Bloodstream Infection Event (Central Line-Associated Bloodstream Infection and Non-central Line Associated Bloodstream Infection)

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Bloodstream Infection Event (Central Line-Associated Bloodstream Infection and Non-central Line Associated Bloodstream Infection)

Introduction

Although a 46% decrease in CLABSIs has occurred in hospitals across the U.S. from 2008-2013, an estimated 30,100 central line-associated bloodstream infections (CLABSI) still occur in intensive care units and wards of U.S. acute care facilities each year.[1] CLABSIs are serious infections typically causing a prolongation of hospital stay, increased cost, and risk of mortality.

CLABSIs can be prevented through proper insertion techniques and management of the central line which are addressed in the CDC's Healthcare Infection Control Practices Advisory Committee (CDC/HICPAC) *Guidelines for the Prevention of Intravascular Catheter-Related Infections, 2011*.[2]

Settings

Surveillance may occur in any inpatient location where denominator data can be collected, which can include critical/intensive care units (ICU), specialty care areas (SCA), neonatal units including neonatal intensive care units (NICUs), step down units, wards, and long-term acute care units. A complete listing of inpatient locations and instructions for mapping can be found in the CDC Locations and Descriptions chapter.

> **Note:** CLABSI surveillance after patient discharge from a facility is not required. However, if discovered, any CLABSI with a date of event (DOE) on the day of or the day after discharge is attributed to the discharging location and should be communicated to that facility to encourage appropriate NHSN reporting of CLABSIs. (See Transfer Rule, Chapter 2). Do not collect or report additional central line days after discharge.

Key Terms and Abbreviations

Refer to the NHSN Patient Safety Manual, Chapter *2 Identifying Healthcare Associated Infections in NHSN* and Chapter 16 *NHSN Key Terms* for definitions of the following universal concepts for conducting HAI surveillance.

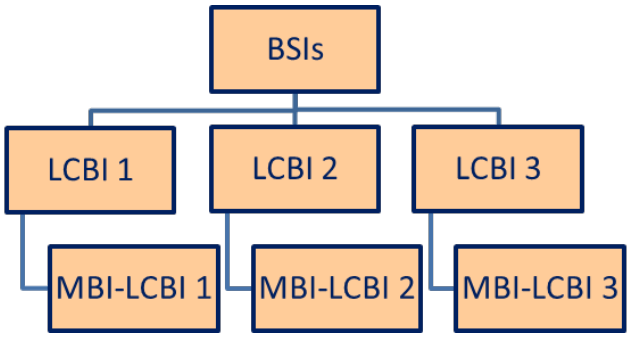
I. Date of event (DOE)
II. Healthcare associated infection (HAI)
III. Infection window period (IWP)
IV. Present on admission (POA)
V. Repeat infection timeframe (RIT)
VI. Secondary BSI attribution period (SBAP)
VII. Location of Attribution (LOA)
VIII. Transfer rule

Definitions Specific to Bloodstream Infection (BSI) / Central Line Associated Bloodstream Infection (CLABSI) Surveillance:

Primary bloodstream infection (BSI): A Laboratory Confirmed Bloodstream Infection (LCBI) that is not secondary to an infection at another body site (see Appendix: Secondary BSI Guide and CDC/NHSN Surveillance Definitions for Specific Types of Infection [Ch-17], urinary tract infection (UTI) [Ch-7], pneumonia (PNEU) [Ch-6], and surgical site infection (SSI) [Ch- 9].

Laboratory Confirmed Bloodstream Infection (LCBIs) Hierarchy; Types of LCBIs

(see Table 1 and Table 2):



Secondary BSI: A BSI that is thought to be seeded from a site-specific infection at another body site (see Appendix: Secondary BSI Guide and CDC/NHSN Surveillance Definitions for Specific Types of Infection, UTI, PNEU, and SSI).

Secondary BSI Attribution Period (SBAP): The period in which a blood specimen must be collected for a secondary BSI to be attributed to a primary site of infection. This period includes the Infection Window Period (IWP) combined with the Repeat Infection Timeframe (RIT). The SBAP is 14-17 days in length depending upon the date of event (See Secondary BSI Attribution period, Chapter 2).

Infusion: The administration of any solution through the lumen of a catheter into a blood vessel. Infusions include continuous infusion (for example, nutritional fluids or medications), intermittent infusion (for example, IV flush), IV antimicrobial administration, and blood transfusion or hemodialysis treatment.

Access: The performance of any of the following activities during the current inpatient admission:

- Line placement
- Use of (entering the line with a needle or needleless device) any central line for:
  - Infusion
  - Withdrawal of blood
- Use for hemodynamic monitoring

Notes:

1. If a patient is admitted to *an inpatient* location with a central line (CL) already in place, and it is the patient's only CL, the day of ***first access*** in an inpatient location begins the central line day count (CL Day for making central line-associated determinations). De-accessing any type of central line (for example, removal of port needle but port remains in body) does not remove the patient from CLABSI surveillance or device day counts for reporting denominator summary data.

2. An inpatient location, for making determinations about central line access, includes but is not limited to, any department or unit within the facility that provides service to inpatients [for example, inpatient Dialysis, Operating Room (OR), Interventional Radiology, Gastroenterology Lab (GI), Cardiac Catheterization lab (CC), wards, ICUs, etc.].

3. Include any inpatient receiving dialysis in CLABSI surveillance conducted in the patient's assigned inpatient location, regardless of whether the patient only has one CL and dialysis staff are the only providers to access it during dialysis treatment.

   Examples: *CLABSIs in the following examples will be attributed to Unit A*
   - Patient on Unit A receives onsite dialysis by contracted dialysis staff
   - Dialysis staff travels to Unit A to provide dialysis to a Unit A patient
   - Patient in Unit A for inpatient care is transported to dialysis unit within the facility for dialysis

   Because CLABSI events cannot be attributed to a non-bedded inpatient location (inpatient location where denominator data is not collected but inpatient care is provided, for example, OR, IR, or inpatient dialysis), such events must be attributed to the inpatient location housing the patient.

Central line (CL): An intravascular catheter that terminates at or close to the heart, **or** in one of the great vessels **AND** is used for infusion, withdrawal of blood, or hemodynamic monitoring. Consider the following great vessels when making determinations about CLABSI events and counting CL device days:

- Aorta
- Pulmonary artery
- Superior vena cava
- Inferior vena cava
- Brachiocephalic veins
- Internal jugular veins
- Subclavian veins
- External iliac veins
- Common iliac veins
- Femoral veins
- In neonates, the umbilical artery/vein.

Notes:

1. Neither the type of device nor the insertion site is used to determine if a device is considered a central line for NHSN reporting purposes.
2. At times, a CL may migrate from its original central location after confirmation of proper placement. NHSN does not require ongoing verification of proper line placement. Therefore, once a line has been designated a CL it remains a CL, regardless of migration, until removed from the body or patient discharge, whichever comes first. CL days are included for any CLABSI surveillance conducted in that location.
3. An introducer is an intravascular catheter, and depending on the location of the tip and its use, may be considered a CL.
4. A non-lumened intravascular catheter that terminates at or close to the heart or in a great vessel that is not used for infusion, withdrawal of blood or hemodynamic monitoring is not considered a CL for NHSN reporting purposes (for example, non-lumened pacemaker wires.)
    - There are some pacemaker wires that do have lumens, which may be considered a central line.

Types of Central Lines for NHSN reporting purposes:

1. Permanent central line: Includes:
    a. Tunneled catheters, including tunneled dialysis catheters
    b. Implanted catheters (including ports)
2. Temporary central line: A non-tunneled, non-implanted catheter
3. Umbilical catheter**:** A vascular catheter inserted through the umbilical artery or vein in a neonate. All umbilical catheters are central lines

Eligible Central Line: A CL that has been in place for **more than two consecutive calendar days** (on or after CL Day 3), following the *first access* of the central line, in an inpatient location, during the current admission. Such lines are eligible for CLABSI events and remain eligible for CLABSI events until the day after removal from the body or patient discharge, whichever comes first. (See Table 3 for examples).

Eligible BSI Organism: Any organism that is eligible for use to meet LCBI or MBI-LCBI criteria. In other words, an organism that is not an excluded pathogen for use in meeting LCBI or MBI-LCBI criteria. All organisms may not be included in the NHSN Terminology Browser. Contact NHSN for guidance regarding organisms that are not found in the browser.

Central line-associated BSI (CLABSI): A laboratory confirmed bloodstream infection where an **eligible BSI organism** is identified, and an **eligible central line** is present on the LCBI DOE or the day before.

Central line days: The number of days a central line is accessed to determine if an LCBI is a CLABSI.

Denominator device days: The count of central lines on an inpatient unit that is recorded in the monthly denominator summary data. This count begins on the first day the central line is present, regardless of access.

Devices **Not** Considered Central Lines for NHSN Reporting Purposes:

- Arterial catheters unless in the pulmonary artery, aorta, or umbilical artery
- Arteriovenous fistula
- Arteriovenous graft
- Extracorporeal life support (ECMO)
- Hemodialysis reliable outflow (HERO) dialysis catheter
- Intra-aortic balloon pump (IABP) devices
- Peripheral IV or Midlines
- Ventricular Assist Device (VAD)

Table 1: Laboratory-Confirmed Bloodstream Infection Criteria:

Must meet **one** of the following LCBI criteria:

Criterion	*Comments and reporting instructions that follow the site-specific criteria provide further explanation and are integral to the correct application of the criteria.* Once an LCBI determination is made, proceed to the MBI-LCBI definitions, and determine if the corresponding MBI-LCBI criteria are also met (for example, after meeting LCBI 2, investigate for potential MBI-LCBI 2)
LCBI 1 If LCBI 1 criterion is met, consider MBI-LCBI 1	Patient of any age has a recognized bacterial or fungal pathogen, not included on the NHSN common commensal list: 1. Identified from one or more blood specimens obtained by a culture **OR** 2. Identified to the genus or species level by non-culture based microbiologic testing (NCT)* methods (for example, T2 Magnetic Resonance [T2MR] or next-generation sequencing [NGS]). ***Note:*** *If blood is collected for culture within 2 days before, or 1 day after the NCT, disregard the result of the NCT and use only the result of the CULTURE to make an LCBI surveillance determination. If no blood is collected for culture within this time period, use the result of the NCT for LCBI surveillance determination.* **AND** Organism(s) identified in blood is not related to an infection at another site (See Appendix: Secondary BSI Guide). *For the purposes of meeting LCBI 1, NCT is defined as a methodology that identifies an organism directly from a blood specimen without inoculation of the blood specimen to any culture media.

<table>
<tr><td></td><td>Notes:
1. If a patient meets both LCBI 1 and LCBI 2 or LCBI 3 criteria, report LCBI 1 with the recognized pathogen entered as pathogen #1 and the common commensal as pathogen #2.
2. An eligible organism in the blood specimen is the only element needed to meet LCBI 1 criterion; therefore, the LCBI 1 DOE will always be the collection date of the first positive blood specimen used to set the BSI IWP.</td></tr>
<tr><td>LCBI 2

If LCBI 2 criterion is met, consider MBI-LCBI 2</td><td>Patient of any age has at least one of the following signs or symptoms: fever (>38.0°C), chills, or hypotension

AND

Organism(s) identified in blood is not related to an infection at another site
(See Appendix: Secondary BSI Guide).

AND

The same NHSN common commensal is identified by culture from two or more blood specimens collected on separate occasions (see Blood Specimen Collection).

