

Intensive Care Unit (ICU) & Neonatal Unit (NNL):

- **Central Line-associated Bloodstream Infection (CLABSI)**
- **Peripheral Line-associated Bloodstream Infection (PLABSI)**

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1. Introduction

Please note in this section wherever central line-associated bloodstream infection (CLABSI) is referred to this also relates to peripheral line-associated blood stream infection (PLABSI) unless otherwise stated. PLABSI is only monitored in the Level 3 Neonatal Unit (NNL).

This VICNISS CLABSI surveillance module is based on the National Health Safety Network (NHSN) Patient Safety Component Manual, Centers for Disease Control and Prevention (CDC) in the United States¹.

Patients in the ICU (adult, paediatric and neonatal) are at higher risk of developing healthcare-associated infections, including bloodstream infections. It is believed that a large proportion of these bloodstream infections are associated with the presence of a central vascular catheter (central line). For the purpose of VICNISS, such infections are termed central line-associated bloodstream infections (CLABSI). Blood stream infections are usually serious infections typically causing prolongation of hospital stay and increased cost and risk of mortality.

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

2. Methodology

This module requires active, patient-based, prospective surveillance of central-line associated infections and their corresponding denominator data. This means that the person undertaking surveillance shall seek out infections during a patient's stay by screening a variety of data sources, such as laboratory, pharmacy, radiology/imaging, admission/discharge/transfer and pathology databases, and patient charts, including history and physical exam notes, nurses/physicians notes, temperature charts, etc.

Due to the potential for poor documentation and the delay in obtaining patient histories from Medical Record (Health Information) offices retrospective chart review should be used only when patients are discharged before all information can be gathered.

Use VICNISS forms to record all required data, using the definitions of each data field. To minimise the ICP's data collection burden, others may be trained to collect the denominator data and to screen data sources for these infections, however the ICP must make the final determination.

Settings

CLABSI Surveillance can be performed in any of the three types of intensive care units:

- Adult Intensive Care Unit (ICU).
- Paediatric Intensive Care Unit (PICU).
- Level 3 Neonatal Unit (NNL).

An adult/paediatric ICU **excludes** nursing areas that provide step-down, intermediate care or telemetry only. Bone marrow transplant units are also excluded.

PLABSI surveillance can be performed in the Level 3 Neonatal Unit (NNL) only.

NOTE: Surveillance for CLABSIs after the patient is discharged from the hospital is not required, however, if discovered, these infections meeting VICNISS criteria, should be reported to VICNISS. No additional central line days are recorded

Requirements

Refer to the [Type 1 VICNISS Performance Indicators](#) on the VICNISS website for required ICU and NNL surveillance activities. For further information also refer to the [VICNISS Type 1 Surveillance Manual \(section 4.1\)](#) on the VICNISS website.

Definitions

As for all infections reported to VICNISS, infections associated with complications or extensions of infections already present on admission, unless a change of pathogen or symptoms strongly suggests the acquisition of a new infection, are not considered healthcare associated. Therefore, infections that become apparent within the first few days of admission must be carefully reviewed to determine whether they should be considered healthcare associated

VICNISS ICU Patient: is an inpatient admission **and** must be admitted to a nursing care area that provides intensive observation, diagnosis, and therapeutic procedures for adults, children and/or neonates who are critically ill.

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 VICNISS system: aorta, pulmonary artery, superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins, and common femoral veins, and in neonates, the umbilical vein/artery.

Note:

- 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 (listed above) or in or near the heart to qualify as a central line.

- An introducer is considered an intravascular catheter, and depending on the location of its tip, maybe a central line.
- Pacemaker wires and other non-lumened devices inserted into central blood vessels of the heart are not considered central lines, because fluids are not infused, pushed, nor withdrawn through such devices.
- The following devices are not considered central lines: extracorporeal membrane oxygenation (ECMO), femoral arterial catheters and Intraaortic ballon pump (IABP) devices. If you have any questions about whether a device qualifies as a central line, please email VICNISS Coordinating Centre at vicniss@mh.org.au.

