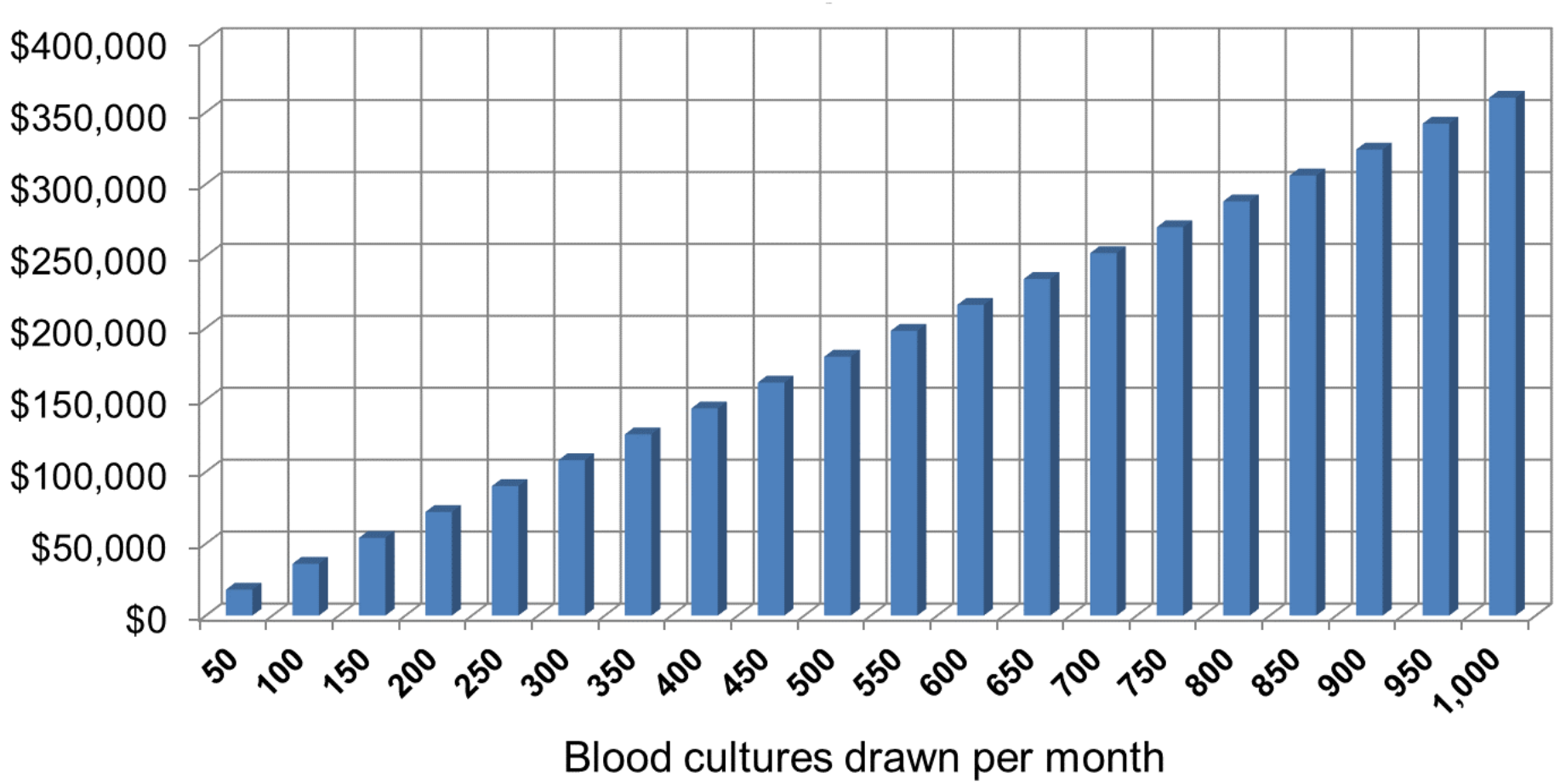
Patients / year		**200**
Avg. cost per incident[1,2]	x	$4,200
Avoidable costs:	=	**$840,000**

[1]Skoglund, E., et al (2018). "Estimated Clinical and Economic Impact Through Use of a Novel Blood Collection Device [Steripath} to Reduce Blood Culture Contamination in the Emergency Department: A Cost-Benefit Analysis." J Clin Microbiol.
[2]Geisler, B., et al (2018). "Potential Cost Savings and Decreased Clinical Burden Associated with Reducing Blood Culture Contamination." Submitted for publication

Monthly cost savings by reducing contamination rate one percentage point



Annual cost savings by reducing contamination rate one percentage point



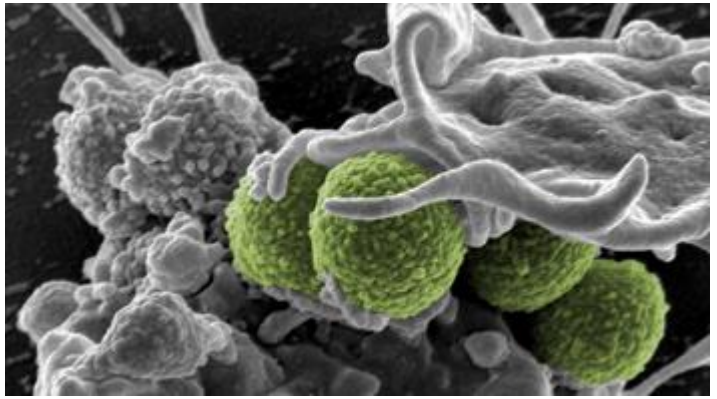
Blood culture contamination can have a devastating impact…

~ 1.2 MILLION

patients impacted by false-positive blood culture results annually in the United States1 , the MAJORITY of which are treated with antibiotics

$4 BILLION+

is spent by our healthcare system each year on unnecessary treatment associated with false-positive blood culture results



3 MILLION +

antibiotic-resistant and *C. diff* infections each year and 48,000 people die – represents a 50% increase in infections and 100% increase in deaths since the 2013 CDC report

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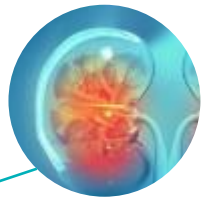
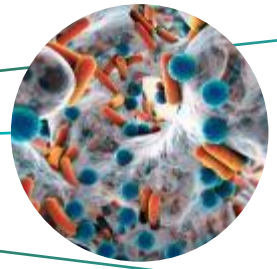
False-positive blood cultures increase many harmful patient safety risks

Misdiagnosed
Patient

Unnecessary Antibiotics

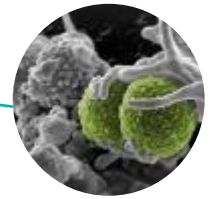


Acute Kidney Injury (AKI)

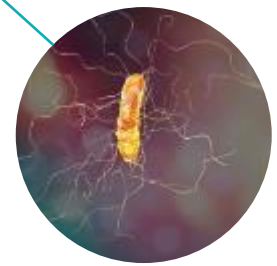


Antibiotic-Resistant Infections

Extended Length of Stay



Exposure to HAIs & HACs



Risk of *C. Difficile*

False-Positive CLABSIs

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Unnecessary False Positive CLABSI Reporting

"43% of reported CLABSIs likely represented contaminants,"

- Boyce et al, AJIC, June 2013

- If a patient with a central venous catheter (CVC) has ONE positive blood culture bottle due to any non-common commensal organism it must be reported as a CLABSI.
- Increases risk of Standardized Infection Ratio (SIR) penalties – fine up to 2% of total annual CMS reimbursement.

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Laboratory Impact

of reducing blood culture contamination

1. Improves workflow
2. Reduces unnecessary tests
3. Improves processes, productivity, performance
4. Reduces overtime
5. Significantly reduces avoidable costs