For common commensal organisms, refer to the NHSN Terminology Browser.
Notes:
1. Criterion elements must occur within the 7-day IWP (as defined in Chapter 2) which includes the collection date of the positive blood specimen, the 3 calendar days before and the 3 calendar days after.

2. The two matching common commensal specimens represent a single element for use in meeting LCBI 2 criterion, and the collection date of the first specimen is used to determine the BSI IWP.

3. At least one element (specifically, a sign or symptom of fever, chills, or hypotension) is required to meet LCBI 2 criterion; the LCBI 2 DOE will always be the date the first element occurs for the first time during the BSI IWP, whether that be a sign or symptom or the positive blood specimen.

<table>
<tr><td></td><td>6/1</td><td>Fever > 38.0 °C</td><td>LCBI 2 DOE = 6/1</td></tr>
<tr><td></td><td>6/2</td><td>No LCBI element</td><td></td></tr>
<tr><td></td><td>6/3</td><td>No LCBI element</td><td></td></tr>
<tr><td rowspan="2">Single element</td><td>6/4</td><td>S. epidermidis (1 of 2)</td><td>Date of 1st diagnostic test = 6/4</td></tr>
<tr><td>6/5</td><td>S. epidermidis (2 of 2)</td><td></td></tr>
<tr><td></td><td>6/6</td><td>No LCBI element</td><td></td></tr>
<tr><td></td><td>6/7</td><td>No LCBI element</td><td></td></tr>
</table>
</td></tr>
</table>

<table>
<tr>
<td>LCBI 3

If LCBI 3 criterion is met, consider MBI-LCBI 3</td>
<td>
Patient ≤ 1 year of age has at least one of the following signs or symptoms:
fever (>38.0°C), hypothermia (<36.0°C), apnea, or bradycardia

AND

Organism(s) identified in blood is not related to an infection at another site
(See Appendix: Secondary BSI Guide).

AND

The same NHSN common commensal is identified by a culture from two or more blood specimens collected on separate occasions (see Blood Specimen Collection).

For common commensal organisms, refer to the NHSN Terminology Browser.

Notes:

1. Criterion elements must occur within the 7-day IWP (as defined in Chapter 2) which includes the collection date of the positive blood specimen, the 3 calendar days before and the 3 calendar days after.
2. The two matching common commensal specimens represent a single element for use in meeting LCBI 3 criterion, and the date of the first is used to determine the BSI IWP.

At least one element (specifically, a sign or symptom of fever, hypothermia, apnea, or bradycardia) is required to meet LCBI 3 criterion; the LCBI 3 DOE will always be the date the first element occurs for the first time during the BSI IWP whether that be a sign or symptom or the positive blood specimen.

<table>
<tr><td></td><td>5/31</td><td>No LCBI element</td><td></td></tr>
<tr><td></td><td>6/1</td><td>No LCBI element</td><td></td></tr>
<tr><td></td><td>6/2</td><td>No LCBI element</td><td></td></tr>
<tr><td rowspan="2">Single element</td><td>6/3</td><td>S. epidermidis (1 of 2)</td><td>Date of 1st diagnostic test = 6/3
LCBI DOE = 6/3</td></tr>
<tr><td>6/4</td><td>S. epidermidis (2 of 2)</td><td></td></tr>
<tr><td></td><td>6/5</td><td>Apnea documented</td><td></td></tr>
<tr><td></td><td>6/6</td><td>No LCBI element</td><td></td></tr>
</table>
</td>
</tr>
</table>

Table 2: Mucosal Barrier Injury Laboratory-Confirmed Bloodstream Infection (MBI-LCBI)

An MBI-LCBI is a subset of the LCBI criteria; therefore, a BSI event must fully meet an LCBI criterion before evaluating for the corresponding MBI-LCBI criterion.

The MBI-LCBI DOE will always be the date the prerequisite LCBI criteria are met. Abnormal ANC and WBC values reflect risk factors for acquiring an MBI-LCBI, not symptoms of infection and therefore are not used in DOE determinations.

Must meet **one** of the following MBI-LCBI criteria

<table>
<tr><th>MBI-LCBI 1</th><th>MBI-LCBI 2</th><th>MBI-LCBI 3</th></tr>
<tr><td>Patient of any age fully meets LCBI 1 criterion</td><td>Patient of any age fully meets LCBI 2 criterion</td><td>Patient <u>≤</u>1 year of age fully meets LCBI 3 criterion</td></tr>
<tr><td>with at least one blood specimen</td><td colspan="2">with at least two matching blood specimens</td></tr>
<tr><td>with ONLY organisms from the NHSN MBI organism list*</td><td colspan="2">with ONLY Viridans Group Streptococcus and/or Rothia spp. alone but no other organisms†</td></tr>
<tr><td>identified by culture or non-culture based microbiologic testing method</td><td colspan="2">identified by culture</td></tr>
<tr><td colspan="3"><u>AND</u>

Patient meets at least <u>one</u> of the following:

1. Is an allogeneic hematopoietic stem cell transplant recipient within the past year with one of the following documented during same hospitalization as positive blood specimen:
a. Grade III or IV gastrointestinal graft versus host disease [GI GVHD]
OR
b. ≥1-liter diarrhea in a 24-hour period (or ≥20 mL/kg in a 24-hour period for patients <18 years of age) with onset on or within the 7 calendar days before the date the positive blood specimen was collected.

OR

2. Is neutropenic, defined as at least two separate days with ANC† and/or WBC values <500 cells/mm^3 collected within a 7-day time period which includes the collection date of the positive blood specimen, the 3 calendar days before and the 3 calendar days after (See Table 5).</td></tr>
</table>

Notes:

1. If a patient meets both MBI-LCBI 1 and MBI-LCBI 2 or MBI-LCBI 3 criteria (specifically has Viridans Group *Streptococcus* or *Rothia* spp. and only MBI organisms in the blood specimen), report organisms as MBI-LCBI 1 with the recognized pathogen as pathogen #1 and the common commensal as pathogen #2.
2. Any combination of ANC and/or WBC values can be used to meet neutropenic criteria provided they are collected on separate days within the 7-day period that includes the date of the positive blood specimen, the 3 calendar days before and the 3 calendar days after.
3. When a blood specimen positive for an organism not included on the NHSN MBI organism list is collected during the BSI RIT of an MBI-LCBI, the initial MBI-LCBI event is edited to an LCBI and the identified non-MBI organism is added.

* Refer to the NHSN Terminology Browser for eligible MBI organisms.

†Eligible positive blood specimens must be collected on separate occasions and limited to the following:

- Viridans Group *Streptococcus* identified in at least two sets of blood specimens
- *Rothia* spp. identified in at least two sets of blood specimens
- Viridans Group *Streptococcus* ***and*** *Rothia* spp. identified in at least two sets of blood specimens

†Formula for calculating ANC if not provided by your laboratory:

- The ANC is not always reported directly in the chart
- The WBC in the chart is usually reported in terms of a thousand cells/mm^3 and can be used to calculate the ANC

ANC = Absolute Segs **+** Absolute Bands

OR

ANC **=** WBC **X** %Segs **+** %Bands **÷** 100

Example:

WBC	Segs	Bands
2 k/mm^3	20%	20%

ANC **=** 2000 ***X*** (20 **+** 20) **÷** 100 **=** 800 cells/mm^3

Reporting Instructions: See below for a Summary of CLABSI Exclusions and Reporting Requirements

When **a BSI event in the presence of a central line** meets one of the CLABSI exclusions listed below the following guidelines are applied:

- The event is reported to NHSN but is NOT considered central line associated.
- **The Central Line field is marked "Yes"** if an eligible central line has been on the BSI DOE and is still in place on the BSI DOE or the day before.
- The events do not contribute to the CLABSI SIR measure.
- In each instance where the date of event of subsequent positive blood specimens are outside of the established BSI RIT, meeting the exclusion criteria, the subsequent positive blood must be investigated as primary or secondary to another site-specific infection. The CLABSI exclusion criteria must be met again in a new BSI IWP to determine if the positive blood specimen is central line associated.

Note: Meeting LCBI criteria in all situations noted below will result in setting a BSI RIT and any associated device days should be included in the denominator summary data counts.

a. **Extracorporeal life support (ECLS or ECMO):** A BSI meeting LCBI criteria with an eligible central line where extracorporeal life support (for example, extracorporeal membrane oxygenation [ECMO]) is present for more than 2 days on the BSI DOE and is still in place on the DOE or the day before, is considered an LCBI. Report such events, marking the ECMO field as "Yes."

b. **Ventricular Assist Device (VAD):** A BSI meeting LCBI criteria with an eligible central line where a VAD is present for more than 2 days on the BSI DOE and is still in place on the DOE or the day before, is considered an LCBI. Report such events, marking the VAD field as "Yes."

c. **Patient Injection:** A BSI meeting LCBI criteria that is accompanied by documentation of observed or suspected patient injection into the vascular access line, within the BSI IWP, will be considered an LCBI for NHSN reporting purposes. This exclusion is very specific to **"INJECTION"**. Manipulating or tampering with the line (such as biting, picking at, sucking on, etc.) DOES NOT meet the intent of this exclusion. The documentation must specifically state the patient was "observed injecting…" or "suspected of injecting…" the device. Insinuations or descriptive events that suggest such behavior DO NOT meet the intent of this exclusion. Report such events, marking the Patient Injection field as "Yes."

d. **Epidermolysis bullosa (EB):** If during the current admission, there is documentation of a diagnosis of EB report such an event, marking the EB field as "Yes."

   Note: The Epidermolysis bullosa (EB) CLABSI exclusion is limited to the genetic forms of EB in the pediatric population.

e. **Munchausen Syndrome by Proxy (MSBP):** If during the current admission, there is documentation or a diagnosis of known or suspected MSBP, also known as factitious disorder, imposed on another (FDIA), report such an event, marking the MSBP fields as "Yes."

f. **Pus at the vascular access site:** Occasionally, a patient with both an eligible central line and another vascular access device will have pus at the other access site. If there is pus at the site of one of the following vascular access devices and a specimen collected from that site has at least one matching organism to an organism identified in the blood during the BSI IWP, report such events marking the "pus at the vascular access site" field as "Yes." Vascular access devices included in this exception are limited to:

- Arterial catheters unless in the pulmonary artery, aorta or umbilical artery
- Arteriovenous fistulae
- Arteriovenous grafts
- 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

Reporting Instructions:

1. Group B *Streptococcus*: Group B *Streptococcus* identified from blood, with a date of event during the first 6 days of life, is not reported as a CLABSI. A BSI RIT is set, and any associated device days should be included in the denominator summary data counts.

2. Do not report an LCBI that has a DOE within a BSI RIT. Any additional organisms identified meeting LCBI criteria are added to the initial BSI event. See RIT guidance in Chapter 2, Identifying Healthcare associated Infections or Chapter 16, Key Terms.

3. Do not report an MBI-LCBI that has a DOE within a BSI RIT. Any additional organisms identified meeting MBI-LCBI criteria are added to the initial BSI event. See RIT guidance in Chapter 2, Identifying Healthcare associated Infections.

4. Only primary BSIs create a 14-day BSI RIT:
Primary BSI example: Patient has a positive blood specimen identifying *Staphylococcus aureus* on hospital day 6, which is not secondary to another site-specific source of infection. A subsequent positive blood specimen is collected on hospital day 12 that identifies *Pseudomonas aeruginosa*. Because the date of event is during the BSI RIT, no new BSI event is reported, and *Pseudomonas* is added to the initial BSI event.