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 or IV antimicrobial administration, or blood, in the case of transfusion or hemodialysis.

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

Temporary Central Line: Non-tunneled catheter – a central venous catheter that is fixed in place at the point of insertion and travels directly from the skin entry site to a vein and terminates close to the heart or one of the great vessels.

Permanent Central Line: Includes:

- Tunneled catheters (including certain dialysis catheters) – a central venous catheter that travels a distance under this skin from the point of insertion before terminating at or close to the heart or one of the great vessels.
- Implanted catheters (including ports).

Central Line-associated Blood Stream Infection (CLABSI): is a primary blood stream infection that is central line associated, i.e., a central line or umbilical catheter must have been in place at the time of, or within 48 hours before onset of the event.

Note:

- There is no minimum period of time that the central line must be in place in order for the BSI to be considered central line associated.
- If the interval between central-line removal and BSI is longer than 48 hours, there must be compelling evidence that the infection was associated with central line use.

Primary Bloodstream Infection (BSI): is a laboratory confirmed bloodstream infection (LCBI) that is not secondary to a HAI meeting [CDC/NHSN criteria](#) at another body site.

Laboratory Confirmed Bloodstream Infection (LCBI): must meet one of the following criteria:

Criterion 1:

- Patient has a recognised pathogen cultured from one or more blood cultures.
and
- Organism cultured from blood is not related to an infection at another site.

Criterion 2:

- Patient has at least one of the following signs or symptoms: fever (>38°C), chills, or hypotension.
and
- signs and symptoms and positive laboratory results are not related to an infection at another site.

and

- 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 separate occasions

Criterion 3:

- Patient \leq 1 year of age has at least one of the following signs or symptoms: fever ($>38^{\circ}\text{C}$ core), hypothermia ($<36^{\circ}\text{C}$ core), apnoea, or bradycardia.

and

- signs and symptoms and positive laboratory results are not related to an infection at another site.

and

- 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 separate occasions

Notes:

1. LCBI criteria 1 and 2 may be used for patients of any age, including \leq 1 year of age.
2. In criterion 1, the phrase “one or more blood cultures” means that at least one bottle from a blood draw is reported by the laboratory as having grown organisms (i.e., is a positive blood culture).
3. In criterion 1, the term “recognised pathogen” does not include organisms considered common commensals (see criteria 2 and 3 for a list of common commensals). A few of the recognised pathogens are *S. aureus*, *Enterococcus spp.*, *E. coli*, *Pseudomonas spp.*, *Klebsiella spp.*, *Candida spp.*, etc.
4. In criterion 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 within two days of each other (e.g., blood drawn on Monday and Tuesday or Monday and Wednesday would be acceptable for blood cultures drawn on separate occasions, but blood draws on Monday and Thursday would be too far apart in time to meet this criterion), and 2) that at least one bottle from each blood draw is reported by the laboratory as having grown the same common commensal (i.e., is a positive blood culture). (See Note 5 for determining sameness of organisms).
 - a. For example, an adult patient has blood drawn at 8 a.m. and again at 8:15 a.m. of the same day. Blood from each blood draw is inoculated into two bottles and incubated (four bottles total). If one bottle from each blood draw set is positive for coagulase-negative staphylococci, this part of the criterion is met.
 - b. For example, a neonate has blood drawn for culture on Tuesday and again on Saturday and both grow the same common commensal. Because the time between these blood cultures exceeds the two-day period for blood draws stipulated in criteria 2 and 3, this part of the criteria is not met.
 - c. 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 or more draws would have to be culture-positive for the same common commensal.
5. If the common commensal is identified to the species level from one culture, and a companion culture is identified with only a descriptive name (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 pathogen along with its antimicrobial susceptibilities. (see examples below).