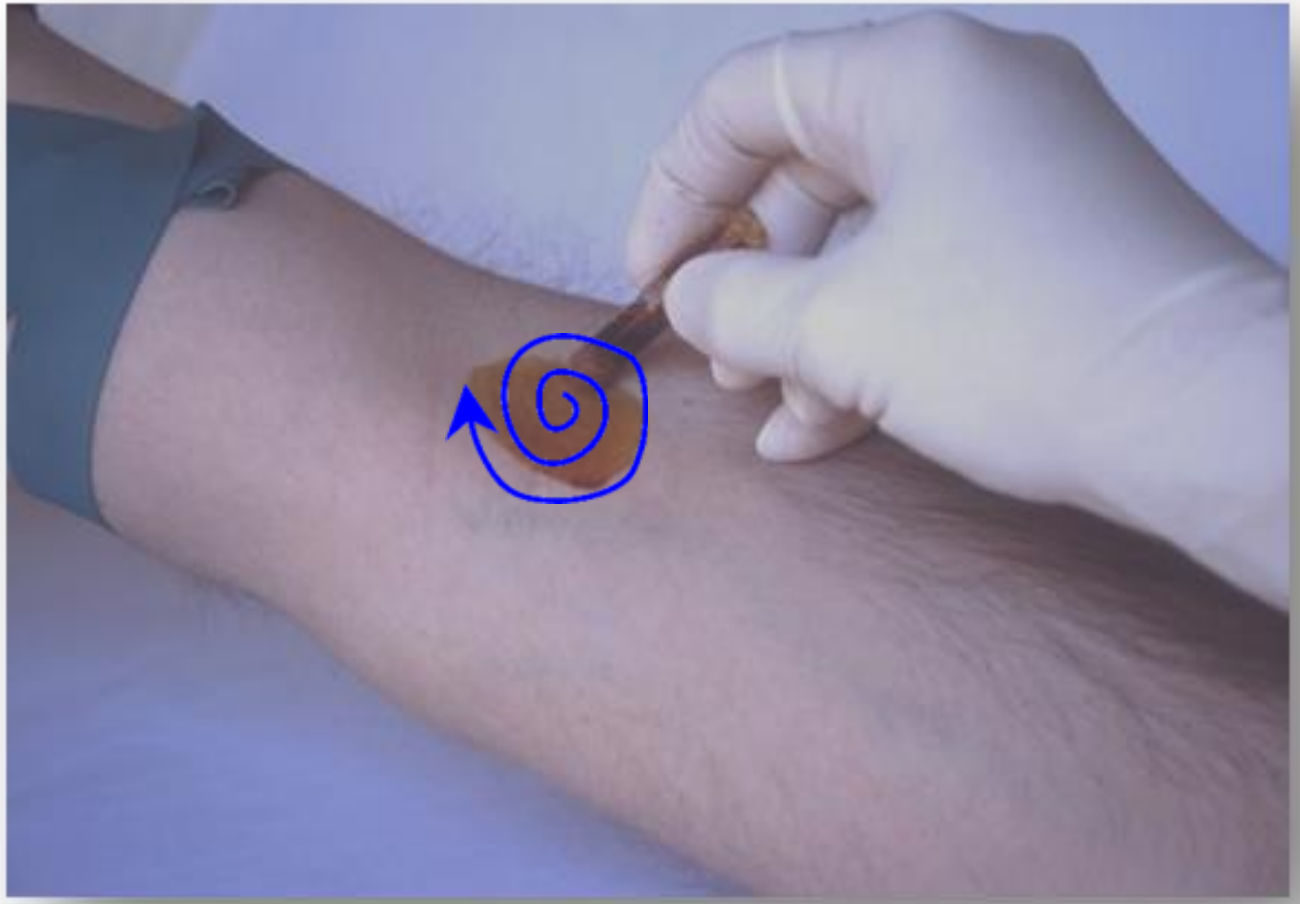
Poll Question #1

WE HAVE DONE THE FOLLOWING TO TRY TO REDUCE BLOOD CULTURE CONTAMINATION

Best Practices

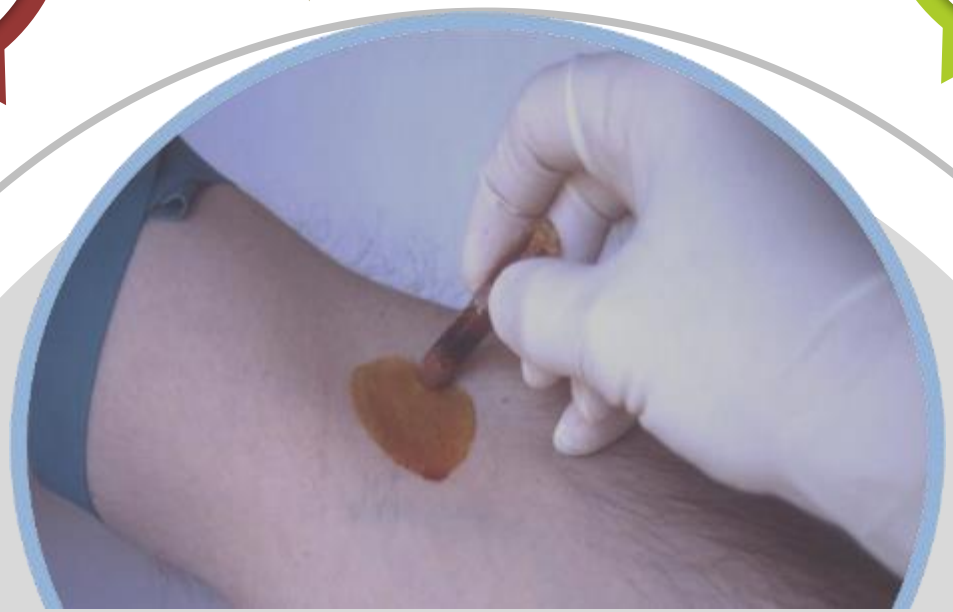
Best practices: site prep

Best practices: site prep



Best Practices

Proper site prep



Best Practices

Not repalpating

Cleansing stoppers

Proper site prep

Best Practices

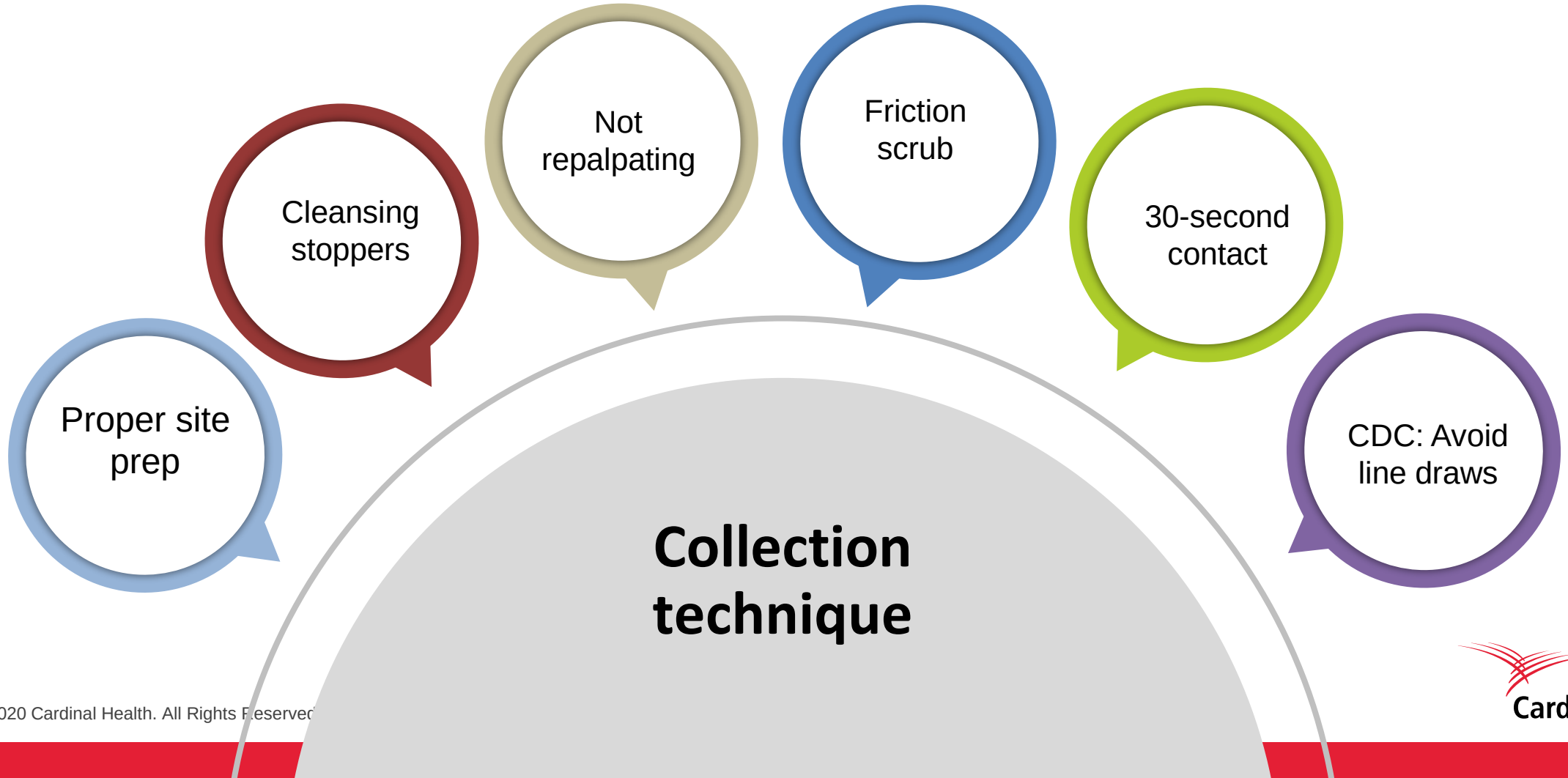
Proper site prep

Cleansing stoppers

Not repalpating

Friction scrub

Best Practices



What Should we Target?

YOUR CONTAMINATION RATE

ASM “Threshold”

3%

Target recommended by industry experts (2011)

2%

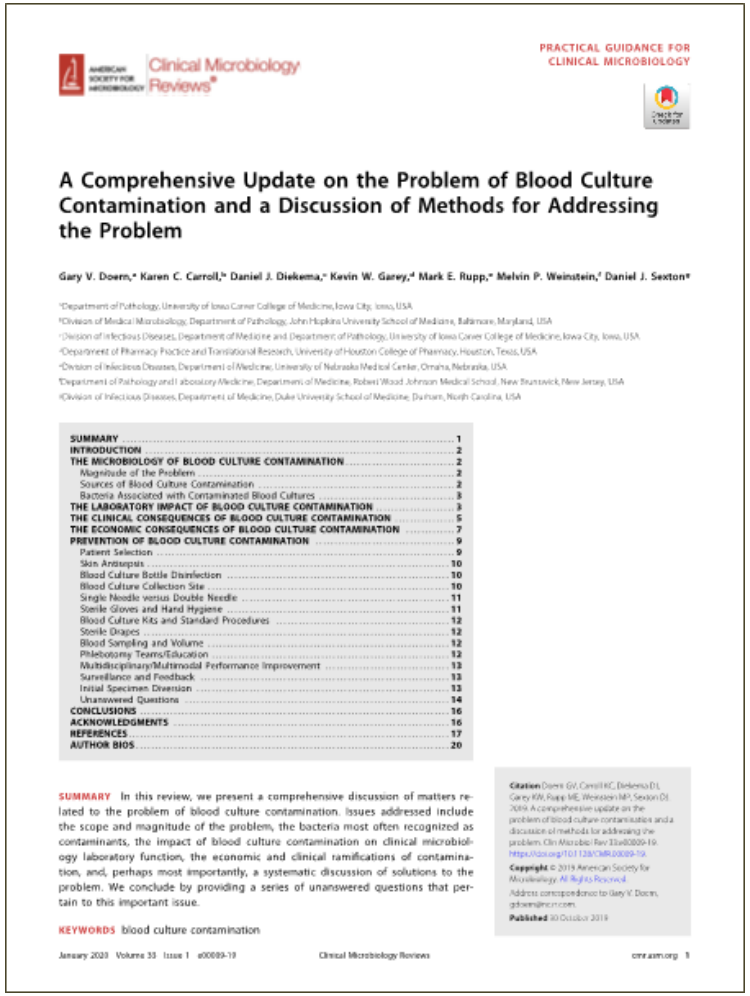
Poll Question #2

THE CURRENT BLOOD CULTURE CONTAMINATION RATE AT MY HOSPITAL IS:

Multi-Discipline Consensus Publication

> It is the opinion of the authors that consideration should be given to the establishment of a **new universal threshold value of ≤1.0%.”**

> When contamination rates **rise above 1%, objective, step-wise quality improvement programs designed to improve patient care and reduce unnecessary costs should be implemented.”**



Clinical Microbiology Reviews

PRACTICAL GUIDANCE FOR CLINICAL MICROBIOLOGY

A Comprehensive Update on the Problem of Blood Culture Contamination and a Discussion of Methods for Addressing the Problem

Gary V. Doern,[a] Karen C. Carroll,[b] Daniel J. Diekema,[c] Kevin W. Garey,[d] Mark E. Rupp,[e] Melvin P. Weinstein,[f] Daniel J. Sexton[g]

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[b]Division of Medical Microbiology, Department of Pathology, Johns Hopkins University School of Medicine, Baltimore, Maryland, USA
[c]Division of Infectious Diseases, Department of Medicine and Department of Pathology, University of Iowa Carver College of Medicine, Iowa City, Iowa, USA
[d]Department of Pharmacy Practice and Translational Research, University of Houston College of Pharmacy, Houston, Texas, USA
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[g]Division of Infectious Diseases, Department of Medicine, Duke University School of Medicine, Durham, North Carolina, USA

SUMMARY In this review, we present a comprehensive discussion of matters related to the problem of blood culture contamination. Issues addressed include the scope and magnitude of the problem, the bacteria most often recognized as contaminants, the impact of blood culture contamination on clinical microbiology laboratory function, the economic and clinical ramifications of contamination, and, perhaps most importantly, a systematic discussion of solutions to the problem. We conclude by providing a series of unanswered questions that pertain to this important issue.

KEYWORDS blood culture contamination

Citation Doern GV, Carroll KC, Diekema DJ, Garey KW, Rupp ME, Weinstein MP, Sexton DJ. 2019. A comprehensive update on the problem of blood culture contamination and a discussion of methods for addressing the problem. Clin Microbiol Rev 33:e00009-19. https://doi.org/10.1128/CMR.00009-19.

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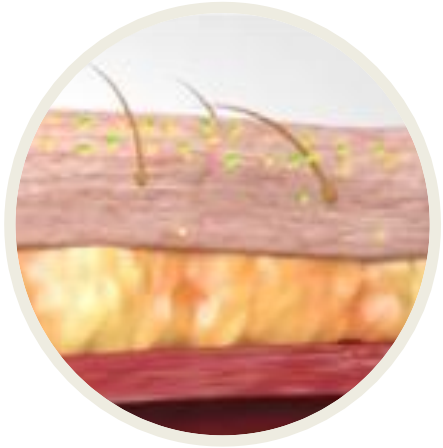
Training and education on “best practices” will not solve the problem.

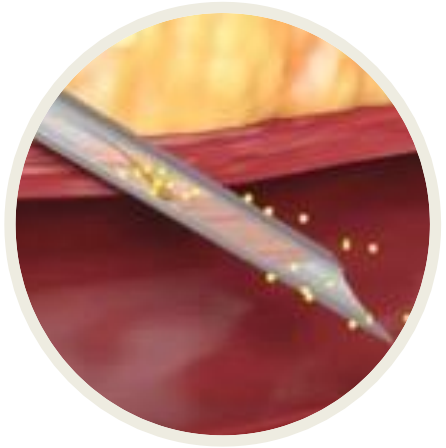
Human Factor(s)

Risk of contamination during assembly, preparation of supplies and skin prep



Skin Flora

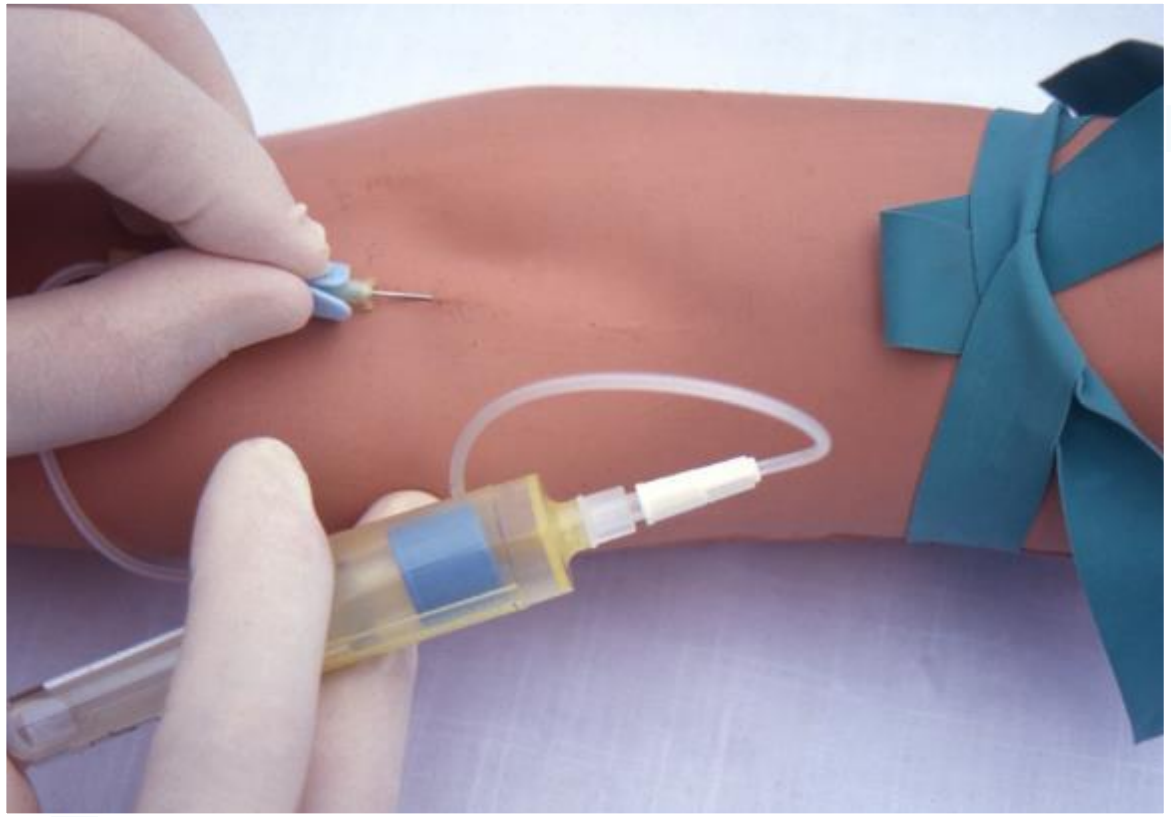
You can disinfect but not sterilize the skin. Up to 20% of skin flora remains viable in the keratin layer of the skin even after skin prep[1]



Skin Plug and Fragments

will enter the culture specimen bottle and commonly will contain viable microorganisms (when present)