5. **Secondary BSIs do not create a 14-day BSI RIT:**

   Secondary BSI example: A symptomatic urinary tract infection (SUTI) with *Enterococcus faecalis* is identified and *E. faecalis* is also identified from a blood specimen on hospital day 11. Because the positive blood culture is collected during the SUTI secondary BSI attribution period, the positive *E.*

faecalis blood specimen is deemed secondary to the SUTI. Since the BSI is secondary to the SUTI, a SUTI RIT is set, not a BSI RIT. On hospital day 15 (also within the SUTI RIT and secondary BSI attribution period), a blood culture growing *Staphylococcus aureus* is collected. Because the blood growing *S. aureus* does not have at least one organism that matches the organism used to meet the SUTI criterion, the BSI cannot be attributed as secondary to the SUTI. Additionally, there is no BSI RIT established; therefore, the BSI will need to be investigated as a new BSI event and either assigned as primary or secondary to another site-specific infection.

Note: The secondary BSI attribution period of a primary source of infection is not a "catch all" for subsequent BSIs.

6. There is no expectation that positive blood specimens collected during the present on admission (POA) time period are investigated. If identified, they are not reported to NHSN. However, if a subsequent positive blood specimen is collected within 14 days of a positive blood specimen collected during the POA time period, it is imperative that a determination is made for the original blood specimen in order to make the correct determination about the subsequent blood specimen.

   Example 1: A patient has a positive blood specimen with *Escherichia coli* (*E. coli)* that is a POA on 6/1. On 6/10, a subsequent positive blood specimen with *Klebsiella pneumoniae* is identified. The 6/1 blood specimen is investigated and if determined a primary BSI, sets a 14-day BSI RIT (6/1-6/14). Therefore, the 6/10 specimen is not a new BSI event and *K. pneumoniae* is added to the POA BSI event if reported.

   Example 2: A patient has a positive blood specimen that identifies *Staphylococcus aureus* present on admission 6/1. On 6/10, a subsequent positive blood specimen with *Klebsiella pneumoniae* is collected. To make the correct determination about the second blood specimen, the initial POA BSI event must be investigated to determine if it is primary or secondary to another site. In reviewing the chart, a right elbow culture from 5/31, is also positive for *S. aureus*, plus the symptoms needed to meet Joint or Bursa infection (JNT) criterion 3c are documented making the 6/1 BSI secondary to JNT. The POA primary JNT infection creates a 14-day JNT RIT (6/1-6/14) during which no new JNT infections are reported. Additionally, since the subsequent blood specimen does not contain at least one matching pathogen to the specimen used to meet the JNT criterion, the positive blood with *K. pneumoniae* cannot be attributed to the original JNT event and must be investigated as a primary or secondary BSI.

Blood Specimen Collection

The "two or more blood specimens drawn on separate occasions" criterion is met if there is blood collected from at least two separate blood draws on the same or consecutive calendar days.

AND

the blood cultures are assigned separate specimen numbers, processed individually, and are reported separately in the final laboratory report.

1. Specimen Collection Considerations: Blood specimens drawn through central lines can have a higher rate of contamination than blood specimens collected through peripheral venipuncture.[3, 4] However, all positive blood specimens, regardless of the site from which they are drawn or the purpose for which they are collected, must be included when conducting in-plan CLABSI surveillance (for example, weekly blood cultures performed in hematology and oncology locations).

2. Catheter tip cultures cannot be used in place of blood specimens for meeting LCBI criteria.

3. In MBI-LCBI 1, 2 and 3, "no other organisms" means there is no identification of a non-MBI-LCBI pathogen (such as *S. aureus*) or 2 matching common commensals (such as coagulase-negative staphylococci) collected from the blood on separate occasions that would otherwise meet LCBI criteria. If this occurs, the infection does not meet MBI-LCBI criteria.

4. When a blood specimen positive for an organism not included on the NHSN MBI organism list is collected during the BSI RIT of an MBI-LCBI, the initial MBI-LCBI event is edited to an LCBI and the identified non-MBI organism is added.

   MBI-RIT Exception: An MBI-LCBI designation will not change to an LCBI event if the following criteria are met:

   1. *The blood culture with the non-MBI organism is collected during an existing BSI (MBI-LCBI) RIT*
      AND
   2. *The blood culture with the non-MBI organism is deemed secondary to an NHSN site-specific infection*

   See Example 5 in the Secondary BSI Guide section of this protocol and Chapter 2 Pathogen Assignment (Example 2b).

Table 3: Examples of Associating the Use of Central Lines to BSI Events (CLABSI):

This table provides examples that illustrate:

- Device association as determined by the presence of an eligible CL on the BSI DOE or the day before.
- The goal of NHSN HAI surveillance is to identify risks to the patient that are the result of device use in general; therefore, NHSN does not require association of a BSI with a specific device when more than one line is present.

Note: The procedure for de-accessing a port involves ensuring patency of the line prior to removal of the needle which involves blood withdrawal, an IV flush and injection of an anticoagulant.

Date	31-Mar	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr
Patient A: Port Status	Port in	Port in	Port in	Port in	Port in	Port in	Port in
Accessed	No	No	**Yes**	Yes	**Yes De-accessed**	No	No
Eligible for CLABSI event	No	No	No **CL Day 1**	No CL Day 2	**Yes-eligible CL** CL Day 3	Yes-eligible CL CL Day 4	Yes-eligible CL CL Day 5

Patient A becomes eligible for a CLABSI on 4/4 because an accessed port is in place for some portion of > 2 consecutive calendar days making it an eligible CL on 4/4 (CL Day 3). The port remains eligible for a CLABSI until it is removed, or the patient is discharged, whichever comes first.

Date	31-Mar	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr
Patient B: CL/Port Status	CL/Port in	CL/Port in	CL/Port in	CL/Port in	**CL/Port in CL/Port out**	No device	No device
Accessed	No	No	**Yes**	Yes	**Removed**	-	-
Eligible for CLABSI event	No -	No -	No **CL Day 1**	No CL Day 2	**Yes-eligible CL** CL Day 3	Yes-eligible CL -	No -

Patient B is eligible for a CLABSI on 4/4 (CL Day 3) through 4/5. An accessed device (CL or port) is in place > 2 consecutive calendar days making it an eligible CL on 4/4 (CL Day 3). A BSI with a DOE on the day of or the day after device removal or patient discharge is considered device associated (CLABSI).

Date	31-Mar	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr
Patient C: CL Status	CL in	CL in	**CL in/ CL out**	CL in	CL in	**CL in/ CL out**	No device
Accessed	Yes	Yes	**Removed**	**Placed**	Yes	**Removed**	-
Eligible for CLABSI event	**Yes-eligible CL** **CL Day 3**	Yes- **eligible CL** CL Day 4	Yes- **eligible CL** CL Day 5	Yes- **eligible CL** CL Day 6	Yes- **eligible CL** CL Day 7	Yes- **eligible CL** CL Day 8	Yes- **eligible CL** -
Patient C is admitted to an inpatient location on 3/29 with a central line in place. Patient C is eligible for a CLABSI on 3/31 (CL Day 3) through 4/6 because an accessed CL is in place > 2 consecutive calendar days. A BSI with a DOE on the day of or the day after device removal or patient discharge is considered a device-associated infection (CLABSI). The patient remains eligible for a CLABSI event through 4/6 because a full calendar day did not pass without a CL in place, therefore, device counts continue uninterrupted.							

Date	31-Mar	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr
Patient D: CL Status	**CL in**	CL in	**CL in/ CL out**	No device	**CL in**	CL in	**CL in**
Accessed	Yes	Yes	**Removed**	-	**Placed**	Yes	Yes
Eligible for CLABSI event	**Yes-eligible CL** **CL Day 3**	Yes-eligible CL CL Day 4	Yes-eligible CL CL Day 5	Yes-eligible CL	**No** **CL Day 1**	No CL Day 2	**Yes-eligible CL** CL Day 3
Patient D is admitted to an inpatient location on 3/29 with a central line in place. Patient D is eligible for a CLABSI 3/31 (CL Day 3) through 4/3. An accessed CL had been in place > 2 consecutive calendar days, however, a full calendar day passed (4/3) with no CL in place, therefore, device day counts start over at CL Day 1 when a new line is placed. After 4/3, the patient will not be eligible for a CLABSI event again until 4/6 when the new CL becomes an eligible CL (CL Day 3).							

Date	31-Mar	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr
Patient E: CL Status	**No device**	**CL in**	CL in	CL in	CL in	CL in	CL in
Accessed	-	**Placed**	Yes	Yes	Yes	Yes	Yes
Eligible for CLABSI event	- **-**	No **CL Day 1**	No CL Day 2	**Yes-eligible CL** CL Day 3	Yes-eligible CL CL Day 4	Yes-eligible CL CL Day 5	Yes-eligible CL CL Day 6
Patient E is eligible for a CLABSI on 4/3 (CL Day 3) through 4/6. Line placement is considered access and begins device day counts for making a CLABSI determination. An accessed device is in place > 2 consecutive calendar days making it an eligible CL on 4/3 (CL Day 3).							

BOLD = change in status

Pathogen Exclusions and Reporting Considerations:

The term "recognized pathogen" in LCBI 1 criterion refers to any organism that is not included on the NHSN common commensal list (Refer to the NHSN Terminology Browser for common commensals used for NHSN reporting purposes).

Exceptions:

a. Organisms that are parasites and viruses are excluded as LCBI pathogens. This exclusion applies to meeting a primary BSI only. Viruses and parasites are eligible for use in secondary BSI determinations.

b. Organisms belonging to the following genera are excluded as LCBI pathogens: *Campylobacter, Salmonella, Shigella, Listeria, Vibrio*, and *Yersinia* as well as *C. difficile,* Enterohemorrhagic *E. coli,* and Enteropathogenic *E. coli*. These organisms are eligible for use in secondary BSI determinations but are not reported as the sole pathogen in a primary BSI.

c. Organisms belonging to the following genera cannot be used to meet any NHSN definition: *Blastomyces, Histoplasma, Coccidioides, Paracoccidioides, Cryptococcus,* and *Pneumocystis.* These organisms are excluded because they typically cause community-associated infections and are rarely known to cause healthcare-associated infections.

1. Business rules written into the pathogen fields of the NHSN application prevent entry of a common commensal as pathogen #1 when attempting to report both a recognized pathogen and common commensal identified in an LCBI 1 or MBI-LCBI 1 event. To save the event successfully, enter the recognized pathogen as pathogen # 1 and the common commensal as pathogen #2.
2. For LCBI criteria 2 and 3, if the common commensal is identified to the species level for one blood specimen, and a companion blood specimen is identified with only a descriptive name, which is complementary to the companion culture (in other words, to the genus level), then it is assumed the organisms are the same.
   - Colony morphology, biotype, and antibiogram comparisons should not be used to determine the "sameness "of organisms because laboratory testing capabilities and protocols vary between facilities.
   - To reduce reporting variabilities due to differences in laboratory practice only genus and species identification should be used, and they should only be reported once.
   - An organism identified to the species level should be reported along with the antibiogram, if available. If antibiograms are available and the sensitivities differ for the same organisms in separate specimens, always report the more resistant panel (see Table 4).
3. A common commensal identified in a single blood specimen is considered a contaminant. A single common commensal organism is not used to meet LCBI 2 or 3 criteria or secondary BSI attribution. Additionally, it does not prevent a case from meeting MBI-LCBI criteria when the organism requirements call for "only" a specific organism or type of organism (for example, "only intestinal organisms from the MBI list").