Culture	Companion Culture	Report as...
<i>S. epidermidis</i>	<i>Coagulase-negative staphylococci</i>	<i>S. epidermidis</i>
<i>Bacillus</i> spp. (not <i>anthracis</i>)	<i>B. cereus</i>	<i>B. cereus</i>
<i>S. salivarius</i>	<i>Strep viridans</i>	<i>S. salivarius</i>

6. Only genus and species identification should be utilised to determine the sameness of 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 LCBI meeting Criterion 2. Report the organism to the genus/species level only once, and if antibiotic sensitivities are available, report the results from most resistant panel.

7. Specimen Collection Considerations: Ideally, blood specimens for culture should be obtained from two to four blood draws from separate venepuncture sites (e.g., right and left antecubital veins), not through a vascular catheter. These blood draws should be performed simultaneously or over a short period of time (i.e., within a few hours).^{3,4} If your facility does not currently obtain specimens using this technique, you may still report BSIs using the criteria and notes above, but you may like to work with appropriate personnel to facilitate better specimen collection practices for blood cultures

Exclusions:

- Purulent phlebitis confirmed with a positive culture of a catheter tip, but with either negative or no blood culture is not considered a BSI thus should not be reported as a CLABSI.
- Infections occurring as the result of the following special situations are not considered healthcare-associated:
 - Infections associated with complications or extensions of infections already present on admission, unless a change in pathogen or symptoms strongly suggests the acquisition of a new infection.
 - Infections in infants that have been acquired transplacentally (e.g., herpes simplex, toxoplasmosis, rubella, cytomegalovirus, or syphilis) and become evident \leq 48 hours after birth.
- Occasionally a patient with both peripheral and central IV lines develops a laboratory confirmed blood stream infection that can clearly be attributed to the peripheral line (e.g. pus at insertion site and matching pathogen from pus and blood). In this situation it is not reported as a CLABSI however if the patient was a neonate it would be reported as a PLABSI.

Location of Attribution: The location where the patient was assigned on the date the BSI was identified, which is further defined as the date when the first clinical evidence appeared or the date the specimen used to meet the BSI criteria was collected, whichever came first.

If a CLABSI develops within 48 hours of transfer from the ICU to another inpatient location in the same facility, the infection is attributed to the ICU. This is called the **Transfer Rule**.

- Example 1: Patient with a central line in place in the ICU is transferred to the surgical ward. Thirty six (36) hours later, the patient meets the criteria for CLABSI. This is reported to VICNISS as a CLABSI for the ICU.
- Example 2: Patient is transferred to the medical ward from the ICU after having the central line removed. Within 24 hours, patient meets criteria for a CLABSI. This is reported to VICNISS as a CLABSI for the ICU.

- Example 3: Patient with a central line in place is transferred from the medical ward to the ICU. After 4 days in the ICU, the patient meets the criteria for a BSI. This is reported to VICNISS as a CLABSI for the ICU.

Exception:

Patient who had no clinical signs and symptoms of sepsis upon arrival to the Emergency Department (ED) and has a central line inserted in ED before being admitted to the ICU. Within 24 hours of admission to the ICU, patient meets criteria for CLABSI. This is reported to VICNISS as a CLABSI for the ICU, because the Emergency Department is not an inpatient location (and no potential denominator data can be collected there).

Denominator Data

Central line days and patient days are used for denominators.

