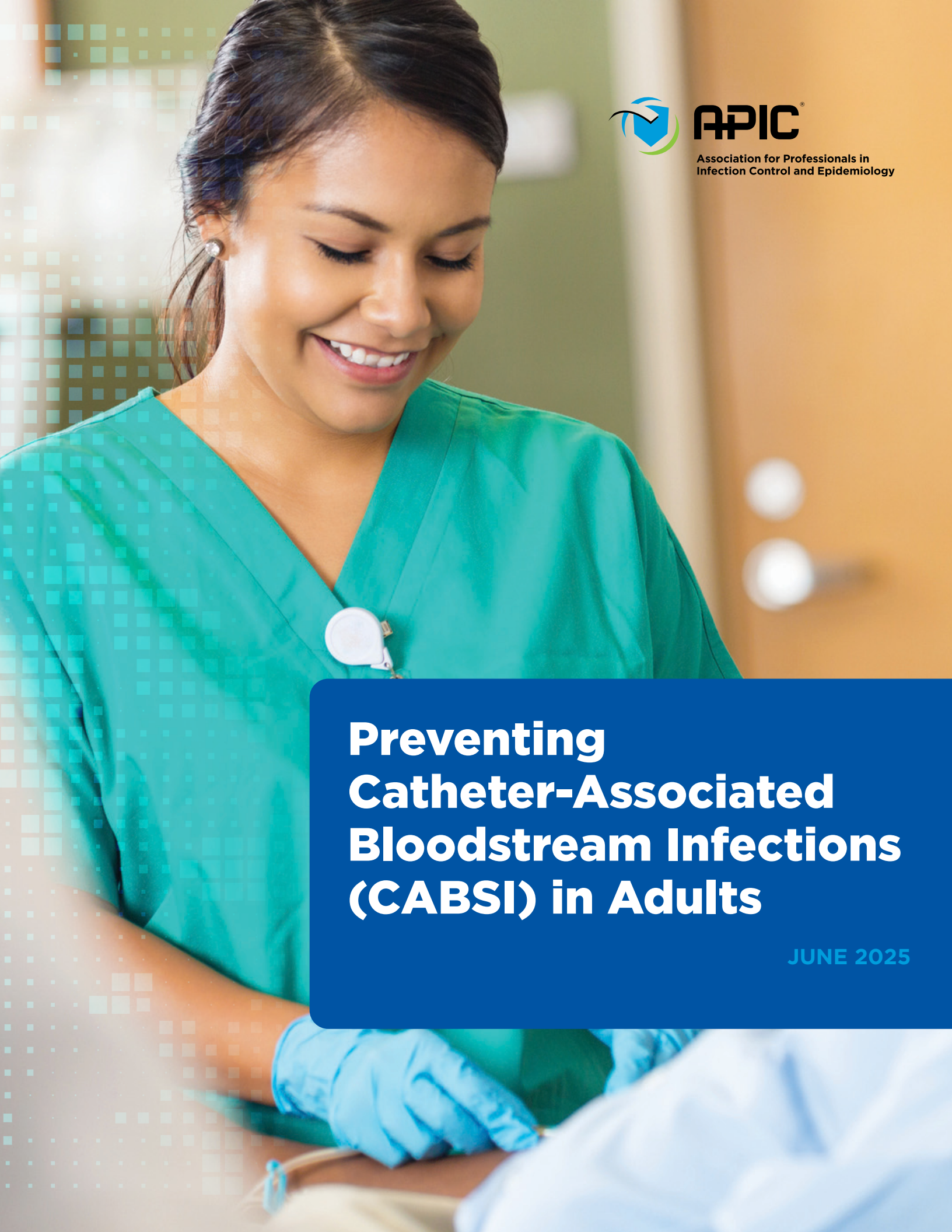

APIC
Association for Professionals in Infection Control and Epidemiology

Preventing Catheter-Associated Bloodstream Infections (CABSI) in Adults

JUNE 2025

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The Association for Professionals in Infection Control and Epidemiology (APIC) is the leading professional association for infection preventionists (IPs) with more than 15,000 members. Our mission is to advance the science and practice of infection prevention and control. APIC advances its mission through patient safety, education, implementation science, competencies and certification, advocacy, and data standardization. Visit us at **apic.org**.

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APIC Implementation Guides help infection preventionists apply current scientific knowledge and best practice to achieve targeted outcomes and enhance patient safety. This series reflects APIC's commitment to implement science and focus on the utilization of infection prevention research. Topic-specific information is presented in an easy-to-understand and use format that includes numerous examples and tools.

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Association for Professionals in Infection Control and Epidemiology

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Purpose of Guide

The purpose of this implementation guide is to provide information and tools to reduce the risk of infection due to catheter-associated bloodstream infections in various practice settings for adults. It condenses evidence-based guidelines into key elements needed to mitigate risks and implement performance improvement processes. The implementation guide includes recommendations intended to be achievable and to represent what are believed to be effective strategies to prevent healthcare-associated infections. These recommendations may guide the development of policies, procedures, and protocols for promoting performance improvement in various practice settings.

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Table of Contents

Glossary of Acronyms 5
Glossary of Terms 7
Checklist for Success 9

Overview of Catheter-Associated Bloodstream Infections 10
Introduction to the Implementation Guide 10
Background 11
Definitions 12
CABSI Definition Details 14
Sources of Bloodstream Infections 15
Risk Factors for CLABSI and CABSI 15
A Primer on Vascular Access Devices 17
Case Definitions 23
Key Regulatory and Accrediting Organizations 24
Practice Standards, Evidence-Based Guidelines, and Expert Consensus Documents 25

Core Components of a CABSI Prevention Program 28
Infrastructure 28
Key Participants 28
Risk Assessment 30
Equipment and Supplies 31
Education, Training, and Competency Assessment 34
Policies and Procedures 35

Best Practices for CABSI Prevention 38
Introduction 38
Essential Practices 38
Additional Practices 42

Monitoring a CABSI Prevention Program 45
Outcome Measures 45
Process Measures 46
Epidemiologic Questions to Investigate 51

Settings-Based Case Studies 53
Scenario 1: Community Hospital 53
Scenario 2: Academic Health Center 54
Scenario 3: Critical Access Hospital 54

Samples of Associated Tools 55

SBAR Communication Tools 58
SBAR: Specimen Diversion Impact on Bloodstream Infection 59
SBAR: Number of Vascular Access Devices 63
SBAR: Anatomical Site Selection of Non-Central Venous Access Devices for Prevention of Bloodstream Infections 66

Glossary of Acronyms

Term	Explanation
ACF	Antecubital fossa
ACHC	Accreditation Commission for Healthcare
AI	Artificial intelligence
ANTT®	Aseptic non touch technique
APIC	Association for Professionals in Infection Control and Epidemiology
AVA	Association for Vascular Access
BSIs	Bloodstream infections
CABSI	Catheter-associated bloodstream infection
CAD	Cumulative attributable difference
CAJ	Cavo-atrial junction
CDC	Centers for Disease Control and Prevention
CHG	Chlorohexidine gluconate
CICC	Centrally inserted central venous catheter
CLABSI	Central line-associated bloodstream infection
CMS	Centers for Medicare and Medicaid Services
CRBSI	Catheter-related bloodstream infection
CRPI	APIC's Center for Research, Practice and Innovation
CUSP	Comprehensive Unit-Based Safety Program
CVAD	Central venous access device
DIVA	Difficult intravenous access
DNV	Det Norske Veritas
EBG	Evidence-based guideline
EMR	Electronic medical record
FICC	Femorally inserted central catheter
HAI	Healthcare-associated infection
HCP	Healthcare personnel
HD	Hemodialysis

Term	Explanation
HERO	Hemodialysis reliable dialysis outflow catheter
HHS	Department of Health and Human Services
HOB	Hospital-onset bacteremia and fungemia
IABP	Intra-aortic balloon pump
ICUs	Intensive care units
IDSA	Infectious Disease Society of America
INS	Infusion Nurses Society
IPC	Infection prevention and control
IPs	Infection preventionists
IT	Information technology
IV	Intravenous
IVC	Inferior vena cava
LTACHs	Long-term care acute hospitals
NHSN	National Healthcare Safety Network
NQF	National Quality Forum
NT	Non-tunneled catheter
PICC	Peripherally inserted central catheter
PIVCs	Peripheral intravenous catheters
SBAR	Situation, background, assessment and recommendation
SC	Subclavian
SUR	Standardized utilization ratio
SVC	Superior vena cava
T	Tunneled catheter
TAP	Targeted assessment for prevention
TIVAD	Totally implantable venous access device (implanted port)
TJC	The Joint Commission
TPN/PPN	Parenteral nutrition (inclusive of total and peripheral parenteral nutrition)
VAD	Vascular access device
VBP	Value-based purchasing

Glossary of Terms

Term	Explanation
Add-on device	An additional component that is added to an administration set or vascular access device (e.g., needleless connector)
Administration set	A tubing set used to deliver infusions
Aseptic Technique	A set of actions intended to prevent infection during invasive clinical procedures
Catheter hub/hub	Catheter access point (e.g., end of catheter tube, needleless connector)
CLIP	The CDC's NHSN defined process for monitoring adherence to central venous access device insertion practices
Contamination	Introduction or transfer of a pathogen or infectious substance from one source to another
Continuous administration set	A primary or secondary administration set that remains connected for the duration of the infusion
Competency	A required level of effective performance in knowledge and skill for patient care
Extraluminal contamination	May introduce a pathogen during any action outside the vascular access device
Extravasation	A vesicant or medication leaks into the surrounding tissue near the vascular access device
Guidewire	A long and flexible coiled wire used to facilitate catheter placement
Infiltration	Intravenous solution or medication leaks into the surrounding tissue near the vascular access device
Infusate	Infusion of solution or medication given intravenously
Implanted port	A catheter inserted in a vein placed under the skin
Intermittent administration set	A primary or secondary administration set that has been disconnected from the point of access
Intraluminal source	May introduce a pathogen inside the vascular access device
Just in case PIVC	PIVCs inserted without anticipated clinical indication, but maintained "just in case" of need
Lumen	The interior space or channel within a catheter
Modified Seldinger insertion technique	Use of a guidewire or dilator for ease of catheter insertion

Term	Explanation
Needleless connector	A device designed to reduce needlesticks that provides access to a vascular catheter without the use of a needle
Occlusion	Obstruction of lumen which prevents the ability to infuse solutions or obtain blood return, may be partial or complete
Seldinger insertion technique	Use of a guide wire for insertion
Thrombosis	The development and formation of a blood clot within the vascular system
Tip termination	The location of a catheter's end or tip within the body
VAD de-escalation	Improving vascular access catheter selection based on the clinical needs of a patient while reducing infection risk
Vesicant	A solution or medication that can cause damage to the surrounding tissue if it leaks from the vascular access device

Checklist for Success

Sections 1-4 will assist infection preventionists in navigating the process to implement catheter-associated bloodstream infection prevention efforts, outlining high-level learning objectives. The Checklist to Success offers a framework to help organize the content within this implementation guide and to orient infection preventionists to the learning outcomes in the respective sections.

Checklist for Success	
Section 1	☐ Explain the key differences between HOB, CABSI, and CLABSI
	☐ Explain the concepts related to CABSI and sources of BSIs
	☐ Describe the key modifiable risk factors associated with CABSI and non-modifiable risk factors associated with CLABSI
	☐ Recognize the relationship between vascular access devices and the associated infection risks
	☐ Summarize the key differences between practice standards, evidence-based guidelines, and expert consensus documents
Section 2	☐ Discuss the fundamental components of an infection prevention program for performance improvement initiatives
	☐ Recognize the relevant program components to evaluate potential risks and identify opportunities for the facility
Section 3	☐ Summarize the current state of best practices for CABSI prevention to inform facility practice
	☐ Summarize the current state of additional practices for CABSI prevention to advance facility practice
	☐ Describe the epidemiologic questions to identify potential root cause(s) of CABSI(s)
Section 4	☐ Identify and interpret outcome and process metrics to monitor and track compliance for CABSI prevention efforts
	☐ Identify and interpret outcome and process measures to track compliance for CABSI prevention efforts

Overview of Catheter-Associated Bloodstream Infections

Introduction to the Implementation Guide

The purpose of this guide is to provide a framework that infection preventionists (IPs) can leverage to reduce the risk of bloodstream infections (BSIs) associated with a vascular access device (VAD). The content throughout this guide is informed by a combination of standards, evidence-based guidelines (EBGs), and expert opinion and aims to shift the current surveillance scope from only central line-associated bloodstream infections (CLABSIs) to all catheter-associated bloodstream infections (CABSIs). Hospital-onset bacteremia and fungemia (HOB) will also be introduced as it applies to CABSI.

The following topics are addressed in this guide:

- Overview of CABSI
- Core components of a CABSI Prevention Program
- Best Practices for CABSI Prevention
- Monitoring a CABSI Prevention Program
- Settings-Based Case Studies
- Sample of Associated Tools
- SBAR Communication Tools

Although this guide addresses mostly CABSI, it is important to note BSIs associated with the following devices are **excluded**:

- Extracorporeal membrane oxygenation (ECMO)
- Intra-aortic balloon pump (IABP)
- Arteriovenous graft/fistula
- Ventricular assist device
- Hemodialysis reliable dialysis outflow (HERO) catheter
- Peritoneal dialysis catheter
- Intra-osseous catheter

Checklist for Success

- ☐ Explain the key differences between HOB, CABSI, and CLABSI
- ☐ Explain the concepts related to CABSI and sources of BSIs
- ☐ Describe the key modifiable risk factors associated with CABSI and non-modifiable risk factors associated with CLABSI
- ☐ Recognize the relationship between vascular access devices and the associated infection risks
- ☐ Summarize the key differences between practice standards, evidence-based guidelines, and expert consensus documents

Additionally, this guide will not specifically address catheter-related bloodstream infections (CRBSIs) as this term refers to the diagnostic criteria used to confirm the catheter as the primary source of BSIs. While this guide will have broad applications across most healthcare settings and for most patient populations, key differences may be present in specific settings. As such, this guide excludes neonatal and pediatric patient populations due to the specialized considerations for these patients. While much of this guidance may be applied to the pediatric population, this document is specifically focused on adults.