Table 4: Reporting Speciated and Unspeciated Organisms Identified from Blood Specimens

Culture Report	Companion Culture Report	Report as…
Coagulase-positive staphylococci	*S. aureus*	*S. aureus*
S. epidermidis	Coagulase-negative staphylococci	*S. epidermidis*
Enterococcus spp.	*E. faecium*	*E. faecium*
Bacillus spp. (not anthracis)	*B. cereus*	*B. cereus*
S. salivarius	*Strep viridans*	*S. salivarius*

Note: When identification to the species level is not provided, the genus of the organism will be reported to NHSN. When identification to the genus level is not provided, report the organism as available on the NHSN organism list (for example, Gram-positive bacillus).

Table 5: Examples Illustrating the MBI-LCBI Criteria for Neutropenia

		Day -7	Day -6	Day -5	Day -4	Day -3	Day -2	Day -1	Day 1*	Day 2	Day 3	Day 4
Pt. A	**WBC**	**100**	**800**	**400**	**300**	**ND**	**ND**	***320***†	***400***† **+ BC* x 1 *Candida* spp.**	**ND**	**550**	**600**
Pt. B	**ANC**	**ND**	**410**	**130**	**ND**	**ND**	***120***†	***110***†	**ND +BC* x 2 viridans strep plus fever >38°C**	***110***	***300***	***320***
Pt. C	**WBC**	**100**	**800**	**400**	**300**	**ND**	**ND**	**ND**	**600 + BC* x *1* *Candida* spp.**	***230***†	**ND**	***400***†

*ND = not done; *Collection date of positive blood specimen; Italics = ANC/WBC < 500 cells/mm^3; † ANC/WBC < 500 cells/mm^3 used to meet neutropenia for MBI-LCBI criteria*

Rationale for Table 5:

Patient A meets MBI-LCBI 1 criterion with neutropenia: Positive blood specimen with intestinal organism (*Candida* spp.) and neutropenia*****. In this case, the WBC values on Day 1 = 400, and Day -1 = 320 are used.

Patient B meets MBI-LCBI 2 criterion with neutropenia: At least two positive blood specimens with *viridans group streptococci,* fever >38°C and neutropenia*. In this case, the ANC values on day -1 = 110 and Day -2 = 120 are used.

Note: Any two of Days -2, -1, 2, 3, and 4 could be used to meet this requirement since WBC and/or ANC values of <500cells/mm^3 were present on those days.

Patient C meets MBI-LCBI 1 criterion with neutropenia: Positive blood specimen with intestinal organism (*Candida* spp.) and neutropenia*. In this case, WBC values on Day 2 = 230 and Day 4 = 400 are used.

*Neutropenia is defined as: 2 separate days of ANC or WBC <500 cells/mm^3 occurring on the collection date of the positive blood specimen (Day 1) or during the 3 days before or the 3 days after Day 1.

Monthly Summary Data

Numerator Data: The *Primary Bloodstream Infection (BSI)* form (CDC 57.108) is used to collect and report each CLABSI that is identified during the month selected for surveillance. For CLABSI surveillance, all LCBI and MBI-LCBI that are identified as central-line associated must be included. The Instructions for Completion of Primary Bloodstream Infection (BSI) form contains brief instructions for collection and entry of each data element on the form. The *Primary BSI* form includes patient demographic information and whether a central line was present, and, if so, the type of central line the patient had if appropriate to the location; these data will be used to calculate line-specific infection rates. Additional data include the specific criteria met for identifying the primary BSI, whether the patient died, organisms identified from blood specimens, and the organisms' antimicrobial susceptibilities.

Reporting Instruction:
During the month of surveillance, if no CLABSI events are identified, the "Report No Events" box must be checked on the appropriate denominator summary screen, (for example, Denominators for Intensive Care Unit [ICU]/other locations [not NICU or SCA], etc.

Table 6: Examples of Denominator Day counts for Device Days

This table provides examples that illustrate:

- Denominator device day counts for a central line present on an inpatient location at the time of the device day count.

Note: If the central line is in place at the time of the denominator device count, it is included in the daily denominator device day count.

Date	31-Mar	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr
Patient A:	Inpatient Location ICU CL inserted	ICU CL in	ICU CL in	ICU CL in	ICU CL in	ICU CL in	ICU CL in
Denominator Day Counts for Device Days	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Patient A has a CL inserted in the ICU. Because the CL is inserted in an inpatient location, Day 1 begins the denominator day count for device days. Patient A has 7 denominator device days for 3/31-4/6.							

Date	31-Mar	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr
Patient B:	ED CL in place at time of admission	Patient admitted to inpatient location ICU CL in	ICU CL in	ICU CL in	ICU CL in	Inpatient Location CL in	Inpatient Location CL in
Denominator Day Counts for Device Days	-	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Patient B has a central line at the time of admission. Because Patient B is admitted to the emergency department on 3/31, the denominator day count for device days does not begin until the patient is transferred to the inpatient location on 4/1. Patient B has 6 denominator device days for 4/1-4/6.							

Date	31-Mar	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr
Patient C:	Inpatient Location ICU CL in place at time of admission	ICU CL in	ICU **CL in/ CL out**	ICU CL in	ICU CL in	**ICU CL in/ CL out**	ICU No device
Denominator Day Counts for Device Days	Day 1	Day 2	Day 3*	Day 4	Day 5	Day 6*	-

Patient C has a central at the time of admission to ICU. Because Patient C is admitted to ICU on 3/31, the denominator day count for device days begins on the date of admission (3/31). Because there is no device on 4/6, the denominator device day count will end on 4/5. Patient C has 6 denominator device days for 3/31-4/5.

Date	31-Mar	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr
Patient D:	Inpatient Location ICU **No device**	Inpatient Location ICU **CL inserted**	ICU CL in	ICU CL in	ICU CL in	ICU CL in	ICU CL in
Denominator Day Counts for Device Days	-	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6

Patient D does not have a central line in place at the time of admission to ICU. Because there is no central line in place on admission, the denominator day count for device days does not begin until the central line is placed in the inpatient location on 4/1. Patient D has 6 denominator device days for 4/1-4/6.

Date	31-Mar	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr
Patient E:	Inpatient Location ICU **Patient admitted with non-accessed port**	Inpatient Location ICU Port not accessed	ICU Port not accessed	ICU Port accessed	ICU Port accessed	ICU Port accessed	ICU Port accessed
Denominator Day Counts for Device Days	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7

Patient E has a non-accessed port at the time of admission to ICU. The denominator device day count begins on the date the patient is admitted to ICU (3/31). Accessing the port on 4/3 does not change the denominator day count for device days. Patient E has 7 denominator device days for 3/31-4/6.

Table 7: Denominator Data Collection Methods

Denominator Data: Device days and patient days are used for denominator reporting. Device-day denominator data that are collected differ according to the patient location. The following methods can be used for the collection of denominator data:

Data Collection Method	Details
Manual, Daily	Denominator data (patient days and device days) should be collected at the same time, every day, for each location performing surveillance to ensure that differing collection methods don't inadvertently result in device days being greater than patient days. • For locations other than specialty care areas/oncology (SCA/ONC) and NICUs, the **number of patients** with at least one central line of any type, is collected daily, at the same time each day during the month and is recorded on the *Denominators for Intensive Care Unit (ICU)/Other Locations (Not NICU or SCA/ONC)* form (CDC 57.118). Only the totals for the month are entered into NHSN. **Notes:** 1. Only one central line per patient is counted per calendar day regardless of the number of central lines present. 2. All central lines on inpatient units should be included in device day counts regardless of access. • For specialty care areas/oncology, the number of patients with at least one central line are separated into those with permanent central lines and those with temporary central lines. The number of patients with at least one central line of either or both type(s), is collected daily, at the same time each day during the month and is recorded on the *Denominators for Specialty Care Area (SCA)/Oncology (ONC)* form (CDC 57.117). Only the totals for the month are entered into NHSN. Temporary and permanent lines are reported separately in this location because permanent lines are more commonly used in this patient population and may be associated with a lower BSI rate when compared to temporary central lines. **Notes:** 1. Only one central line per patient is counted per calendar day regardless of the number of central lines present. 2. All central lines on inpatient units should be included in device day counts regardless of access.

Data Collection Method	Details
	3. If a patient has both a temporary and a permanent central line, only report the temporary line because it is associated with a higher risk of bloodstream infection. The Instructions for Completion of Denominators for Intensive Care Unit (ICU)/Other Locations (Not NICU and SCA/ONC) and Instructions for Completion of Denominators for Specialty Care Areas (SCA)/Oncology (ONC) contain brief instructions for collection and entry of each data element on the form. • In NICUs, the number of patients with at least one central line is stratified by birth weight in five categories because the risk of BSI varies by birth weight. These data are reported on the *Denominators for Neonatal Intensive Care Unit (NICU)* form (CDC 57.116). **Note:** 1. Report only birth weight when entering BSI denominator data. The infant's weight at the time of BSI identification is not used and should not be reported. For example, a neonate weighs 1006 grams at birth but remains in the NICU for two months and has a body weight of 1650 grams when a CLABSI develops; enter the birth weight of 1006 grams on the BSI form. 2. All central lines on inpatient units should be included in device day counts regardless of access. The *Instructions for Completion of Denominators for Neonatal Intensive Care Unit (NICU)* form contains brief instructions for collection and entry of each data element on the forms.
Manual, sampled once/week (collected at the same time on the same designated day, once per week)	• To reduce staff time spent collecting surveillance data, once weekly sampling of denominator data to generate estimated central line days, may be used as an alternative to daily collection in non-oncology ICUs and wards (see Notes below). Sampling may not be used in SCA/ONC locations or NICUs. During the month, the number of patients in the location (patient-days) and the number of patients with at least one central line of any type (central line days) is collected on a designated day each week (for example, every Tuesday), and at the same time each day. • Evaluations of this method have repeatedly shown the use of Saturday or Sunday generate the least accurate estimates of denominator data; therefore, weekend days should not be selected as the designated denominator data collection day.[6-8] If the designated day is missed, collect the denominator data on the next available weekday.

Data Collection Method	Details
	• The following must be collected and entered into NHSN: 1. The monthly total for patient-days, collected daily 2. The sampled total for patient-days 3. The sampled total central line-days When these data are entered, the NHSN application will calculate an estimate of central line-days. **Notes:** 1. To ensure the accuracy of estimated denominator data obtained by sampling, only ICU and ward location types with an average of 75 or more central line-days per month are eligible to use this method. A review of each location's central line denominator data for the past twelve months in NHSN will help determine which locations are eligible. 2. The accuracy of estimated denominator data generated by sampling can be heavily influenced by incorrect or missing data. Careful implementation of data collection following the guidance in this protocol is essential to avoid erroneous fluctuations in rates or standard infection ratios (SIRs).
Electronic	For <u>any</u> location, denominator data from electronic sources (in other words, central line days from electronic charting may be used only after a validation of a minimum 3 consecutive months proves the data to be within 5% (+/-) of the manually collected once-a-day counts. When converting from one electronic counting system to another electronic counting system, the new electronic system should be validated against manual counts as above. If electronic counts for the new electronic system are not within 5% of manual counts, resume manual counting and continue working with IT staff to improve design of electronic denominator data extraction (while reporting manual counts) until concurrent counts are within 5% for 3 consecutive months. **Notes:** This guideline is important because validating a new electronic counting system against an existing electronic system can magnify errors and result in inaccurate denominator counts. • Perform the validation of electronic counts separately for each location conducting CLABSI surveillance.

