Bloodstream Infection (Central Line-Associated Bloodstream Infection [CLABSI] and Non-central line-associated Bloodstream Infection [BSI]) Event

Introduction: An estimated 41,000 central line-associated bloodstream infections (CLABSI) occur in U.S. hospitals each year.[1] These infections are usually serious infections typically causing a prolongation of hospital stay and increased cost and risk of mortality.

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

Settings: Surveillance will occur in any inpatient location where denominator data can be collected, which may 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 care units. A complete listing of inpatient locations and instructions for mapping can be found in the CDC Locations and Descriptions chapter.

NOTE: Surveillance for CLABSIs after the patient is discharged from the facility is not required. However, if discovered, any CLABSIs with event date on the day of discharge or the next day should be reported to NHSN (see Transfer Rule). No additional central line days are reported.

Requirements: Surveillance for HAI CLABSI is performed in at least one inpatient location in the healthcare institution for at least one calendar month as indicated in the *Patient Safety Monthly Reporting Plan* (CDC 57.106).

Definitions:

Present on Admission (POA): Infections that are POA, as defined in Chapter 2, are not considered HAIs and therefore are never reported to NHSN.

Healthcare-associated infections (HAI): All NHSN site specific infections must first meet the HAI definition as defined in Chapter 2 before a site specific infection (e.g., CLABSI) can be reported to NHSN.

Primary bloodstream infections (BSI): Laboratory-confirmed bloodstream infections (LCBI) that are not secondary to an infection at another body site (see Appendix 1. Secondary Bloodstream Infection (BSI) Guide and Surveillance Definitions chapter).

Date of event: For a BSI the date of event is the date when the last element used to meet the laboratory-confirmed bloodstream infection (LCBI) criterion occurred. Synonym: infection date.

Central line: An intravascular catheter that terminates at or close to the heart or in one of the great vessels which is used for infusion, withdrawal of blood, or hemodynamic monitoring. The following are considered great vessels for the purpose of reporting central-line BSI and counting central-line days in the NHSN system:

- 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 insertion site nor the type of device may be used to determine if a line qualifies as a central line. The device must terminate in one of the great vessels or in or near the heart and be used for one of the purposes outlined above, to qualify as a central line.
2. An introducer is considered an intravascular catheter, and depending on the location of its tip and use, may be a central line.
3. Pacemaker wires and other non-lumened devices inserted into central blood vessels or the heart are not considered central lines, because fluids are not infused, pushed, nor withdrawn through such devices.
4. The following devices are not considered central lines:
   - Extracorporeal membrane oxygenation (ECMO)
   - Femoral arterial catheters
   - Intraaortic balloon pump (IABP) devices.
   - Hemodialysis reliable outflow (HeRO) dialysis catheters

Infusion: The introduction of a solution through a blood vessel via a catheter lumen. This may include continuous infusions such as nutritional fluids or medications, or it may include intermittent infusions such as flushes, IV antimicrobial administration, or blood transfusion or hemodialysis.

Umbilical catheter: A central vascular device inserted through the umbilical artery or vein in a neonate.

Temporary central line: A non-tunneled, non-implanted catheter.
Permanent central line: Includes

- Tunneled catheters, including certain dialysis catheters
- Implanted catheters (including ports)

Central line-associated BSI (CLABSI): A laboratory-confirmed bloodstream infection (LCBI) where central line (CL) or umbilical catheter (UC) was in place for >2 calendar days on the date of event, with day of device placement being Day 1,
and
a CL or UC was in place on the date of event or the day before. If a CL or UC was in place for >2 calendar days and then removed, the date of event of the LCBI must be the day of discontinuation or the next day. If the patient is admitted or transferred into a facility with a central line in place (e.g., tunneled or implanted central line), and that is the patient's only central line, day of first access as an inpatient is considered Day1. "Access" is defined as line placement, infusion or withdrawal through the line.

Notes:

- **Central lines that are removed and reinserted**: If, after central line removal, the patient is without a central line for at least 1 full calendar day (NOT to be read as 24 hours), then the central line day count will start anew. If instead, a new central line is inserted before a full calendar day without a central line has passed, the central line day count will continue.
- To distinguish subsequent LCBIs from a previously unresolved LCBI, see **Note** following HAI definition in Chapter 2.
- Patients suspected or known to have accessed their own IV lines are **not** excluded from CLABSI surveillance. A facility must protect the line as best they can. Prevention efforts may include providing a patient sitter and/or removal of the catheter as soon as is clinically possible.

EXAMPLES:

- Patient in MICU has central line inserted/accessed on June 1. On June 3, the central line is still in place and the patient has positive blood culture with *S. aureus*. This is a CLABSI because the central line was in place for >2 calendar days (June 1, 2, and 3) on the date of event (June 3).
- Patient has a central line inserted on June 1. On June 3, the central line is removed and on June 4 the patient has a positive blood culture with *S. aureus*. This is a CLABSI because the central line was in place for >2 calendar days (June 1, 2, and 3), and was in place the day before the date of event (June 3).
- A central line is placed in the facility on May 30th. On June 3, the central line is removed and on June 5 patient spikes a fever of 38.3°C. Two blood culture sets collected on June 6 are positive for *S. epidermidis*. This is may be a healthcare-associated bloodstream infection but it is not a CLABSI because the central line was not place the day of or the day before LCBI Criterion 2 was met (June 6, the date of the last LCBI element).