Manual Diversion Technique



1. Prep the site
2. Prep the discard tube
3. Withdraw 1.5-2.0 mL
4. Discard the tube
5. Apply culture bottles

Peer-reviewed published data has shown only modest unsustainable reductions in contamination

Lowest published contamination rate achieved is 2.2%

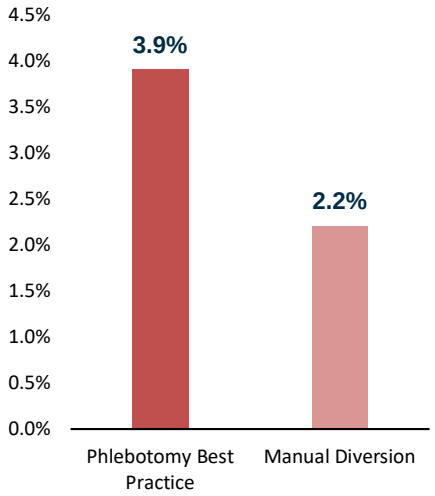
Manual Diversion Technique

CHALLENGES

- Adds additional steps to an already complex procedure
- Susceptible to touch point contaminations
- Difficult, if not impossible to disinfect waste tube top
- Risk of cross-contamination of the sheathed inoculation needle
  - ***Can lead to contamination of both bottles = "True Positive"***
- No consistency in achieving required 1.5-2.0mL diversion volume
- Requires continuous staff training, education and oversight to ensure compliance
- Not an engineered approach: **NOT** practical, reproducible or sustainable

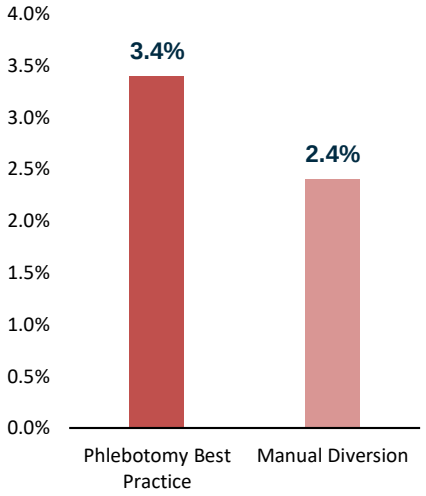
PEER-REVIEWED PUBLICATIONS

Manual Diversion (waste tube)



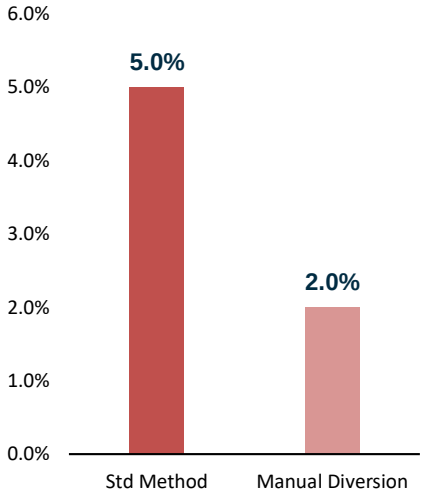
Innovation for Reducing Blood Culture Contamination: Initial Specimen Diversion Technique
Patton, et al, *J Clin Micro*, 2010
n = 3,733

- 9 months
- 44% reduction in BCC
- **2.2% BCC rate with manual ISD**



Effect of Initial Specimen Diversion Technique on Blood Culture Contamination Rates
Binkhamis, et al, *J Clin Micro* 2014
n = 27,145

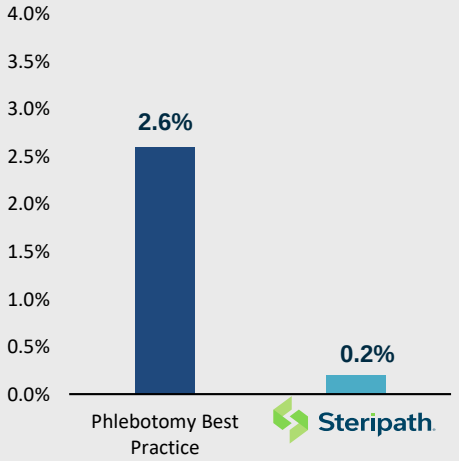
- 11 months
- 30% reduction in BCC
- **2.4% BCC rate with manual ISD**



Modification of Blood Test Draw Order to Reduce Blood Culture Contamination
Zimmerman, et al, *Clin Infect Dis,* 2019
n = 490

- 2 months
- 60% reduction in BCC
- **2.0% BCC rate with manual ISD**

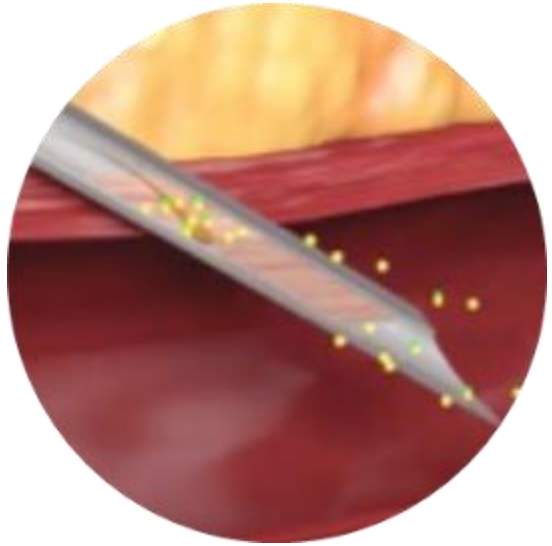
Use of ISDD



Reduction in Blood Culture Contamination in the ED Through the Use of Initial Specimen Diversion Device®
Rupp, et al, *Clin Infect Dis*, 2017
n = 1,808

- 12 months
- **92% reduction in BCC**
- **0.2% BCC rate**

The Initial Specimen Diversion Device®



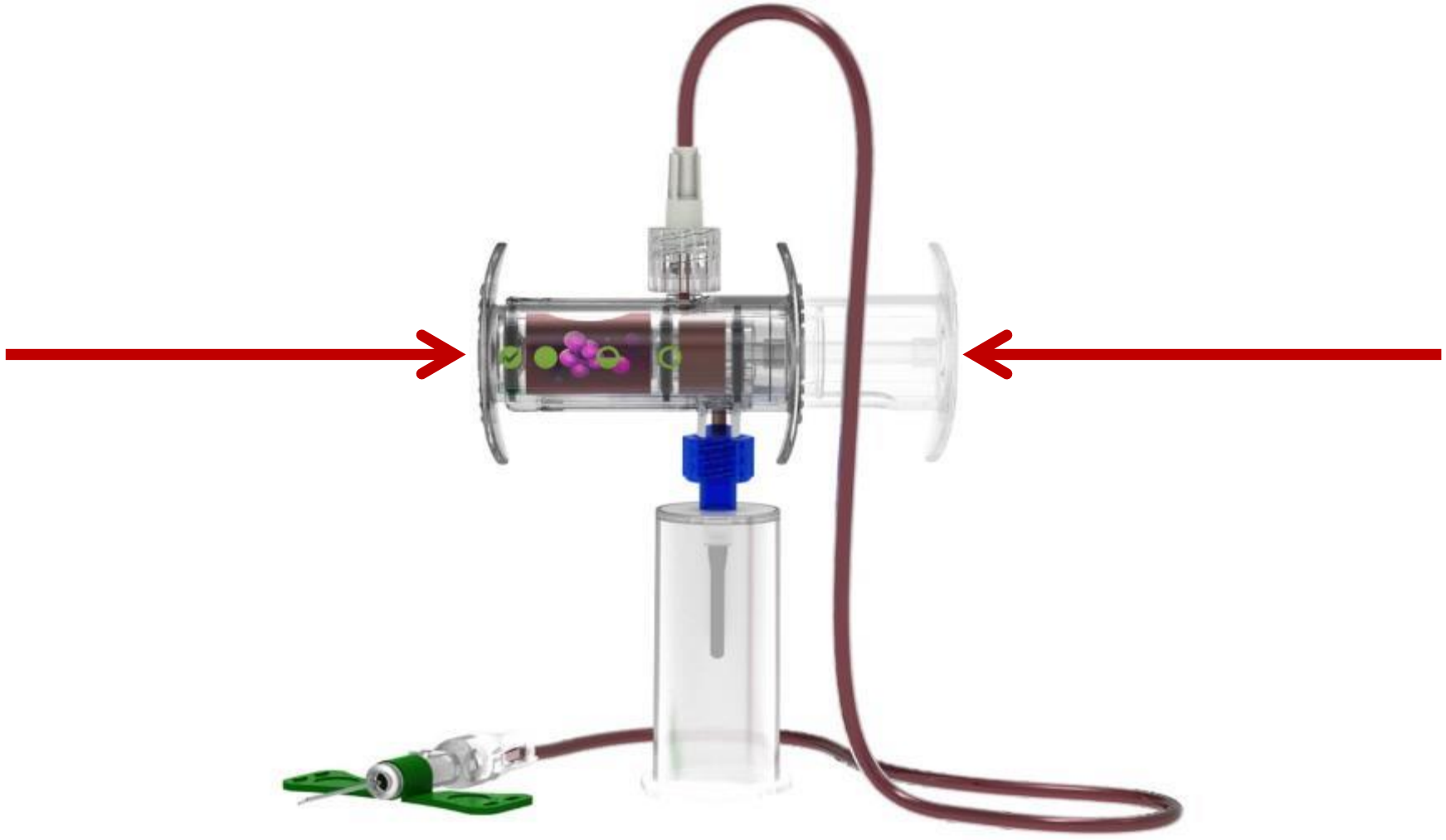
- The first 1.5 – 2.0 mL of blood contains normal skin flora even when properly prepped
- Diverting the first 1.5 – 2.0 mL removes contaminates

The Initial Specimen Diversion Device®

STERIPATH ® GEN2

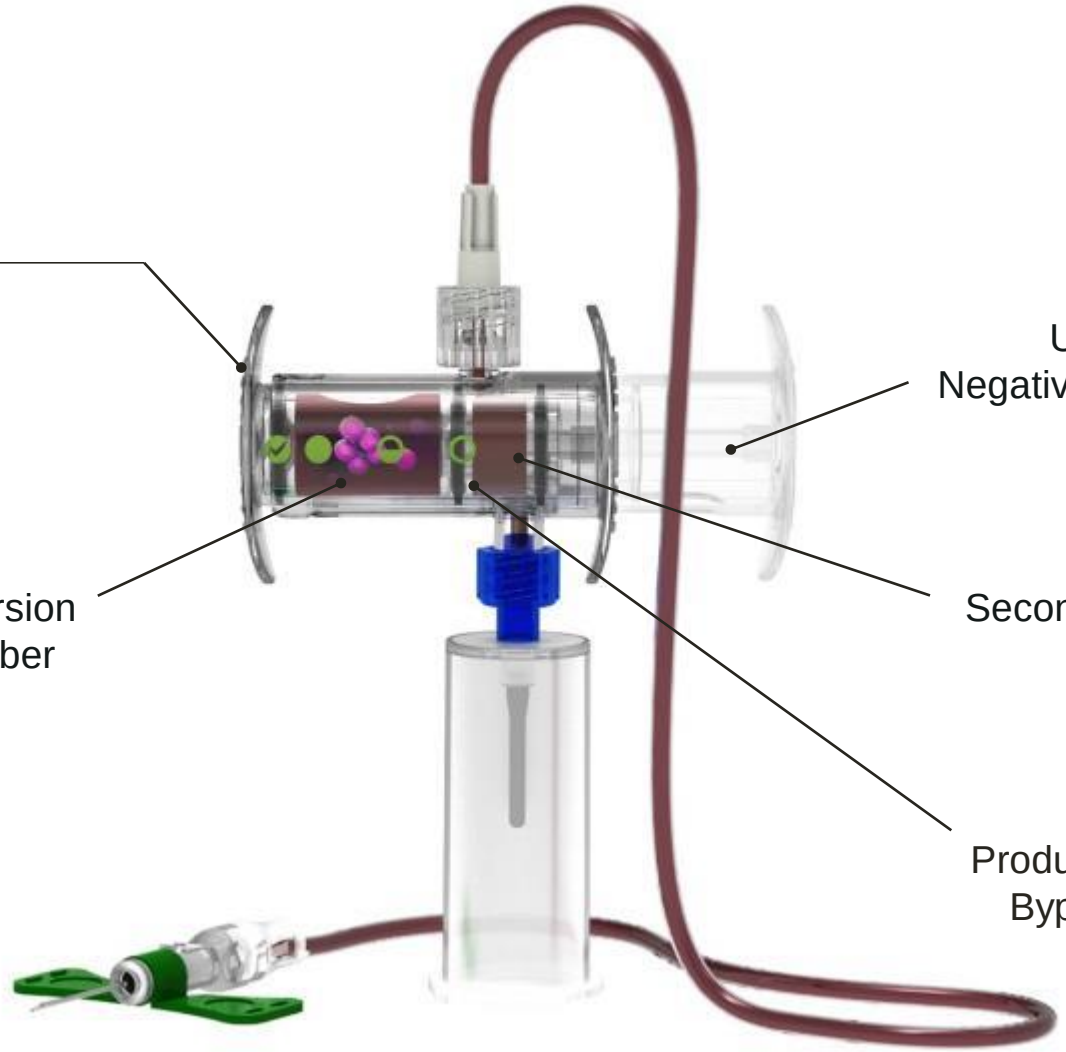
- Reduction in false positives up to **92%**
- 12-month sustained contamination rate as low as **0.2%**
- Positive predictive value as high as **97%**
- Reduction in vancomycin DOT up to **37%**
- Shorten length of stay by average of **2 days**
- Reduce HAIs / HACs by as much as **23%**
- Avg. annualized cost savings of **$945,000**

Human Factors Engineered Out



Human Factors Engineered Out

9” Luer
For Peripheral IV Start
Blood Culture Draws



Active Initial Specimen
Diversion Mechanism

User-Controlled
Negative-Pressure Diversion

1.5-2.0 mL Diversion
Isolation Chamber

Second Blood Flow Path

Product Design Prevents
Bypassing Diversion

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Integrated Syringe Collection

For Pediatrics (0.6 – 0.8 mL)

Requires FDA Market Clearance

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Poll Question #3

BLOOD CULTURES AT OUR FACILITY ARE DRAWN BY:

ISDD® Peer-Reviewed Published Studies

Clinical Infectious Diseases
2017 (July)

Clinical Infectious Diseases

MAJOR ARTICLE

Reduction in Blood Culture Contamination Through Use of Initial Specimen Diversion Device

Mark E. Rupp,[1] R. Jennifer Cavalieri,[1] Cole Morell,[1] and Elizabeth Lyden[2]

[1]Division of Infectious Diseases, and [2]Department of Epidemiology, University of Nebraska Medical Center, Omaha

(See the Editorial Commentary by McAdam on pages 206–7.)

