Interior Health

ARO BLOODSTREAM INFECTION (ARO BSI) PROTOCOL

INFECTION PREVENTION AND CONTROL

July 2025

Interior Health

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Introduction

Bloodstream infections (BSI) are associated with significant morbidity, mortality, prolonged hospital stays, and increased healthcare costs. When caused by an antibiotic-resistant organism (ARO), the healthcare burden is greater due limited treatment options and the need for additional interventions. Timely and accurate BSI surveillance is important to measure disease incidence, provide internal and external comparisons, and evaluate intervention effectiveness (Public Health Agency of Canada [PHAC], 2023; Centers for Disease Control and Prevention [CDC], 2025; American Society for Microbiology [ASM], 2024; Alberta Health Services [AHS], 2025).

Surveillance can be performed for all BSIs, but the Interior Health (IH) Infection Prevention and Control (IPAC) program has focused effort on two types of BSIs based on clinical significance and prevalence in acute care.

1) BSIs with any of the following antibiotic-resistant organisms (AROs): methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococcus (VRE), carbapenemase-producing organisms (CPO), and *Candida auris* (C. auris).
2) BSIs attributed to a central line in critical care patients *(this will not be addressed in this protocol - see separate CLABSI protocol for further details on this surveillance).*

Additional BSI surveillance will be determined by the IPAC leadership as required.

Goal

To decrease healthcare-associated (HA) BSIs associated with MRSA, VRE, CPO, C. auris in Interior Health.

Objectives

1. To establish site-specific rates for HA BSIs with an antibiotic-resistant organism (MRSA, VRE, CPO, C. auris) in the patient population under surveillance in acute care facilities in Interior Health.
2. To leverage surveillance data to develop and assess IPAC interventions that enhance patient safety.
3. To establish quarterly and annual incidence rates of HA ARO BSIs under surveillance for trend analysis and benchmarking.
4. To identify clusters of HA ARO BSIs and identify areas (facilities and units) requiring intervention.

Methodology

All new episodes of positive blood cultures with an antibiotic-resistant organism (MRSA, VRE, CPO, or C. auris) while admitted as an inpatient to an Interior Health acute care facility are eligible for surveillance. ARO blood culture results are identified via lab results that flow electronically into the IPAC Dashboard App. The Infection Control Professionals (ICPs) review blood culture results to determine if they represent a new BSI case. If so, they will classify as healthcare-associated (HA) or community-acquired (CA), and gather other relevant case details within the IPAC Dashboard App.

Patient Population

All individuals admitted to Interior Health acute care facilities where inpatient care is provided 24 hours per day, 7 days a week, who have a positive ARO blood culture collected while admitted.

Case Definition

Inclusion Criteria

- All BSIs positive for MRSA, VRE, CPO, or C. auris while admitted to a facility under surveillance;
- BSI cases identified in patients admitted to an acute care facility, or identified in patients in the emergency department/outpatient clinic who are subsequently admitted to an acute care facility under surveillance

Exclusion Criteria

- BSI cases identified in the emergency department for patients who are discharged and not subsequently admitted
- BSIs positive with any other organism not listed above

- Clinic or other outpatient cases who are NOT subsequently admitted to hospital

Recurrent versus New BSI

- If the same organism is isolated from a subsequent blood culture:
  - **Recurrent BSI:**
    - If less than or equal to 14 days from a negative blood culture
      OR
    - Less than or equal to 14 days since completion of antibiotic treatment for the ARO BSI
      THEN: considered a recurrent BSI and **associate to previous case**
  - **New BSI:**
    - If greater than 14 days from a negative blood culture (if done)
      AND
    - Greater than 14 days from completion of antibiotic therapy
      THEN: report as a new infection and create a new dashboard case
- If multiple AROs are isolated from a single blood culture, report all organisms under a single BSI record. An exception to this is if one of the organisms is secondary to another body site, while one of the organisms is a primary infection – in this scenario report both primary and secondary BSI records separately.
- If a patient has a subsequent positive blood culture with a different organism, report it as a new BSI case.