Location of attribution: The inpatient location where the patient was assigned on the date of the LCBI event, which is further defined as the date when the first element used to meet the LCBI criterion occurred (see exception below).

INPATIENT DIALYSIS:
Inpatients receiving dialysis are included in any CLABSI surveillance in the location in which they are housed, regardless of whether or not the central line is the only central line and only accessed for dialysis. This also applies to patients in Long-Term Acute Care (LTAC) facilities within Acute Care Facilities when dialysis is received from the Acute Care Facility staff.

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 Unit A patient
- Patient resides on Unit A for inpatient care, but is transported to dialysis unit within the facility for dialysis. Since CLABSIs cannot be attributed to non-bedded locations, such an event must be attributed to the inpatient location housing the patient.
- Facilities may choose to capture information about the presence of a dialysis catheter in patients with LCBIs. The BSI collection form includes a data field "Any hemodialysis catheter present," which may be marked yes or no, and utilized internally by facility to identify association of dialysis to LCBI.

EXCEPTION TO LOCATION OF ATTRIBUTION:

Transfer Rule: If the date of event for a CLABSI is the day of transfer or discharge, or the next day, the infection is attributed to the transferring location.. Receiving facilities should share information about such HAIs with the transferring facility to enable reporting. This is called the Transfer Rule and examples are shown below:

- Patient with a central line in place in the SICU is transferred to the surgical ward. On the next day, the patient meets criterion for an LCBI. This is reported to NHSN as a CLABSI for the SICU.
- Patient without a central line is transferred from the medical ward on hospital day 3 to MICU. Later that day a central line is inserted. The next day, LCBI criteria are met. This would be considered a BSI and attributed to the medical ward; however, it is not a CLABSI because the central line was not in place >2 days on the date of event.
- Patient with a central line in place is transferred from the medical ward to the coronary care ICU (CCU). After 4 days in the CCU and with the central line still in place, all elements of LCBI are met. This is reported to NHSN as a CLABSI for the CCU.
- After a two week hospital stay, a patient on the urology ward of Hospital A has his only central line removed and is discharged home a few hours later. The IP from Hospital B calls the next day to report that this patient has been admitted to

Hospital B and meets LCBI criteria. This CLABSI should be reported to NHSN for, and by, Hospital A and attributed to the urology ward.

NOTE: Example of multiple transfers within the transfer rule time-frame:

3/22	3/23	3/24
Patient in Unit A	Patient transferred from Unit A to Unit B. Later that day, patient transferred to Unit C. (day of transfer)	Patient transferred from Unit C to Unit D. This is also the date of event for a CLABSI. This CLABSI is attributed to Unit A since Unit A was the original unit initiating the transfer in the 2 day time-frame. (day after transfer)

Table 1. *Laboratory-Confirmed Bloodstream Infection Criteria*

Criterion	**Laboratory-Confirmed Bloodstream Infection (LCBI)** *Comments and reporting instructions that follow the site-specific criteria provide further explanation and are integral to the correct application of the criteria.* Must meet one of the following criteria:
LCBI 1	Patient has a recognized pathogen cultured from one or more blood cultures *and* organism cultured from blood is not related to an infection at another site.(See Appendix 1 Secondary BSI Guide)
LCBI 2	Patient has at least one of the following signs or symptoms: fever (>38.0°C), chills, or hypotension *and* organism cultured from blood is not related to an infection at another site (See Appendix 1 Secondary BSI Guide) *and* the same common commensal (i.e., diphtheroids [*Corynebacterium* spp. not *C. diphtheriae*], *Bacillus* spp. [not *B. anthracis*], *Propionibacterium* spp., coagulase-negative staphylococci [including *S. epidermidis*], viridans group streptococci, *Aerococcus* spp., and *Micrococcus* spp.) is cultured from two or more blood cultures drawn on separate occasions (see comment 3a below). Criterion elements must occur within a timeframe that does not exceed a gap of 1 calendar day between adjacent elements. (See complete list of common commensals at

	http://www.cdc.gov/nhsn/XLS/master-organism-Com-Commensals-Lists.xlsx) **NOTE:** The matching common commensals represent a single element; therefore, the collection date of the first common commensal is the date of the element used to determine the Date of Event.

6/1/2013	6/2/2013	6/3/2103	6/4/2013	Date of LCBI Event = 6/1/2013
S. epidermidis (1 of 2)	*S. epidermidis* (1 of 2)	No LCBI elements	Fever > 38.0 °C	

LCBI 3	Patient ≤ 1 year of age has at least one of the following signs or symptoms: fever (>38.0°C core), hypothermia (<36.0°C core), apnea, or bradycardia *and* positive laboratory results are not related to an infection at another site (See Appendix 1 Secondary BSI Guide) *and* the same common commensal (i.e., diphtheroids [*Corynebacterium* spp. not *C. diphtheriae*], *Bacillus* spp. [not *B. anthracis*], *Propionibacterium* spp., coagulase-negative staphylococci [including *S. epidermidis*], viridans group streptococci, *Aerococcus* spp., *Micrococcus* spp.) is cultured from two or more blood cultures drawn on the same or consecutive days and separate occasions (see Comment 3a below). Criterion elements must occur within a timeframe that does not exceed a gap of 1 calendar day between adjacent elements. (See complete list of common commensals at http://www.cdc.gov/nhsn/XLS/master-organism-Com-Commensals-Lists.xlsx) **NOTE:** The matching common commensals represent a single element; therefore, the collection date of the first common commensal is the date of the element.