- 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 data.
- *Central line days*: is a daily count of the number of patients in the ICU (PICU or NNL) with one or more central lines of any type. To calculate central line days, for each day of the month, at the same time each day, record the number of patients who have a central line. At the end of the month sum the daily counts and record on [ICU Monthly Denominator](#) or [NNL Monthly Denominator](#) form.
- *Peripheral line days*: is a daily count of the number of patients with a peripheral line in the NNL during a time period. To calculate peripheral line days, for each day of the month, at the same time each day, record the number of patients who have a peripheral line. At the end of the month sum the daily counts and record on [NNL Monthly Denominator](#) form.
- If a patient has two lines, count as one line only, for example: 1) a PICC and a vascath, count as one central line only; 2) an umbilical catheter and a central line, count as one central line only; 3) a peripheral line and a central line, count as one central line only.
- *Patient days*: is a daily count of the number of patients in the ICU during a time period. To calculate patient days, for each day of the month, at the same time each day, record the number of patients. At the end of the month sum the daily counts and record on [ICU Monthly Denominator](#) or [NNL Monthly Denominator](#) form.
- For further explanation of required data fields see [Instructions for Completion of ICU-NNL CABSI-PLABSI Data Forms](#) on the VICNISS website.
- All attempts should be made to collect denominator data on weekends, public holidays etc. However, if a day is missed, use the previous day's data for that day. If two days are missed, use data from the day counting is resumed for the second day. For example, if both Saturday and Sunday are missed, use Friday's data for Saturday and Monday's data for Sunday.
- The denominator data **must also be collected on the first day of the month after ceasing the ICU surveillance components**. For example, if the surveillance period is January, February and March, denominator data must also be collected on 1st April.
- *Denominators for NNL (neonatal patients)* are further stratified by birthweight into five categories, since risk of BSI varies by birthweight. Birthweight is the infant's weight at the time of birth and should not be changed as the infant gains weight. For example, if a neonate weights 1006 grams at birth but remains in the Neonatal Unit for two months and has a body weight of 1650 grams when it develops a CLABSI, the recorded birthweight should still be 1006 grams.

Numerator Data

Report laboratory-confirmed BSIs that are central line-associated i.e., a central line was in place at the time of, or within 48 hours before, onset of the event. NOTE: There is no minimum period of time that the central line must be in place in order for the BSI to be considered central line-associated.

- When there is a positive blood culture and clinical signs and symptoms of localised infection at a vascular access site, but no other infection can be found, the infection is considered a primary BSI.
- Occasionally a patient with both a peripheral and central IV line develops a primary bloodstream infection (LCBI) that can clearly be attributed to the peripheral line (e.g., pus at the insertion site and matching pathogen from pus and blood). In this situation this should not be reported as a CLABSI. This would be reported as a PLABSI in the NNL module.
- Report each CLABSI identified in ICU that meets VICNISS criteria during the selected month for surveillance on [ICU Infection \(Numerator\)](#) form.
- Report each CLABSI/PLABSI identified in a neonate that meets VICNISS criteria during the month selected for surveillance on [NNL Infection \(Numerator\)](#) form.
- For further explanation of required data fields see [Instructions for Completion of ICU-NNL CLABSI-PLABSI Data Forms](#) on the VICNISS website. These data will be used to calculate line-specific infection rates.
- All patients in the selected ICU at the beginning of the month and all patients admitted to the ICU during the month (new arrivals) are monitored for CLABSI.
- While all participants may not agree with all the criteria, it is important that VICNISS hospitals consistently use them for reporting infections to VICNISS so rates between hospitals can be appropriately compared. Where clear consensus is lacking, the criteria are based on the best information available.

3. Data Analyses

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, e.g. adult medical/surgical, paediatric. Separate rates and ratios will also be calculated for birthweight categories in Neonates.

For further information see [VICNISS Type 1 Surveillance Manual \(section 3, Interpretation of Surveillance Results\)](#) on the VICNISS website.

4. References

1. Centers for Disease Control and Prevention. The National Healthcare Safety Network (NHSN) Manual. Patient Safety Component Protocol. 2010 www.cdc.gov/nhsn/TOC_PSCManual.html (last accessed July 2011).
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4. Baron EJ, Weinstein MP, Dunne Jr WM, Yagupsky P, Welch DF, and Wilson DM. Blood Cultures IV. ASM Press: Washington, DC; 2005.