Types of BSI

All lab confirmed BSIs can be classified as primary or secondary to an infection at another body site (see Appendix B for algorithm).

Primary BSI

- **Primary Line-Related:**
  - Organism is unrelated to an infection at another body site according to NHSN definitions (refer to Secondary BSI definition in this protocol pg 5)
    AND
  - A central line [a] was in place for >2 calendar days on the date of the positive blood culture, with day of device placement being day 1
    OR
  - A vascular access device (VAD) [b] was in place for >2 calendar days on the date of the positive blood culture, with the date of device placement being day 1 and there is pus at the VAD site that was cultured positive with a matching organism
  - **Note:** if the patient was in the ICU, please refer to the CLABSI protocol to determine if the BSI is also a CLABSI case
- **Primary Unknown Origin:**
  - BSI is not secondary to an infection at another site (based on NHSN infection definitions) and patient does not meet any of the other Primary BSI definitions

a: Central Line: An intravascular catheter that terminates at or close to the heart or in one of the great vessels which is used for infusion, withdrawal of blood, or hemodynamic monitoring. See CLABSI protocol for more details on eligible lines.

b: Vascular access device (VAD): VAD's include: Arterial catheters (unless in the pulmonary artery, aorta, or umbilical artery); arteriovenous fistulae; arteriovenous graft, atrial catheters (also known as transthoracic intra-cardiac catheters, those catheters inserted directly into the right or left atrium via the heart wall); hemodialysis reliable outflow (HERO) dialysis catheters; intra-aortic balloon pump (IABP) devices; non-accessed CL (those neither inserted nor used during current admission); peripheral IV or Midlines.

Secondary BSI

These are BSIs which are related to a primary infection at another body site. The NHSN definitions of healthcare-associated infections are used to determine criteria of infection at another body site. For a BSI to be considered secondary to an infection at another body site, the following requirements must be met:

- A NHSN site-specific infection definition must be fully met
  AND
- One of the following scenarios must be met:
  - At least one organism from the blood specimen matches an organism identified from a site-specific infection that is used as an element to meet the NHSN site specific infection criterion AND the blood specimen is collected during the secondary BSI attribution period [c] (see NHSN for Date of Event and Secondary BSI Attribution Period definitions for more information);
    OR
  - An organism identified in the blood specimen is an element that is used to meet the NHSN site-specific infection criterion and is collected during the site-specific infection window period. [d]

c: Secondary BSI Attribution Period: The period in which a blood specimen must be collected for a secondary bloodstream infection to be attributed to a primary site infection. This includes the infection window period (7 days), and the 10 days following the infection window period.

d: Infection Window Period: The 7-days during which all site-specific infection criteria must be met. It includes the collection date of the first positive diagnostic test that is used as an element to meet the site-specific criterion, the 3 calendar days before and the 3 calendar days after.

Secondary BSI Example

Hospital Day	Infection Window Period for Primary Site of Infection	Secondary BSI Attribution Period
1		
2		
3		
4	**Urine culture:** ≥ 10-100 x 10^6 CFU/L VRE	
5	Fever > 38.0°C	
6		
7		
8		
9		
10		**Blood culture:** VRE positive
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		

Healthcare-associated BSI Secondary to UTI

- Blood culture with an ARO identified on or after the third calendar day of admission
- Urine culture and blood culture pathogen = VRE
- Urine culture met NHSN UTI criteria during infection window period
- Blood culture taken during secondary BSI attribution period

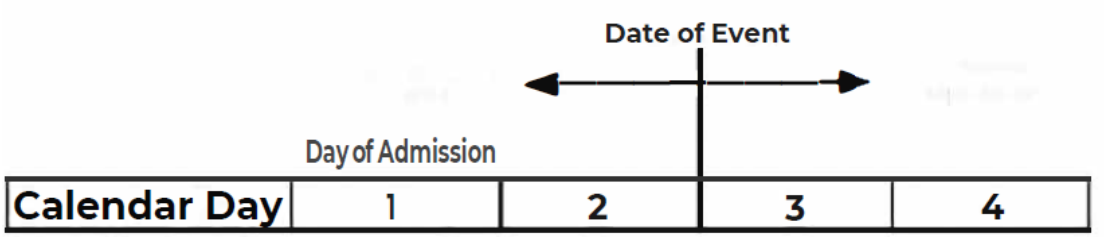
Infection Window Period
(First positive diagnostic test, 3 days before and 3 days after)