6/1/2013	6/2/2013	6/3/2103	6/4/2013	Date of LCBI Event = 6/1/2013
S. epidermidis (1 of 2)	*S. epidermidis* (1 of 2)	No LCBI elements	Fever > 38.0 °C	

Criterion	**Mucosal Barrier Injury Laboratory-Confirmed Bloodstream Infection (MBI-LCBI)** *In 2014 when reporting an LCBI, it is required to indicate which of the underlying conditions of the MBI-LCBI criterion was met, if any. All CLABSI, whether LCBI or MBI-LCBI, must be reported if CLABSI is part of your Monthly Reporting Plan.* Must meet one of the following criteria:
MBI-LCBI 1	Patient of any age meets criterion 1 for LCBI with at least one blood culture growing any of the following intestinal organisms with no other organisms isolated (See Comment #5): *Bacteroides* spp., *Candida* spp., *Clostridium* spp., *Enterococcus* spp., *Fusobacterium* spp., *Peptostreptococcus* spp., *Prevotella* spp., *Veillonella* spp., or Enterobacteriaceae* *and* patient meets at least one 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 culture: a. Grade III or IV gastrointestinal graft versus host disease [GI GVHD] (See Comment #6) 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 7 calendar days before the date the positive blood culture was collected. 2. Is neutropenic, defined as at least 2 separate days with values of absolute neutrophil count (ANC) or total white blood cell count (WBC) <500 cells/mm^3 within a seven-day time period which includes the date the positive blood culture was collected (Day 1), the 3 calendar days before *and* the 3 calendar days after (See Table 4 for example). *See Table 3 for partial list of eligible Enterobacteriaceae genera.
MBI-LCBI 2	Patient of any age meets criterion 2 for LCBI when the blood cultures are growing only viridans group streptococci with no other organisms isolated *and* patient meets at least one 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 culture:

	a. Grade III or IV gastrointestinal graft versus host disease [GI GVHD] (See Comment #6) 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 7 calendar days before the date the first positive blood culture was collected. 2. Is neutropenic, defined as at least 2 separate days with values of absolute neutrophil count (ANC) or total white blood cell count (WBC) <500 cells/mm^3 within a seven-day time period which includes the date the positive blood culture was collected (Day 1), the 3 calendar days before *and* the 3 calendar days after (See Table 4 for example).
MBI-LCBI 3	Patient ≤1 year of age meets criterion 3 for LCBI when the blood cultures are growing only viridans group streptococci with no other organisms isolated *and* patient meets at least one 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 culture: a. Grade III or IV gastrointestinal graft versus host disease [GI GVHD] (See Comment #6) b. ≥20 mL/kg diarrhea in a 24-hour period with onset on or within 7 calendar days before the date the first positive blood culture is collected. 2. Is neutropenic, defined as at least 2 separate days with values of absolute neutrophil count (ANC) or total white blood cell count (WBC) <500 cells/mm^3 on or within a seven-day time period which includes the date the positive blood culture was collected (Day 1), the 3 calendar days before *and* the 3 calendar days after. (See Table 4 for example)
Comments	1. In LCBI criterion 1, the term "recognized pathogen" includes any organism not included on the common commensal list (see criteria 2 and 3 or Supporting Material section at http://www.cdc.gov/nhsn/acute-care-hospital/clabsi/index.html for the list of common commensals). 2. LCBI criteria 1 and 2 and MCI-LCBI criteria 1 and 2 may be used for patients of any age, including those patients ≤1 year of age. 3. In LCBI criteria 2 and 3, if the pathogen or common commensal

is identified to the species level from one blood culture, and a companion blood culture is identified with only a descriptive name, which is complementary to the companion culture (e.g., to the genus level), then it is assumed that the organisms are the same. The organism identified to the species level should be reported as the infecting organism along with its antibiogram if available (see Table 2 below). Only genus and species identification should be utilized to determine the sameness of organisms (i.e., matching organisms). No additional comparative methods should be used (e.g., morphology or antibiograms) because laboratory testing capabilities and protocols may vary between facilities. This will reduce reporting variability, solely due to laboratory practice, between facilities reporting LCBIs meeting criterion 2. Report the organism to the genus/species level only once, and if antibiogram data are available, report the results from the most resistant panel.

   a. In LCBI criteria 2 and 3, the phrase "two or more blood cultures drawn on separate occasions" means 1) that blood from at least two blood draws were collected on the same or consecutive calendar days and 2) were collected in a manner which suggests that 2 separate blood draw site preparations were performed. This will reduce misidentification of contaminated blood cultures as LCBI. For example, blood cultures drawn from different sites (e.g., different venipunctures, a combination of venipuncture and lumen withdrawal, or different lumens of the same central line) should undergo separate decontaminations and are therefore considered drawn on "separate occasions".
   b. A blood culture may consist of a single bottle for a pediatric blood draw due to volume constraints. Therefore, to meet this part of the criterion, each bottle from two single bottle blood draws would have to be culture-positive for the same commensal.