Data Analyses:

All data that are entered into NHSN can be analyzed at event or summary level. The data in NHSN can be visualized and analyzed in various ways, for example, descriptive analysis reports for both the denominator and numerator data.

Types of CLABSI Analysis Reports

Standardized Infection Ratio (SIR):

The standardized infection ratio (SIR) is calculated by dividing the number of observed events by the number of predicted events. The number of predicted events is calculated using probabilities estimated from statistical models constructed from national NHSN data, which represents the baseline population. For more information on SIR and the CLABSI parameter estimates, please see the 2015 SIR guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf.

$$\text{SIR} = \frac{Observed\ (O)\ HAIs}{Predicted\ (P)\ HAIs}$$

While SIRs can be calculated for single locations, the measure also allows you to summarize your data across multiple locations, adjusting for differences in the incidence of infection among the location types. For example, you can obtain one CLABSI SIR adjusting for all locations reported. Similarly, you can obtain one CLABSI SIR for all ICUs in your facility. In addition, IRF units within Acute Care Hospitals will be separated from all other ACH locations.

For more information on using the CLABSI SIR reports, please see the troubleshooting guide: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/clabsicauti_sirtroubleshooting.pdf.
For further information regarding the p-value and 95% confidence interval, see the following guide: https://www.cdc.gov/nhsn/ps-analysis-resources/keys-to-success.html

Note: The SIR will be calculated only if the number of predicted events (numPred) is ≥1 to help enforce a minimum precision criterion.

Standardized Utilization Ratio (SUR):

The SUR, or standardized utilization ratio, is a summary measure used to track device use at a national, state, local, or facility level over time. The SUR adjusts for various facility and/or location-level factors that contribute to device use. The method of calculating an SUR is similar to the method used to calculate the Standardized Infection Ratio (SIR), a summary statistic used in NHSN to track healthcare-associated infections (HAIs). In device-associated HAI data analysis, the SUR compares the actual number of device days reported to what would be predicted, given the standard population (specifically, the NHSN baseline), adjusting for several factors that have been found to be significantly associated with differences in device utilization.

In other words, an SUR greater than 1.0 indicates that more device days were observed than predicted; conversely, an SUR less than 1.0 indicates that fewer device days were observed than predicted. SURs are currently calculated in NHSN for the following device types: central lines, urinary catheters, and ventilators.

More information regarding the 2015 SUR calculations can be found at:
https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sur-guide-508.pdf
https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/run-interpret-sur-reports.pdf

Rates and Ratios:

The CLABSI rate per 1000 central line days is calculated by dividing the number of CLABSIs by the number of central line days and multiplying the result by 1000. The Central Line Utilization Ratio is calculated by dividing the number of central line days by the number of patient days. These calculations will be performed separately for different types of ICUs, specialty care areas, oncology units, and other locations in the institution. Separate rates and ratios will also be calculated for different types of central lines in specialty care areas/oncology locations and for birth weight categories in NICUs.

$$\text{CLABSI Rate} = \frac{No.\ of\ CLABIs}{No.\ of\ Central\ Line\ Days} * 1000$$

Device Utilization Ratio

The Central Line Utilization Ratio is calculated by dividing the number of central line catheter days by the number of patient days.
These calculations will be performed separately for the different types of ICUs, specialty care areas, and other locations in the institution, except for neonatal locations. DURs are useful for the purposes of tracking device use over shorter periods of time and for internal trend analyses.

$$\text{DUR} = \frac{No.\ of\ Central\ Line\ Days}{No.\ of\ Patient\ Days}$$

Descriptive analysis

Descriptive analysis output options of numerator and denominator data, such as line listings, frequency tables, and bar and pie charts are available in the NHSN application. CLABSI SIRs, rates, and run charts are also available. A line list, frequency table, and rate table are also available to analyze pathogens and antimicrobial susceptibility data reported for CLABSIs. Guides on using NHSN analysis features are available from: https://www.cdc.gov/nhsn/ps-analysis-resources/reference-guides.html.

NHSN Group Analysis:

NHSN Group Users can perform the same analysis as facility level users in NHSN. A few helpful tools in NHSN for groups are listed in the resources below. These tools are guides on how to start and join a Group; how to create a template to request data from facilities; how to determine the level of access granted by the facility following the previous steps, and how to analyze the facilities data.

Group Analysis Resources:

NHSN Group Users Page: https://www.cdc.gov/nhsn/group-users/index.html

Group User's Guide to the Membership Rights Report: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/GroupAnalysisWebinar.pdf

Group User's Guide to the Line Listing- Participation Alerts: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/group-alerts.pdf

Data Quality Resources

Data Quality Website: https://www.cdc.gov/nhsn/ps-analysis-resources/data-quality/index.html
Data Quality Manual: https://www.cdc.gov/nhsn/pdfs/pscmanual/Instructions_DQ.pdf
Data Quality Training: https://www.cdc.gov/nhsn/training/analysis/index.html
Verifying BSI Events Contributing to CLABSI Numerator: https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/bsi-excluded-linelist-508.pdf

Additional Resources

Analysis Resources: https://www.cdc.gov/nhsn/ps-analysis-resources/index.html
Analysis Reference Guides: https://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html
NHSN Training: https://www.cdc.gov/nhsn/training/index.html

Table 8: CLABSI Measures Available in NHSN

Measure	Exclusions	Calculation	Application
CLABSI SIR	MBI-LCBIs, ECMO, VAD, MSBP, EB, Patient self-injection, and Pus at vascular site	$\frac{\text{The number of Observed CLABSIs}}{\text{The number of Predicted CLABSIs}}$	Both location specific and summarized measure
MBI-LCBI SIR (ACH Only)	ECMO, VAD, MSBP, EB, Patient self-injection, and Pus at vascular site	$\frac{\text{The number of Observed MBI} - \text{LCBIs}}{\text{The number of Predicted MBI} - \text{LCBIs}}$	Both location specific and summarized measure
CLABSI Rates	MBI-LCBIs, ECMO, VAD, MSBP, EB, Patient self-injection, and Pus at vascular site	$\left(\frac{\text{The number of CLABSIs for a location}}{\text{The number of Central Line Days for that location}}\right) \times 1000$	Location specific measure only
MBI-LCBI Rates	ECMO, VAD, MSBP, EB, Patient self-injection, and Pus at vascular site	$\left(\frac{\text{The number of MBI\_LCBIs for a location}}{\text{The number of Central Line Days for that location}}\right) \times 1000$	Location specific measure only
Central Line SUR		$\frac{\text{The number of Observed Central Line Days}}{\text{The number of Predicted Central Line Days}}$	Both location specific and summarized measure
DUR		$\frac{\text{Central Line Days for a location}}{\text{The Patient Days for that location}}$	Location specific measure only

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[8] See, I., et al. ID Week 2012 (Abstract #1284): Evaluation of Sampling Denominator Data to Estimate Urinary Catheter- and Ventilator-Days for the NHSN. San Diego, California. October 19, 2012.

Appendix: Secondary BSI Guide (not applicable to Ventilator-associated Events [VAE])

The purpose of using the CDC/NHSN infection criteria is to identify and consistently categorize infections that are healthcare-associated into major infection and site-specific infection types. LCBI criteria include the caveat that organism(s) identified from the blood cannot be related to infection at another and must be a primary BSI. One must be sure there is no other CDC/NHSN defined primary site-specific infection that may have seeded the bloodstream secondarily; otherwise, the bloodstream infection may be misclassified as a primary BSI and erroneously associated with the use of a central line, specifically called a CLABSI. For locations performing in-plan VAE surveillance, refer to Figure B2 in this appendix, as well as the VAE chapter for specific guidance on assigning a secondary BSI to a VAE. When conducting BSI surveillance, the PNEU definitions as well as UTI, SSI and all definitions found in Chapter 17 are available for attributing a secondary BSI for any patient in any location.

> **Example:** A ventilated patient in an adult location where VAE surveillance is being conducted can have a secondary BSI assigned to VAE or PNEU. A ventilated patient in a neonatal location where in-plan PedVAP surveillance is not an option can have a secondary BSI assigned to PNEU.

Secondary BSI Scenarios: For the purposes of NHSN reporting, for a bloodstream infection to be determined secondary to another site of infection, the following requirements must be met: *

An NHSN site-specific definition must be met; either one of the CDC/NHSN Surveillance Definitions for Specific Types of Infections (defined in Chapter 17), or UTI, PNEU or SSI definitions.

AND

One of the following scenarios must be met:

Scenario 1: At least one organism from the blood specimen matches an organism identified from the site-specific specimen 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 (infection window period + repeat infection timeframe) †.

OR

Scenario 2: An organism identified in the blood specimen is an element that is used to meet a NHSN site-specific infection criterion, and therefore is collected during the site-specific infection window period.

Exception to Scenarios 1 & 2: Necrotizing Enterocolitis (NEC)

The Necrotizing Enterocolitis (NEC) criteria include neither a site-specific specimen (to apply Scenario 1) nor an organism identified from blood specimen (to apply Scenario 2). A BSI is considered secondary to NEC if the patient meets one of the two NEC criterion below AND an organism identified from blood specimen collected during the secondary BSI attribution period is an LCBI pathogen, or the same common commensal is identified from two or more blood specimens drawn on separate occasions collected on the same or consecutive calendar days.

Necrotizing enterocolitis in infants (≤ 1 year of age) must meet one of the following criteria:

1. Infant has at least ***one*** of the clinical and ***one*** of the imaging test findings from the lists below:
   At least *one* clinical sign:
   a. bilious aspirate** (see **Note**)
   b. vomiting
   c. abdominal distention
   d. occult or gross blood in stools (with no rectal fissure)

   And at least *one* imaging test finding which if equivocal is supported by clinical correlation (specifically, physician documentation or physician designee of antimicrobial treatment for NEC):
   a. Pneumatosis intestinalis
   b. Portal venous gas (Hepatobiliary gas)
   c. Pneumoperitoneum

   ****Note:** Bilious aspirate from a transpyloric feeding tube should be excluded

2. Surgical NEC: Infant has at least ***one*** of the following surgical findings:
   a. surgical evidence of extensive bowel necrosis (>2 cm of bowel affected)
   b. surgical evidence of pneumatosis intestinalis with or without intestinal perforation

NEC Exception Notes:

- Pneumatosis is considered an equivocal abdominal imaging finding for Necrotizing enterocolitis.
  - Examples of abdominal imaging include KUB, ultrasound, or an abdominal x-ray
- NEC criteria cannot be met in patients > 1 year of age. Review Gastrointestinal tract infection (GIT) for eligibility.

Endocarditis Exception Note:

- **The Endocarditis (ENDO) criteria have different rules** for infection window period, RIT, pathogen assignment and secondary BSI attribution period. (See ENDO criteria in Ch. 17)

Applying Secondary BSI Attribution Using Scenario 1 or Scenario 2

Below are examples with guidance on how to distinguish between a primary or secondary BSI. The definition of "matching organisms", important notes, and reporting instructions are also provided. See Figure B1: Secondary BSI Guide for algorithmic display of the following instructions.

Scenario 1: An organism identified from the site-specific infection is used as an element to meet the site-specific infection criterion, **AND** the blood specimen contains at least one matching organism to that site-specific specimen. The positive blood specimen must be collected during the site-specific infection's secondary BSI attribution period.

For your convenience, a list of infection criteria that include a blood specimen with at least one matching pathogen to the site-specific specimen that is used as an element to meet the definition are included in Table B1). Table B1 lists the **only** site-specific infections eligible for secondary BSI attribution.