Secondary BSI Attribution Period
(Infection window period of primary infection event + 10 days after)

Note: This example is adapted from the National Healthcare Safety Network Secondary BSI example (CDC, 2025a)

Case Classification:

Once a positive blood culture has been identified as meeting inclusion criteria, it will be classified as healthcare-associated (HA) or community-associated (CA).



1. Healthcare-associated to your acute care facility (**HA-YAF**)

BSI is identified on or after the 3rd calendar day (or 72 hours) of admission, where calendar day 1 is the day of hospital admission.

and

The primary BSI or the infection site where the secondary BSI is attributed to must not be present or incubating at the time of admission. If the patient has been admitted to acute care for less than 3 calendar days prior to the onset of the BSI, there must be compelling evidence that the infection is attributed to the hospital (i.e., there is an established epidemiological link)

OR

Patient has been hospitalized in your facility in the last 7 days or up to 90 days [e] (depending on the source of infection)

OR

Patient has had a healthcare exposure at your facility that would have resulted in this bacteremia (using best clinical judgement) [f]

Note: HA-YAF case classification definition for Newborns (<28 days old):

- The newborn is on or beyond calendar day 3 (>72hrs) of their hospitalization
- The mother was NOT known to have the same ARO as the BSI on admission and there is no epidemiological reason to suspect that the mother was colonized prior to admission, even if the newborn is <48 hours of age.

2. Healthcare-associated to any other healthcare exposure (**HA-Other**)

Any patient who has a bacteremia not acquired at your facility that is thought to be associated with any other healthcare exposure using best clinical judgement [f] (e.g. another acute care facility, long-term care, rehabilitation facility, clinic, ED visit or exposure to a medical device).

Direct transfers between inpatient facilities:
If all elements of a BSI are present in less than 3 calendar days (<72 hours) of transfer from one inpatient location to another in the same facility or to another facility under surveillance (i.e., on the day of transfer or the next day), the infection may be attributed back (HA-back) to the transferring location or facility. To meet this HA-back criteria, the patient must have been at the sending facility for at least 3 calendar days (≥72 hours). The Infection Control Professional (ICP) should share information about such HA infections with the transferring facility to ensure accurate reporting and awareness.

Community-Associated (CA) BSI

No exposure to healthcare that would have resulted in this bacteremia (using best clinical judgement)[f] and does not meet the criteria for HA BSI.

e: Only applies to bacteremia from a surgical wound that occurs within 90 days after a surgical procedure completed should be considered HA to the site where the surgery was performed.
f: Consideration should be given to the frequency and nature of exposure to a medical device and/or procedure. For example, patients attending dialysis, receiving chemotherapy, outpatient visits involving invasive procedures or day surgery may be more likely to be considered HA compared to adult patients with occasional outpatient or community health clinic visits.

Other Considerations for Classification

BSI identified in Surgical Site Infections (SSIs):
If a BSI is identified as secondary to an SSI, it will be classified as HA to the facility where the surgery was done if the infection occurs within the National Healthcare Safety Network (NHSN) SSI defined follow-up time.

Secondary BSI:
If a BSI is determined to be secondary to a primary infection that was present or incubating on admission, the BSI would not be considered HA.

Mandatory Data Entry

- All new episodes of BSI with an antibiotic-resistant organism (MRSA, VRE, CPO, C. auris) of any case classification (HA and CA)
    - Entry for MRSA is also required in the **ARO module** – refer to the MRSA protocol for more information on correct case classification.
    - Entry of primary line-related BSIs for ICU patients with an eligible central line may require entry into the **CLABSI module** – refer to the CLABSI protocol for more information on case inclusion.