4. Specimen Collection Considerations: Although blood cultures drawn through central lines can have a higher rate of contamination than blood cultures collected through peripheral venipuncture [3, 4] all positive blood cultures, regardless of the sites from which they were collected, must be included when conducting in-plan CLABSI surveillance.
5. In MBI-LCBI 1, 2 and 3, "No other organisms isolated" means there is not isolation in a blood culture of another recognized pathogen (e.g., *S. aureus*) or common commensal (e.g., coagulase-negative staphylococci) other than listed in MBI-LCBI criterion 1, 2 or 3 that would otherwise meet LCBI criteria. If

	this occurs, the infection should not be classified as MBI-LCBI. •
REPORTING INSTRUCTIONS	1. Report organisms cultured from blood as BSI–LCBI when no other site of infection is evident (see Appendix 1. Secondary Bloodstream Infection [BSI] Guide). 2. Catheter tip cultures are not used to determine whether a patient has a primary BSI. 3. When there is a positive blood culture and clinical signs or symptoms of localized infection at a vascular access site, but no other infection can be found, the infection is considered a primary BSI. 4. Purulent phlebitis confirmed with a positive semiquantitative culture of a catheter tip, **but with either negative or no blood culture** is considered a CVS-VASC, not a BSI, SST-SKIN, or a ST infection. 5. Occasionally a patient with both peripheral and central IV lines develops a primary bloodstream infection (LCBI) that can clearly be attributed to the peripheral line (e.g., pus at the insertion site and/or matching pathogen from pus and blood). In this situation, enter "Central Line = No" in the NHSN application. You should, however, include the patient's central line days in the summary denominator count. 6. If your state or facility requires that you report healthcare-associated BSIs that are not central line-associated, enter "Central Line = No" in the NHSN application when reporting these BSIs. You should, however, include all of the patient's central line days in the summary denominator count.

Table 2. ***Examples of How to Report Speciated and Unspeciated Organisms Isolated from Blood Cultures***

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*

Table 3. ***Partial List of Criterion 1 MBI-LCBI Eligible Enterobacteriaceae Genera***
(See complete list of MBI Pathogens at http://www.cdc.gov/nhsn/XLS/master-organism-Com-Commensals-Lists.xlsx)

Citrobacter
Enterobacter
Escherichia
Klebsiella
Proteus
Providencia
Salmonella
Serratia
Shigella
Yersina

Table 4. ***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* w/ *Candida* spp. x1**	**ND**	**550**	**600**
Pt. B	**ANC**	**ND**	**410**	**130**	**ND**	**ND**	**120**	**110**	**ND +BC* w/ viridans strep x2 and fever >38°C**	**110**	**300**	**320**
Pt. C	**WBC**	**100**	**800**	**400**	**300**	**ND**	**ND**	**ND**	**600 + BC* w/ *Candida* spp. x1**	**230**	**ND**	**400**

ND = not done
*Day the blood specimen that was positive was collected

Patient A meets MBI-LCBI criterion 1, sub-criterion 2: Positive blood culture with intestinal organism (*Candida* spp.) and neutropenia (2 separate days of WBC <500 cells/mm^3 occurring on the date the positive blood culture was collected [Day 1] or during the 3 days before or the 3 days after that date). In this case, the Day 1 value = 400, and Day -1 value = 320.

Patient B meets MBI-LCBI criterion 2, sub-criterion 2: At least 2 positive blood cultures with viridans group streptococci (in this case, 2 positive), and fever >38°C and neutropenia (2 separate days of ANC <500 cells/mm^3 occurring on the date the positive blood culture was collected [Day 1] or during the 3 days before or the 3 days after that date). In this case, the Day -1 value = 110 and

Day -2 value = 120. Note: any two of Days -2,-1, 2, 3, and 4 could be used to meet this requirement since WBC or ANC under 500 were present on those days.

Patient C meets MBI-LCBI criterion 1, sub-criterion 2: Positive blood culture with intestinal organism (*Candida* spp.) and neutropenia (2 separate days of WBC <500 cells/mm^3 occurring on the date the positive blood culture was collected [Day 1] or during the 3 days before or the 3 days after that date). In this case, Day 2 value =230 and Day 4value = 400]).

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. 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, the organisms isolated from blood cultures, and the organisms' antimicrobial susceptibilities.

REPORTING INSTRUCTION:

- If no CLABSIs are identified during the month of surveillance, the Report No Events box must be checked on the appropriate denominator summary screen, e.g., Denominators for Intensive Care Unit (ICU)/Other locations (Not NICU or SCA), etc.

Denominator Data: Device days and patient days are used for denominators (see Key Terms chapter). Device-day denominator data that are collected differ according to the location of the patients being monitored; however, within a location, they should be collected at the same time each day. When denominator data are available from electronic databases, these sources may be used as long as the counts are not substantially different (+/- 5%) from manually-collected counts, pre-validated for a minimum of 3 months.

For locations other than specialty care areas/oncology (SCA/ONC) and NICUs, the number of patients with one or more central lines of any type is collected daily, at the same time each day, during the month and 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. When denominator data are available from electronic sources (e.g., central line days from electronic charting), these sources may be used as long as the counts are not substantially different (+/- 5%) from manually-collected counts, pre-validated for a minimum of 3 months.

For specialty care areas/oncology, the number of patients with one or more central lines is dichotomized into those with permanent central lines and those with temporary central

lines on the *Denominators for Specialty Care Area (SCA)/Oncology (ONC)* form (CDC 57.117). Each is collected daily, at the same time each day. Only the totals for the month are entered into NHSN. This distinction in lines is made because permanent lines are commonly used in patients frequenting these areas and may be associated with lower rates of BSI than central lines inserted for temporary use. If a patient has both a temporary and a permanent central line, count the day only as a temporary line day. 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 forms.