Background

BSI surveillance formally began in the 1970s when the Centers for Disease Control and Prevention (CDC) began collecting CLABSI data in intensive care units (ICUs) in hospitals. Surveillance and prevention efforts continued, including large initiatives such as the Michigan-based Comprehensive Unit-Based Safety Program (CUSP) collaborative, leading to an estimated 34-55.2% reduction in ICU CLABSIs from 2001 to 2009.[1,2]

This spurred the Department of Health and Human Services (HHS) to issue the National Action Plan to Prevent Healthcare-Associated Infections (HAI) in 2009, establishing a five-year plan to reduce CLABSIs by 50% in the United States from 2009 to 2013. Soon after, Congress introduced the National HAI Action Plan into value-based purchasing (VBP), creating a strong financial incentive to focus on CLABSI prevention. ICU CLABSI data began being reported to the Centers for Medicare and Medicaid Services (CMS) Inpatient Quality Reporting Program in 2011.

The focus on CLABSI prevention placed an emphasis on central venous access devices (CVADs), resulting in some healthcare facilities using peripheral intravenous catheters (PIVCs) when CVADs were indicated to avoid reporting CLABSIs and being subjected to VBP penalties. Such practices prompted the CDC and CMS to release a joint statement urging facilities not to implement inappropriate practices to avoid reporting infections. Avoiding the use of CVADs despite clinical need can lead to patient harm and does not eliminate the risk of developing a BSI.

Organizations have published standards of practice, such as the *Infusion Therapy Standards of Practice 9th Edition* published by the Infusion Nurses Society (INS), and EBGs, such as the *Standards of Care for Peripheral Intravenous Catheters (PIVC): Evidence based Expert Consensus* published by the Association for Vascular Access (AVA), that address practices beyond that of CVADs. The Association for Professionals in Infection Control and Epidemiology (APIC) is responding to this evolution by updating the 2015 *Guide to Preventing Central Line Associated Bloodstream Infections*, to focus on all CABSIs. This expansion serves as an important step to shift the IP's focus from CVADs to all VADs, and eventually HOB.

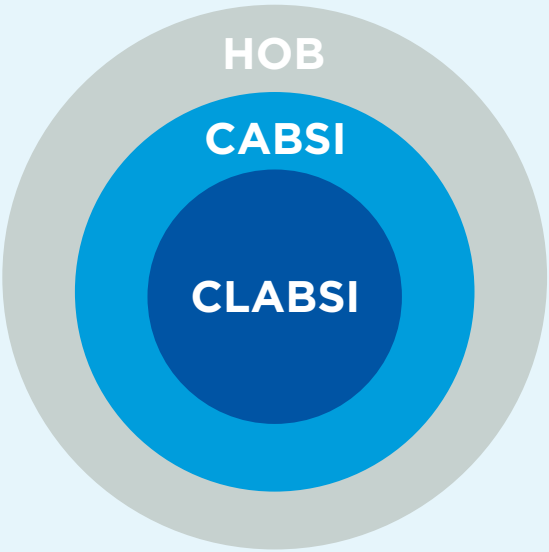
While this guide will not address HOB in detail, it is important to acknowledge the intended future of BSI surveillance. CABSI is a subset of HOB, but other sources may likely contribute to BSIs, and those sources contribute to the burden of infections that can be prevented. The National Quality Forum (NQF), in conjunction with multidisciplinary key participants, published the *Hospital-Onset Bacteremia and Fungemia Playbook* in 2024 intended to help healthcare organizations build their infection prevention programs to include HOB surveillance and prevention.[3] The intention is to update this guide to focus on HOB as surveillance continues to expand.

Definitions

HOB, CABSI, and CLABSI are surveillance definitions with varying scopes of criteria. It is important to remember that these terms are not clinical definitions and are utilized for surveillance purposes. The nested infographic illustrates the broadening scope to identify BSIs within the healthcare facility; however, it does not visually represent accurate proportions of BSI incidence.

The most narrowly defined term, CLABSI, refers specifically to BSIs associated with a CVAD. In contrast, CABSI includes infections associated with all types of VADs. The broadest surveillance category is HOB, which captures all hospital-onset BSIs, regardless of any device association. The table below further defines these terms and discusses reporting requirements and possible attributable sources.

Relationship of Definitions for HOB, CABSI, and CLABSI



Comparison of HOB, CABSI, and CLABSI by Definition, CMS Reporting Requirement, and Attributable Sources

TYPE OF BSI	DEFINITION	CMS REPORTING REQUIREMENT	ATTRIBUTABLE SOURCES

HOB	**NHSN definition:** Bacterial or fungal pathogen identified from a blood culture on hospital day four or greater[5]	No - Under development	• VADs
			• All primary sources, regardless of causative organism or association with medical devices. Examples include:
			  • Urinary sources
			  • Respiratory/ pneumonia
			  • Surgical site infections
			  • Skin and soft tissue infections

CABSI	**Suggested definition:** Laboratory confirmed BSI in a patient who has had any VAD in place at the time of, or the day before, the onset of the infection, and the infection is not related to an infection at another site. The original catheter or a series of one or more VADs must be in place for greater than 2 calendar days[4] *Note: See details below for more information*	No - Not unless associated with CVADs (i.e., CLABSI)	All VADs
CLABSI	**NHSN definition:** Laboratory confirmed BSI in a patient who had a CVAD in place at the time of, or the day before, the onset of the infection, and the infection is not related to an infection at another site. The original catheter or a series of one or more CVADs must be in place for greater than 2 calendar days[4]	Yes - Adult, Pediatric, and Neonatal ICUs; Adult and Pediatric Medical/Surgical wards	CVADs

CABSI Definition Details

There is not a standardized case definition for CABSI at the time of this document's creation. As such, the above suggested definition is extrapolated from the National Healthcare Safety Network (NHSN) CLABSI definition. Establishing a standardized CABSI definition poses challenges. For example, a framework to attribute a BSI to a specific VAD when multiple concurrent VADs exist is needed to better identify possible root cause(s). A CABSI definition will likely evolve over time as surveillance efforts continue to develop. Healthcare facilities considering expanding the scope of BSI surveillance to include all VADs (i.e., CABSI) should select a measurement methodology and utilize it consistently. It is important to remember that the numerator includes only those patients who meet the established case definition, whereas the denominator includes all patients who could meet the case definition (i.e., at-risk population). IPs can consider the following when determining how to best measure CABSI in their facility in the absence of a standardized case definition:

— Determining whether PIVCs should be measured as a group or stratified individually (i.e., all PIVCs versus short PIVC, long PIVC, midline).

  - Separating VAD types into categories allows for more precise monitoring, yet it becomes complicated when a patient has multiple VADs.

— Determining attribution of VAD denominator days in patients with more than one VAD and/or more than one VAD type (e.g., patients with a CVAD and a PIVC). NHSN's current CVAD denominator day definition counts one denominator day per patient, regardless of the number of CVADs a patient has in place on a given day. Examples for consideration include, but are not limited to:

  - Counting the denominator day of the VAD type with the highest risk of infection only (e.g., if a patient has a CVAD and two PIVCs, this will count as 1 CVAD denominator day only).
  - Counting one denominator day for each VAD type but not each VAD within that type (e.g., if a patient has a CVAD and two PIVCs, this will count as 1 CVAD denominator day and 1 PIVC denominator day).
  - Counting one denominator day for each VAD (e.g., if a patient has a CVAD and two PIVCs, this will count as 1 CVAD denominator day and 2 PIVC denominator days).
  - Extrapolating PIVC denominator days by conducting a point prevalence survey and multiplying it by patient days.

— Determining attribution of VAD to BSI in patients with more than one VAD and/or more than one VAD type (e.g., patients with a CVAD and a PIVC).

  - Attribution of BSI to the VAD with the highest risk of infection (e.g., if a patient had a CVAD and PIVCs, the BSI will be attributed to the CVAD).
  - Attribution of BSI to the VAD with clinical signs of infection (e.g., if a patient has two PIVCs and one has redness around the insertion site and the other PIVC has no signs of infection, the BSI will be attributed to the PIVC with the redness at the insertion site).

Sources of Bloodstream Infections

BSIs can develop from several sources which may include, but are not limited to, the respiratory tract, intraabdominal abscess, urinary tract infection, post-operative surgical wounds, or VADs. VAD-associated BSIs can arise from intraluminal or extraluminal introduction of an organism. Intraluminal sources include any action that may introduce a pathogen inside the VAD (e.g., starting a new IV therapy without adequate needleless connector/hub hygiene prior to accessing). Extraluminal sources include any action that may introduce a pathogen outside the VAD catheter (e.g., not maintaining a clean, dry, intact dressing over the VAD insertion site). BSIs are categorized as primary or secondary for surveillance purposes. A BSI is considered primary when it is not associated with an infection at another body site. A secondary BSI is seeded from an infection at another body site.[4]

Risk Factors for CLABSI and CABSI

Risk factors for CLABSI and CABSI are most often discussed as modifiable and non-modifiable. Two recent systematic reviews identified risk factors increasing the probability of CLABSI. LaFuente et al (2023), published a systematic review/meta-analysis that identified the following factors as increasing the probability of CLABSI: total parenteral nutrition (TPN), multilumen devices, chemotherapy treatment, immunosuppression, and duration of catheter use.[6] Alsharhani et al. (2023) described similar risk factors in a systematic review, including duration of catheter use and hematologic malignancies but also added surgical complexity and length of intensive care unit stay.[7]

Infection Control and Hospital Epidemiology (ICHE) published a compendium, *Strategies to Prevent Central Line Associated Bloodstream Infections in Acute-care Hospitals: 2022 Update*, in which Buetti et al. reported independent risk factors for CLABSI as identified in at least two published studies.[8] Non-modifiable risk factors associated with CLABSI are listed in the table immediately below. There is insufficient literature available at the time this document is released to adequately assess non-modifiable risk factors associated with PIVC. More literature is available regarding modifiable risk factors associated with both CVAD and PIVC, as detailed in the subsequent table.

Non-Modifiable Risk Factors Associated with CLABSI

NON-MODIFIABLE RISK FACTORS
Immunocompromised status[6,8]
Chemotherapy treatment[6]
Parenteral nutrition (PPN/TPN)[6,7,8]
Poor skin integrity[9]
Prolonged hospitalization prior to catheterization[7,8]
Kidney disease[6] *Note: Kidney disease was independently related to CRBSI in three studies but did not show a positive association with CLABSI risk in a meta-analysis that included those studies.*
Body mass index greater than 40[8]
Hematological malignancies[7]
Surgical complexity[7]
Length of ICU stay[7]
Neutropenia[7]

Modifiable Risk Factors Associated with CABSI

MODIFIABLE FACTOR	LOWER RISK	HIGHER RISK
Insertion circumstances[8,9,10]	Elective/Planned	Emergency
Skill of inserter[10]	Specialized	General
Insertion site[9,10]	Location with appropriate space to maintain intact dressing and most appropriate insertion site based on vascular assessment	-
Skin antisepsis[8,9,10]	2% chlorhexidine with 70% alcohol	70% alcohol, 10% povidone-iodine in aqueous solution or in alcohol
Catheter lumens[6,7,8,9,10]	Single lumen	Multiple lumens
Multiple catheters[8,9,10]	Inserting only clinically indicated VADs	Inserting/maintaining VADs "just in case"
Catheter dwell time[6,7,8,9,10]	Shorter dwell time*	Longer dwell time*
Dressing integrity[8,9,10]	Maintaining clean, dry, intact for 7 days	Increased/unnecessary dressing disruptions
Catheter type[9,10]	Use of antimicrobial-impregnated catheters in select patient populations	-
Catheter add-on devices and administration sets[8,9,10]	Use of less add-on devices Changing administration sets at appropriate intervals	Using more add-on devices than necessary. Non-compliance with changing administration sets according to policy.
Reduced nurse to patient ratio[8] *Note: evidence currently available for CLABSI only*	Higher nurse to patient ratio	Lower nurse to patient ratio

**Note: Catheter dwell time should be based on clinical indication; routine catheter replacement is not recommended.*

A Primer on Vascular Access Devices

VADs play a significant role in contemporary medicine. VADs serve as an essential medical tool allowing healthcare clinicians access to their patient's bloodstream, facilitating administration of intravenous (IV) medications, fluids, blood products, and nutrition. Technological advancements have driven the development of a varying array of VAD types to meet patient care needs. A VAD is selected based on patient-specific vascular access needs as well as ease of use, patient comfort, and risk of complications.

In optimal healthcare environments, the selection of the most appropriate VAD involves a collaborative decision-making process between the healthcare team and the patient. The process for VAD selection focuses on choosing the device that best provides the required access while minimizing vessel injury and depletion. This generally involves inserting the least invasive catheter into the largest diameter (healthy) vessel required to meet the vascular access needs. Other factors to consider include:

- Prescribed therapy or treatment regimen: the type of therapy, duration of therapy, and the specific requirements of the infusate are crucial in determining the appropriate VAD.
- Patient's clinical presentation: the patient's diagnosis, overall health, and specific clinical needs.
- Vascular health: the history of infusion therapy and vascular access, as well as the condition of the skin and vessels at potential insertion sites.
- Patient's age and comorbidities: age related factors and any existing comorbidities can influence the choice of VAD.
- Patient preference: the patient's preference for the type and location can influence the decision.
- Site selection: start at the most distally appropriate site and choose the site based on vessel health and preservation strategies, patient comfort, and the type of VAD. Refer to the *Infusion Therapy Standards of Practice 9th Edition* for more information on site selection, risks, and benefits.[10]
- Available vascular access resources: availability of trained staff and appropriate equipment and supplies.

The information below is a general overview. For a complete review of currently identified best practices, review other EBGs or practice standards such as the *Infusion Therapy Standards of Practice 9th Edition*.[10]

VADs are discussed in two primary categories within this implementation guide: PIVCs and CVADs. The figure on the following page provides an overview of the location and attributes of each VAD type. Nomenclature for vascular access devices is variable depending on setting or country, thus additional information is available in this article.