Background. Blood culture contamination is a clinically significant problem that results in patient harm and excess cost.

Methods. In a prospective, controlled trial at an academic center Emergency Department, a device that diverts and sequesters the initial 1.5–2 mL portion of blood (which presumably carries contaminating skin cells and microbes) was tested against standard phlebotomy procedures in patients requiring blood cultures due to clinical suspicion of serious infection.

Results. In sum, 971 subjects granted informed consent and were enrolled resulting in 904 nonduplicative subjects with 1808 blood cultures. Blood culture contamination was significantly reduced through use of the initial specimen diversion device" (ISDD) compared to standard procedure: (2/904 [0.22%] ISDD vs 16/904 [1.78%] standard practice, $P = .001$). Sensitivity was not compromised: true bacteremia was noted in 65/904 (7.2%) ISDD vs 69/904 (7.6%) standard procedure, $P = .41$. No needlestick injuries or potential bloodborne pathogen exposures were reported. The monthly rate of blood culture contamination for all nurse-drawn and phlebotomist-drawn blood cultures was modeled using Poisson regression to compare the 12-month intervention period to the 6 month before and after periods. Phlebotomists (used the ISDD) experienced a significant decrease in blood culture contamination while the nurses (did not use the ISDD) did not. In sum, 73% of phlebotomists completed a post-study anonymous survey and widespread user satisfaction was noted.

Conclusions. Use of the ISDD was associated with a significant decrease in blood culture contamination in patients undergoing blood cultures in an Emergency Department setting.

Clinical Trials Registration. NCT02102087.

Keywords. blood culture; contamination; initial specimen diversion device.

Blood cultures are frequently obtained in the care of patients with serious infections to detect bacteremia and fungemia and guide specific antimicrobial therapy. Unfortunately, contamination rates routinely range from 0.6% to 6%, resulting not infrequently in unnecessary antibiotic treatment and added laboratory expense [1]. False-positive blood cultures increase laboratory costs by approximately 20%, are associated with a nearly 40% increase in antibiotic charges, are treated with antimicrobials up to one half of the time, extend the length of hospital stay by up to 5 days, and subject patients to the real harms associated with antibiotic exposure such as toxicity, adverse effects, interactions, and emergence of resistance [2–7]. Because of their clinical significance, great efforts have been expended to limit false-positive blood cultures including the use of various skin disinfectants, trained phlebotomy teams, blood culture kits, needle exchange systems, culture bottle disinfection protocols, use of sterile gloves, and other programmatic attempts to limit contamination [1, 2, 8, 9]. Contamination of blood cultures is thought to be due in part to skin fragments colonized with bacteria that are dislodged with venipuncture [10]. The purpose of this project was to test a device that diverts and sequesters the first 1.5–2 mL portion of blood, which presumably carries the contaminating skin fragments, from the culture specimen to determine whether blood culture contamination is diminished [11].

Received 21 December 2016; editorial decision 1 March 2017; accepted 28 March 2017; published online May 17, 2017.

Correspondence: M.E. Rupp, 8005400 Nebraska Medical Center, Omaha, NE 68198 (merupp@unmc.edu).

Clinical Infectious Diseases® 2017;65(2):201–5

DOI: 10.1093/cid/cix284

METHODS

Study Design

Single center, prospective, controlled, open label trial. This study was reviewed and approved by the UNMC Institutional Review Board. This trial was registered at Clinicaltrials.gov (NCT 02102087).

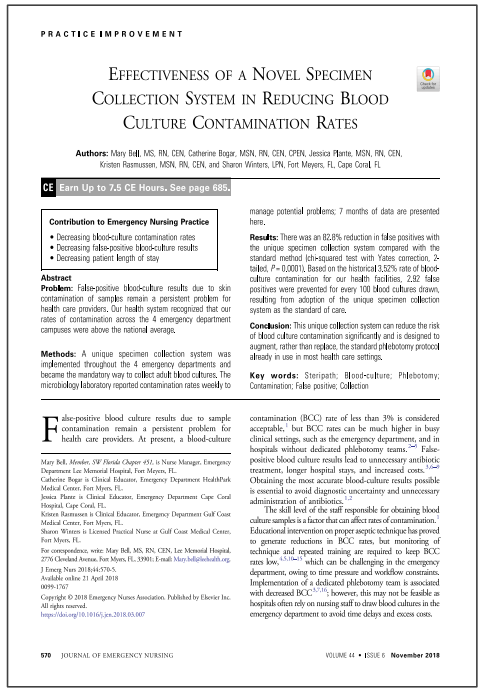
Setting

Emergency department and trauma center in an urban 689-bed university hospital.

Test Device

Initial specimen diversion device (ISDD) (SteriPath®, Magnolia Medical Technologies), a pre-assembled, sterile blood culture

Journal for Emergency Nursing 2018 (Nov)



PRACTICE IMPROVEMENT

Effectiveness of a Novel Specimen Collection System in Reducing Blood Culture Contamination Rates

Authors: Mary Bell, MS, RN, CEN, Catherine Bogar, MSN, RN, CEN, CPEN, Jessica Plante, MSN, RN, CEN, Kristen Rasmussen, MSN, RN, CEN, and Sharon Winters, LPN, Fort Meyers, FL, Cape Coral, FL

CE Earn Up to 7.5 CE Hours. See page 685.

Contribution to Emergency Nursing Practice

- Decreasing blood-culture contamination rates
- Decreasing false-positive blood-culture results
- Decreasing patient length of stay

Abstract

Problem: False-positive blood-culture results due to skin contamination of samples remain a persistent problem for health care providers. Our health system recognized that our rates of contamination across the 4 emergency department campuses were above the national average.

Methods: A unique specimen collection system was implemented throughout the 4 emergency departments and became the mandatory way to collect adult blood cultures. The microbiology laboratory reported contamination rates weekly to manage potential problems; 7 months of data are presented here.

Results: There was an 82.8% reduction in false positives with the unique specimen collection system compared with the standard method (chi-squared test with Yates correction, 2-tailed, $P = 0.0001$). Based on the historical 3.52% rate of blood-culture contamination for our health facilities, 2.92 false positives were prevented for every 100 blood cultures drawn, resulting from adoption of the unique specimen collection system as the standard of care.

Conclusion: This unique collection system can reduce the risk of blood culture contamination significantly and is designed to augment, rather than replace, the standard phlebotomy protocol already in use in most health care settings.

Key words: Steripath; Blood-culture; Phlebotomy; Contamination; False positive; Collection

False-positive blood culture results due to sample contamination remain a persistent problem for health care providers. At present, a blood-culture contamination (BCC) rate of less than 3% is considered acceptable,[1] but BCC rates can be much higher in busy clinical settings, such as the emergency departments, and in hospitals without dedicated phlebotomy teams.[2–4] False-positive blood culture results lead to unnecessary antibiotic treatment, longer hospital stays, and increased costs.[5–7] Obtaining the most accurate blood-culture results possible is essential to avoid diagnostic uncertainty and unnecessary administration of antibiotics.[1,2]

The skill level of the staff responsible for obtaining blood culture samples is a factor that can affect rates of contamination.[1] Educational intervention on proper aseptic technique has proved to generate reductions in BCC rates, but monitoring of technique and repeated training are required to keep BCC rates low,[4,5,10–13] which can be challenging in the emergency department, owing to time pressure and workflow constraints. Implementation of a dedicated phlebotomy team is associated with decreased BCC[3,7,10]; however, this may not be feasible as hospitals often rely on nursing staff to draw blood cultures in the emergency department to avoid time delays and excess costs.

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Sharon Winters is Licensed Practical Nurse at Gulf Coast Medical Center, Fort Myers, FL.

For correspondence, write: Mary Bell, MS, RN, CEN, Lee Memorial Hospital, 2776 Cleveland Avenue, Fort Myers, FL, 33901; E-mail: Mary.bell@leehealth.org.

J Emerg Nurs 2018;44:570-5.

Available online 21 April 2018

0099-1767

https://doi.org/10.1016/j.jen.2018.03.007

Journal of Clinical Microbiology 2019 (Jan)

Journal of Clinical Microbiology

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

American Journal of Infection Control 2019 (Jan)

ARTICLE IN PRESS

American Journal of Infection Control 000 (2018) 1–5

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Reducing blood culture contamination using an initial specimen diversion device

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Key Words:
False positive culture
Subcutaneous colonization
Inpatient

Objectives: False positive blood cultures result from contamination, consuming laboratory resources and causing unnecessary antibiotic treatment and prolonged hospital stay. Skin disinfection reduces contamination; however, bacteria colonizing human skin are also found in tissues deep into the skin surface. A diversion device diverts the initial 1–2 mL of blood to remove any potentially contaminated skin plug. This study investigates the effect of the device on culture contamination in hospitalized patients.

Methods: In this prospective controlled pragmatic study, blood cultures were obtained using an initial specimen diversion device, either via integrated needle or attachment to a newly placed intravenous catheter. Cultures taken using standard methods served as the control.

Results: Six hundred seventy-one blood cultures were obtained. Two hundred seven cultures were taken using an initial specimen diversion device, with 2 (1.0%) contaminated cultures. Four hundred sixty-four cultures were taken without the device, with 24 (5.2%) contaminated cultures ($P < .008$). No significant difference was shown in the rate of true-positive cultures.

Conclusions: The use of a diversion device was associated with reduced culture contamination in hospitalized patients over a 6-month period, without concomitant reduction in true-positive cultures. This intervention may result in a reduction in costs, antibiotic use, and duration of hospital stay.

Bloodstream infections cause significant morbidity and mortality and their prompt identification is an essential part of modern medicine. Blood cultures, first described in the latter part of the 19th century,[1] are an essential element of the diagnosis and treatment of patients with such infections. However, as with all medical testing, false-positive results occur and can cause delays in diagnosis, inappropriate treatment, and significantly added expenses.[2,3] False-positive results in blood cultures have been described for as long as there have been such cultures and are primarily owing to contaminants.[1,4] It has been estimated that up to 50% of positive blood cultures represent contamination.[5,6] These false-positive cultures, at the microbiological laboratory level, require significant additional resources for examination. In addition, and perhaps more importantly, these false-positive cultures may result in unnecessary antibiotic treatment as well as prolonged hospital stay, causing needless harm to patients. These result in an

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Funding/support: Magnolia Medical Technologies (Seattle, WA), provided the Steripath device as well as initial technical support in their use. The funding source did not provide any other financial support nor were they involved in the study design; the collection, analysis and interpretation of data, in the writing of the report, or in the decision to submit the article for publication.

FSZ and MVA contributed equally to this work.

Conflicts of interest: None to report.

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Model to evaluate the impact of hospital-based interventions targeting false-positive blood cultures on economic and clinical outcomes

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Keywords:
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False-positive
Quality of health care
Costs and cost analysis

SUMMARY

Background: Blood culture contamination (BCC) increases length of stay (LOS) and leads to unnecessary antimicrobial therapy and/or hospital-acquired conditions (HACs).

Aim: To quantify the magnitude of additional LOS, costs to hospitals and society, and harm to patients attributable to BCC.

Methods: A retrospective matched survival analysis was performed involving hospitalized patients with septicaemia-compatible symptoms. BCC costs, HACs and potential savings were calculated based on the primary LOS data, a modified Delphi process and published sources. The cost analysis compared standard care with interventions for reducing BCC, and estimated annual economic and clinical consequences for a typical hospital and for the USA as a whole.

Findings: Patients with BCC experienced a mean increase in LOS of 2.35 days ($P=0.0076$). Avoiding BCC would decrease costs by $6463 [$4818 from inpatient care (53% of which was from reduced LOS) and 26% from reduced antibiotic use]. Annually, in a typical 250- to 400-bed hospital, employing phlebotomists would save $1.3 million and prevent 24 HACs (including two cases of *Clostridium difficile* infection); based on clinical efficacy evidence, use of the studied initial specimen diversion device (ISDD) would save $1.9 million and prevent 34 HACs (including three cases of *C. difficile* infection). In the USA, the respective strategies would prevent 69,300 and 102,900 HACs (including 6000 and 8900 cases of *C. difficile* infection) and save $5 and $7.5 billion.