In NICUs, the number of patients with one or more central lines is stratified by birthweight in five categories since risk of BSI varies by birthweight. These data are collected on the *Denominators for Neonatal Intensive Care Unit (NICU)* form (CDC 57.116).

NOTE: The weight of the infant at the time of BSI is not used and should not be reported. For example, if 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, record the birthweight of 1006 grams on the BSI form. 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.

Data Analyses: The Standardized Infection Ratio (SIR)[6] is calculated by dividing the number of observed infections by the number of predicted infections. The number of predicted infections, is calculated using CLABSI rates from a standard population during a baseline time period, which represents a standard population's CLABSI experience.[7]
NOTE: The SIR will be calculated only if the number of expected HAIs (numExp) is ≥1 to help enforce a minimum precision criterion.

NOTE: In the NHSN application, "predicted" is referred to as "expected".

$$\text{SIR} = \frac{\text{Observed (O) HAIs}}{\text{Expected (E) HAIs}}$$

While the CLABSI SIR 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 will be able to obtain one CLABSI SIR adjusting for all locations reported. Similarly, you can obtain one CLABSI SIR for all specialty care areas in your facility.
NOTE: Only those locations for which baseline data have been published will be included in the SIR calculations.

The CLABSI rate per 1000 central line days is calculated by dividing the number of CLABSI 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, and other locations in the institution. Separate rates and ratios will also be calculated for different types of catheters in specialty care areas/oncology locations and for birthweight categories in NICUs.

Descriptive analysis options of numerator and denominator data are available in the NHSN application, such as line listings, frequency tables, and bar and pie charts. SIRs and CLABSI rates and run charts are also available. Guides on using NHSN analysis features are available from: http://www.cdc.gov/nhsn/PS-Analysis-resources/reference-guides.html.

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[1]CDC Vital Signs. Making healthcare safer: reducing bloodstream infections. March 2011. Available at: http://www.cdc.gov/VitalSigns/HAI/index.html.

[2] O'Grady NP, Alexander M, Burns LA,, Dellinger EP, Garland J, Heard SO, Maki DG, et al. Guidelines for the prevention of intravascular catheter-related infections, 2011. Clinical Infectious Diseases 2011; 52 (a):1087-99.

[3] Clinical and Laboratory Standards Institute (CLSI). *Principles and Procedures for Blood Cultures; Approved Guideline*. CLSI document M47-A (ISBN 1-56238-641-7). Clinical and Laboratory Standards Institute, 940 West Valley Road, Suite 1400, Wayne, Pennsylvania, USA, 2007.

[4] Baron EJ, Weinstein MP, Dunne Jr WM, Yagupsky P, Welch DF, and Wilson DM. Cumitech IC: Blood Cultures IV. ASM Press: Washington, DC; 2005.

[5] Lee, A, Mirrett, S., Reller, LB., Weinstein, MP. Detection of bloodstream infections in adults: how many blood cultures are needed? Journal of Clinical Microbiology, 2007; Nov;45(11): 3546-8. Epub 2007 Sep 19.

[6] Your guide to the Standardized Infection Ratio (SIR). October 2010. http://www.cdc.gov/nhsn/PDFs/Newsletters/NHSN_NL_OCT_2010SE_final.pdf

[7] Edwards et al. (2009). National Healthcare Safety Network (NHSN) report: Data summary for 2006 through 2008, issued December 2009. Available at: http://www.cdc.gov/nhsn/PDFs/dataStat/2009NHSNReport.PDF

Appendix 1. Secondary Bloodstream Infection (BSI) Guide (not applicable to Ventilator-associated Events [VAE])

What is the meaning of the statement "not related to infection at another site" in relation to a positive blood culture?

The purpose of using the CDC/NHSN infection criteria is to identify and consistently categorize infections that are healthcare-associated into major and specific infection sites or types. LCBI criteria include the caveat that the organism(s) cultured from the blood cannot be related to infection at another site (i.e., must be a primary BSI). One must be sure that there is no other CDC-defined primary site of infection that may have seeded the bloodstream secondarily; otherwise the bloodstream infection may be misclassified as a primary BSI or erroneously associated with the use of a central line, i.e., called a CLABSI. For locations participating in in-plan VAE surveillance, refer to the VAE chapter for specific guidance on assigning a secondary BSI to a VAE.
For purposes of NHSN, for a bloodstream infection to be determined to be secondary to a primary infection site, (i.e. related to an infection at another site, such that primary site of infection may have seeded the bloodstream secondarily) the patient must meet one of the NHSN site specific definitions. To be considered secondary to a site specific infection, an element of the BSI criteria must occur within a time frame that is no more than 2 days before or 7 days after the date of the site specific event (date of site specific event = day 1). For example, you cannot call a bloodstream infection secondary to UTI based on a physician diagnosis of UTI alone.
Below are listed several scenarios that may occur with guidance on how to distinguish between the primary or secondary nature of a BSI, along with the definition of "matching organisms", and important notes and reporting instructions.