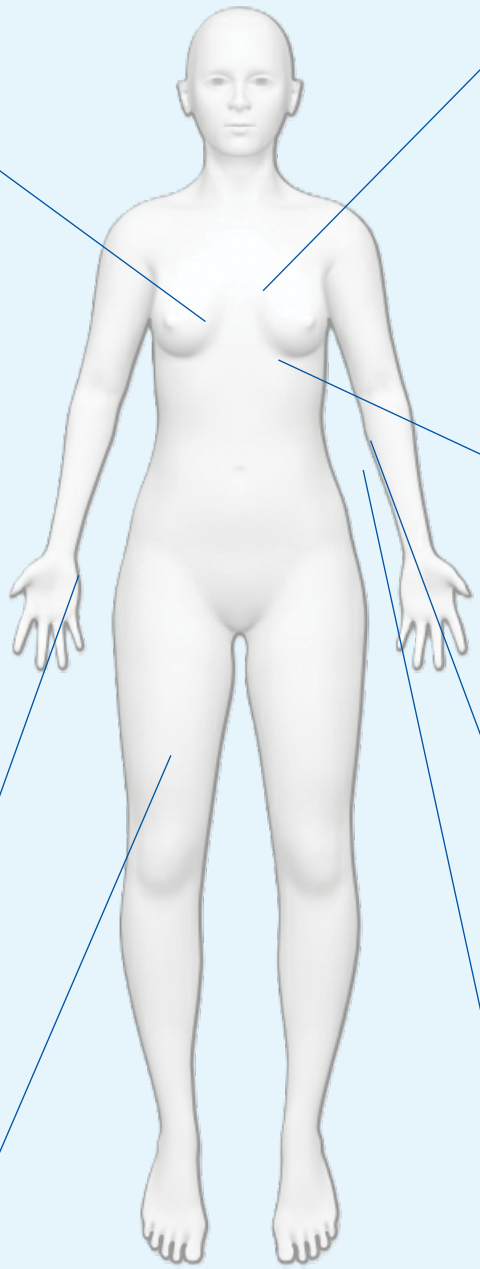
Overview of the Location and Attributes of PIVCs and CVADs

CICC (Non-Tunneled):
- Common insertion site: **Chest** (subclavian/ axillary vein)
- Tip ends at lower SVC/ cavo-atrial junction (CAJ)/upper right atrium
- CVAD, hemodialysis catheter (HD)
- Anticipated duration: < 7 days

CICC (Tunneled):
- Insertion site: **Chest** (internal jugular, subclavian, axillary)
- Tip ends at lower SVC/ CAJ/ upper right atrium
- Small Bore Tunneled Catheter, HD
- Anticipated duration > 14 days

Short/Long PIVC:
- Common insertion site: upper extremities, but can be placed in neck and lower extremities to meet outlying circumstances
- Anticipated duration: < 4 days

FICC: Femoral inserted central catheter
- Insertion Site: **Groin/ Mid-thigh** (femoral vein–tunneled or non-tunneled)
- Tip ends in the Inferior Vena Cava (IVC)
- Femoral CVAD; Mid-thigh PICC; HD
- Anticipated duration:
  - CVC < 7 day;
  - Mid-thigh PICC or Tunneled > 7 days



ICC (Non-Tunneled):
- Insertion site: **Neck** (internal jugular)
- Tip ends at lower SVC/CAJ
- CVAD, pulmonary arterial catheter, cordis, introducer, multi-lumen access, HD
- Anticipated duration: < 7 days

TIVAD (Implanted Port):
- Common insertion site: **Chest**
- Resides below skin
- Tip ends at lower SVC/CAJ/upper RA
- Anticipated duration >14 days

PICC: (Peripherally inserted central catheter)
- Insertion site: **Upper Arm** (above elbow)
- Tip ends at lower SVC/CAJ
- Anticipated duration: > 7 days

Midline:
- Insertion Site: **Upper Arm** (above elbow)
- Tip ends at the axillary region
- Anticipated duration: < 14 days

PIVCs are the shortest in length and the most common VAD used for short-term duration therapies. PIVCs are primarily inserted in the periphery by cannulating superficial and deep veins in all extremities, but most often in the hand and arm.

In adults, the use of lower extremity veins is typically avoided unless necessary due to emergent situations or when other sites are unavailable. PIVC selection aspects include, but are not limited to, indication and insertion site:

— Indication refers to therapy type, duration, patient age, history, comorbidities, and skin integrity.

— Insertion site is chosen at the most distally appropriate location while considering venous health, vessel preservation strategies, patient comfort, preference, and type of PIVC.

— Insertion of PIVCs should be avoided in areas of flexion, pain, compromised skin, hand (unless < 24-hour duration), antecubital fossa (due to high failure rates).

PIVCs include three categories:

— **Short PIVCs:** typically up to 2 inches (50 mm) in length, most appropriate for shorter duration, inserted distal to the antecubital fossa (ACF).

— **Long PIVCs:** typically ranging 2-5 inches (50-125 mm) in length, most appropriate for shorter duration but selected when there is limited access to superficial veins. Long PIVCs are commonly inserted in the forearm, ACF, or upper extremity with tip location distal to the axilla.

— **Midlines:** typically ranging 3-8 inches (8-12 cm) in length, most appropriate for therapies indicated between 1-4 weeks. A midline insertion is in a deep vein of the upper arm with tip location in the axilla.

The table below synthesizes the above information and compares the features of the different PIVC categories.

Comparison of Features by PIVC Types

FEATURE	SHORT PIVC	LONG PIVC	MIDLINE CATHETER
Anticipated duration of therapy	4 days or less	4 days or less	1-4 weeks
Preferred vein location	Upper extremity: forearm preferred in most adults chronic kidney disease patients may differ	Upper extremity: superficial or deep	Upper extremity: above ACF (superficial or deep)
Insertion Site	Distal to the ACF	Forearm, ACF, upper arm	Upper arm terminating in the axilla
Tip Location	Upper extremity: distal to axilla	Upper extremity: distal to axilla	Axilla
Insertion Complexity	Over-the-needle (catheter mounted over hollow needle)	Over-the-needle, Seldinger technique (use of a guide wire for insertion)	Seldinger or Modified Seldinger technique (use of a guidewire and may use dilator for easing catheter insertion)
Benefits	Most commonly placed VAD; easier to assess for infiltration, ability to administer vasopressors short-term if placing a CVAD delays life-saving treatment*	Able to access deeper veins (commonly used for ultrasound guided insertion)	Lab draws for longer term use and typically longer dwell times when compared to PIVCs
Risks *Note: for all PIVCs, risks include, but are not limited to, phlebitis, infiltration, infection, dislodgement, and occlusion.*	Risk of complications when used for labs due to clotting or irritation of the vein	Risk of complications when used for labs due to clotting or irritation of the vein; delayed recognition of infiltration/ extravasation	Typically, not used for continuous vesicants due to increased extravasation risk when compared to CVADs; delayed recognition of infiltration/ extravasation

*Note: The topic of PIVC administration of vesicants is complex and rapidly evolving. While there is a growing body of evidence to suggest there are opportunities to administer vesicants peripherally, it is inappropriate to globally recommend PIVC administration of vesicants specifically to avoid CVAD placement (i.e., CLABSI avoidance practices). It is recommended to collaborate with experts within your facility responsible for determining appropriate use of VADs and therapeutic routes of administration.[10]

CVADs are inserted at various locations of the body and must be long enough in length to ensure the catheter tip terminates in a central vein. It is important to note that vascular access specialists target tip termination in the distal third of the SVC or the upper third of the right atrium, whereas the NHSN definition of a CVAD includes tip termination in a great vessel (e.g., superior vena cava (SVC) or inferior vena cava (IVC)). This difference can create confusion when discussing CVAD details in healthcare facilities due to the differences in clinical application versus standardized surveillance definitions. CVADs are appropriate for patients requiring higher levels of vascular access care, such as cardiac monitoring, rapid fluid bolus, long-term access, vasoactive IV medications, chemotherapy, and/or total parental nutrition.

CVAD includes four categories for the purpose of this implementation guide:

- **Peripherally inserted central catheters (PICCs)**: PICCs insert into peripheral veins in the arm with the distal tip preferably ending in the cavo-atrial junction (CAJ). An advantage of PICCs is that they can be placed and removed in many different healthcare settings by a large variety of healthcare professionals.
- **Centrally inserted central catheters (CICCs):** CICCs include tunneled (T) and non-tunneled (NT) catheters and insert into the internal jugular or subclavian veins with the distal tip ending in the distal third of the SVC or upper third of the right atrium. An advantage of CICCs is the utility in critical care environments and in instances when a PICC is deemed inappropriate.
- **Femorally inserted central catheters (FICCs):** FICCs include femoral CVADs and mid-thigh PICCs and insert into the femoral vein with the distal tip ending in the IVC above the level of the diaphragm. An advantage of femoral CVADs is their use during emergencies, providing quick and easy access. Mid-thigh PICC insertions can be used for reliable access when other insertion sites are not feasible or have been exhausted.
- **Totally implantable venous access devices (TIVADs):** TIVADs are commonly inserted into the internal jugular, axillary, and subclavian veins with the distal tip ending in the distal third of the SVC. Advantages of TIVADs include their use for long-term therapies greater than 30 days and patient comfort.

CVAD selection should consider risks versus benefits, such as the medical necessity for venous access, patient presentation and history, insertion site (i.e., based on anatomy, vein appropriateness, anticipated access duration, prescribed therapy), catheter type and size, insertion and maintenance expertise, and risk of infections and other complications. The main risk of all CVAD types is infection and thrombosis, although the risk may vary with the insertion site. The table below provides an overview of CVAD features.[10], [11]

Comparison of Features by CVAD Types

FEATURE	PICC	CICC	FICC	TIVAD (IMPLANTED PORT)
Insertion Site	Peripheral veins (arm)	Central veins (neck/chest)	Femoral vein (groin)	Internal jugular / Subclavian vein
Anticipated Duration of Therapy	>7 days	< 14 days (NT) > 31 days (T)	< 7 days (groin) > 7 days (mid-thigh)	> 30 days
Catheter Tip Position	Distal 3rd SVC or upper 3rd of RA	Distal 3rd SVC or upper 3rd of RA	IVC, above the level of the diaphragm	Distal 3rd SVC or upper 3rd of RA
Indications	Long-term therapy	Short- to medium- term therapy (NT) or Long-term therapy (T)	Emergent or short-term therapy; alternative access sites	Long-term intermittent therapy
Benefits	Can be placed and removed in many different healthcare settings by a large variety of healthcare professions	Direct access, rapid flow	Quick access for emergencies in a large vessel that is typically available when other sites are unavailable	Greater acceptance and satisfaction among patients as they can freely engage in normal activities without access disruption and reduced infection risk
Risks	Deep vein thrombosis	T: Difficulty of insertion, traditionally requiring insertion in procedural setting; NT: Infection, pneumothorax	Deep vein thrombosis	Difficulty of insertion, traditionally requiring insertion in procedural setting, pneumothorax

Case Definitions

Clinical definitions, claims-based definitions, and surveillance definitions are intended for different purposes and should not be used interchangeably. IPs should be able to explain the differences between these types of definitions.

— **Clinical definitions:** These are intended to be used for clinical diagnosis and treatment purposes of CRBSI, which should be conducted by a physician or advanced practice provider (APP). As mentioned before, clinically diagnosed CRBSI is not addressed in this implementation guide.

— **Claims-based definitions:** Billing codes are used following an inpatient admission to collect data on healthcare-associated CLABSI incidence. These billing codes identify the patient's medical condition for the encounter to determine the appropriate reimbursement based on the services provided. Coding definitions do not utilize the same review process as surveillance definitions.

— **Surveillance definitions:** These are intended to define the incidence of a condition and are useful in the measurement and monitoring of performance improvement efforts.

- The NHSN provides standardized definitions and methodology for performing surveillance for CLABSIs through the Patient Safety Component. Facilities submitting to NHSN can obtain their unit-specific infection rates as well as standardized infection ratios (SIRs) that allow a facility to compare their actual number of infections to the expected number of infections for specific types of units and/or the facility. The system also allows the tracking and comparison of CVAD utilization. Published data summaries are available regardless of participation.

- As of 2011, with expansions in 2012 and 2015, CMS requires CLABSI surveillance reporting from long-term care acute hospitals (LTACHs) and acute care hospitals from all adult, pediatric, and neonatal intensive care units, as well as any other patient care locations meeting the NHSN definition for adult and pediatric medical, surgical and combined medical/surgical ward.

Key Regulatory and Accrediting Organizations

Key differences exist between regulatory and accrediting organizations. A regulatory organization sets mandatory rules and standards that must be followed by law, while an accrediting organization provides certification that a healthcare facility has met specific performance standards during a survey of the facility. Regulatory organizations can partner with accrediting organizations to provide "deemed status," meaning that the accrediting organization can determine during a survey that the healthcare facility meets or exceeds the requirements of the regulatory organization. The table below is not exhaustive but does include key organizations that provide guidance and standards regarding CLABSI and/or CABSI.