Conclusion: Costs and clinical burdens associated with false-positive cultures are substantial and can be reduced by available interventions, including phlebotomists and use of ISDD.

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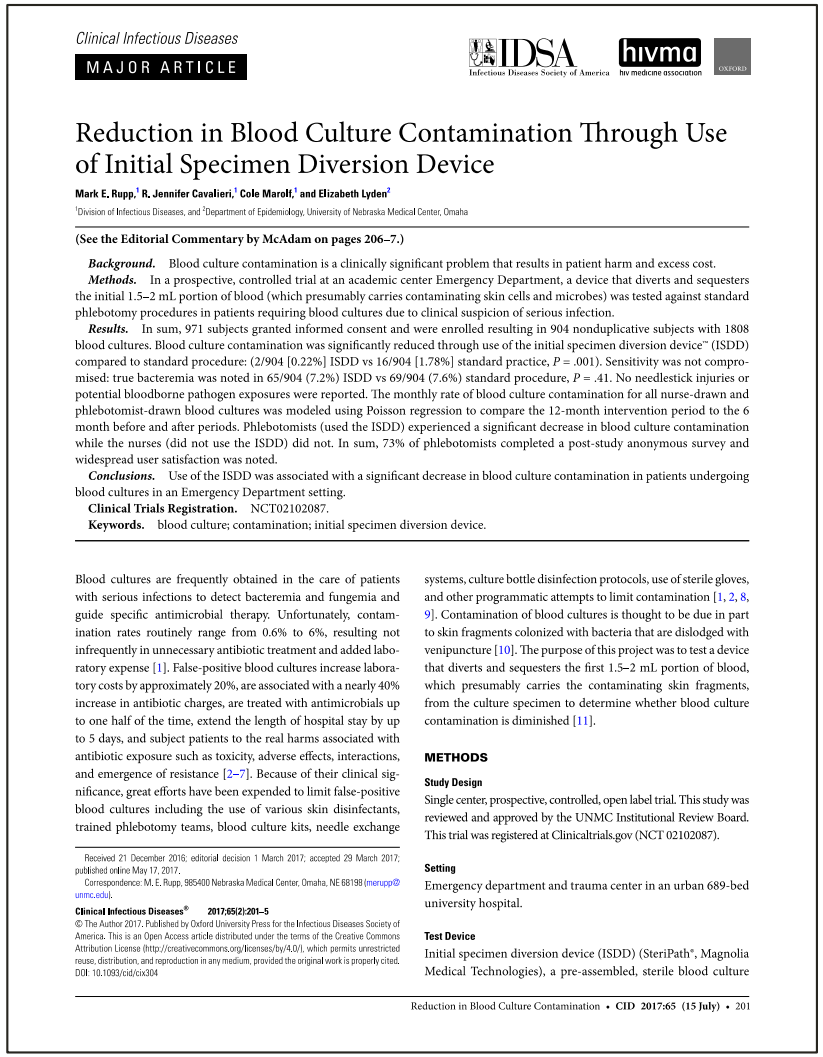
PEER-REVIEWED PUBLICATION



Clinical Infectious Diseases

MAJOR ARTICLE

IDSA Infectious Diseases Society of America · hivma hiv medicine association · OXFORD

Reduction in Blood Culture Contamination Through Use of Initial Specimen Diversion Device

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[1]Division of Infectious Diseases, and [2]Department of Epidemiology, University of Nebraska Medical Center, Omaha

(See the Editorial Commentary by McAdam on pages 206–7.)

Background. Blood culture contamination is a clinically significant problem that results in patient harm and excess cost.

Methods. In a prospective, controlled trial at an academic center Emergency Department, a device that diverts and sequesters the initial 1.5–2 mL portion of blood (which presumably carries contaminating skin cells and microbes) was tested against standard phlebotomy procedures in patients requiring blood cultures due to clinical suspicion of serious infection.

Results. In sum, 971 subjects granted informed consent and were enrolled resulting in 904 nonduplicative subjects with 1808 blood cultures. Blood culture contamination was significantly reduced through use of the initial specimen diversion device™ (ISDD) compared to standard procedure: (2/904 [0.22%] ISDD vs 16/904 [1.78%] standard practice, $P = .001$). Sensitivity was not compromised: true bacteremia was noted in 65/904 (7.2%) ISDD vs 69/904 (7.6%) standard procedure, $P = .41$. No needlestick injuries or potential bloodborne pathogen exposures were reported. The monthly rate of blood culture contamination for all nurse-drawn and phlebotomist-drawn blood cultures was modeled using Poisson regression to compare the 12-month intervention period to the 6 month before and after periods. Phlebotomists (used the ISDD) experienced a significant decrease in blood culture contamination while the nurses (did not use the ISDD) did not. In sum, 73% of phlebotomists completed a post-study anonymous survey and widespread user satisfaction was noted.

Conclusions. Use of the ISDD was associated with a significant decrease in blood culture contamination in patients undergoing blood cultures in an Emergency Department setting.

Clinical Trials Registration. NCT02102087.

Keywords. blood culture; contamination; initial specimen diversion device.

Blood cultures are frequently obtained in the care of patients with serious infections to detect bacteremia and fungemia and guide specific antimicrobial therapy. Unfortunately, contamination rates routinely range from 0.6% to 6%, resulting not infrequently in unnecessary antibiotic treatment and added laboratory expense [1]. False-positive blood cultures increase laboratory costs by approximately 20%, are associated with a nearly 40% increase in antibiotic charges, are treated with antimicrobials up to one half of the time, extend the length of hospital stay by up to 5 days, and subject patients to the real harms associated with antibiotic exposure such as toxicity, adverse effects, interactions, and emergence of resistance [2–7]. Because of their clinical significance, great efforts have been expended to limit false-positive blood cultures including the use of various skin disinfectants, trained phlebotomy teams, blood culture kits, needle exchange systems, culture bottle disinfection protocols, use of sterile gloves, and other programmatic attempts to limit contamination [1, 2, 8, 9]. Contamination of blood cultures is thought to be due in part to skin fragments colonized with bacteria that are dislodged with venipuncture [10]. The purpose of this project was to test a device that diverts and sequesters the first 1.5–2 mL portion of blood, which presumably carries the contaminating skin fragments, from the culture specimen to determine whether blood culture contamination is diminished [11].

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Correspondence: M. E. Rupp, 985400 Nebraska Medical Center, Omaha, NE 68198 (merupp@unmc.edu).

Clinical Infectious Diseases® 2017;65(2):201–5

DOI: 10.1093/cid/cix304

METHODS

Study Design

Single center, prospective, controlled, open label trial. This study was reviewed and approved by the UNMC Institutional Review Board. This trial was registered at Clinicaltrials.gov (NCT 02102087).

Setting

Emergency department and trauma center in an urban 689-bed university hospital.

Test Device

Initial specimen diversion device (ISDD) (SteriPath®, Magnolia Medical Technologies), a pre-assembled, sterile blood culture

Clinical Infectious Diseases

University of Nebraska Medical Center

TITLE: Reduction in Blood Culture Contamination Through the Use of Initial Specimen Diversion Device® [Steripath®]

PUBLICATION: ***Clinical Infectious Diseases* - 2017:65 (15 July)**

INSTITUTE: **University of Nebraska Medical Center**

AUTHORS: Mark E. Rupp, MD, et al

AFFILIATIONS: Division of Infectious Disease, Department of Epidemiology, Emergency Department

DESIGN: Single center, prospective, controlled, matched-pair, open label trial over a 12-month period – 904 patients (1,808 cultures)

METHOD: Phlebotomists collected two cultures from each subject.
1) One using Phlebotomy best practices
2) One using Steripath

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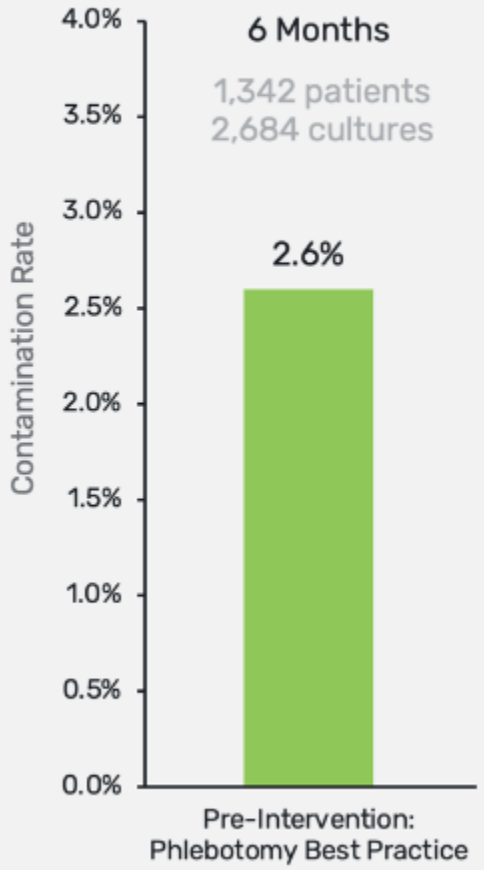
Reduction in Blood Culture Contamination Through the Use of Initial Specimen Diversion Device®

University of Nebraska Medical Center

- *Clinical Infectious Diseases* - 2017:65 (15 July)



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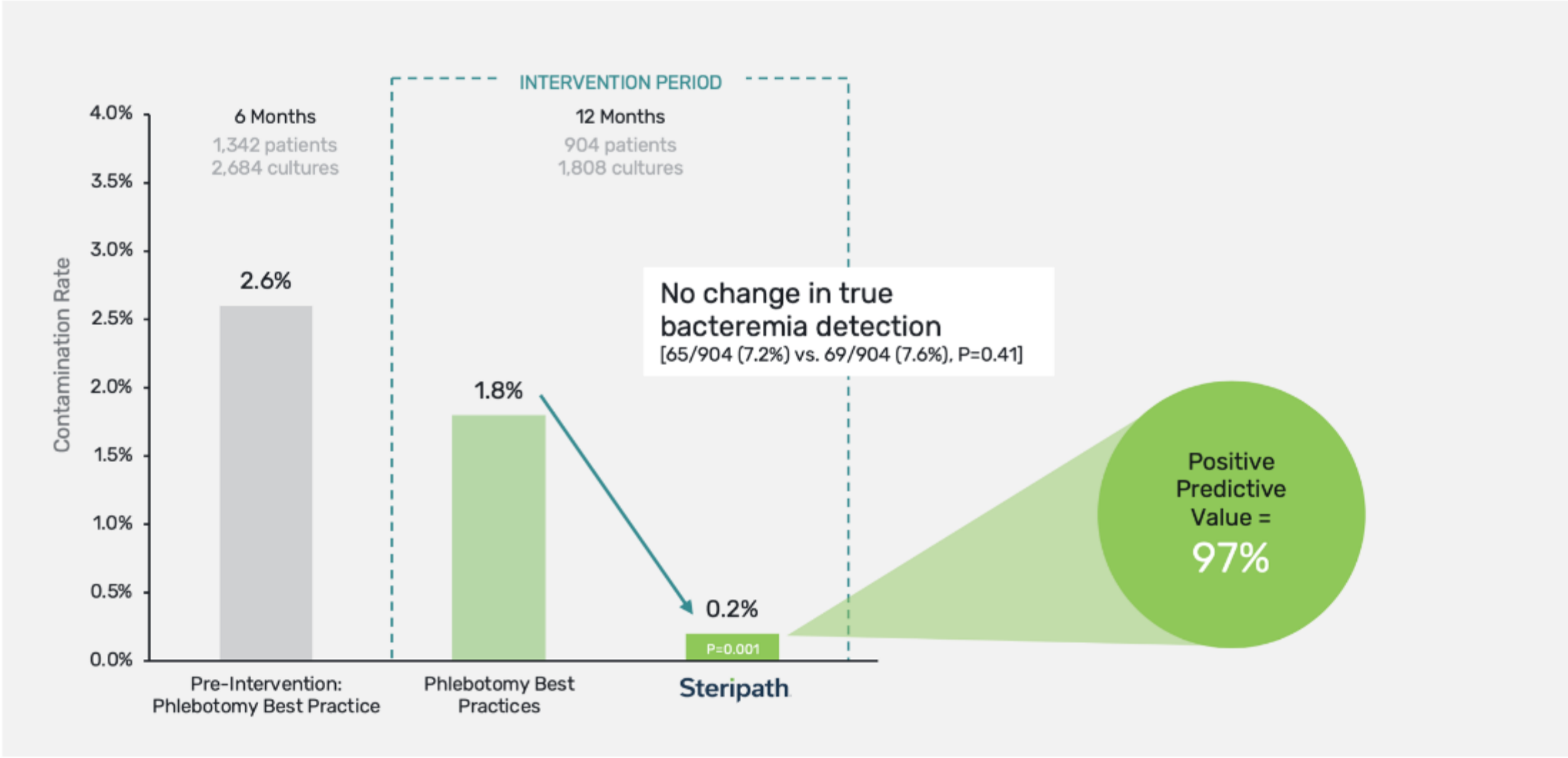
Clinical Infectious Diseases - 2017:65 (15 July)