1. **Blood and site-specific specimen cultures match for at least one organism**: In a patient suspected of having an infection, blood and a site-specific specimen are collected for culture and both are positive for at least one matching organism. then the BSI is considered secondary to that site-specific infection.
    a. Example: Patient meets HAI criteria for a symptomatic urinary tract infection (suprapubic tenderness and $>10^5$ CFU/ml of *E. coli*) and blood culture from the same date grows *E. coli*. This is an HAI SUTI with a secondary BSI and the reported organism is *E. coli*.
    b. Example: Patient meets HAI criteria for a symptomatic urinary tract infection (suprapubic tenderness and $>10^5$ CFU/ml of *E. coli*) and blood culture from the same date grows *E. coli* and *P. aeruginosa*. This is an HAI SUTI with a secondary BSI and the reported organisms are *E. coli* and *P. aeruginosa*, since both site and blood culture are positive for at least one matching pathogen
    Example: Patient meets HAI criteria for a symptomatic urinary tract infection (suprapubic tenderness and $>10^5$ CFU/ml of *E. coli*) and blood culture from the same date grows *E. coli* and *S. epidermidis*. This is an HAI SUTI with a secondary BSI and the reported organism is only *E. coli*, since the single

common commensal *S. epidermidis* positive blood culture by itself does not meet BSI criteria.

2. **Blood and site-specific specimen cultures do <u>not</u> match**: There are two scenarios that can occur when a patient suspected of having an infection has blood and a site-specific specimen cultured but the organisms do not match.
    a. If the site-specific culture is an element used to meet the infection site criterion and the blood isolate is also an element used to meet another criterion at the same infection site, then the BSI is considered secondary to that site-specific infection.
        i. Example: Postoperative patient becomes febrile and complains of nausea and abdominal pain. Blood and an aseptically-obtained T-tube drainage specimen are collected for culture. A CT scan done that day shows fluid collection suggestive of infection. Culture results show *Escherichia coli* from theT-tube drainage specimen but the blood grows *Bacteroides fragilis.* Because the patient meets IAB criteria by positive site-specific culture (IAB criterion 3a) and by positive blood culture as an element of a different criterion of the same infection site (IAB 3c), the blood is considered a secondary BSI to an IAB and both organisms would be listed as the IAB infection pathogens. No primary BSI would be reported.

    b. If the site-specific culture is an element used to meet the infection site criterion and the blood isolate is not, then the BSI is considered a primary infection.

        i. Example: Postoperative patient has an intraabdominal abscess (IAB) noted during reoperation and purulent material is obtained at that time which grows Escherichia coli. The patient spikes a fever two days later and blood culture shows Bacteroides fragilis. Because the organisms from the site and blood cultures do not match, and no site-specific criterion that includes positive blood culture as an element is met, both a site-specific infection (GI-IAB criteria 1 and 2) and a primary BSI would be reported.
        ii. Example: Unconscious ICU patient with a Foley catheter and central line for past 4 days spikes a fever; blood, urine and sputum specimens are collected for culture. The urine culture grows >100,000 CFU/ml of Escherichia coli, blood culture grows Enterococcus faecium, and sputum shows oral flora only. Because the organisms from the urine and blood cultures do not match, and a UTI criterion that includes positive blood culture as an element is not met, both a SUTI (SUTI criterion 1a) and a primary BSI would be reported. This infection does not meet the ABUTI criterion since that requires at least one matching uropathogen organism in urine and blood in an asymptomatic patient.

3. **Negative or no site-specific specimen culture, only a positive blood culture**: In a patient suspected of having an infection, if the site specific specimen is negative or, there is no site-specific specimen if a site-specific infection criterion is met, utilizing a positive blood culture as an element, the BSI is considered secondary to that site-specific infection. If no site specific criterion utilizing a positive blood culture is met, then the BSI cannot be considered secondary to this specific type of infection.
    a. Example: Patient has purulent material from the intra-abdominal (IAB) space cultured and it yields no growth. The patient also has fever, abdominal pain, a positive blood culture with *Pseudomonas aeruginosa*, and radiographic evidence of IAB infection. This patient does not meet IAB criterion 1 (positive culture from purulent material) but does meet IAB criterion 3c, an element of which is a positive blood culture (signs/symptoms plus positive blood culture plus radiographic evidence). This BSI is considered secondary to the IAB and *P. aeruginosa* is listed as the IAB infection pathogen.
    b. Example: Patient has a central line in place for 10 days. Patient complains of knee joint tenderness, in his native knee, and limited range of motion. CT scan findings suggest joint (JNT) infection but culture of a needle-aspirated joint fluid is negative. A blood culture from the same time period grows *S. aureus*. While this patient does not meet JNT criterion 1 (positive joint fluid culture), he does meet JNT criterion 3c (signs/symptoms plus positive blood culture). Since a positive blood culture is part of the criterion met for JNT infection, this BSI is considered secondary to the JNT infection and not reported as a CLABSI. *S. aureus* is reported as the pathogen for the JNT infection.
    c. Example: Patient who is 4 days status post vaginal hysterectomy has purulent drainage from the vaginal cuff seen upon pelvic exam. She also has a blood culture positive with *S. aureus.* Although this patient meets criterion 1, of VCUF (vaginal cuff) infection (i.e. posthysterectomy patient has purulent drainage from the vaginal cuff on gross anatomical exam), if there is no other related site of infection, this BSI will be considered primary for NHSN reporting, since there is no VCUF criterion met that includes a positive blood culture as one of the elements.