Denominators & Rate Calculations

The number of inpatient days are used for calculation of HA BSIs, and the number of inpatient admissions are used for calculation of CA BSIs.

Incidence Rates for Interior Health Hospitalized Patients

Case Classification	Calculations
Healthcare-associated (HA) ARO BSI [g]	$\frac{\text{Number of HA ARO BSI cases}}{\text{Number of patient-days}} \times 10{,}000$
Community-associated (CA) ARO BSI	$\frac{\text{Number of CA ARO BSI cases}}{\text{Number of admissions}} \times 1{,}000$

g: Rates may be further analyzed to derive rates for Primary or Secondary BSI, or by organism type (MRSA, VRE, CPO, or C. auris)

Comparator Rates

Internal and external surveillance rates are used as comparators. The internal rates are the historical rates for Interior Health from the previous fiscal year (once surveillance is established). The external rates are provided by the Canadian Nosocomial Infection Surveillance Program (CNISP) which are created from data submitted by mostly large and tertiary acute care facilities; therefore, may not provide appropriate comparisons for smaller acute care facilities.

Reporting

Communication and dissemination of surveillance reports is an integral part of surveillance to inform IPAC practice within Interior Health facilities and provide support for interventions that improve the quality of patient care delivered. Responsibility for compiling, reporting, and disseminating data and reports is shared between the IPAC and Epidemiology and Surveillance Unit (ESU). Formal reports are generated routinely, using reconciled and validated data.

Data Quality

The purpose of evaluating the quality of data is to ensure that surveillance-related events are monitored efficiently and effectively. The evaluation should involve the assessment of the program (i.e., the protocol and reporting) and system (i.e., electronic data collection tool) attributes, including relevance, simplicity, flexibility, data quality, acceptability, consistency, representativeness, timeliness and stability. Additionally, with increasing use of technology, informatics concerns for surveillance systems need to be addressed. These include evaluating hardware and software, applying standard data formatting and coding, performing quality checks and adhering to confidentiality and security standards.

A standardized approach is used to reconcile and validate the data. The first component entails ensuring the surveillance-related events are entered in a manner that is consistent with the protocol definitions. Outliers are identified and reviewed with the ICPs to verify that the data was correctly entered, and definitions were consistently applied according to the protocol and NHSN definitions. Final designation of cases is a collaborative effort between facility-based ICPs, the Epidemiologist and Medical Microbiologist.

Data Quality Working Group

The IPAC Data Quality Working Group is responsible to develop, review and update indicator protocols to include the precise methodology for data collection to ensure consistency. Decisions from the Data Quality Working Group on specific protocol questions are

communicated to the Interior Health ICPs through the Data Quality Forum. These decisions will be supplemental to the protocol and will be incorporated into the protocol, when revised.

Protocol Revision History

Date	Details
July 2025	Protocol Approved by Data Quality Working Group

References

Alberta Health Services. (2025). Bloodstream Infection (BSI) Protocol. Retrieved April 2025, from https://www.albertahealthservices.ca/assets/healthinfo/ipc/hi-ipc-sr-bsi-surveillance-protocol.pdf

American Society for Microbiology. (2024). Antimicrobial Resistance and Bloodstream Infections. Retrieved April 2025, from https://asm.org/articles/2024/december/antimicrobial-resistance-and-bloodstream-infection#:~:text=These%20conditions%20require%20immediate%20medical,infections%20(BSIs)%20increasingly%20difficult.