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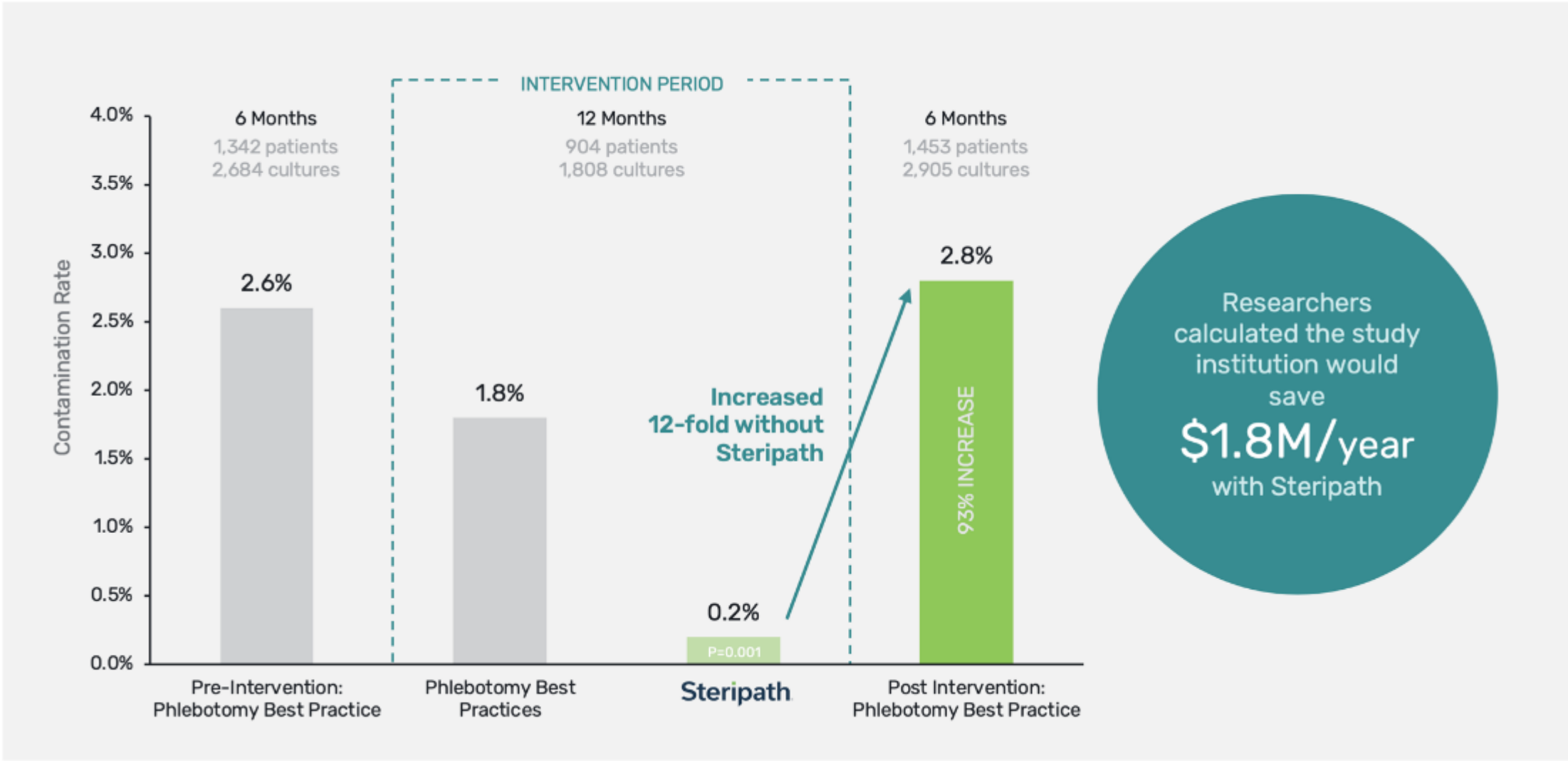

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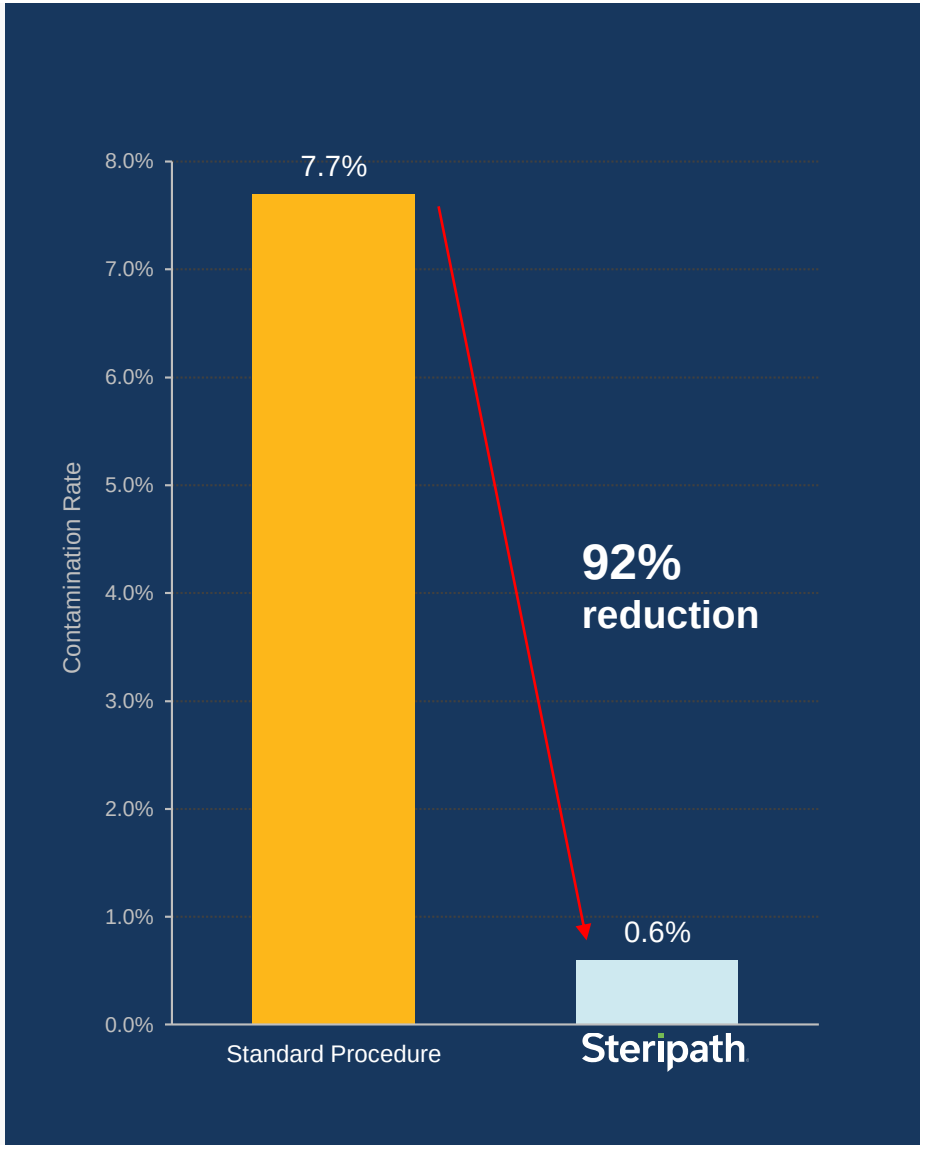
BAMC

Presented Abstract

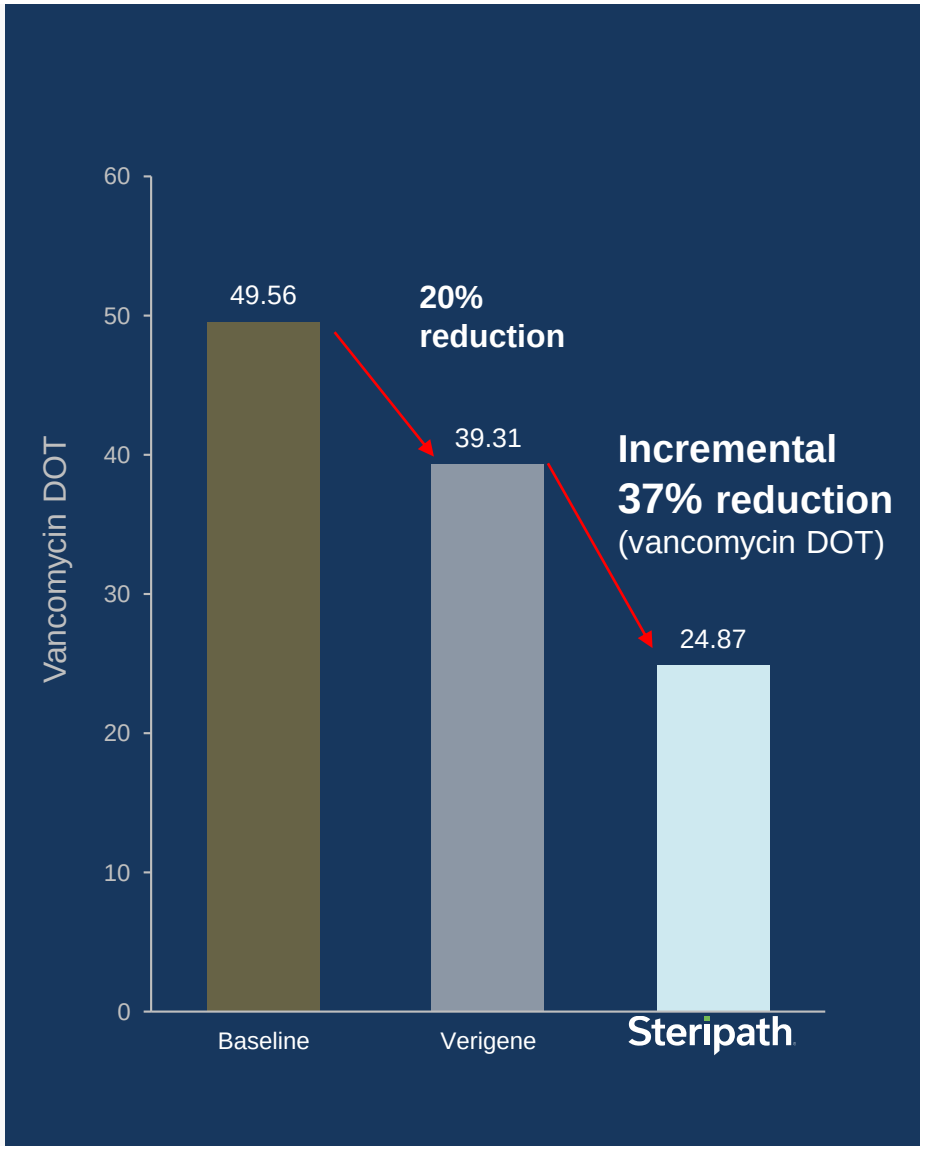
TITLE:	Reduction of Blood Culture Contaminations in the Emergency Department using Steripath® ISDD®
CONFERENCE:	*Department of Defense Healthcare Quality and Safety Award Winner* – 2016 (Submitted for Publication)
INSTITUTE:	**Brooke Army Medical Center**
AUTHORS:	LTC Charlotte Lanteri Ph.D., et al
AFFILIATIONS:	Department of Emergency Medicine
DESIGN:	Single center, prospective, open label trial
METHOD:	Blood cultures collected in the Emergency Department. Patients randomized to either standard method or use of Steripath via **venipuncture** and **peripheral IV starts.**
RESULTS:	**92%** reduction in contamination with Steripath Steripath: **0.6%** (5/784) contamination rate Standard procedure: **7.7%** (52/672) contamination rate
SUMMARY:	Saved over **$235,000** during 5-month trial period