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

1. If genus and species are identified in both cultures, they must be the same.
    a. Example: A blood culture reported as *Enterobacter cloacae* and an intraabdominal specimen of *Enterobacter cloacae* are matching organisms.
    b. Example: A blood culture reported as *Enterobacter cloacae* and an intraabdominal specimen of *Enterobacter aerogenes* are NOT matching organisms as the species are different.
2. If the organism is less definitively identified in one culture than the other, the identifications must be complementary.
    a. Example: A surgical wound growing *Pseudomonas* spp. and a blood culture growing *Pseudomonas aeruginosa* are considered a match at the genus level and therefore the BSI is reported as secondary to the SSI.
    b. Example: A blood culture reported as *Candida albicans* and a urine culture reported as yeast are considered to have matching organisms because the organisms are complementary, i.e. Candida is a type of yeast.

Notes:
1. If the blood isolate by itself does not meet BSI criteria (e.g., only one positive blood culture of a common commensal), then that isolate may not be used to indicate the presence of a secondary BSI (see example 1c).
2. Antibiograms of the blood and potential primary site isolates do not have to match.
3. Blood and site-specific specimens do not have to be collected on the same day but there must be evidence of infection at the specific site at the time of blood culture collection.

Reporting Instructions:
1. For reporting secondary BSI for possible and probable VAP, see Chapter 10.
2. Do not report secondary bloodstream infection for vascular (VASC) infections, Ventilator-Associated Conditions (VAC), or Infection-related Ventilator-Associated Complications (IVAC).
3. If a site-specific criterion requiring positive culture results is met, be sure to check the positive culture box when specifying the criteria used when adding the event, even if another criterion that does not include culture results is also met. For example, using the scenario in 2.a.i above, the following boxes for criteria used would be checked when entering the SSI into the NHSN application: fever, nausea, pain or tenderness, positive culture, positive blood culture, imaging test evidence of infection.

Instructions for Completion of Primary Bloodstream Infection (BSI) Form (CDC 57.108)

Data Field	Instructions for Data Collection
Facility ID	The NHSN-assigned facility ID will be auto-entered by the computer.
Event #	Event ID number will be auto-entered by the computer.
Patient ID	Required. Enter the alphanumeric patient ID number. This is the patient identifier assigned by the hospital and may consist of any combination of numbers and/or letters.
Social Security #	Optional. Enter the 9-digit numeric patient Social Security Number.
Secondary ID	Optional. Enter the alphanumeric ID number assigned by the facility.
Medicare #	Optional. Enter the patient's Medicare number.
Patient name	Optional. Enter the last, first, and middle name of the patient.
Gender	Required. Check Female, Male, or Other to indicate the gender of the patient.
Date of Birth	Required. Record the date of the patient birth using this format: MM/DD/YYYY.
Ethnicity	Optional. Specify if the patient is either Hispanic or Latino, or Not Hispanic or Not Latino.
Race	Optional. Specify one or more of the choices below to identify the patient's race: American Indian/Alaska Native Asian Black or African American Native Hawaiian/Other Pacific Islander White
Event type	Required. BSI.
Date of event	Required. For LCBI criterion 1, the date of positive blood culture collection. For LCBI criterion 2, the date when the first element used to meet this criterion occurred. Enter date of this event using this format: MM/DD/YYYY. NOTE: If a device has been pulled on the first day of the month in a location where there are no other device days in that month, and a device-associated infection develops after the device is pulled, attribute the infection to the previous month.
Post-procedure BSI	Optional. Check Y if this event occurred after an NHSN-defined procedure but before discharge from the facility, otherwise check N.
NHSN procedure code	Conditionally required. If Post-procedure BSI = Y, enter the appropriate NHSN procedure code. **NOTE:** A BSI cannot be "linked" to an operative procedure unless that procedure has already been added to NHSN. If the procedure was previously added, and the "Link to Procedure" button is clicked, the fields pertaining to the operation will be auto-entered by the computer.

Data Field	Instructions for Data Collection
ICD-9-CM procedure code	Optional. The ICD-9-CM code may be entered here instead of (or in addition to) the NHSN Procedure Code. If the ICD-9-CM code is entered, the NHSN code will be auto-entered by the computer. If the NHSN code is entered first, you will have the option to select the appropriate ICD-9-CM code. In either case, it is optional to select the ICD-9-CM code. Only those ICD-9-CM codes identified in Table 1 of the Surgical Site Infection Event Chapter (Chapter 9 of NHSN Manual: Patient Safety Component Protocol) are allowed.
MDRO Infection Surveillance	Required. Enter "Yes", if the pathogen is being followed for Infection Surveillance in the MDRO/CDI Module in that location as part of your Monthly Reporting Plan: MRSA, MSSA (MRSA/MSSA), VRE, CephR-*Klebsiella*, CRE-E. *coli*, CRE-*Enterobacter*, CRE-*Klebsiella*, MDR-*Acinetobacter* or *C. difficile*. If the pathogen for this infection happens to be an MDRO but your facility is not following the Infection Surveillance in the MDRO/CDI Module in your Monthly Reporting Plan, answer "No" to this question.
Location	Required. Enter the inpatient location to which the patient was assigned on the date of the BSI event. If the date of BSI occurs on the day of transfer or discharge from a location or the next day, indicate the transferring/discharging location, not the current location of the patient, in accordance with the Transfer Rule (see Key Terms section).
Date admitted to facility	Required. Enter date patient admitted to facility using this format: MM/DD/YYYY. An NHSN Inpatient is defined as a patient whose date of admission to the healthcare facility and the date of discharge are <u>different</u> calendar days. When determining a patient's admission dates to both the facility and specific inpatient location, the NHSN user must take into account all such days, including any days spent in an inpatient location as an "observation" patient before being officially admitted as an inpatient to the facility, as these days contribute to exposure risk. Therefore, all such days are included in the counts of admissions and patient days for the facility and specific location, and facility and admission dates must be moved back to the first day spent in the inpatient location. **NOTE Recently Discharged Patients:** If a previously unreported BSI is identified on the day of discharge or the day after discharge, enter the previous date of admission.