Centers for Disease Control and Prevention. (2025). National Healthcare Safety Network: Bloodstream Infection Event (Central Line-Associated Bloodstream Infection and Non-central Line Associated Bloodstream Infection). Retrieved April 2025, from http://www.cdc.gov/nhsn/PDFs/pscManual/4PSC_CLABScurrent.pdf

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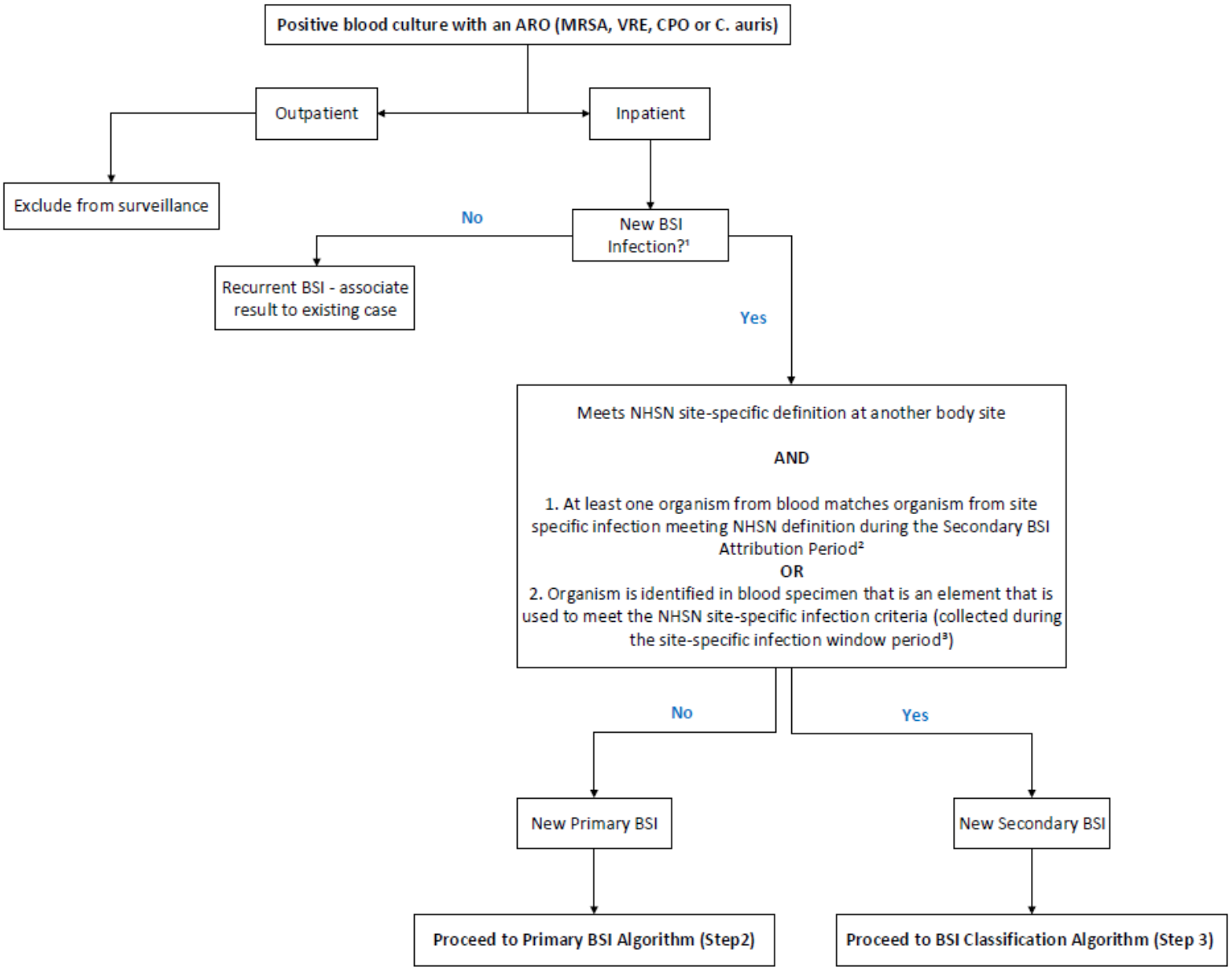
Public Health Agency of Canada. (2023). Canadian Nosocomial Infection Surveillance Program (CNISP) Surveillance for Central Line Associated Blood Stream Infections (CLABSI) in Intensive Care Units - CLABSI Surveillance Protocol. Retrieved April 2025, from https://ipac-canada.org/photos/custom/Members/CNISPpublications/CNISP%202024%20CLABSI%20Protocol_EN_final.pdf