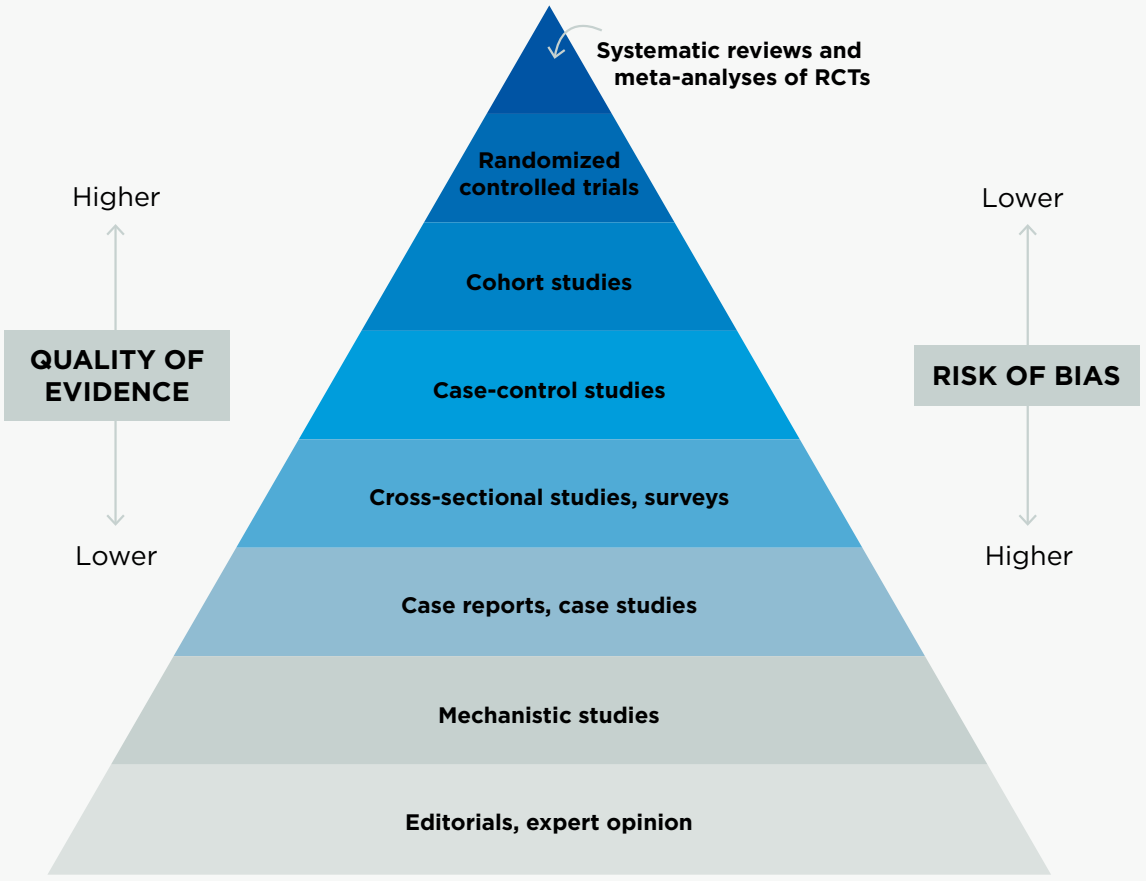
Regulatory and Accreditation Organization for CLABSI

TYPE OF ORGANIZATION	KEY ORGANIZATIONS REGARDING CLABSI PREVENTION	REGULATION OR STANDARD
Regulatory	CMS	Code of Federal Regulations (CFR) Part 482: Conditions of Participation for Hospitals: Section 482.42 Condition of Participation: Infection Prevention and Control and Antibiotic Stewardship Programs.
	State Health Department	State-specific rules apply.
Accreditation	The Joint Commission (TJC)	• TJC Standards, Infection Prevention and Control (IPC) Chapter *(available for purchase).* • National Patient Safety Goal 07.01.01 Reduce the risk of HAIs *Note: TJC standards and tools are specific to the care setting. There are other chapters to which IPC is cross-walked such as leadership and environment of care.*
	Det Norske Veritas (DNV)	DNV National Integrated Accreditation of Healthcare Organizations (NIAHO®) Accreditation Requirements, Interpretive Guidelines and Surveyor Guidance.
	Accreditation Commission for Healthcare (ACHC)	ACHC merged with Healthcare Facilities Accreditation Program (HFAP) in 2020. It provides standards as compliant, not compliant, or not applicable including infection prevention and antibiotic stewardship for hospitals, laboratories, and ambulatory surgery.

Practice Standards, Evidence-Based Guidelines, and Expert Consensus Documents

Practice standards and EBGs are considerations and recommendations for clinical practice informed by a thorough review and ranking of the best scientific evidence available at the time of publication. Practice standards are considered to be more prescriptive, outline the expectations of the profession, and are informed by EBGs. EBGs are developed through a process of rigorous literature review and evidence ranking and are often referenced in regulatory and accrediting documents. When a specific standard or guideline is not required by a regulatory or accrediting organization, a risk assessment can be used to determine which document is most appropriate. When there is a lack of evidence on a topic, an expert consensus document may exist to represent the collective opinions of experts in a topic area at the time. If a practice standard or EBG is not available or not feasible to implement, an expert consensus document can be utilized to help inform decision-making at the facility. Practice standards and EBGs rank each intervention based on the strength of evidence using the Hierarchy of Evidence. This hierarchy ranks the quality of evidence and the risk of bias of available information. The weakest quality of evidence and the highest risk of bias is located at the base of the triangle. The strongest quality of evidence and the lowest risk of bias is located at the peak of the triangle. Research should be reviewed critically to ensure quality, relevance, and generalizability to a specific clinical setting.

Hierarchy of Evidence



The table below highlights the primary documents used for the purpose of establishing recommendations throughout this implementation guide.

Resources for Practice Standards, EBGs, and Expert Consensus Document for CLABSI and/or CABSI		
ORGANIZATION	**KEY RESOURCE**	**TYPE OF RESOURCE**
INS	2024 Infusion Nurses Society: Infusion Therapy Standards of Practice, 9th edition.	Practice Standards (Including EBG and Expert Consensus)
SHEA **IDSA** **APIC**	Strategies to Prevent Central line-associated Bloodstream Infections in Acute-Care Hospitals: 2022 Update.	EBG and Expert Consensus
CDC	Guidelines for the Prevention of Intravascular Catheter-Related Infections, 2011.	EBG and Expert Consensus
IDSA	Clinical Practice Guidelines for the Diagnosis and Management of Intravascular Catheter-related Infection: 2009 Update by IDSA.	EBG and Expert Consensus
AVA	Association for Vascular Access (AVA) Standards of Care for Peripheral Intravenous Catheters: Evidence based expert consensus, September 18, 2024.	EBG and Expert Consensus

Supplemental Resources

» *APIC Text*, Chapter 4: Accrediting and Regulatory Agencies
» *APIC Text*, Chapter 11: Surveillance
» *APIC Text*, Chapter 35: Vascular Access Device-Associated Infections
» *IDSA*, Preventing Central Line-Associated Bloodstream Infections: A Position Paper by the International Society for Infectious Diseases (2024 Update)
» *WHO*, Guidelines for the Prevention of Bloodstream Infections and other Infections Associated with the Use of Intravascular Catheters: Part I: Peripheral Catheters

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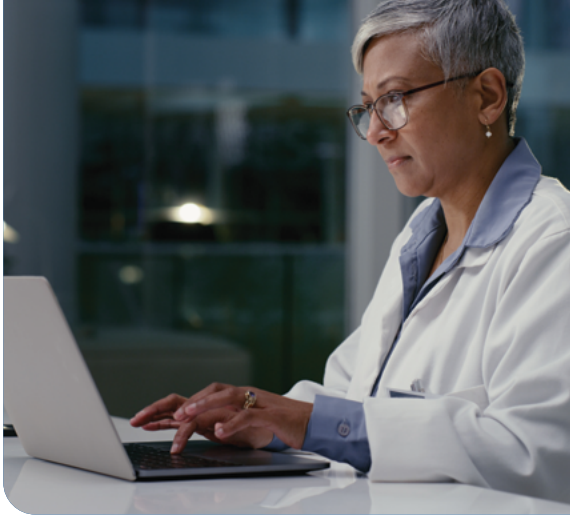
SECTION 2:

Core Components of a CABSI Prevention Program



Infrastructure

A CABSI prevention program is fundamental to facilitate process improvement efforts for CABSI reduction. CABSI prevention efforts should reflect the unique needs of the facility and patient population. A multidisciplinary team comprised of key participants should collaboratively conduct a risk assessment to determine the specific risks and priorities at their facility. After the risk assessment is completed, the multidisciplinary team should develop a plan to implement strategies aimed at preventing CABSI.

Key Participants

An effective CABSI prevention program requires a multidisciplinary team to incorporate varying perspectives and skill sets. A team leader should be appointed to coordinate activities and ensure the ongoing effectiveness of the CABSI prevention program. Team members should be selected based on their role, responsibility, and expertise. While key participants may vary between facilities, there are essential roles that every prevention program should include. The table below lists the recommended roles that a facility should include in a CABSI prevention program. However, this list is not exhaustive and additional roles should be identified as needed to adequately address the needs of the facility and the patient population served.

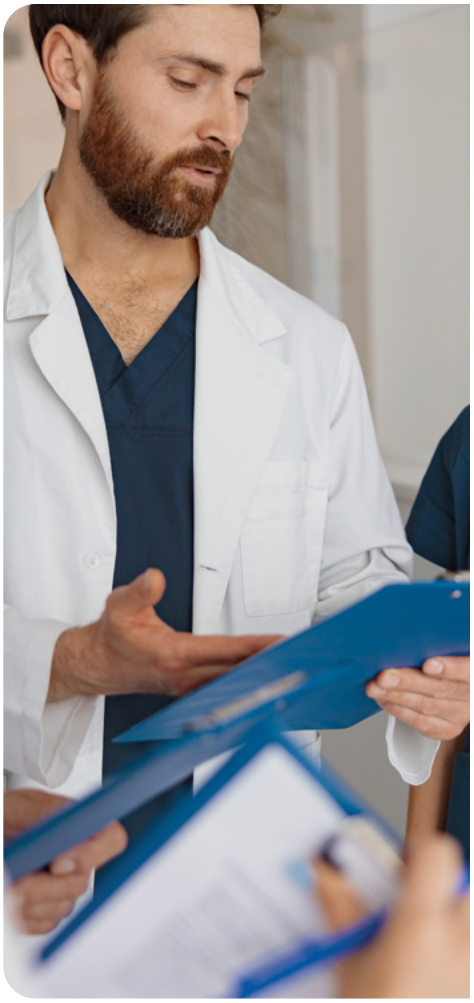
Checklist for Success

- ☐ Discuss the fundamental components of an infection prevention program for performance improvement initiatives
- ☐ Recognize the relevant program components to evaluate potential risks and identify opportunities for the facility

CABSI Prevention Program Key Participants

DEPARTMENT/POSITION	ROLE ON MULTIDISCIPLINARY TEAM
Clinical and/or Operational Leadership	Executive Sponsor
Infection Preventionist	Primary*
Vascular Access Specialist	Primary*
Physician/Advanced Practice Provider	Primary*
Nursing	Primary*
Hospital Epidemiologist/Infection Prevention Medical Director	Participant
Clinical Nurse Specialist	Participant
Nursing Professional Development	Participant
Unlicensed Assistance Personnel	Participant
Microbiology/Molecular Laboratorian	Participant
Information Technology	Participant
Antibiotic Stewardship/Clinical Pharmacist	Participant
Quality Improvement	Participant
Environmental Services	Consultant
Supply Chain	Consultant
Risk Management	Consultant

*May serve as team leader



Risk Assessment

A risk assessment is intended to systematically identify and evaluate existing and potential risks so that a plan can be made to minimize those risks. The table below provides suggestions for important considerations as a facility drills down to better understand the data and identified risks. Several of these considerations will be discussed in detail in other sections.

CABSI-Specific Risk Assessment

RISK FACTOR	POTENTIAL CONSIDERATIONS
Organizational culture and leadership support	• Does the CABSI prevention program have strong leadership support? • Has an executive sponsor been identified to assist with removing barriers?
Current and historical CABSI rates and/or CLABSI Standardized Infection Ratios (SIR) *Note: SIRs are currently only available for CLABSI. This may evolve over time as CABSI definitions develop.*	• Are CABSI rates higher or lower than expected? Has this changed in comparison to previous years? If so, is the cause of the change known? • Are there specific units with higher-than-expected rates? • Are there specific device types with higher-than-expected rates?
Current and historical VAD utilization	• Is the facility and each unit's rate higher or lower than expected? • Where in the facility are catheters inserted (e.g., emergency department, inpatient unit)? • Who inserts the catheters? • What is the distribution of VAD utilization by device type (e.g., PIVCs versus CICC versus PICC versus FICC)? • Are there opportunities to remove idle VADs? If so, are there specific units with more opportunity? • Are PIVCs being used specifically as a CLABSI prevention strategy versus based on clinical appropriateness?
Root/apparent cause analyses or drill downs that have been conducted on previous CABSIs	• What are the known contributing factors to CABSIs identified at the facility? • Are the contributing factors different depending on the specific unit or device? • Are there identified trends of causal organisms? • What is the prevalence of patients with multiple VADs?
Process measures intended to provide insight into compliance with the existing CABSI prevention program	• What processes are currently in place to prevent CABSI? • Are the processes implemented in a highly reliable way? • Are there defined metrics available that adequately assess compliance with the processes? • Are the processes/protocols/policies standardized across the facility?
Risks that are specific to the patient population served by the facility	Does the facility routinely care for: • patients who inject drugs? • patients with end stage renal disease? • trauma patients or other surgical/medical patients requiring volume resuscitation? • immunocompromised patients? • burn patients?

CABSI-Specific Risk Assessment	
RISK FACTOR	**POTENTIAL CONSIDERATIONS**
Availability of key resources and supplies	• Are the approved supplies consistently available for aseptic VAD insertion and maintenance? • Is vein visualization technology available and accessible? • Is there a defined vascular access expert, or equivalent personnel, available for consultation?
Personnel	• What is the level of training and competency for inserters and those providing routine care? • What are the staffing ratios for each role over time and does it correlate to infection rates/ratios?
Patency and flushing protocols	Does the facility have patency assessment and flushing protocols?

Equipment and Supplies

Facilities must ensure the appropriate equipment and supplies are available to support CABSI prevention practices. These supplies should be well organized and easily accessible. Staff should be trained in the appropriate selection and use based on the needs of each patient and facility policy and protocol. The information below outlines options for supplies and considerations for determining if they are appropriate for the facility. It is important to note that each VAD type may require different insertion and maintenance supplies depending on the type of insertion and VAD.

Note: *A technique called Aseptic Non Touch Technique (ANTT®) has been gaining traction within the United States and has been adopted by both AVA and INS.[1,2] The ANTT® framework is a standardized approach used for aseptic technique during procedures, and in some facilities this framework has replaced the more general terminology "aseptic technique." For purposes of this document, the term "aseptic technique" will continue to be utilized for familiarity and clarity. Each facility should ensure there is clarity regarding the performance of effective aseptic technique with established policies.*

CABSI Equipment and Supplies		
TYPE OF SUPPLY/ EQUIPMENT	**CATEGORIES**	**CONSIDERATIONS**
Vascular access device	Catheter type	See primer on VAD in the previous section.
	Characteristics (e.g., length, diameter, number of lumens)	Least invasive, smallest diameter, fewest lumens, and fewest number of devices to meet vascular access requirements and prescribed therapy.
	Materials and coatings	A clinical assessment should be used to determine the most appropriate catheter materials and whether advanced materials (e.g., antimicrobial, antithrombogenic, hydrophilic) catheters should be made available.