Data Field	Instructions for Data Collection
Risk Factors: If ICU/Other locations, central line	Required. Answer this question if the location is an intensive care unit (ICU) or location other than a specialty care area (SCA) or neonatal intensive care unit (NICU). Check Y if patient had a central line (CL) for more than 2 calendar days when the first element of the LCBI criterion was present (date of event) and the device was in place on the date of event or the day before,. otherwise, check N. Day of device insertion = Day 1 **NOTE:** If the patient has both a peripheral and a central line and the BSI can clearly be attributed to the peripheral line (e.g., pus at insertion site and matching pathogen from pus and blood), check N.
Risk Factors: If Specialty Care Area/Oncology, Permanent central line Temporary central line	Required. Answer these questions if the location is an SCA or oncology location: Check Y if patient had a tunneled or implaneted central line (CL) for more than 2 calendar days when the first element of the LCBI criterion was present (date of event) and the device was in place on the date of event or the day before, otherwise check N. Day of device insertion = Day 1 Check Y if patient had a non-tunneled or non-implanted central line (CL) for more than 2 calendar days when the first element of the LCBI criterion was present (date of event) and the device was in place on the date of event or the day before, otherwise check N. Day of device insertion = Day 1 **NOTE:** If the patient has both a peripheral and a central line and the BSI can clearly be attributed to the peripheral line (e.g., pus at insertion site and matching pathogen from pus and blood), check N.
Risk Factors: If NICU, Central line Birthweight	Required. Answer these questions if the location is an NICU: Check Y if patient had a central line (CL) or umbilical catheter (UC) for > 2 calendar days when the first element of the LCBI criterion was present (date of event) and the device was in place on the date of event or the day before, otherwise check N. Day of device insertion = Day 1 Required. Enter patient's weight at the time of birth in grams, <u>not</u> the weight on the date of event. **NOTE:** If the patient has both a peripheral and a central line and the BSI can clearly be attributed to the peripheral line (e.g., pus at insertion site and matching pathogen from pus and blood), check N.
Any hemodialysis catheter present	Optional. Check Y if the patient had any central line in place for the purpose of hemodialysis. Check N if the patient had no central line in place for the purpose of hemodialysis. If the patient has >1 central line at the time of the

Data Field	Instructions for Data Collection
	event, check Y if any were in place for the purpose of hemodialysis. There is no requirement for this central line to have been accessed to check Y.
Location of device insertion	Optional. Enter the patient location where the central line was inserted. • If the patient has more than one central line, enter the location where the first central line was inserted. • If the patient has both a permanent and a temporary central line, enter the location where the temporary line was inserted.
Date of device insertion	Optional. Enter the date the central line was inserted. If the patient has more than one central line, facility may choose which insertion date to record.
Event Details: Specific event	Required. Check Laboratory-confirmed (LCBI).
Event Details: Specify criteria used:	Required. Check each of the elements of the criterion that were met.
Event Details: Died	Required. Check Y if patient died during the hospitalization, otherwise check N.
Event Details: BSI contributed to death	Conditionally required if patient died. Check Y if the BSI contributed to death, otherwise check N.
Event Details: Discharge date	Optional. Date patient discharged from facility using this format: MM/DD/YYYY.
Event Details: Pathogen identified	Required. This field will be auto entered by the computer as Y. Specify pathogens on reverse of form.
Pathogen # for specified Gram-positive Organisms, Gram-negative Organisms, Fungal Organisms, or Other Organisms	Up to three pathogens may be reported. If multiple pathogens are identified, enter the pathogen judged to be the most important cause of infection as #1, the next most as #2, and the least as #3 (usually this order will be indicated on the laboratory report). If the species is not given on the lab report or is not found on the NHSN drop down list, then select the "spp" choice for the genus (e.g., *Bacillus natto* is not on the list so would be reported as *Bacillus* spp.).
Antimicrobial agent and susceptibility results	Conditionally required if Pathogen Identified = Y. • For those organisms shown on the back of an event form, susceptibility results are required only for the agents listed. • For organisms that are not listed on the back of an event form, the entry of susceptibility results is optional. Circle the pathogen's susceptibility result using the codes on the event forms. Additional antimicrobial agents and susceptibility results may be reported

Data Field	Instructions for Data Collection
	for up to a total of 20 agents.
Custom Fields	Optional. Up to 50 fields may be customized for local or group use in any combination of the following formats: date (MM/DD/YYYY), numeric, or alphanumeric. **NOTE:** Each custom field must be set up in the Facility/Custom Options section of the application before the field can be selected for use.
Comments	Optional. Enter any information on the event.