Appendix A: BSI Protocol Definitions

Term	Definitions
Calendar days	Used for determining the timeline of presenting with or acquiring a BSI. Calendar day 1 is the day of patient admission or day of surgical procedure.
Epidemiological Link	A case is thought to be epidemiologically linked to another person(s) or healthcare worker(s) in a facility (e.g., shared same room, same ward/unit, same caregiver, and same procedure/surgery as a known patient/resident with the same antibiotic-resistant organism).
Infection	Presence of microorganism from any site with signs and the manifestation of symptoms of a clinical infection. Refer to National Healthcare Safety Network definitions for infection definitions from specific sites (CDC, 2025).
Infection window period	The 7-days during which all site-specific infection criteria must be met. It includes the day of the first positive diagnostic test (i.e. lab specimen collection, imaging test, procedure or exam, physician diagnosis and initiation of treatment) that is an element of the site-specific infection criterion, was obtained, and the 3 calendar days before and the 3 calendar days after. For site-specific infection criteria that does not include a diagnostic test, the first documented localized sign or symptom that is an element of the National Healthcare Safety Network infection criterion, excluding SSIs, should be used to define the window (i.e., site specific pain, purulent exudate) (CDC, 2025a).
Secondary BSI attribution period (Infection window period + 10 days)	The infection window period of the primary infection event and 10 days after. This 10 day period is not the same as the 10 days used for determining a recurrent BSI. The BSI protocol does not use the Repeat Infection Timeframe that is included in the National Healthcare Safety Network definition (CDC, 2025a)
Vascular access devices	Device inserted in a patient to access the bloodstream for frequent or regular administration of drugs, like intravenous (IV) antibiotics. If there is a pus at one of the following vascular access devices and a specimen collected from that site has at least one matching organism to an organism found in the blood during the infection window period, the BSI will not be considered central line-associated. Vascular access devices included in this exception are limited to: o Arterial catheters unless in the pulmonary artery, aorta or umbilical artery o Arteriovenous fistulae o Arteriovenous grafts o Atrial catheters (also known as transthoracic intra-cardiac catheters, those catheters inserted directly into the right or left atrium via the heart wall) o Hemodialysis reliable outflow (HERO) dialysis catheters o Intra-aortic balloon pump (IABP) devices o Non-accessed CL (those neither inserted nor used during current admission) o Peripheral IV or Midlines