CABSI Equipment and Supplies

TYPE OF SUPPLY/ EQUIPMENT	CATEGORIES	CONSIDERATIONS
Insertion kits	Insertion kit design	A multidisciplinary team should work together to select the insertion kits that work best with the facility's insertion protocols to provide consistency, improve efficiency, reduce errors, and increase compliance and cost-effectiveness. Kit design should consider human factors to ease usability, improve ergonomics, and reduce cognitive load through familiarity. Creating multiple kits for different VAD types is one strategy to ensure the right supplies are available at the time of insertion.
	Insertion kit contents	Standardized supply kits should include a comprehensive set of supplies that align to institutional insertion protocols and VAD type. See examples below (not all inclusive, nor mandatory depending upon type of VAD and insertion).
	Antisepsis and personal protective equipment (PPE)	Selection of supplies is dependent upon the insertion technique.
	Dressing and securement	Dressing type, (with or without an antimicrobial agent (e.g., Chlorhexidine Gluconate (CHG) sponge, CHG impregnated dressing)) and securement device should be selected based on the specific needs of the organization (i.e., types of devices used, patient population served, etc.).
	Other maintenance supplies	Considerations when selecting a locking agent are based on device type but also include the risk of intraluminal contamination, the need to maintain patency, and dwell time. Catheter hubs and needleless connectors should be disinfected prior to use. Saline flushes should be readily available.
	Additional equipment	Scissors, medical tape, sterile ultrasound gel and transducer covers (when ultrasound guidance is used during VAD insertion), anesthetic, educational materials, and documentation materials.[3] *Note: It is not recommended to use medical tape to secure a VAD dressing for adherence.*

CABSI Equipment and Supplies

TYPE OF SUPPLY/ EQUIPMENT	CATEGORIES	CONSIDERATIONS
Dressing kit	Dressing change kit design	A multidisciplinary team should collaborate to select the dressing change kit that works best with the facility's protocols to provide standardization, improve efficiency, reduce errors, increase procedural compliance, and address cost-effectiveness. Kit design should consider human factors to ease usability, improve ergonomics, and reduce cognitive load through familiarity.
	Dressing change kit content	Standardized dressing change kit should include a comprehensive set of supplies that align with institutional dressing change protocols and VAD type. See examples below (not all inclusive, nor mandatory dependent upon type of VAD and insertion).
	Dressing, Antimicrobial Agent, and Securement	Dressing, antimicrobial agent, and securement device should align with institutional policy and VAD type.
	Antisepsis and personal protective equipment	Selection of supplies is dependent upon device type, complexity of insertion, efficacy for intended purpose, and expertise of the inserter.
	Additional supplies	Adhesives, adhesive remover, medical tape, tubing anchors, labels, barrier film.
Patient hygiene products	CHG treatment (or alternative in patients with CHG allergy)	Ease of use, availability of supplies, likelihood of compliance, and cost should be considered.
Blood culture collection products	Blood culture collection kits	Having appropriate supplies available and packaged together increases the likelihood of compliance.
	Diversion device and waste tubes	Diversion devices or waste tubes can be utilized as a strategy for reducing the risk of blood culture contamination at the time of collection.

Education, Training, and Competency Assessment

Education, training, and competency assessment are vital components of a CABSI prevention program and should be addressed upon hire, at routine intervals, and as needed to address new practices, processes, or equipment. Keep in mind that a competency assessment requires the measurement of the successful performance of a given skill.

A multidisciplinary team should oversee the entire process, whenever possible, to ensure targeted materials and evidence-based competency assessments for the individuals providing this care are appropriate.

Below is a template that includes recommended educational/competency topics based on the activity performed:

THE FACILITY SHOULD IDENTIFY ROLES AND RESPONSIBILITIES FOR EACH PART OF THE EDUCATION, TRAINING, AND COMPETENCY PROCESS, INCLUDING:
1. Identification of roles that require education and training only versus education, training, and competency validation
2. Assignment of responsibilities to educators and trainers
3. Development of role-specific education, training, and competency validation
4. Instruction and documentation of education and training
5. Evaluation of knowledge, performance, and documentation

Education Topics by Activity

ACTIVITY PERFORMED	RECOMMENDED EDUCATION TOPICS
Requesting a VAD order/ ordering a VAD	• Appropriate indications for catheter insertion* • Risk of CABSI or other complication to a patient and impact to the organization
Vascular assessment and VAD insertion	• Appropriate site selection following vascular assessment* • Application of vascular assessment to determine the appropriate clinician for insertion (e.g., difficult IV access (DIVA) assessment) • Consider early referral to a vascular access specialist if patient assessment yields no visible or palpable veins. Each clinician should have a maximum of two attempts or less prior to escalating to a more skilled clinician. • Appropriate device selection with considerations for vessel health, infection risk, blood flow, and prescribed therapy* • Appropriate insertion kit selection • Aseptic insertion technique* • Appropriate securement and documentation • Adequate training for an observer to appropriately identify deviations from best practice and/or policy*
VAD maintenance	Facility-specific bundle elements (e.g., dressing is clean, dry, and intact; administration set changes, site assessment)*
Daily assessment of VAD indication	• Appropriate indications for continued catheter use* • Risks associated with extended catheter duration • Appropriate VAD de-escalation and/or removal • Removing “just in case” PIVCs

*Consider assessing competency

Education Topics by Activity	
ACTIVITY PERFORMED	**RECOMMENDED EDUCATION TOPICS**
Blood culture ordering	Diagnostic stewardship and appropriate indications for placing a blood culture order*
Blood culture collection	• Appropriate collection technique, products, and protocols • Blood culture specimen collection from peripheral insertion or newly placed PIVC, rather than existing VAD unless the CVAD is suspected as a source of infection* • Impact of blood culture contamination to patient and organization • Considerations for preventing blood culture contamination*
Patient hygiene	Chlorhexidine treatment in accordance with facility policy*

*Consider assessing competency

In addition to clinician education, patient education is crucial to ensure appropriate understanding of the insertion, care, and maintenance of all VADs. While patient education is not the responsibility of IPs, it is important to note that facility structures vary, and the IP may be involved in creating educational content.

Policies and Procedures

A CABSI prevention policy is a key tool in communicating expectations for CABSI prevention practices across the facility. This could be included as a subsection of a larger VAD-related policy or as a standalone document. The foundation of a policy should be EBGs, and care should be taken to avoid including elements that may routinely change over time (e.g., referencing product brand names). During regulatory and accreditation surveys, the facility is expected to be in compliance with each element of its policy, and therefore it is important to consider the wording and content included. Procedures provide more detailed information instructing the end user on how to complete a task and can supplement a policy as needed. Checklists can also be created to summarize key steps for procedures.

AT A MINIMUM, CABSI PREVENTION POLICIES AND PROCEDURES SHOULD INCLUDE THE FOLLOWING TOPICS:
Type and frequency of education
Required responsibilities, education, and competency of healthcare workers involved in ordering, insertion, care, maintenance, and removal of VADs
Education, training and competency requirements for ordering, insertion, maintenance, and removal of VADs
Appropriate indications for the use of VADs
Ordering process and documentation requirements for VAD insertion
Process for evaluating patient's vasculature and clinical condition to determine the most appropriate VAD with vessel preservation in mind
Aseptic insertion practices
Frequency of review of indication/necessity for continued use of VAD and removal when no longer clinically indicated
VAD maintenance practices and patient hygiene and documentation of these tasks
Specimen collection and storage practices
Patient education regarding insertion, maintenance, and removal of VADs

Information Technology

Electronic technologies can be leveraged as part of a CABSI prevention program to enhance accuracy, efficiency, and reliability. Below are considerations for each type of technology as it relates to a prevention program:

— **Electronic medical record (EMR) software:** As EMR software continues to evolve, IPs should routinely reassess ways technology can be leveraged to support decision making. Collaboration with Information Technology (IT) professionals, subject matter experts, and end users is essential when considering EMR changes. BSI surveillance and prevention can be enhanced by using technology to identify patients at high risk of developing a BSI, prompting early intervention, and optimizing treatment decisions. Additionally, the EMR may be used to track data related to catheter placement and evidence-based management. Examples of utilizing the EMR are provided below:

  - Providing prompts and alerts for high-risk scenarios
    Example: Building alerts in the EMR that notify clinicians when a dressing change is due based on the facility policy.

  - Monitoring compliance with documentation of prevention practices
    Example: Creating monthly reports that summarize the frequency with which patients with a VAD had appropriate documentation of maintenance practices according to facility policy.

— **Infection prevention surveillance software:** Surveillance software products are available to improve the efficiency of surveillance and reliability of data. Each facility should assess its internal needs and resources when determining which surveillance software is appropriate. A cost/benefit analysis can be useful in describing the potential time savings associated with introducing surveillance software when used wisely, compared to non-automated surveillance, and how that software could allow IPs to reallocate time towards more effective workflows.

— **Dashboards and reporting software**: Many facilities utilize software to display the status of key outcome and process measures. IPs should work closely with IT and quality departments to ensure that infection prevention and control metrics are accurate and communicated widely to all relevant key participants.

— **Artificial intelligence (AI)**: The opportunities for using IT to support CABSI prevention will expand as AI advances. AI may be used for activities such as automated surveillance, early detection and prediction of a BSI, or assistance with data analysis and reporting. IPs will benefit from adopting AI tools as facilities approve their use in healthcare.

Supplemental Resources

» *APIC Text*, Chapter 7: Product Evaluation
» *APIC Text*, Chapter 3: Education and Training
» *APIC Text*, Chapter 6: Healthcare Informatics and Information Technology

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SECTION 3:

Best Practices for CABSI Prevention

Introduction

Practice standards and EBGs are utilized to make informed patient care decisions and guide healthcare facility policies and practice. These recommendations are usually ranked based on the strength of evidence which should guide the selection and prioritization of the most effective interventions known as best practices. The implementation of best practices will be influenced by clinical setting, clinical expertise, and informed patient choice. Establishing standardized protocols, when appropriate, is important to increase the likelihood of staff compliance. Healthcare facilities should implement frequent and routine auditing when necessary to monitor practices as described in Section 4.

The next section, Essential Practices, will provide recommendations for the implementation of best practices guided by those with the strongest evidence for CLABSI/CABSI prevention. Following the Essential Practices, the next section, Additional Practices, will provide suggestions on other interventions that experts suggest may influence the prevention of CLABSI/CABSI.

Checklist for Success

- ☐ Summarize the current state of best practices for CABSI prevention to inform facility practice
- ☐ Summarize the current state of additional practices for CABSI prevention to advance facility practice
- ☐ Describe the epidemiologic questions that can be used to help identify potential root cause(s) of CABSI(s)

Essential Practices

This section is intended to summarize practices that are considered essential for preventing CABSI. It is important to acknowledge that many of the below practices are based on research specific to CVADs.

Note: This implementation guide aims to focus on all VADs; therefore, recommendations were often extrapolated to VADs based on CVAD-focused research. Education and process monitoring should be considered for each essential element, and competency assessment should be conducted as appropriate.

Insertion Elements

ESSENTIAL PRACTICE	IMPLEMENTATION TASKS	RATIONALE
Use VADs only when necessary and appropriately indicated.[1,2,3,4]	• Utilize an approved list of indications for VADs. • Use the EMR to require providers to enter the indication prior to insertion.	All VADs have a risk of negative patient outcomes. It is prudent to ensure all VADs have a clinical indication and are not inserted and/or maintained "just in case".
Utilize vascular visualization technology when appropriate for VAD insertions (e.g., ultrasound, near infrared).[1,2,3,4]	• Ensure vascular visualization technology is readily available, and that staff are appropriately trained • Ensure appropriate supplies and disinfectant product(s) are readily available and staff are trained for use.[5]	Vascular visualization technology increases insertion success.
Perform clinical and venous assessments to identify the most appropriate insertion site and catheter.[3,4]	Use the appropriate catheter, insertion site, and insertion experts (e.g., vascular access specialist) to minimize repeat attempts and decrease complications.	Patient and venous assessments will allow the clinician to identify the catheter that is the least invasive, has the smallest diameter, and the fewest number of lumens based on the intended purpose, anticipated duration of use, known complications, and experience of individual catheter operators. Review MAGIC Guidelines and other literature for additional insertion considerations and details.
Use appropriate insertion practices, including hand hygiene, glove use, aseptic and sterile technique, and sterile supplies.[1,2,3,4]	• Use a written facility approved procedure for VAD insertion. • Use a checklist in the EMR to improve the reliability and monitoring of insertion protocols. • Ensure appropriate sterile supplies are available at the point of use.	Appropriate use of aseptic and/or sterile technique minimizes the risk of introducing pathogens into the bloodstream.
Ensure appropriate securement and stabilization after insertion.[2,3,4]	Ensure securement devices are available and utilized appropriately.	Appropriate securement and stabilization decrease the risk of dislodgement, which decreases risk for microtrauma and the potential need for exchanging catheter. Stabilization can also impact the ease of VAD maintenance.

Maintenance Elements		
ESSENTIAL PRACTICE	**IMPLEMENTATION TASKS**	**RATIONALE**
Use appropriate maintenance practices (based on VAD type), including hand hygiene, glove use, aseptic and sterile technique, and sterile supplies when manipulating the insertion site, catheter access point, or dressing.[1,2,3,4]	Use the EMR to prompt documentation of daily process metrics.	Appropriate use of aseptic and/or sterile technique minimizes the risk of introducing pathogens to the insertion site or bloodstream.

Ensure the dressing remains clean, dry, intact, and changed every seven days and immediately as needed when not clean, dry, or intact.[1,2,3,4]
• Use CHG-containing dressings for adult patient with CVADs.[1,2,3]
• Consider the potential benefit of CHG-containing dressings for PIVCs.[4]
	• Implement routine auditing process to monitor compliance and ensure feedback is provided to frontline staff to improve practice as needed.
	• Ensure supplies (e.g., dressing change kits) are readily available.
	• Ensure staff who are performing dressing changes are trained and competent.
		Dressings help reduce microbial growth near the VAD insertion site.
		• Changing the dressing too frequently can introduce pathogens to the site and increase the risk of infection.
		  • A high level of evidence exists demonstrating BSI reduction with use of CHG containing dressings for CVADs.
		  • Less data is available to demonstrate the impact of CHG containing dressings for PIVCs.
		  • If a gauze dressing is used, the dressing should be changed every 48 hours, or immediately when not clean, dry, or intact.