BAMC

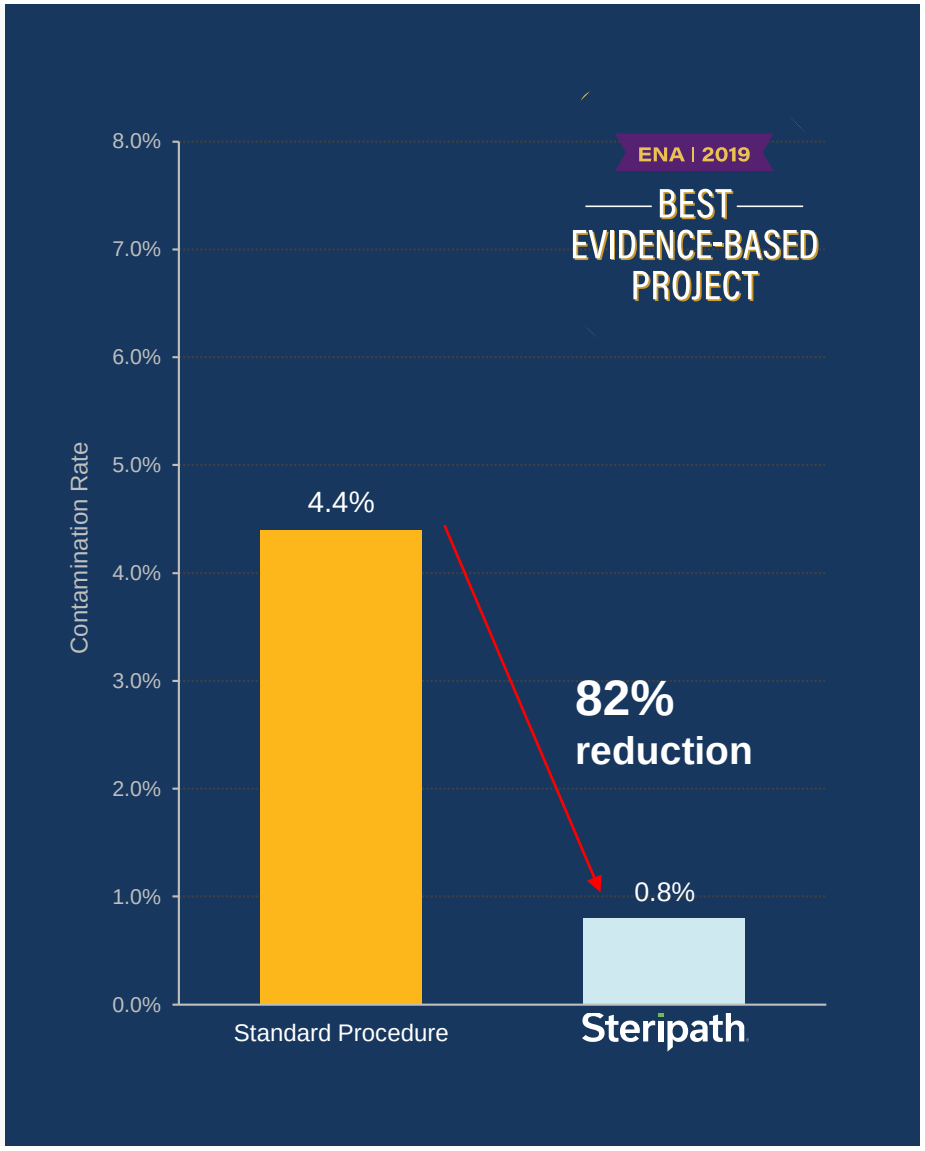
Presented Abstract

TITLE:	**Impact of Initial Specimen Diversion Device® and Molecular Pathogen Identification on Vancomycin Use**
CONFERENCE:	*SHEA Conference – 2017* *Submitted for Publication*
INSTITUTE:	**Brooke Army Medical Center**
AUTHORS:	David Chang, MD, et al
AFFILIATIONS:	Infectious Diseases, Microbiology, Antimicrobial Stewardship Program
DESIGN:	Single center, retrospective, non-randomized
METHOD:	**Comparison of Vancomycin DOT** before and after interventions to reduce pathogen detection time (Verigene®) and blood culture contamination (Steripath® in ED).
RESULTS:	Vancomycin DOT per 1,000 patient days decreased 20%, 49.56 to 39.31 (P=0.001) after implementation of PCR. **Steripath** resulted in an **incremental decrease in vancomycin DOT by 37% (P=0.007)**, 39.31 to 24.87
SUMMARY:	Greater de-escalation of Vancomycin DOT was best achieved through a combination of a molecular detection assay and Steripath.



Presented Abstract

TITLE:	Don’t Stick Me Again - Reducing Blood Culture Contamination in the Adult Emergency Department
CONFERENCE :	*ENA Conference Award Winner* – 2019
INSTITUTE:	**Inova Fairfax Hospital**
AUTHORS:	Kara Bauman, MN, RN, CEN, CPEN, TCRN
AFFILIATIONS :	Adult Emergency Department
DESIGN:	Single center, prospective, controlled, non-randomized trial
METHOD:	**12-month trial period** the ISDD was used for blood culture collection via **venipuncture** and **peripheral IV starts.**
RESULTS:	**82%** reduction in blood culture contamination. **(0.8 % v 4.4%)**
SUMMARY:	Reduced costs. Promoted antibiotic stewardship. **69%** of Steripath draws were via PIV starts.

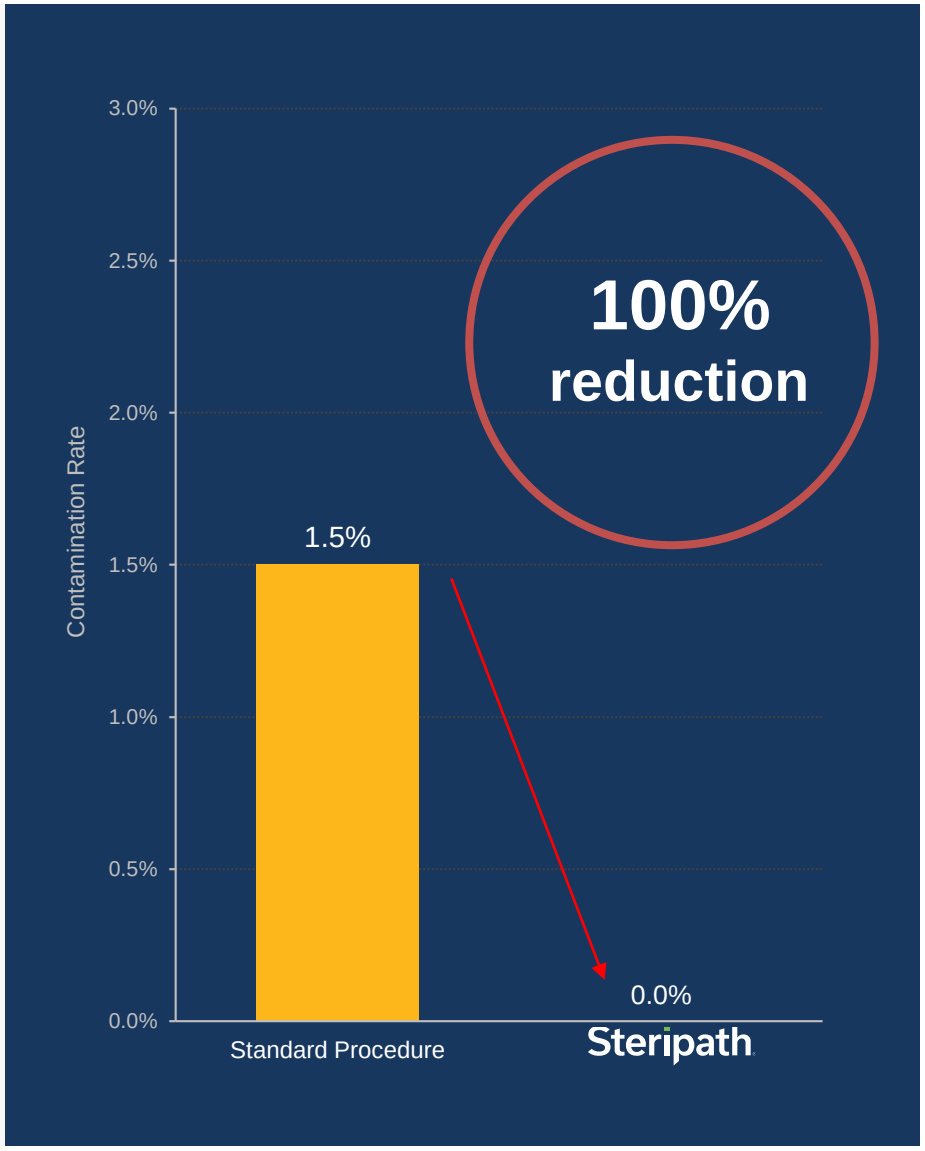


Stanford HEALTH CARE

Health Forum
An American Hospital Association Company

Presented Abstract

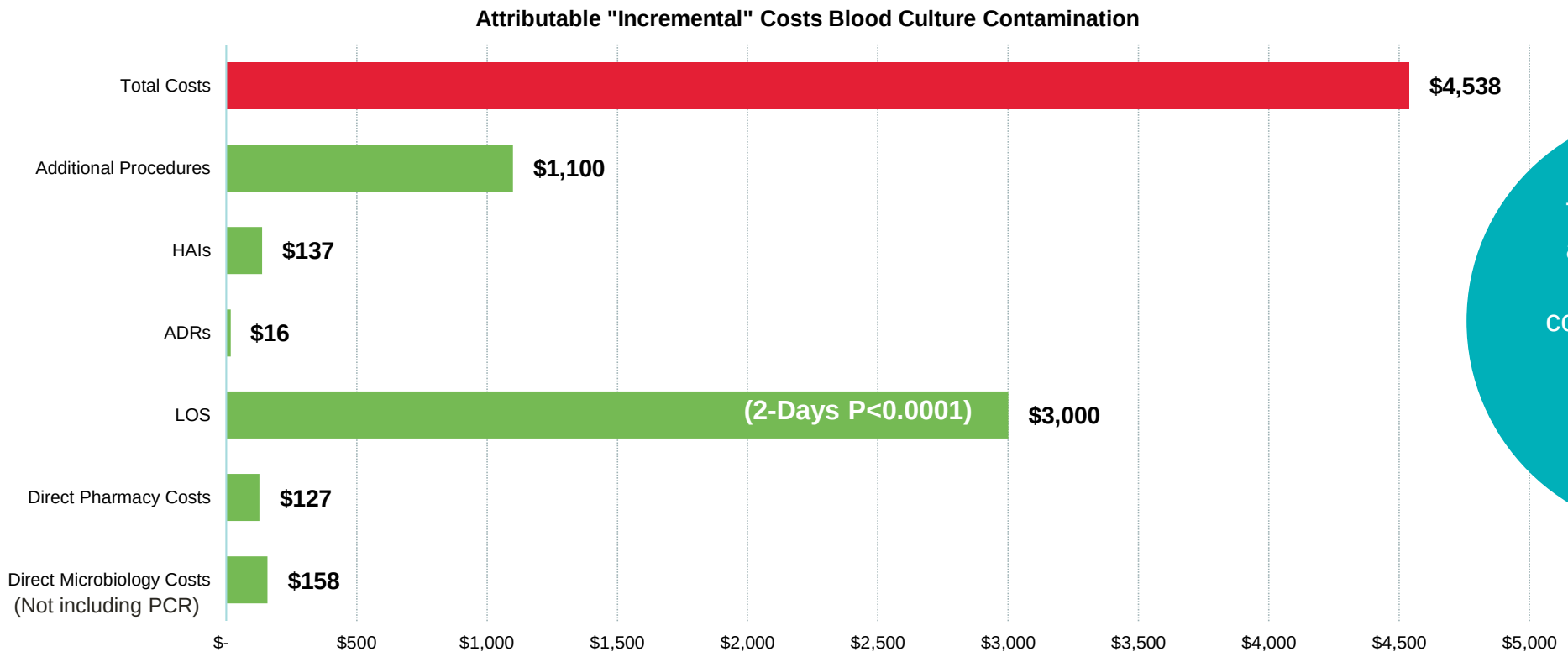
TITLE:	Hospital-wide Phlebotomy Elimination of Blood Culture Contamination Using Steripath Gen2 Initial Specimen Diversion Device (ISDD)
CONFERENCE:	*AHA Health Forum Educational Webinar* – 2019 Pending submission for publication
INSTITUTE:	**Stanford Health Care**
AUTHORS:	Lucy Tompkins, MD, PhD et al
DESIGN:	Single center, prospective, controlled study
METHOD:	Blood cultures were obtained **hospital-wide** by **Phlebotomy team** using the Steripath Gen2 Initial Specimen Diversion Device compared to standard method.
RESULTS:	**0.0%** (ISDD – 0/4,462) **v 1.5%** (standard procedure - 35/2,456)
SUMMARY:	Up to **88%** user-compliance. Prevent up to **103** patients from exposure to risks of false positives **ZERO false positive CLABSIs** when Steripath was used.



Peer Reviewed Publication

Steripath ISDD® Clinical and Economic Impact Study

J. Clin. Micro – Jan. 2019



Total incremental attributable costs per blood culture contamination event

=

$4,538

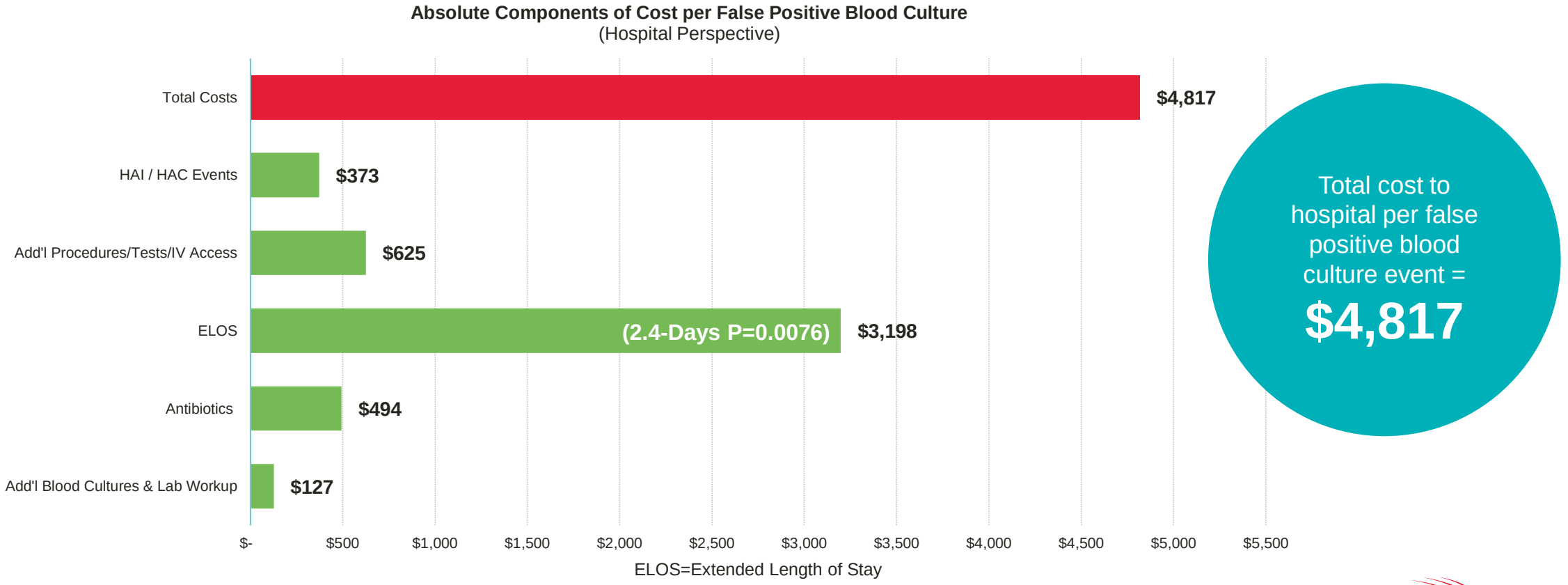
LOS=Length of Stay; ADR=Adverse Drug Reaction; HAI=Hospital Acquired Infection

[1]Skoglund, E., et al (2018). "Estimated Clinical and Economic Impact Through Use of a Novel Blood Collection Device [Steripath} to Reduce Blood Culture Contamination in the Emergency Department: A Cost-Benefit Analysis." J Clin Microbiol.