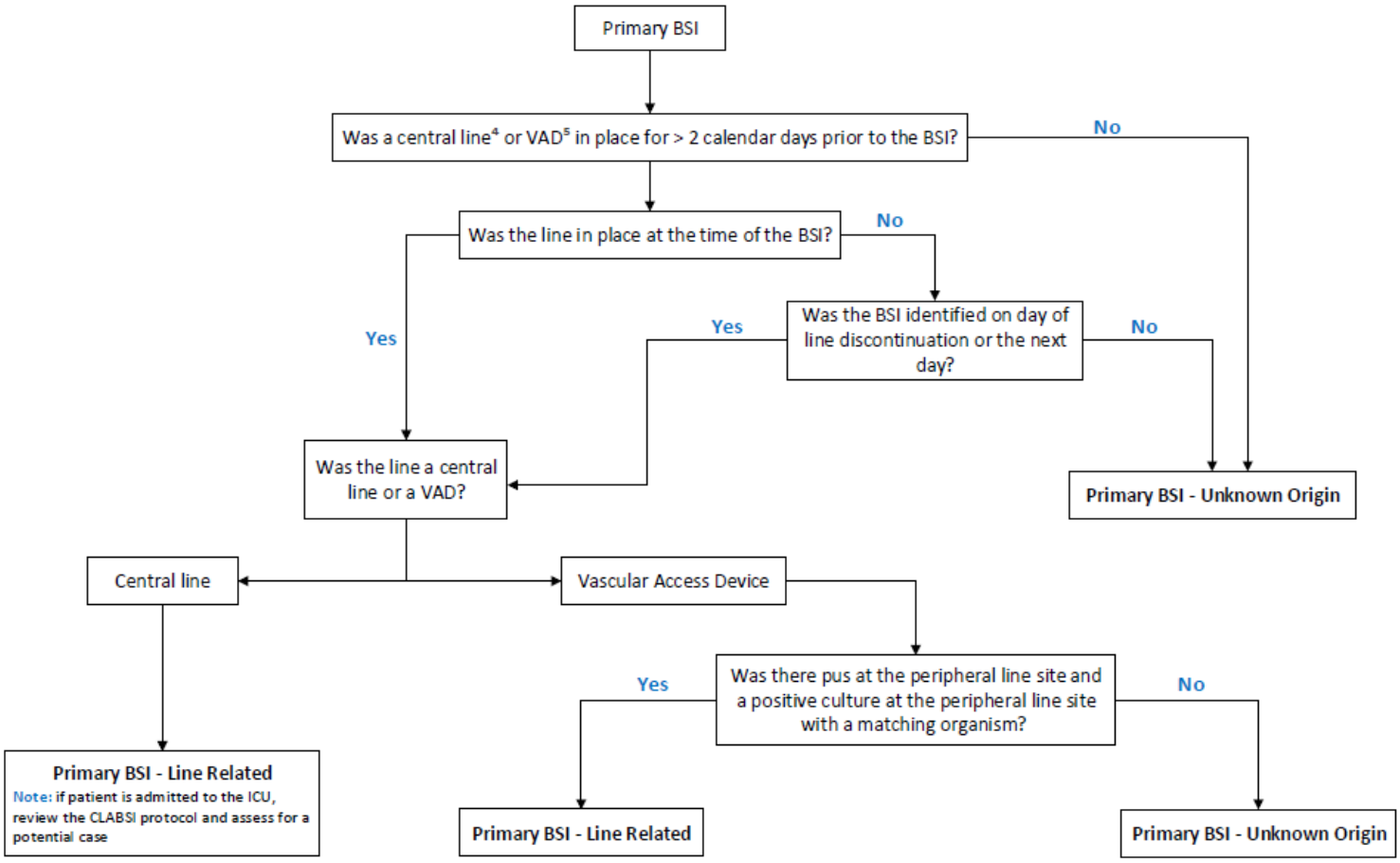
Appendix B: BSI Algorithms

First Step: Primary or Secondary BSI?



1. **New BSI:** In subsequent blood cultures, if the same microorganism is identified **greater** than 14 days from a negative culture (if culture was done) **AND greater** than 14 days from the completion of antibiotic therapy for the BSI, **REPORT** as a NEW infection. If not, consider it as a recurrent BSI.
2. **Secondary BSI Attribution Period:** The infection window period of the primary infection event plus 10 days after (total of 17 days)
3. **Infection Window Period:** Seven days which all site-specific infection criteria must be met. It includes the days the first positive diagnostic test that is an element of the BSI criteria was obtained, the 3 calendar days before and the 3 calendar days after.

Second Step: Primary BSI Algorithm



Proceed to Third Step: BSI Classification Algorithm

4. **Central Line:** An intravascular catheter that terminates at or close to the heart or in one of the great vessels which is used for infusion, withdrawal of blood, or hemodynamic monitoring. If a patient is in the ICU, assess for a potential CLABSI case in addition to an ARO-BSI case.
5. **Vascular access device (VAD):** Devices included are: arterial catheters unless in the pulmonary artery, aorta, or umbilical artery; arteriovenous fistulae; arteriovenous graft; atrial catheters (also known as transthoracic intra-cardiac catheters, those catheters inserted directly in the right or left atrium via the heart wall); hemodialysis reliable outflow (HERO) dialysis catheters; intra-aortic balloon pump (IABP) devices; non-accessed CL (those neither inserted nor used during current admission); peripheral IV or midlines.