Ensure appropriate disinfection of the catheter access point prior to accessing and only attach sterile devices to the catheter hub.[1,2,3,4]	Establish a process for disinfection of the catheter hub/needleless connector.	Microbial burden of the catheter hub/needleless connector is minimized with appropriate disinfection. This reduces the risk of introducing intraluminal pathogens when administering infusates.
*Note: Based on INS committee consensus due to minimal data		

Maintenance Elements

ESSENTIAL PRACTICE	IMPLEMENTATION TASKS	RATIONALE
Exchange administration set and add-on devices at appropriate intervals, depending on the infusates.[1,2,3]	• Implement an auditing process to monitor compliance and ensure feedback is provided to frontline staff to improve practice as needed. • Ensure supplies are readily available.	It is important to change the administration set at appropriate intervals: • Every 7 days for continuous infusions other than lipids, TPN/PPN, or blood/blood products. • Every 24 hours for TPN/PPN. • Every 6-12 hours for propofol and within 24 hours or when the vial is changed for other lipid emulsions. • Every 24 hours for intermittent primary and secondary administration sets.* • Every 4 hours for blood/blood products. • It is important to ensure facility policy reflects instructions for use for medical devices when establishing replacement intervals for administration sets.
Provide daily CHG treatment for adult patients in an ICU setting.[1,2,3]	• Implement auditing process to monitor compliance and ensure feedback is provided to frontline staff to improve practice as needed. • Ensure supplies are readily available.	Providing daily CHG treatments to ICU patients and those with a CVAD is well recognized to reduce CLABSI.
Use proper technique when collecting blood for lab tests, including transport and storage practices.[3]	• Establish a blood specimen collection policy or procedure with clear steps. • Consider the use of blood culture collection kits.	Improper specimen collection can result in inaccurate results (e.g., false positive, false negative), potentially creating additional clinical needs and unnecessary treatment.
Ensure VAD remains patent for duration of use.[3,4]	Establish a process for frontline staff to ensure patency of VAD prior to use.	Catheter patency (i.e., flushed and aspirated for brisk blood return) helps ensure proper VAD function and decreases the risk of complications, including BSIs.
Remove VAD when no longer clinically indicated.[1,2,3,4]	• Establish a process at the unit level to discuss the VAD indication daily. • Utilize the EMR to prompt daily reviews of VAD.	All VADs have a risk of negative patient outcomes. It is prudent to ensure all VADs have a clinical indication and are removed as soon as clinically indicated to minimize the risk of negative outcome(s).

*Note: Based on INS committee consensus due to minimal data

Maintenance Elements		
ESSENTIAL PRACTICE	**IMPLEMENTATION TASKS**	**RATIONALE**
Do not routinely replace VADs at set intervals.[1,2,3,4]	Ensure facility policy does not specify a set timeframe for VAD replacement.	VADs inserted under suboptimal conditions (i.e., without adherence to aseptic technique) should be removed as soon as possible, but within 48 hours. Consider utilizing EMR documentation to identify VADs inserted sub-optimally. Routine replacement of VADs (clinically indicated removal) may be appropriate after a healthcare facility has successfully implemented appropriate insertion, care, and maintenance practices. Healthcare facilities should conduct assessments and surveillance of outcomes.

*Note: Based on INS committee consensus due to minimal data

Additional Practices

Facilities can consider additional practices in settings where infection rates have remained above expected despite implementing the essential prevention strategies. Additional practices tend to be focused on specific patient populations or specific practices with a growing but limited evidence base to support their effectiveness. Education and process monitoring should be considered for each element.

Note: Due to limited published evidence regarding the effectiveness of these additional practices, key participants at a facility need to review and discuss an additional practice prior to selection. Clear objectives, timeframes for project evaluation, and risks should be determined prior to implementation.

Insertion Elements		
ADDITIONAL PRACTICE	**IMPLEMENTATION TASKS**	**RATIONALE**
Use a bundle for VAD insertions.	• Create an insertion bundle by utilizing 3-5 elements with the strongest evidence. • Currently there is no comprehensive recommended bundle for non-CVAD BSI prevention efforts; thus, a facility should conduct a risk assessment based on their patient population and clinical setting.	Increasing process reliability may result in increases in insertion success and reduce risk of complications.
Utilize a custom insertion kit to enhance the safety and efficacy of VAD insertion procedures.	Create and utilize custom kits to enhance efficiency, safety, and efficacy of VAD insertion procedures, in conjunction with a high reliability quality and safety program.	Assists insertion standardization by providing custom materials to meet variations in local practice/clinical needs.
Utilize additional trained personnel to ensure insertion safety and success.[1,2,3]	• Standardize protocol for two-person VAD insertion. • Utilize vascular access teams/experts to reduce CABSI.	Improved aseptic technique, quality of insertion, reduction in errors, and training and mentorship.
Leverage insertion technology advancements to increase success and ease insertion.[1,2,3,4]	• Utilize tip location systems (e.g., fluoroscopy, intracavitary Electrocardiogram) • Utilize automated uploads for CVAD insertion documentation (e.g., Wi-Fi) • Consider using enhanced training and simulation methods (e.g., virtual reality, video capture feedback)	Tip location equipment can improve insertion safety and success by providing timely feedback and accurate tip placement. Automatic document upload can enhance the efficiency, accuracy Provides hands-free equipment adjustment and documentation to improve insertion success and accuracy. Use of insertion technology can enhance learning and boosts confidence.
Consider the use of new materials for insertion practices.[1,3,4]	Consider utilizing new materials that may further lower CABSI rates after other improvement efforts have been established.	Newly developed catheters can be used to improve CVAD performance and utilization (e.g. antimicrobial coating, biofilm resistant or anti-thrombogenic properties).

Maintenance Elements		
ADDITIONAL PRACTICE	**IMPLEMENTATION TASKS**	**RATIONALE**
Utilize a bundle for VAD care and maintenance.	Create/utilize a post-insertion care bundle by utilizing evidence from available literature.	Implement a VAD post-insertion care bundle to improve quality of care and reduce risk of complications.
Utilize custom dressing change kits.	Create and utilize custom kits to improve dressing changes.	Assists standardization by reducing risk of missing items and streamlining dressing change process.
Utilize additional personnel to ensure dressing change safety and success.[1,2,3,4]	Utilize vascular access teams for reducing CABSI.	Utilizing a two-person VAD dressing change can help identify breaks in aseptic technique throughout the process.
Consider the use of new materials for maintenance practices.[1,2,3,4]	Consider implementing new materials that may further lower CABSI rates after other improvement efforts have been established.	Materials can be used to enhance VAD care (e.g., locking solutions, skin protectant, and special adhesives)
Consider implementing daily CHG treatment for adult patients in non-ICU settings.	• Implement auditing process to monitor compliance and ensure feedback is provided to frontline staff to improve practice as needed. • Ensure supplies are readily available.	Although there is not sufficient literature at this time specific to all VADs across non-ICU care settings, consider implementing this practice if CABSI rates are high than expected.

Supplemental Resources

» *APIC Text*, Chapter 35: Vascular Access Device-Associated Infections

References

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SECTION 4:

Monitoring a CABSI Prevention Program

Outcome Measures

Various outcome and process measures can be used to evaluate the quality and safety of clinical care regarding VADs. Outcome measures, such as CABSI rates, are utilized to determine if a healthcare facility is accomplishing the goals established by the program. Process measures, such as CABSI bundle compliance, are used to monitor the adherence to the facility's policy and procedures aimed at reducing negative outcomes (e.g., CABSI). Although process measures may indicate practice deviation, they do not necessarily correlate to the root cause of the unmet goal. Quality improvement tools, such as a root cause analysis, may be utilized to further explore potential causes.

Both outcome and process measures are essential in ensuring quality care and patient safety in preventing CABSI. The following tables address outcome and process measures for CABSI.

Checklist for Success

- ☐ Identify and interpret outcome and process metrics to monitor CABSI prevention efforts
- ☐ Identify and interpret outcome and process measures to track compliance for CABSI prevention efforts

Common Outcome Measures for CABSI			
DESCRIPTION	**NUMERATOR**	**DENOMINATOR**	**COMMENT(S)**
CABSI Rate *Note: See CABSI definition details in* Section 1	Observed number of CABSI event(s) as defined by facility	Observed number of VAD days as defined by facility	Numerator/Denominator x 1000
CLABSI Rate	Observed number of CLABSI event(s) per NHSN surveillance definition	Observed number of CVAD days per NHSN surveillance definition	Numerator/Denominator x 1000 A facility-wide unadjusted CLABSI rate should be used with caution. Refer to risk adjusted unit rates.
CLABSI SIR	Observed number of CLABSI event(s) per NHSN surveillance definition	Predicted number of CLABSI events(s) per NHSN surveillance definition	SIR is a summary measure that compares the actual number of infections to the number predicted given the standard population, adjusting for several risk factors. It is calculated by NHSN.
CVAD Standardized Utilization Ratio (SUR)	Observed number of CVAD days per NHSN surveillance definition	Predicted number of CVAD days per NHSN surveillance definition	SUR is a summary measure that compares the actual number of device days reported to what would be predicted, given the standard population, adjusting for several risk factors. It is calculated by NHSN.
Cumulative Attributable Difference (CAD)	Not applicable	Not applicable	CAD is the number of excess infections that need to be prevented to reach a SIR goal.
Targeted Assessment for Prevention (TAP) Reports	TAP reports generate CAD metrics for specific inpatient units		TAP reports rank facilities or locations within those facilities by CAD to help facilities prioritize locations where the greatest prevention impact could be achieved.

Process Measures

Routine process measurement is critical to ensuring compliance with facility policy. When CABSI rates exceed expectations or fail to meet facility goals, facilities may enhance process surveillance to include additional measures. Process measurement can occur through five methods which may be used individually or grouped to improve surveillance findings. The following table describes methods of direct observation of practice, point prevalence rounding, staff interviews, EMR automated metrics, and manual chart review.

Five Methods of Process Measurement

METHOD	DETAILS	BENEFITS	CHALLENGES
Direct observation of practice	• A trained observer watches a clinician perform a specific practice to determine compliance with policy and/or procedure. • Insertion technique may be observed just-in-time and/or in simulation	• Captures actual practice versus documentation • Encourages interactions between IPs and healthcare personnel (HCP) • Allows for just-in-time feedback	• Requires a skilled observer • Potential discomfort of the observed clinician • Time consuming • Coordination between procedure schedule, clinician, and observer
Point prevalence rounding	A trained observer conducts rounds at a regular interval to observe and document prevention practices for all patients at risk.	• Captures actual practice versus documentation • Allows for just-in-time feedback	• Requires a skilled observer • Time-consuming • Bias can be introduced if all shifts are not included
Staff interviews	• A trained observer interviews frontline caregivers to gain insight into opportunities for improvement. • Often used in areas with higher-than-expected rates to identify potential causes not reflected in metrics.	• Encourages interactions between IPs and HCP • Use open-ended questions to gain HCP insights that would not otherwise be known	• Time-consuming • Bias can be introduced based on interviewer skill and selection of interviewees • Interviewee may feel discomfort
Automated metrics using the EMR	Use of IT tools that allow aggregation of process metrics documented in the EMR such as CHG treatment and maintenance care.	• More efficient than manual data collection • Requires less IP time in data collection but still must be interpreted	• Provides only documentation data versus actual practice • May require resources and support external to IP to set up and maintain metrics
Manual chart review	• Reviewer manually extracts data from the medical record • Useful to gather non-discrete data on individuals with confirmed CABSI	Useful when automated metrics are not available	• Requires a trained reviewer • Time-consuming • The number of feasible reviews may be limited • Provides data on quality of documentation, not necessarily actual performed practice

The facility risk assessment can assist the multidisciplinary team in identifying the most appropriate metrics for the facility. Below is a list of possible metrics for each essential practice. Note that these metrics are intended to provide additional perspective and information into the CABSI prevention program but that each metric has inherent limitations.

Common Process Measures for CABSI

PROCESS STEP	METRIC	DEFINITION	WHEN TO CONSIDER	DATA COLLECTION METHOD/S
Insertion	Insertion site frequency	Distribution of the various anatomical sites in which VADs are inserted	There is suspicion that a patient-specific risk assessment is not being performed prior to site selection	Automated metric using the EMR, consider validation of documentation
	Device type frequency	Distribution of the various VADs (e.g., CICC, PICC, FICC, PIVC)	There is suspicion that the correct vascular access device type is not being used reliably based on patient need	Automated metric using the EMR
	Number of lumen frequency	For multi-lumen devices, distribution of the number of lumens in inserted VADs	There is suspicion that VADs with more lumens than required are being used routinely	Automated metric using the EMR
	Securement type frequency at insertion	Distribution of the various securement types at time of insertion	There is suspicion that a securement type might be increasing risk of patient infection	Automated metric using the EMR
	Indication type frequency	Distribution of the various indication types at time of insertion	There is suspicion that higher risk devices are being inserted than is appropriate	Automated metric using the EMR; may require chart review
	Patient location at time of insertion frequency	Distribution of where patients are located when VADs are inserted	There is suspicion that increased infections are related to the department in which lines are being placed	Automated metric using the EMR

Common Process Measures for CABSI

PROCESS STEP	METRIC	DEFINITION	WHEN TO CONSIDER	DATA COLLECTION METHOD/S
Insertion (continued)	Inserter role frequency	Distribution of the various roles of providers inserting VADs	There is suspicion that increased infections are related to the role/skill of the individual inserting the device	Automated metric using the EMR; may require chart review
	Insertion bundle measures	Percent of CVAD insertions in which all bundle measures are documented as compliant	There is suspicion that a CABSI trend may be related to CVAD insertion practices	Automated metric using the EMR
Maintenance	Necessity indications selected frequency	Distribution of the various indication types selected at daily assessment	There is suspicion that a critical evaluation of the continued need for the VAD is not occurring daily	Automated metric using the EMR; may require chart review
	Dwell time from insertion to date of infection event	Calculated frequency of each VAD type based on dwell time categories	There is suspicion that higher risk devices are being used more often than is appropriate	Automated metric using the EMR
	Average catheter dwell time by VAD type	Calculated average days of all VADs broken down by type from date of insertion to date of removal	There is suspicion that infections are related to insertion-specific factors	Automated metric using the EMR
	Blood culture positivity rate	Number of positive blood cultures divided by total number of blood cultures collected in a given time frame	There is suspicion that blood culture positivity rates overall have changed	Automated metric using the EMR

Common Process Measures for CABSI

PROCESS STEP	METRIC	DEFINITION	WHEN TO CONSIDER	DATA COLLECTION METHOD/S
Maintenance (continued)	Blood culture organism frequency	Frequency of organisms that grow in each blood culture type	There is suspicion of a single source cause for increased infection rates or trend for sources by environmental reservoir	Automated metric using the EMR
	Blood culture collection source frequency	Frequency of blood culture collection source documented as CVAD, PIVC, blood, or other	There is suspicion that blood cultures are being drawn too frequently from central lines	Automated metric using the EMR
	Percent of blood cultures in which growth only occurred in one of two sets	For patients with two blood cultures collected on the same day, what percentage are both sets positive versus one set	There is suspicion of contamination during blood culture collection	May require chart review
	Compliance with documenting daily CHG treatment	Percent of patients who both qualify for daily CHG treatment and receive the treatment	There is suspicion that CHG treatment is not being administered per policy	May require chart review

Epidemiologic Questions to Investigate

A comprehensive deep dive into patients with CABSI can be a useful method for identifying trends and, in turn, identifying effective interventions. The deep dive should include active multidisciplinary discussion regarding the care of the patient. Additionally, a thorough chart review can help highlight details that may have contributed to the patient's outcome. The following table highlights some epidemiologic questions to consider when attempting to identify trends among patients with CABSI.