Peer Reviewed Publication

Impact of Hospital-Based Interventions [Phlebotomy & Steripath® ISDD®] Targeting False-Positive Blood Cultures on Economic and Clinical Outcomes

Journal of Hospital Infection - 2019 (March)

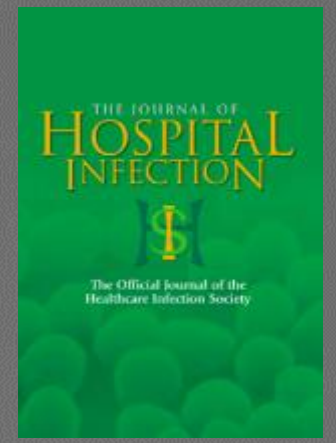


Total cost to hospital per false positive blood culture event =

$4,817

Peer Reviewed Publication

MASSACHUSETTS GENERAL HOSPITAL | HARVARD MEDICAL SCHOOL | WING TECH INC.



“(The use of ISDD) would **save the typical 250- to 400-bed hospital $1.9M** or **$186 per blood culture**, and **prevent 34 HACs** (including **three *C. difficile* cases**)”[1]

– Journal of Hospital Infection - 2019 (March)

Major Academic Institutions:

Blood Culture Contamination Cost Studies (2019)

Study Institution/Researcher	Study	Incremental Hospital Costs per Blood Culture Contamination Event
UNIVERSITY of HOUSTON	**University of Houston** Steripath ISDD Cost-Benefit Study (*J. Clin Micro* - 2019)[1]	**$4,739**
MASSACHUSETTS GENERAL HOSPITAL HARVARD MEDICAL SCHOOL WING TECH INC.	**Mass General/Harvard Medical School/WingTech Inc.** Impact of Hospital-Based Interventions [Phlebotomy compared to Steripath ISDD] Targeting False Positive Blood cultures (*Journal of Hospital Infection* – 2019)[2]	**$4,817**
University of Nebraska Medical Center	**University of Nebraska Medical Center**.* Retrospective ISDD Cost Effectiveness Study[3] (*Submitted for publication*)[3]	**$3,409**
	Average Cost Per False Positive Event	**$4,321**

*Pending publication

[1]Skoglund, E., et al (2019). "Estimated Clinical and Economic Impact Through Use of a Novel Blood Collection Device [Steripath} to Reduce Blood Culture Contamination in the Emergency Department: A Cost-Benefit Analysis." *J Clin Microbiol*.

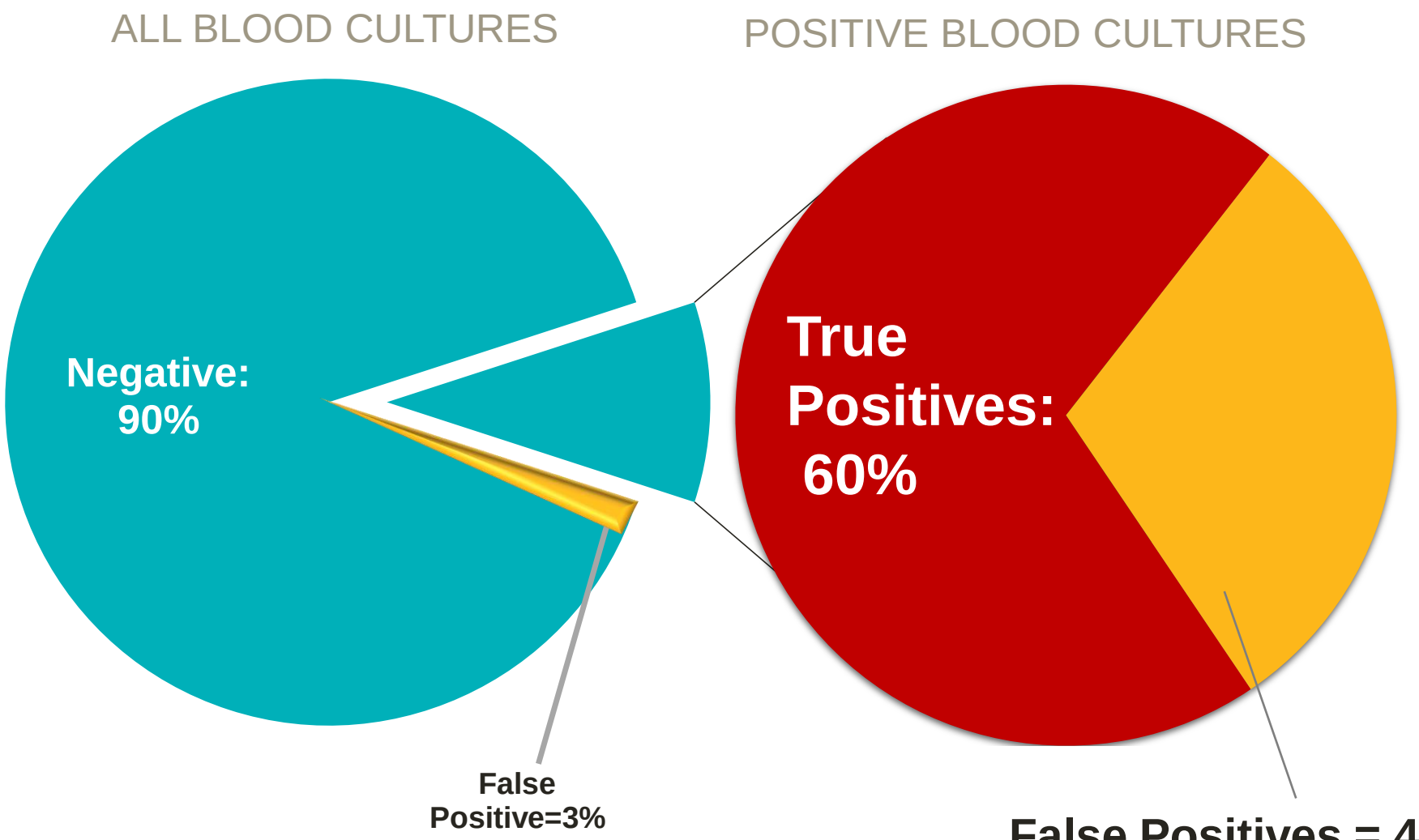
[2]Geisler, B., et al. "Impact of Hospital-Based Interventions [Phlebotomy & Steripath® ISDD®] Targeting False-Positive Blood Cultures on Economic and Clinical Outcomes." *Journal of Hospital Infection* (2019) March

[3]Retrospective Study Data

Peer-Reviewed Published Studies & Clinical Study Poster Presentations

#	Institution *Publication/Conference*	Study Period (months)	*Starting* BCC Rate (%)	ISDD BCC Rate (%)	BCC Reduction (%)	Cost Savings (Annualized)
1	University of Nebraska Medical Center *Clinical Infectious Diseases, July 2017*	12	*2.6%*	**0.2%** (P=0.001)	**92%**	$1,800,000
2	Lee Health System (4 sites) *Journal of Emergency Nursing, Nov. 2018*	7	*3.5%*	**0.6%** (P=0.0001)	**83%**	$1,100,000
3	Brooke Army Medical Center *DOD Healthcare Quality Safety Award, 2016*	5	*7.7%*	**0.6%**	**92%**	$564,000
4	Brooke Army Medical Center *SHEA, 2017*	14	***37% reduction in vancomycin DOT*** *(P=0.007)*			
5	Medical University of South Carolina *Institute for Healthcare Improvement, 2016*	8	*4.2%*	**0.6%**	**86%**	NR
6	Rush University Medical Center *IDSA – IDWeek, 2017*	3	*4.3%*	**0.6%**	**86%**	NR
7	Medical University of South Carolina *Institute for Healthcare Improvement, 2017*	20	*4.6%*	**0.9%**	**80%**	$447,000
8	Inova Fairfax Hospital *ENA, 2019 (Awarded Best Evidence-Based Project)*	12	*4.4%*	**0.8%**	**82%**	$932,000
9	Beebe Healthcare *ASM, 2018*	4	*3.0%*	**0.8%**	**75%**	NR
10	VA Houston *ENA, 2018*	7	*5.5%*	**0.9%** (P=0.01)	**83%**	NR
11	Shaare Zedek Medical Center *American Journal of Infection Control, March 2019*	6	*5.2%*	**1.0%** (P=0.008)	**81%**	NR
12	University of Houston *J. Clin. Micro, January 2019*	ISDD can save the hospital **$4,739 per false positive** blood culture event				
13	Mass General / Harvard / WingTech *Journal of Hospital Infection, March 2019*	ISDD can save the hospital **$4,817 per false positive** blood culture event and **$1.9M annually** and **prevent 34 HACs including 3 C.*diff***				

Your Contamination Rate:
What Should You Target?

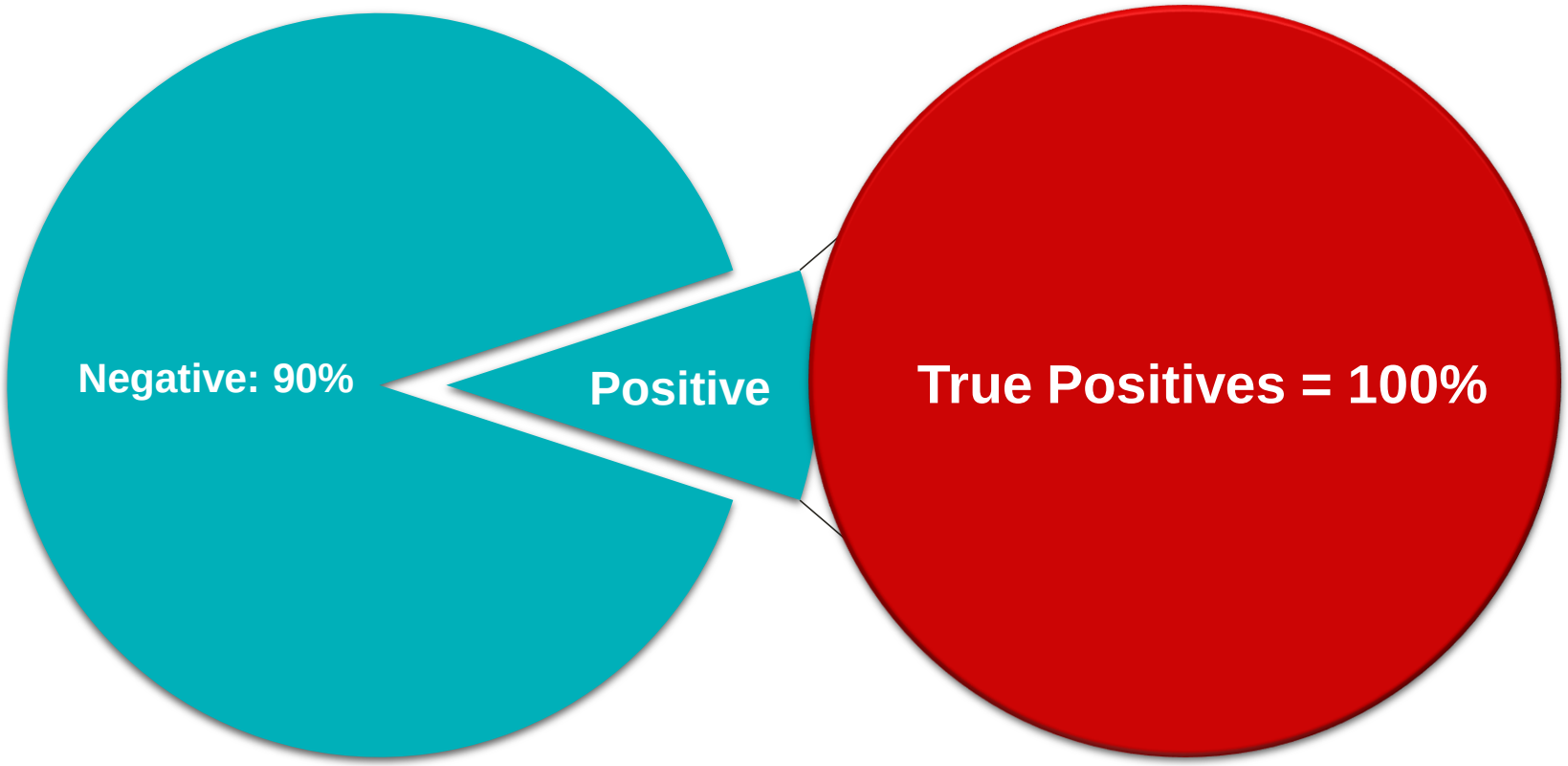


Your Contamination Rate:

What Should You Target?

ALL BLOOD CULTURES

POSITIVE BLOOD CULTURES



- Personal Productivity
- Departmental Efficiency
- Effective Antibiotic Stewardship

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Thank You!