Example A: Patient meets NHSN criteria for a symptomatic urinary tract infection (suprapubic tenderness and $\geq 10^5$ CFU/ml of *Escherichia. coli*) and blood specimen collected during the symptomatic urinary tract infection (SUTI) secondary BSI attribution period is positive for *Escherichia coli*. This is a SUTI with a secondary BSI and the reported organism is *Escherichia coli*.

Example B: Patient meets NHSN criteria for a symptomatic urinary tract infection (suprapubic tenderness and $\geq 10^5$ CFU/ml of *Escherichia coli*) and blood specimen collected during the SUTI secondary BSI attribution period grows *E. coli* and *Pseudomonas aeruginosa*. This is a SUTI with a secondary BSI and the reported organisms are *E. coli* and *P. aeruginosa* since both site and blood specimens are positive for at least one matching pathogen.

Example C: Patient meets NHSN criteria for a symptomatic urinary tract infection (suprapubic tenderness and $\geq 10^5$ CFU/ml of *Escherichia coli*) and a single blood specimen collected during the SUTI secondary BSI attribution period is positive for *E. coli* and *Staphylococcus epidermidis*. This is a SUTI with a secondary BSI and the reported organism is only *E. coli* since the single common commensal *S. epidermidis* positive blood specimen does not meet BSI criteria.

Scenario 2: An organism identified from a blood specimen is an element used to meet the site-specific infection criterion and is collected during the site-specific infection window period.

A list of site-specific infections that include a positive blood culture as an element are included in Table B1). Table B1 lists the **only** site-specific infections eligible for secondary BSI attribution.

Example D: Patient becomes febrile (> 38.0° C) and complains of nausea and abdominal pain. CT scan performed on the same day shows an intraabdominal abscess and a blood specimen collected the same day results in the identification of *Bacteroides fragilis.* Because the patient meets intraabdominal infection criterion 3b (IAB 3b), where identification of an organism from the blood specimen is a required element, along with at least two signs and symptoms and a CT scan showing an intraabdominal abscess, the BSI is considered secondary to an IAB 3b infection.

Example E: Patient is febrile, has a new onset of cough and has a positive chest imaging test indicating the presence of an infiltrate. Blood specimens collected identified *Pseudomonas aeruginosa.* Because the patient can meet the PNU2 definition using the identification of organisms from a blood specimen as one of the elements of the infection criterion, and there is an infiltrate on chest imaging test, fever, plus new onset of cough, the BSI is considered secondary to PNEU (PNU2).

***Example F:** Following a COLO procedure, on day 10 of the SSI surveillance period the patient becomes febrile (>38.0°C) and complains of nausea and abdominal pain. A CT scan performed indicates an abscess in the intraabdominal cavity definitive for infection. The following day cultures are performed that showed *Escherichia coli* from a T-tube drainage specimen and *Bacteroides fragilis* from a blood specimen. Although the organisms in the site-specific specimen

culture and blood culture do not match for at least one organism, the blood culture is considered secondary to IAB because the patient meets IAB criterion 3b with fever, nausea, and abdominal pain. Also, the CT scan results are definitive for an intraabdominal infection, and there is an MBI organism identified in the blood specimen. The organism identified in the blood specimen is used as an element to meet the Organ/Space SSI site-specific infection criterion and is collected during the SSI surveillance period. The patient also meets IAB criterion 3a with fever, nausea, abdominal pain, and the organism (*Escherichia coli*) identified from the site-specific specimen culture. Although the organism identified (*Escherichia coli),* differs from the organism used to meet IAB criterion 3b (*Bacteroides fragilis)*, the BSI is considered secondary to the organ/space SSI IAB and both organisms (*Escherichia coli* and *Bacteroides fragilis*) would be listed as the IAB infection pathogens.

***Example G:** Patient is febrile with a new onset of cough and has a positive chest imaging test indicating the presence of an infiltrate. Blood and bronchoalveolar lavage (BAL) specimens are collected that identifies *Klebsiella pneumoniae* > 10^4 CFU/ml from the BAL and *Pseudomonas aeruginosa* from the blood. Although the organisms in the blood specimen and site-specific specimen do not match for at least one organism, the patient can meet PNU2 using either the identification of an organism from blood specimen or the BAL specimen as one of the elements of the infection criterion. The positive blood culture or BAL specimen plus the infiltrate on chest imaging test, fever, and new onset of cough are used to fully meet the PNU2 definition. The blood culture is considered to be a secondary BSI to PNEU and both organisms are listed as PNEU pathogens.

*****_In situations where an NHSN infection definition can be met using more than one criterion of the infection definition, it is possible that identification of an organism from the blood and site-specific specimens may not match, and a BSI may still be considered a secondary BSI._

Reporting Guidance - When Scenario 1, 2, or the NEC Exception Cannot Be Applied:

If the organism identified from the blood specimen does not match the organism from the site-specific specimen, and that blood specimen cannot be used to meet the site-specific infection criteria, that blood specimen cannot be considered a secondary BSI, and in this scenario, the positive blood specimen is considered a primary BSI.

Example 1: Patient has pustules on their abdomen along with tenderness and swelling. Purulent material is obtained from the pustules and is positive for *Streptococcus* Group B. A blood specimen collected the same day identifies methicillin resistant *Staphylococcus aureus.* Because the organisms from the pustules and blood specimen do not match, and SKIN does not include a positive blood specimen as an element, both a site-specific infection, SKIN (criterion 1 and 2a), and a primary BSI is reported.

Example 2: A patient has an abscess in the soft tissue around a percutaneous endoscopic gastrostomy (PEG) tube, identified by CT scan, and there is purulent drainage noted from the site. There is no site-specific specimen collected, or other sites of infection identified, however, a blood specimen is positive for *Staphylococcus aureus.* Since there are no site-specific cultures collected, ST criterion 1 is not met which means a blood specimen cannot deemed secondary. Therefore, the positive blood specimen must be investigated as primary BSI. The patient has an ST infection (criterion 2), and a primary BSI with the pathogen *Staphylococcus aureus*.

Table B1: Secondary BSI Guide: List of all NHSN primary site-specific definitions available for making secondary BSI determinations using Scenario 1 or Scenario 2

<table>
<tr><th>Scenario 1</th><th>Scenario 2</th></tr>
<tr><td>A positive blood specimen must contain at least one eligible matching organism to the site-specific specimen</td><td>Positive blood specimen must be an element of the site-specific definition</td></tr>
<tr><td>And the blood specimen is collected in the site-specific secondary BSI attribution period</td><td>And blood specimen is collected in the site-specific infection window period</td></tr>
<tr><td>And an eligible organism identified from the site-specific specimen is used as an element to meet the site-specific definition</td><td>And an eligible organism identified in a blood specimen is used as an element to meet the site-specific definition</td></tr>
<tr><td>
<table>
<tr><th>Site</th><th>Criterion</th></tr>
<tr><td>ABUTI</td><td>ABUTI</td></tr>
<tr><td>BONE</td><td>1</td></tr>
<tr><td>BRST</td><td>1</td></tr>
<tr><td>CARD</td><td>1</td></tr>
<tr><td>CIRC</td><td>2 or 3</td></tr>
<tr><td>CONJ</td><td>1a</td></tr>
<tr><td>DECU</td><td>1</td></tr>
<tr><td>DISC</td><td>1</td></tr>
<tr><td>EAR</td><td>1, 3, 5 or 7</td></tr>
<tr><td>EMET</td><td>1</td></tr>
<tr><td>ENDO</td><td>1</td></tr>
<tr><td>EYE</td><td>1</td></tr>
<tr><td>GE</td><td>2a</td></tr>
<tr><td>GIT</td><td>2a, 2b (only yeast)</td></tr>
<tr><td>IAB</td><td>1 or 3a</td></tr>
<tr><td>IC</td><td>1</td></tr>
<tr><td>JNT</td><td>1</td></tr>
<tr><td>LUNG</td><td>1</td></tr>
<tr><td>MED</td><td>1</td></tr>
<tr><td>MEN</td><td>1</td></tr>
<tr><td>ORAL</td><td>1, 3a, 3d (only yeast)</td></tr>
<tr><td>OREP</td><td>1</td></tr>
<tr><td>PJI</td><td>1 or 3e</td></tr>
<tr><td>PNEU</td><td>2 or 3</td></tr>
<tr><td>SA</td><td>1</td></tr>
<tr><td>SINU</td><td>1</td></tr>
<tr><td>SSI</td><td>SI, DI or OS</td></tr>
<tr><td>SKIN</td><td>2a</td></tr>
<tr><td>ST</td><td>1</td></tr>
<tr><td>UMB</td><td>1a</td></tr>
<tr><td>UR</td><td>1a or 3a</td></tr>
<tr><td>USI</td><td>1</td></tr>
<tr><td>SUTI</td><td>1a, 1b or 2</td></tr>
<tr><td>VASC only as SSI</td><td>1</td></tr>
<tr><td>VCUF</td><td>3</td></tr>
</table>
</td><td>
<table>
<tr><th>Site</th><th>Criterion</th></tr>
<tr><td>ABUTI</td><td>ABUTI</td></tr>
<tr><td>BONE</td><td>3a</td></tr>
<tr><td>BURN</td><td>1</td></tr>
<tr><td>DISC</td><td>3a</td></tr>
<tr><td>ENDO</td><td>4a, 4b, 4c, 4d (titer excluded), 4f, 5a, 5b, 5c, 5d (titer excluded), 5f, 6e, or 7f plus other criteria as listed</td></tr>
<tr><td>GIT</td><td>1b or 2c</td></tr>
<tr><td>IAB</td><td>2b or 3b</td></tr>
<tr><td>JNT</td><td>3c</td></tr>
<tr><td>MEN</td><td>2c or 3c</td></tr>
<tr><td>OREP</td><td>3a</td></tr>
<tr><td>PNEU</td><td>2 or 3</td></tr>
<tr><td>SA</td><td>3a</td></tr>
<tr><td>UMB</td><td>1b</td></tr>
<tr><td>USI</td><td>3b or 4b</td></tr>
</table>
</td></tr>
</table>

Secondary BSI Reporting Instructions:

- For reporting secondary BSI for possible VAP (PVAP), see Figure B2 and Chapter 10.
- Do **not** report secondary bloodstream infection for vascular (VASC) infections, ventilator-associated conditions (VAC), infection-related ventilator-associated complications (IVAC), or pneumonia 1 (PNU1).
- When a BSI is suspected to be secondary to a lower respiratory tract infection, the BSI can be determined secondary to VAE or PNEU definitions. (See Figure B2).
- Site-specific organism exclusions apply to secondary BSI attribution as well.

A **matching organism** is defined as one of the following:

1. If genus and species are identified in both specimens, they must be the same.
    a. **Example:** An intraabdominal specimen is used as an element to meet an IAB definition and is growing *Enterobacter cloacae.* A blood specimen with a collection date in the IAB secondary BSI attribution period is growing *Enterobacter cloacae.* These are considered matching organisms.
    b. **Example:** An intraabdominal specimen is used as an element to meet an IAB definition and is growing *Enterobacter aerogenes.* A blood specimen with a collection date during the IAB secondary BSI attribution period is growing *Enterobacter cloacae.* These are NOT considered matching organisms as the species, aerogenes and cloacae, are different.