Epidemiologic Questions to Investigate	
Population focused	• Are CABSI rates higher in a specific gender, age group, race/ethnicity, or diagnosis? • Are CABSI rates higher on a specific unit? *Note: Keep in mind that some units are more likely to have higher CABSI rates (e.g., burn ICU will likely have a higher rate when compared to a medical/surgical unit).*
Insertion criteria	• Are CABSI rates higher in patients who had their VAD inserted on a specific unit or by a specific inserter? • How many days have elapsed from insertion to the date of event for each CABSI? *Note: This can help provide information as to whether infections may be related to insertion or maintenance practices* • Are CABSI rates higher in patients with certain VAD type? • Are CABSI rates higher in patients with VADs inserted in certain anatomic locations? • Did patients with CABSIs have multiple VADs, including previously removed VADs (e.g., failed PIVCs)? • Did patients with CABSIs have all insertion bundle elements documented and met? • Was the indication for insertion of the VAD(s) appropriate? • Are CABSI rates higher in patients with multiple lumens?

Maintenance criteria	• Were all the maintenance elements documented and met in the days prior to the date of the event?
	• Was the daily indication of the VAD(s) appropriate in the days prior to the date of the event?
	• How many dressing disruptions occurred in the days prior to onset of BSI?
	  • Was the dressing changed more frequently than every 7 days? If so, why?
	• Was the patient's chlorhexidine treatment documented in the days prior to the date of the event?
	  • Is the documentation in accordance with facility policy for use of CHG?
	  • Among patients with CVADs, was daily chlorhexidine treatment provided?

Microbiology results	Is there a trend in the organisms identified in patients with CABSIs? Review APIC's Ready for Reference for Microbes guide for additional details about organisms.
Materials	Are the correct supplies available for insertion and maintenance procedures? • If available, are the correct supplies utilized for insertion and maintenance procedures?
Healthcare workers	Have the clinicians who are inserting and maintaining VADs completed the required education and training?

Supplemental Resources

» *APIC Text*, Chapter 17: Performance Measures
» *APIC Text*, Chapter 10: General Principles of Epidemiology
» *APIC Text*, Chapter 15: Risk-Adjusted Comparisons

SECTION 5:

Settings-Based Case Studies

Scenario 1: Community Hospital

As the infection preventionist in the local community hospital, you have noted an increase in BSIs in your facility. Upon reviewing the data, you determine most of the recently identified BSIs are associated with PIVCs. You talk with the nursing professional development (NPD) specialist and learn they recently implemented education on always using the ultrasound machine to place PIVCs. As you review nursing insertion practices with the ultrasound machine, you identify gaps in aseptic technique. The gaps are at various points in the insertion process and are sporadic across many staff members. You bring your findings back to the NPD specialist and ask about the process to verify competency to use the ultrasound machine. You learn there is not a clearly defined education plan or competency check-off. What would be your next steps?

You review the *Infusion Therapy Standards of Practice* published by INS and *The Standards of Care for Peripheral Intravenous Catheters (PIVC): Evidence based Expert Consensus* published by AVA to learn that it is considered best practice to use vein visualization technology for all VAD insertions. However, given that your findings showed deviation from proper aseptic technique, you should collaborate with the NPD specialist to develop a training and competency check-off process focused on the proper use of technology and vascular assessments. This allows nurses to use the most appropriate vein visualization technology to help ensure there are “no blind sticks” and be able to maintain appropriate aseptic technique during VAD insertions.

Scenario 2: Academic Health Center

You are an infection preventionist at an academic health center, and you are reviewing your NHSN standardized utilization ratio (SUR) for CVADs. The data shows a higher-than-expected SUR in the medical ICU (MICU). You review the CVAD utilization data in this unit further and identify the majority of CVADs are inserted in the internal jugular vein. You know from your diligent review of the CDC *Guidelines for the Prevention of Intravascular Catheter-Related Infections, 2011* that it recommends using a subclavian site rather than a jugular site to minimize infection risk for CVAD placement. As such, you approach your MICU medical director and ask that they change insertion site selection. The medical director is resistant to this change, and you don't understand why given that the guidelines clearly state the optimal site selection to reduce infection risk. What would be your next steps?

When discussing site selection with providers, you learn they favor internal jugular vein insertions to minimize the risk of a pneumothorax during insertion. As you begin to review the literature and other EBGs, you learn there are many other considerations for site selection and VAD de-escalation. You determine that there is not one single best location for VAD insertions, rather, it is a multifactorial decision-making process including factors such as the anticipated duration of therapy, medication compatibility, kidney function, comorbid contraindications, and many others. You work with the providers to consider assessing the patient's clinical situation to determine the optimal device and insertion location. After educating yourself and the team on vessel preservation concepts, they determine they may be able to allow more experienced providers to insert in other locations when an internal jugular vein insertion is not optimal.

Scenario 3: Critical Access Hospital

You are the infection preventionist at a critical access hospital and your facility has seen a recent increase in CLABSIs. This has caused your facility to have a higher-than-expected standardized infection ratio (SIR). Upon reviewing your NHSN data, you determine that the recently identified CLABSIs are all associated with PICCs. All recently identified CLABSIs are among patients in the same unit. You immediately begin to review this unit's maintenance practices and conduct additional bundle audits across all units to compare the differences. After two weeks of time-intensive auditing, your facility has identified another CLABSI on a different unit, and the audit data shows no major differences in practice among the units. What would be your next steps?

Although it may seem as though the infection preventionist may need to look at maintenance practices on the unit with the identified CLABSIs, reviewing additional data prior to action may have helped prevent unnecessary work. Additional data illustrates an average of 2 days from PICC insertion to the date of infection. Furthermore, the organisms identified as the cause of the CLABSI are *Staphylococcus aureus*. These data suggest the recent CLABSIs may be more likely associated with insertion practices rather than maintenance practices. Upon review, you learn that the clinician inserting PICCs at your facility recently began inserting catheters alone. When observing an insertion, you identify several gaps in aseptic technique. You should work with the employees to ensure their understanding of the importance of inserting VADs with aseptic technique. You could consider implementing a two-person insertion practice that allows for a secondary observer who is trained and competent in insertion and observation practices. This secondary employee can help ensure the inserter is able to maintain aseptic technique to prevent CLABSIs.

SECTION 6:

Samples of Associated Tools

The following appendices are samples of associated tools used to prevent CABSI. These examples may be adapted after performing a risk assessment. This will ensure that specific criteria are utilized in these pathways based on patient population and/or facility protocols.

Adult PIVC Insertion Escalation Pathway
Guidance for CVAD De-Escalation

Adult PIVC Insertion Escalation Pathway

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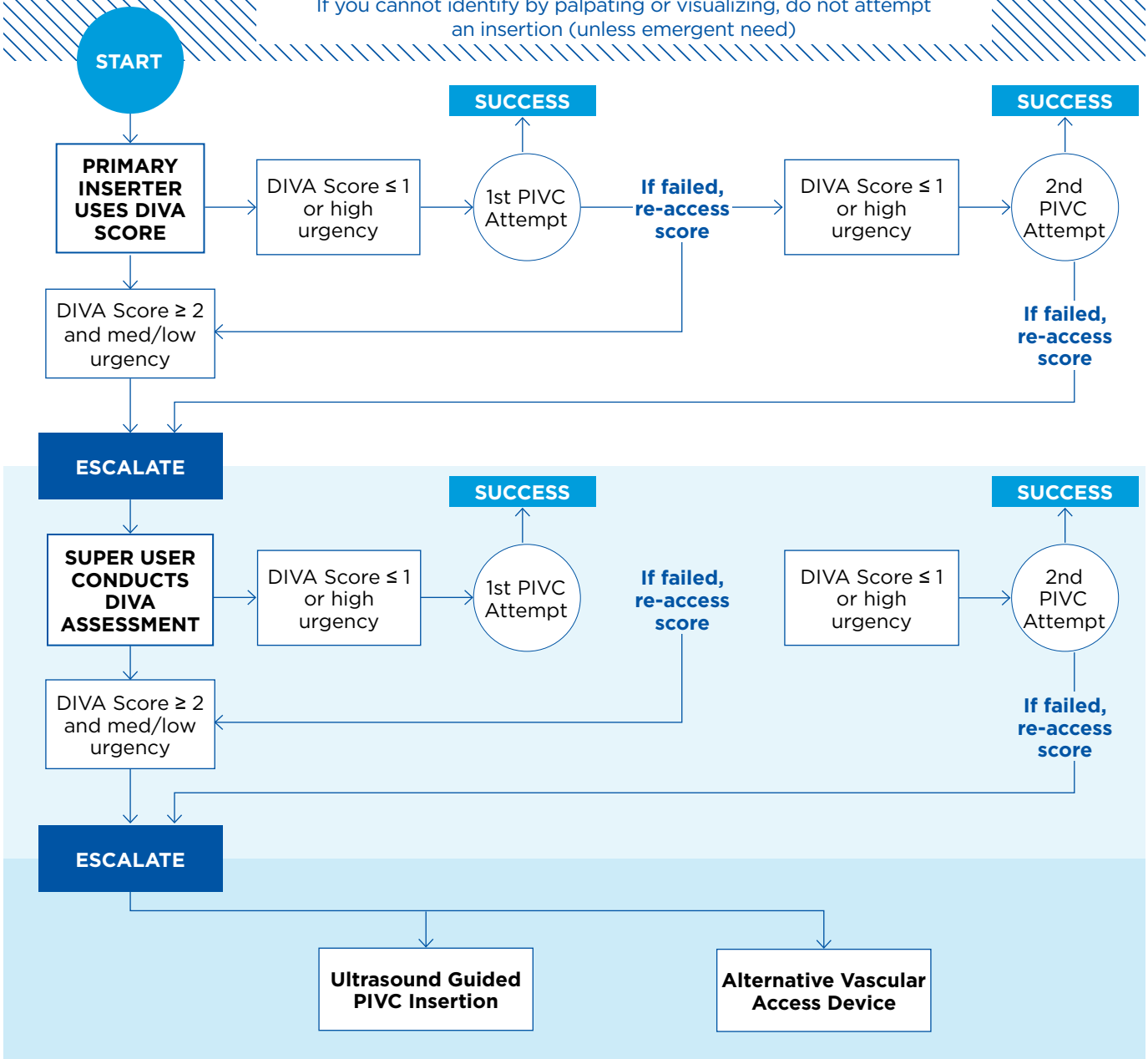
NO BLIND INSERTIONS

If you cannot identify by palpating or visualizing, do not attempt an insertion (unless emergent need)



DIFFICULT IV ACCESS (DIVA) GUIDE (> 1 POINT)

Difficult IV Access (DIVA) Score	Points
Cannulation site cannot be identified through palpation/visualization	2
Prior History of DIVA status	1
Prior History of IV Drug Use (IVDU)	1
Obesity (BMI > 30)	1

Adapted from Bahl, A et al. (2024). An Improved Definition and SAFE Rule for Predicting Difficult Intravascular Access (DIVA) in Hospitalized Adults. *Journal of Infusion Nursing*, 47 (2), 96-107.

Guidance for CVAD De-Escalation

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START

IS YOUR PATIENT FREE FROM THESE CONDITIONS:

- Suspected/known Blood Stream Infection
- CVAD mechanical failure, dislodgement, or occlusion that cannot be resolved
- DVT in relevant vasculature that cannot be resolved with anticoagulation

NO →

FLAG FOR DISCUSSION

Consider CVAD **removal** or **replacement** based on relevant factors (e.g., type of microorganism causing bacteremia)

YES ↓

DOES YOUR PATIENT HAVE ANY OF THESE CVAD INDICATIONS:

- Administration of central line only IV medications (e.g., TPN, vesicants, vasoactive agents)
- Patient is categorized as a **Difficult IV Access (DIVA)** and has **ANY** of the following conditions:
  - Clinically unstable
  - Frequent lab draws
  - Multiple non-compatible infusates
- Anticipated long-term intermittent infusion (e.g., chemotherapy, hemodialysis, inotropes or vasodilators)
- Continuous invasive monitoring

NO →

FLAG FOR DISCUSSION

- Consider replacing with **PIV**
- When anticipated infusion is greater than 4 days, consider replacement with a **midline catheter**

YES ↓

IS CVAD INDICATED FOR OUTPATIENT CARE OR LONG-TERM DURATION?

NO →

- **Maintain** current CVAD
- If multiple CVAD present, consider **removal** in conjunction with infusate de-escalation

YES ↓

FLAG FOR DISCUSSION

- Consider appropriate **long-term catheter** (e.g., PICC, Tunneled Line, or Port)
- If multiple CVAD present, consider **removal** in conjunction with infusate de-escalation

DIFFICULT IV ACCESS (DVA) GUIDE (> 1 POINT)

Difficult IV Access (DIVA) Score	Points
Cannulation site cannot be identified through palpation/visualization	2
Prior History of DIVA status	1
Prior History of IV Drug Use (IVDU)	1
Obesity (BMI > 30)	1

Adapted from Bahl, A et al. (2024). An Improved Definition and SAFE Rule for Predicting Difficult Intravascular Access (DIVA) in Hospitalized Adults. *Journal of Infusion Nursing*, 47 (2), 96-107.

SECTION 7:

SBAR Communication Tools

The following appendices are standardized communication tools known as SBARs, which stands for:

1. **S**ituation,
2. **B**ackground,
3. **A**ssessment, and
4. **R**ecommendations.