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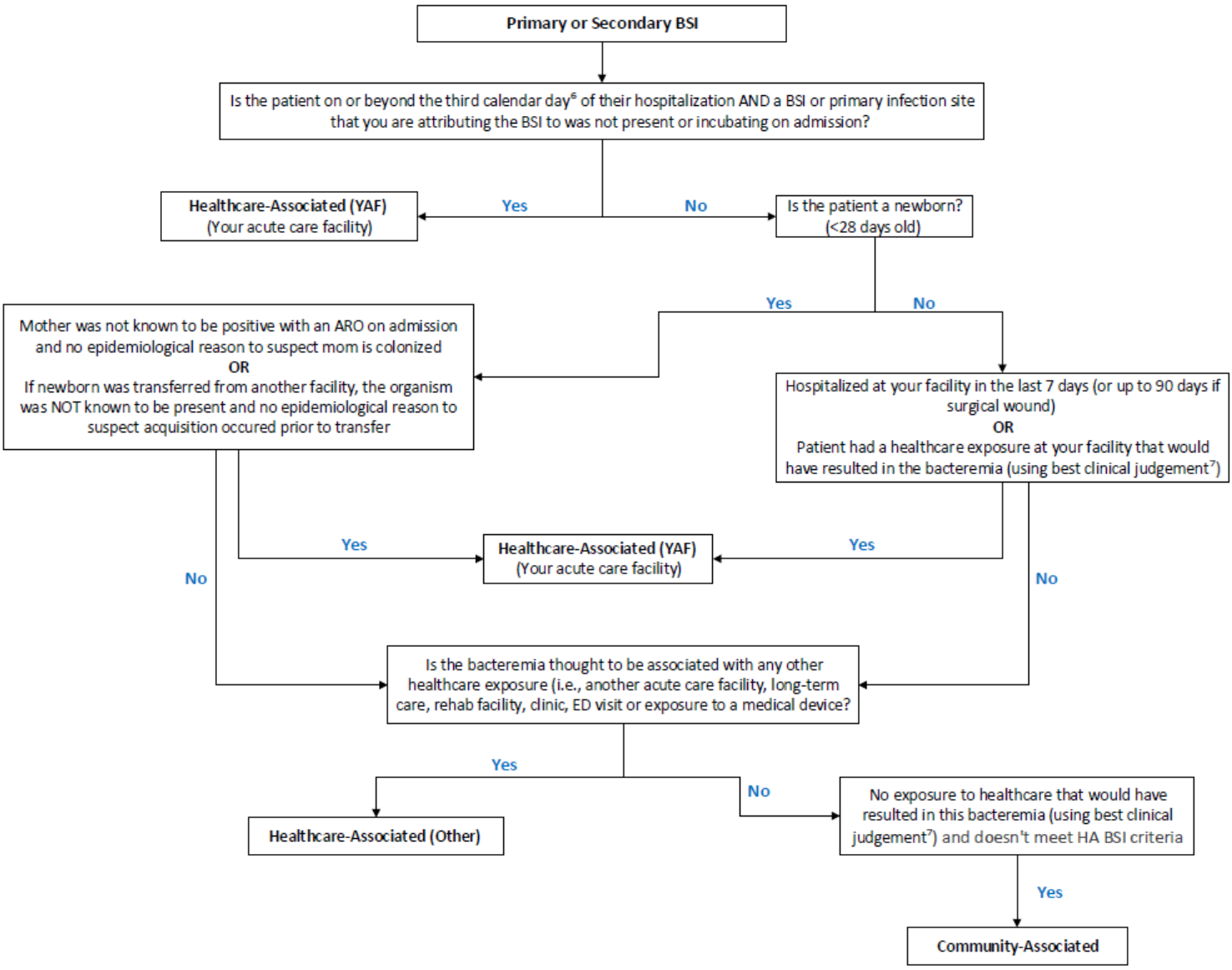
Third Step: BSI Classification Algorithm



6. Calendar Day 1 is the day of acute care admission
7. Consideration should be given to the frequency and nature of exposure to a medical device and/or procedure. For example, patients attending dialysis, receiving chemotherapy, outpatient visits involving invasive procedures or day surgery may be more likely to be considered HA compared to adult patients with occasional outpatient or community health clinic visits.