2. Organisms must at least match to the genus level and at that level the organisms must be the same.
    a. **Example:** A surgical wound growing *Pseudomonas* species is used to meet deep incisional SSI criteria and a blood specimen growing *Pseudomonas aeruginosa* is collected in the SSI secondary BSI attribution period. The organisms are considered matching at the genus level, and therefore the BSI is secondary to the SSI.
    b. **Example:** A PCR identifying *Enterococcus faecalis* in CSF meets the MEN definition. A subsequent blood culture collected in the MEN secondary BSI attribution period is identified as *Enterococcus* species. The organisms are considered matching at the genus level *Enterococcus*, and therefore the BSI is secondary to MEN.

3. There are two exceptions to the matching organisms definition:
    a. Infections meeting LCBI 2 criterion with *Staphylococcus or Streptococcus*
    Example (*Staphylococcus*): A patient has a fever and a previous chest tube site that is reddened and swollen, and a culture is collected from the soft tissue site. A culture of the chest tube site is positive for *Staphylococcus* species therefore, the ST 1 definition is met. The next day, two blood culture sets are collected and both blood cultures are positive for coagulase-negative *Staphylococcus*. The site-specific and blood organisms are NOT considered matching, because *Staphylococcus* species could be a coagulase-negative or a coagulase-positive *Staphylococcus.* Therefore, the BSI is not considered secondary to the ST 1.

Example (*Streptococcus*): A patient has a fever and a previous chest tube site that is reddened and swollen, and a culture is collected from the soft tissue site. The chest tube site culture is reported positive for *Streptococcus* species therefore, the ST 1 definition is met. The next day, two blood culture sets are collected and both blood cultures are positive for *Streptococcus*, viridans group. The site-specific and blood organisms are NOT considered matching, because *Streptococcus* species could represent a *Streptococcus*, viridans group or non- *Streptococcus*, viridans group. Therefore, the BSI is not considered secondary to the ST 1.

b. In cases where an organism is identified only as "yeast" or "yeast not otherwise specified," the organism can be considered a match to other yeasts, when the yeast is collected during the required timeframe, whether more fully identified or not.

Example: A tissue culture from the ulcer margin of a decubiti is reported positive for yeast is used as an element to meet the DECU definition. A blood specimen collected in the secondary BSI attribution period of the DECU is reported as *Candida albicans*. In this example, the two organisms are considered matching organisms as the organisms are complementary (specifically, *Candida* is a type of yeast).

Note: This exception is limited to yeast and does not apply to identification of organisms identified as Gram-positive cocci, Gram negative rods, etc.

Yeasts isolated from non-sterile sites are commonly not identified to the genus or genus and species level.

Example: A culture of tissue from the ulcer margin of a decubiti reported positive for a Gram-negative rod is used as an element to meet DECU definition. A blood specimen collected in the secondary BSI attribution period of the DECU is reported as *E. coli*. In this example the two organisms are NOT considered matching organisms.

Notes:

1. Antibiograms of the blood and potential primary site isolates do not have to match.

2. If the blood specimen alone does not meet BSI criteria (for example, only one blood specimen positive for a common commensal), that specimen may not be used to meet secondary BSI criteria (see Scenario 1c).

Pathogen Assignment

- Additional pathogens identified from secondary BSIs, should be added to the pathogens reported for the primary infection type. The Secondary BSI data collection field should be checked yes.

  MBI-RIT Exception: An MBI-LCBI designation will not change to an LCBI event if the following criteria are met:

  1. *The blood culture with the non-MBI organism is collected during an existing BSI (MBI-LCBI) RIT*

     AND

  2. *The blood culture with the non-MBI organism is deemed secondary to an NHSN site-specific infection*

  See Example 5 in the Secondary BSI Guide section of this protocol and Chapter 2 Pathogen Assignment (Example 2b)

- If at least one BSI pathogen with a collection date in the secondary BSI attribution period matches an organism from a specimen that was used to meet a site-specific infection criterion (either a site-specific specimen or a blood specimen) the BSI is considered secondary to the event. However, if no matching pathogen is identified, the subsequent BSI pathogen must be evaluated and deemed primary or secondary to another site-specific infection**.**

  Example: A patient with a primary UTI with *Escherichia coli* and a secondary BSI with *Escherichia. coli* has a subsequent positive blood specimen with *yeast. Yeast* is an excluded pathogen for meeting UTI criteria; therefore, the subsequent blood must be evaluated as primary or secondary to another site-specific infection.

- A secondary BSI pathogen may be assigned to two different primary sites of infection (for example, UTI and an IAB infection). In Example 1 below, two primary sites of infection have been identified and a blood culture is collected within both the SUTI and the IAB secondary BSI attribution period. The blood culture pathogen matches the pathogens for both primary sites of infection (SUTI and IAB). Therefore, the pathogen is reported for both primary sites of infection as a secondary bloodstream infection.

Example 1: Pathogen Assignment

Hospital Day (HD)	UTI SBAP	UTI RIT	UTI Infection Window Period	IAB Infection Window Period	IAB RIT	IAB SBAP
1						
2						
3						
4		1	**Urine culture**: >100,000 cfu/ml ***K. pneumoniae***			
5		2	Fever > 38.0 C			
6		3				
7		4				
8		5		Fever >38.0 C, Abdominal pain		
9		6		CT Scan: Abdominal abscess		
10		7	**Blood culture: *K. pneumoniae***	**Blood culture: *K. pneumoniae***		
11		8				
12		9				
13		10				
14		11				
15		12				
16		13				
17		14				
18						
19						
20						
21						
22						
23						
			SUTI & Secondary BSI DOE = HD 4 Pathogen: *K. pneumoniae*	**IAB & Secondary BSI DOE = HD 8 Pathogen: *K. pneumoniae***		

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

Repeat Infection Timeframe (RIT)
(date of event = day 1)

Secondary BSI Attribution Period (SBAP) (Infection Window Period + RIT)

Date of Event (DOE)
Date the first element occurs for the first time within the infection window

Example 2: Pathogen Assignment (continued)

Pathogens excluded from specific infection definitions (for example, yeast in UTI, or *Enterococcus* spp. for PNEU) are also excluded as pathogens for BSIs secondary to that type of infection (they cannot be added as a pathogen based on the infection type). In example 2 below, the excluded organism must be accounted for as either 1) a primary bloodstream infection (BSI/CLABSI) or, 2) a secondary bloodstream infection attributed to another primary infection (for example, IAB, SINU).

A blood culture with yeast and *E. faecalis* is collected during the SUTI RIT. A BSI secondary to a SUTI (E. faecalis) is identified. *E. faecalis* is already documented as the SUTI pathogen, however, the yeast cannot be reported as a secondary BSI pathogen, because yeasts are excluded organisms in the UTI definition. Since there is no other primary source of infection for which the yeast BSI can be assigned as secondary, a primary BSI with yeast is identified.

Note: The *Enterococcus faecalis* is not reported as a pathogen for the primary BSI because if an excluded UTI organism, yeast, had not been identified, a primary BSI would not have been reported.

Hospital Day (HD)	UTI SBAP	UTI RIT	UTI Infection Window Period	BSI Infection Window Period	BSI RIT
1					
2					
3		1	Dysuria		
4		2	**Urine culture**: > 100,000 cfu/ml ***E. faecalis***		
5		3			
6		4			
7		5			
8		6			
9		7			
10		8			
11		9	**Blood culture: *E. Faecalis* / Yeast**	**Blood culture: *E. faecalis* / Yeast**	1
12		10			2
13		11			3
14		12			4
15		13			5
16		14			6
17					7
18					8
19					9
20					10
21					11
22					12
23					13
24					14
25					
			UTI & Secondary BSI DOE = HD 3 Pathogen: *E. faecalis*	**Primary BSI DOE = HD 11 Pathogen: Yeast**	

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

Repeat Infection Timeframe (RIT)
(date of event = day 1)

Secondary BSI Attribution Period (SBAP)
(Infection Window Period + RIT)

Date of Event (DOE)
Date the first element occurs for the first time within the infection window period

Example 3: Pathogen Assignment (continued)

Hospital Day (HD)	IAB SBAP	IAB RIT	IAB Infection Window Period	IAB Infection Window Period
1	Admit		Abdominal pain & distention	
2	PICC placed			
3				
4			US guided drainage-5L purulent peritoneal fluid: ***Klebsiella pneumoniae*** and ***E. coli***	
5				
6				
7				
8				
9				
10				Abdominal pain
11				CTS multiple liver abscesses **Blood culture:** ***C. glabrata, L. casei***
12				
13				jaundice, fever
14				
15				
			IAB 1 DOE = HD 4 Pathogens: *K. pneumoniae, E. coli*	**IAB 3b & Secondary BSI DOE = HD 4 Pathogens: *C. glabrata, L. casei***

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

Repeat Infection Timeframe (RIT)
(date of event = day 1)

Secondary BSI Attribution Period (SBAP)
(Infection Window Period + RIT)

Date of Event (DOE)
Date the first element occurs for the first time within the infection window period

Only one infection of a specific type (or major type: BSI, UTI and PNEU) is reported during an RIT for that specific type of event. However, a new event of the same specific type (or major type: BSI, UTI and PNEU) can be identified during a RIT if all required elements of the new event occur within a new IWP; the DOE of the new event must be within the RIT of the initial event. In example 3, IAB criteria 1 is met on hospital day 4 using organisms identified from purulent fluid. During the IAB RIT (hospital day 4-hospital day 17), IAB criteria 3b is met (on hospital day 10) using two symptoms, positive imaging evidence of an abscess and a positive blood specimen. Because the positive blood specimen was used to re-meet an IAB criterion during the IAB RIT, the blood specimen is considered secondary to IAB. The pathogens, in this case, do not have to match because another definition (IAB 3b) is fully met within a new IAB IWP (hospital day 8-hospital day 14). Because the DOE (hospital day 10) occurs within the RIT of the initial IAB 1, a new event is not reported. The DOE, RIT, and device association are not changed. Any additional organisms identified (*C. glabrata and L. casei*) are added to the initial IAB event if reported.

Example 4: Pathogen Assignment (continued)

Hospital Day (HD)	GIT SBAP	GIT RIT	GIT Infection Window Period	GIT Infection Window Period
1	Admit		Fever & vomiting	
2	PICC placed			
3				
4			CT bowel abscess	
5				
6			**Blood culture: *Enterococcus faecalis* X2**	
7				
8				
9				
10				
11				**Blood culture: *Candida glabrata***
12				
13				Abscess drainage: ***Candida glabrata*** Abdominal pain and nausea
14				
15				
			GIT-2c & Secondary BSI DOE= HD 1 Pathogen: *E. faecalis*	**GIT-2a & Secondary BSI DOE = HD 1 Pathogen: *C. glabrata***

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

Repeat Infection Timeframe (RIT)
(date of event = day 1)

Secondary BSI Attribution Period (SBAP)
(Infection Window Period + RIT)

Date of Event (DOE)
Date the first element occurs for the first time within the infection window period

Only one infection of a specific type (or major type for BSI, UTI and PNEU) is reported during an RIT for that type of event. However, a new event of the same specific type (or major type for BSI, UTI and PNEU) can be identified during an RIT if all required elements occur within a new IWP and the DOE is within the RIT of the initial event. In example 4, GIT criterion 2c is met on hospital day-1 using two symptoms, positive imaging, evidence of an abscess, and a positive blood specimen for *Enterococcus faecalis*. GIT 2a is met during the GIT RIT (two symptoms and positive abscess). The positive blood specimen occurs within the GIT secondary BSI attribution period and matches the organism identified from the abscess culture, *Candida glabrata*. Therefore, the positive blood culture is considered secondary to the GIT infection. The pathogens, in this case, do not have to match because another definition (GIT 2a) is fully met within a new GIT IWP (hospital day 8-hospital day 14). Because the DOE (hospital day 11) occurs within the RIT of the initial GIT 2c, a new event is not reported. The DOE, RIT, and device association are not changed but any additional organism identified (*C. glabrata*) is added to the initial GIT event if reported. This scenario is applicable to any site-specific infection definition from Chapter 17 or major infection type including BSI, UTI or PNEU.