Three topics have been selected for the SBARs that have little to no established practice standards, evidence-based guideline, or expert census document. These SBARs are provided as a template for facilities to utilize when discussing these topics and may be updated and/or adapted as new research becomes available to inform effective decision-making in various clinical settings.

Specimen Diversion Impact on BSI
Number of Vascular Access Devices
Anatomical Site Selection of Non-CVADs for Prevention of BSIs

SBAR: Specimen Diversion Impact on Bloodstream Infection

APIC CRPI | Last updated 5/2/25

1 Situation:

An evidence-based guideline or expert consensus statement is not currently available to answer the question: Among hospitalized patients who have a blood culture collected, what is the impact of specimen diversion (e.g., diversion device, bypass, waste tube) on bloodstream infections?

2 Background:

- A literature search identified 121 articles utilizing common search terms (Table 1).
  - Nine articles[1-9] remained after full-text review and application of restrictions (Table 2).
  - One of the articles was a systematic literature review1 which utilized nine articles for a meta-analysis (including four articles identified during our literature review).
    - » In 83,325 collected blood cultures, it was found that initial blood culture diversion devices were associated with lower frequency of blood culture contamination (p= 0.29).
- Below are highlights from the remaining four articles[6-9]:

ELEMENT	FINDINGS
Type of device assessed	One study utilized a specimen diversion device; Three studies utilized a waste tube
Size of study	Study populations ranged from 810 to 27,145 samples
Endpoints	Blood culture contamination rate was an outcome measure in all four studies
Results	All four studies showed a statistically significant reduction in the blood culture contamination rate

- The Centers for Disease Control and Prevention (CDC) outlines the risks associated with blood culture contamination in the following document: Blood Culture Contamination: An Overview for Infection Control and Antibiotic Stewardship Programs Working with the Clinical Laboratory, including increased length of stay and increased cost.
- American Society for Microbiology states "institutions (facilities) that draw blood cultures should consider implementing a diversion device as part of the procedure for drawing peripheral blood cultures (evidence quality: II, recommendation strength: moderate)".[10]
- Infusion Therapy Standards of Practice 2024 states "studies have demonstrated reduction in blood culture contamination with use of a diversion device." (Standard 41, Blood Sampling).[11]
- In a joint guide by the Infectious Diseases Society of America and the American Society for Microbiology mention the benefits of device diversion to reduce skin contaminants.[12]
- The Agency for Healthcare Research and Quality suggests considering initial specimen diversion to mitigation contamination from the skin.[13]

3 Assessment:

— Multiple large, well-designed studies suggest a correlation between the use of a waste tube or diversion device and a reduction in blood culture contamination rates.

- Use of a waste tube or diversion device could potentially reduce costs and length of stay associated with blood culture contamination.
- Some factors to consider when deciding between utilizing a waste tube or diversion device are likelihood of compliance, sustainability, and cost.

— There is insufficient evidence to correlate the use of a diversion device or waste tube with bloodstream infection. Few initial diversion studies utilize bloodstream infection as an endpoint, precluding further analysis.

- Using a blood culture contamination rate as an outcome measure is another important consideration. Most definitions of blood culture contamination are limited to common skin commensals and do not include pathogenic organisms that may have been present on the skin at time of collection, resulting in inoculation and growth within the blood culture bottle. A facility's reported blood culture contamination rate will likely not include that scenario, precluding a complete analysis of the full impact of initial specimen diversion as a method for preventing a false-positive blood culture.

4 Recommendation:

1. Consider the use of a waste tube or diversion device as a strategy for reducing blood culture contamination rates when blood culture contamination rates are higher than expected despite high compliance with appropriate collection technique.
2. Further research is necessary to understand the relationship between initial specimen diversion and bloodstream infection. Consideration should be given to expanding the definition of blood culture contamination to include pathogenic organisms in patients without clinical evidence of bacteremia to allow for a better understanding of overall blood culture contamination.

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Table 1: Literature Search Terms

BLOOD CULTURE COLLECTION*	SPECIMEN DIVERSION	BLOODSTREAM INFECTIONS OR GENERAL INFECTIONS
Blood culture Blood culturing Blood specimen collection	"discard initial blood" blood culture diversion blood specimen diversion ByPass Syringe closed initial specimen diversion device diversion techniques methods diversion tube diverting initial blood specimen diversion Initial Specimen Diversion Device initial specimen diversion technique initial specimen diversion technology Kurin Lock sterile diversion devices Steripath Vacutainer Waste tube	Bacteremia Bloodstream infection Blood stream infection Sepsis Septicemia PLABSI LABSI CRBSI CLABSI HAI HOBS HA-BSI NBSI

Table 2: Exclusions

Animal studies
Case studies or commentary articles
Articles not utilizing bloodstream infection or blood culture contamination as an outcome

SBAR: Number of Vascular Access Devices

APIC CRPI | Last updated 5/2/25

1 Situation:

An evidence-based guideline or expert consensus statement is not currently available to answer the question: Among patients with indwelling vascular access devices (VADs) who develop a bloodstream infection (BSI), what impact does multiple devices rather than a single device have on infection incidence during hospitalization?

2 Background:

— A literature search identified 422 articles utilizing common search terms (Table 1)

— Four articles[1-4] remained after full text review and the application of restrictions (Table 2)

- Alshahrani et. al conducted a systematic literature review1 on the clinical implications and risk factors of central line-associated bloodstream infections (CLABSIs), which identified 15 articles for meta-analysis (including one article[3] identified during our literature review).
  - » 17,846 pediatric cardiac critical care patients with at least one central venous catheter found that the use of multiple central venous access devices (CVADs) was an independent risk for CLABSI (p=0.048).

— Below are highlights from the remaining three articles[2-4]:

ELEMENT	FINDINGS
Device assessed	All three studies focused on CVADs.
Size of study	Studies ranged from 79 to 23,088 patients, with the lowest number in that range being hematological and solid tumor patients.[4]
Endpoints	BSI was an endpoint in all three studies.
Results	Two of three studies showed a statistically significant reduction in BSI. • 52 out of 373 ICU patients in a multi-center study with the presence of more than one CVAD developed a BSI (p=0.41).[2] • 73 patients out of 249 with a CLABSI had concurrent CVADs (p <0.01). This study focused mainly on peripherally inserted central catheters (PICCs).[3] • Severe infection was more common among patients with concurrent CVADs compared to those with one CVAD (p<0.05). In particular, the presence of two CVADs was found to have a higher risk of infection in hematological patients; 8 out of 14 patients with two CVADs had severe infections.[4]

3 Assessment:

— In these limited studies, it is demonstrated that there is a possible association, not causation, with concurrent CVADs and increased risk of a BSI in patients.

— Determining a possible association between concurrent CVAD utilization and increased risk of a BSI may be difficult due to current CVAD utilization data reported to NHSN (i.e., a patient who has multiple concurrent CVADs, only a single device day is counted) s using CLABSI criteria from the Centers for Disease Control and Prevention (CDC).

4 Recommendation:

1. Considerations may be given to re-evaluate insertion practices for placing an additional CVAD for select patient populations, unless clinically indicated and therapeutically necessary.
2. Consider incorporating a question in the epidemiological review process of BSI events to determine if there is a trend of patients with multiple VADs during hospitalization.
3. Perform an assessment using surveillance data from a facility to determine the frequency of concurrent CVAD insertions in select patient populations; review BSI events to analyze possible root causes, in addition to considerations for the type of organism (e.g., skin flora).
4. Further research is needed to evaluate BSI risk for patients with concurrent devices (e.g., CVAD and PIVC). However, it is important to caution healthcare facilities against using PIVCs to infuse therapy (i.e., specifically to avoid CLABSI surveillance definitions) when a CVAD may be more appropriate.

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Table 1: Literature Search Terms

PATIENTS WITH VASCULAR ACCESS DEVICES	SPECIMEN DIVERSION	BLOODSTREAM INFECTIONS OR GENERAL INFECTIONS
arterial line Catheter (replaces all specific catheter terms in the most inclusive VAD search string*) Catheterization central line implanted port intra-arterial line intravenous line midline peripheral IV PICC Port-A-Cath PortACath vascular access device/port/ reservoir venous access device/port/ reservoir venous port venous reservoir	monolumen bilumen multilumen multiple lumen “number of lumen” “number of ports” Single lumen Single port Double lumen Double port Dual lumen Dual port Pigtail Quadruple lumen Triple lumen	Bacteremia Bloodstream infection Blood stream infection Sepsis Septicemia PLABSI LABSI CRBSI CLABSI HAI HOBS HA-BSI NBSI General Infections Infection Bacteremia Sepsis Septicemia PLABSI LABSI CRBSI CLABSI HAI HOBS HA-BSI NBSI

Table 2: Exclusions

Non-hospitalized patient populations
Animal studies
Case studies or commentary articles
Articles not utilizing bloodstream infection as an outcome

SBAR: Anatomical Site Selection of Non-Central Venous Access Devices for Prevention of Bloodstream Infections APIC CRPI | Last updated 5/2/25

1 Situation:

An evidence-based guideline is not currently available to answer the question: Among hospitalized patients requiring non-central venous access devices, how does the anatomical site selection for vascular access devices influence the incidence of bloodstream infections during hospitalization?

2 Background:

- A literature search identified 318 articles utilizing common search terms (Table 1).
- Eight studies and one systematic review and meta-analysis[1-7,10] remained after full text review and application of additional restrictions (Table 2).
    - Four[2-5] of the eight articles identified in our review were included in a systematic review and meta-analysis published in 2014 by O'Horo et al. In the twelve comparative studies included in the meta-analysis, arterial catheters placed at the femoral site had a relative risk of catheter-related bloodstream infection (CR-BSI) 1.94 times greater than those placed at the radial site.[1]
    - A cohort study published in 2022 assessed 403,206 patients with peripheral intravenous catheters (PIVCs) and found a statistically significant reduction in bloodstream infections ($p=0.046$) when the PIVC was inserted into the hand versus other upper extremity sites.[6]
    - A retrospective case-control study published in 2019 identified 45 hospital-onset episodes of S. aureus bacteremia, 16 of which were in patients with peripheral venous catheters. PIVCs placed in the antecubital area were statistically ($p=0.02$) more likely to be associated with a hospital-onset S. aureus bacteremia than those inserted in non-antecubital sites.[10]
    - A multi-center observational study of 7,235 patients published in 2020 found a statistically significant higher rate ($p<0.01$) of non-fermenting gram-negative bacilli in femorally-inserted catheters as compared to non-femorally inserted (including both central venous access devices (CVADs) and arterial catheters).[7]
    - A case-control study published in 2023 assessed 65 cases of hospital-onset bacteremia, 12 in patients with PIVCs. Odds ratios for each PIVC insertion location are as follows: antecubital 0.35, wrist 1.62, overall flexure 0.57, forearm 1.42.11
- The Infusion Nurses Society Standards of Practice, and as a result, the Association for Vascular Access makes the following recommendation in their 2024 Standards of Care for Peripheral Intravenous Catheters: Evidence-Based Expert Consensus.[8,9]
    - Clinicians inserting PIVCs use upper extremity sites in adult patients, when clinically appropriate.
        - » Clinicians inserting PIVCs give preference to vessels of the forearm unless clinically inappropriate (e.g., for chronic kidney disease).
    - Clinicians avoid suboptimal PIVC sites such as areas of flexion, injury, infection, lymphedema, lymph node dissection, fistulas, fractures, impaired skin integrity, or locations of planned procedures.

- » For PIVCs inserted in areas of flexion, use joint stabilization to reduce the risk of complications. Joint stabilization must not obscure the PIVC insertion site or obstruct the infusion of vascular pathway.
- » PIVCs should not be inserted on the trunk of the body (e.g., chest, breast).

3 Assessment:

- Although risk of infection is an important consideration when selecting the insertion site for vascular access, it is not the only consideration. Joint flexion, patient injury, lymphedema, lymph node dissection, fistulas, fractures, impaired skin integrity, and locations of planned procedures are some of the other key considerations.
- Multiple studies suggest higher rates of bloodstream infection in arterial catheters inserted in the femoral artery than those placed in the radial artery.1
- There is insufficient evidence to confidently correlate PIVC insertion site with risk of bloodstream infection, though it may be possible to extrapolate the relationship for some sites based on the more robust findings for central venous catheters
  a. A single large study[6] suggests a lower risk of blood stream infections with peripheral intravenous catheters (PIVC) when inserted in the hand versus other upper extremity sites. Interpretation of these findings is limited by the fact that hand insertion is compared with all other upper extremity sites versus assessing each site individually.
  b. Study results conflict regarding the risk of infection utilizing the antecubital insertion site for PIVC. One small study showed an increased incidence of hospital-onset S. aureus bacteremia in patients with PIVC inserted into an antecubital site[10], while another showed a lower odds ratio of bloodstream infection with the antecubital site in comparison with other upper extremity sites.

4 Recommendation:

1. When clinically appropriate, arterial catheters should be placed in the radial arterial rather than the femoral artery to reduce the risk of bloodstream infections.
2. PIVC insertion decisions should be based on vascular assessment of each patient. When clinically appropriate, clinicians should insert PIVCs in the upper extremity, favoring the vessels of the forearm and avoiding suboptimal sites such as areas of flexion.

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Table 1: Literature Search Terms

PATIENTS REQUIRING VASCULAR ACCESS DEVICES	ANATOMICAL SITE	INSERTION SITE	GENERAL INFECTIONS
arterial line Catheter (replaces all specific catheter terms in the most inclusive VAD search string*) Catheterization central line implanted port intra-arterial line intravenous line midline peripheral IV PICC Port-A-Cath PortACath vascular access device/port/reservoir venous access device/port/reservoir venous port venous reservoir sensitivity. For example, use of the term “catheter” above will capture “arterial catheter”, “central catheter”, dialysis catheter”, etc.	cephalic Subclavian Jugular Forearm Antecubital Hand Femoral Extremities “upper body” “lower-body” wrist	Insertion site Insertion location Site of insertion Catheter site Access point Access option Accesses	Infection Bacteremia Sepsis Septicemia PLABSI LABSI CRBSI CLABSI HAI HOBS HA-BSI NBSI

Table 2: Exclusions

Non-hospitalized patient populations
Studies that only included central vascular catheters
Animal studies, case studies, or commentary articles
Articles not utilizing bloodstream infection as an outcome
Studies older than 25 years
Studies only addressing pediatric or neonatal populations

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