Example 5: Pathogen Assignment (continued)

Hospital Day	RIT	Infection Window Period	Infection Window Period	RIT	SBAP
1					
2					
3					
4					
5		WBC – 400 cells/mm^3			
6					
7	1	**Blood culture**: ***E. faecalis***			
8	2				
9	3				
10	4	WBC – 300 cells/mm^3	Erythema, Pain	1	
11	5		**Skin culture:** ***Staphylococcus aureus***	2	
12	6			3	
13	7			4	
14	8			5	
15	9			6	
16	10			7	
17	11			8	
18	12			9	
19	13		**Blood culture:** ***Staphylococcus aureus***	10	
20	14			11	
21				12	
22				13	
23				14	
24					
25					
26					
		MBI-LCBI 1 **Date of Event = HD 7** **Pathogen: *E. faecalis***	**SKIN 2a & Secondary BSI** **Date of Event = HD 10** **Pathogen: *Staphylococcus aureus***		

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

Repeat Infection Timeframe (RIT)
(date of event = day 1)

Secondary BSI Attribution Period (SBAP)
(Infection Window Period + RIT)

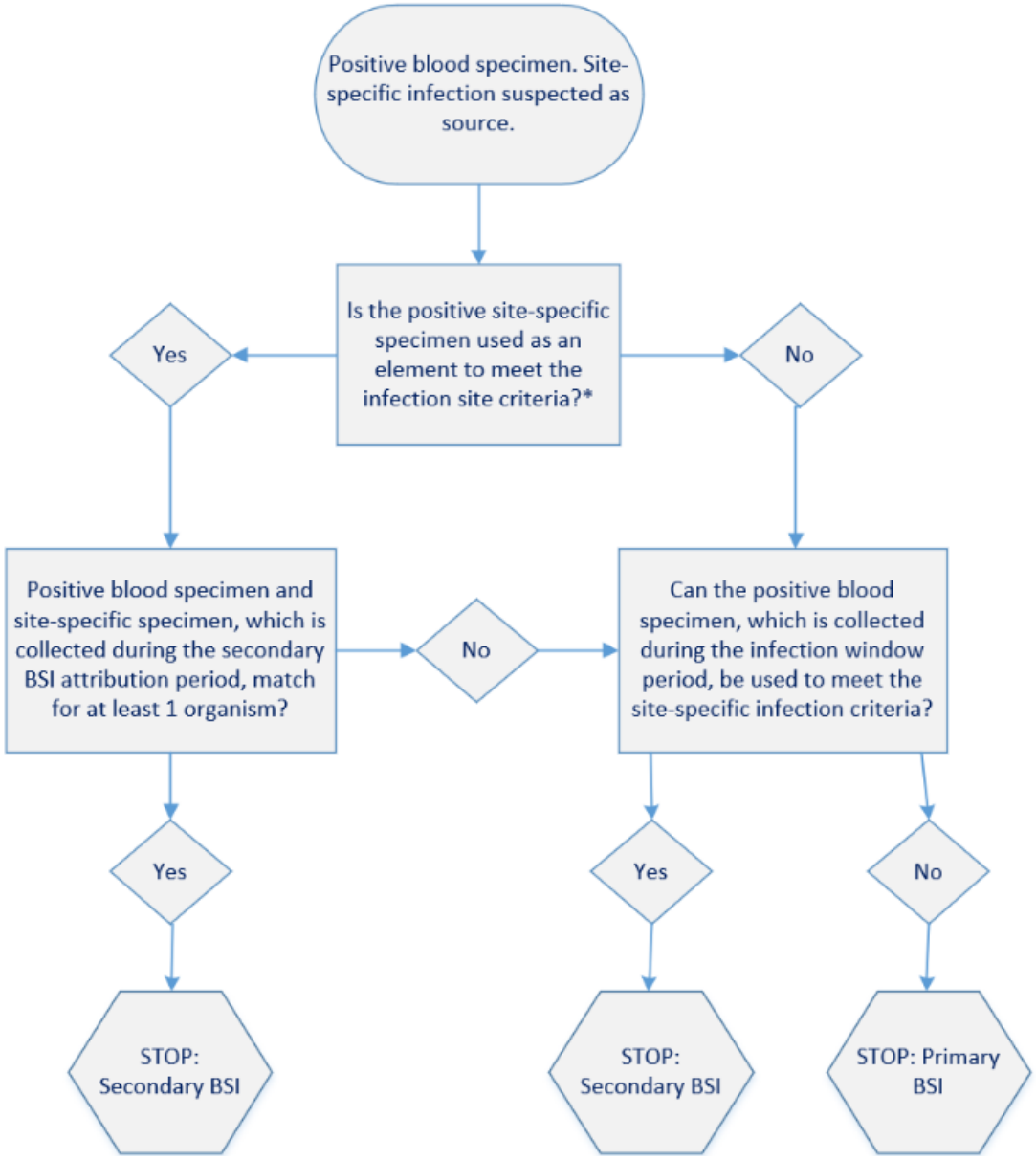
Date of Event (DOE)
Date the first element occurs for the first time within the infection window period

A non-MBI organism is NOT assigned to an MBI-LCBI (primary BSI) event when a blood culture with a non-MBI organism is collected during a BSI (MBI-LCBI)-RIT and deemed secondary to an NHSN site-specific infection. The MBI-LCBI designation will not change to an LCBI event. On day 7 of hospital admission, *Enterococcus faecalis* is identified in a blood culture meeting MBI-LCBI 1 criteria. During the BSI RIT of the

MBI-LCBI 1 event, a blood culture with a non-MBI organism (*Staphylococcus aureus*) is collected but is deemed secondary to a SKIN 2a. Because the *Staphylococcus aureus* (a non-MBI organism) is secondary to SKIN 2a, the MBI-LCBI 1 designation **will not** change to an LCBI 1.

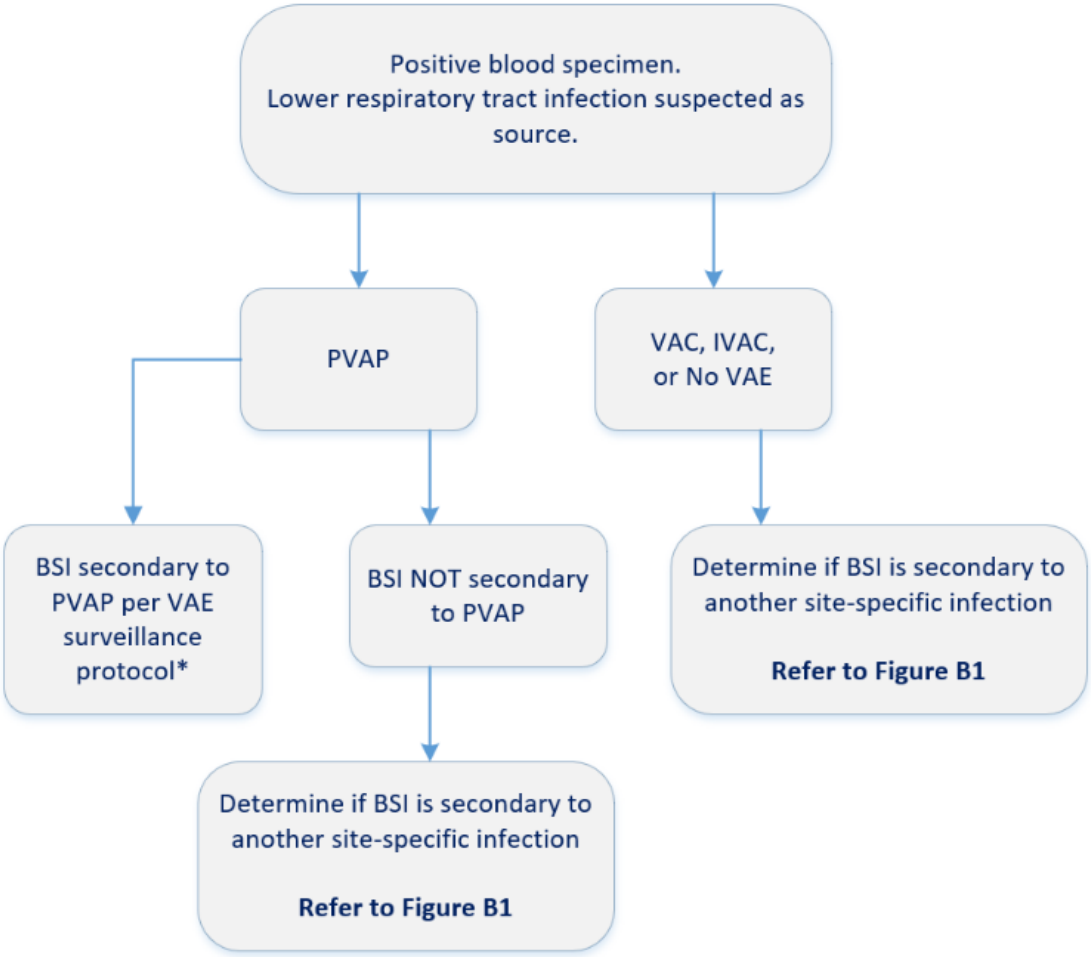
Figure B1: Secondary BSI Guide for eligible organisms*‡

(Not applicable to Ventilator-associated Events [VAE], See Figure B2)



*__Exception:__ The necrotizing enterocolitis (NEC) definition does not include criteria for a matching site-specific specimen, nor an organism identified from a blood specimen, however an exception for assigning a BSI secondary to NEC is provided. A BSI is considered secondary to NEC if the patient meets one of the two NEC criteria **AND** an organism identified from a blood specimen, collected during the secondary BSI attribution period, is an LCBI pathogen or the same common commensal is identified from 2 or more blood specimens drawn on separate occasions on the same or consecutive days.

Figure B2: VAE Guidance for Secondary BSI Determination



*Secondary BSIs may be reported for possible VAP (PVAP) events, provided that at least one organism identified from the blood specimen matches an organism identified from an appropriate respiratory tract specimen (including respiratory secretions, pleural fluid, and lung tissue). The respiratory tract specimen must have been collected on or after the 3rd day of mechanical ventilation and within 2 calendar days before or after the day of onset of worsening oxygenation to be considered as a criterion for meeting the PVAP definition. In addition, the blood specimen must have been collected during the 14-day event period, where day 1 is the day of onset of worsening oxygenation.

- In cases where PVAP is met with only the histopathology criterion and no culture or non-culture based testing is performed on an eligible respiratory specimen, and there is also a positive blood specimen, a secondary BSI to VAE is not reported.
- In cases where a culture or non-culture based testing of respiratory secretions, pleural fluid, or lung tissue is performed and does not identify an organism that matches an organism identified from blood, a secondary BSI to VAE is not reported.

Note: Any *Candida* species or yeast not otherwise specified, any coagulase-negative *Staphylococcus* species, and any *Enterococcus* species identified from blood cannot be deemed secondary to a PVAP, unless the organism was also identified from pleural fluid or lung tissue.