Missouri Healthcare-Associated Infection Reporting System (MHIRS)

Central Line-Associated Bloodstream (CLAB) Infection Surveillance
Coronary, Medical, Surgical, Medical/Surgical, Pediatric and Neonatal Intensive Care Units (ICUs)

A. INTRODUCTION

An estimated 248,000 bloodstream infections occur in U.S. hospitals each year.[1] Although more study is needed, it is believed that a large proportion of these infections are associated with the presence of a central vascular catheter. Bloodstream infections are usually serious infections that typically cause a prolongation of hospital stay, increased cost, and risk of mortality. CLAB infections can be prevented through proper management of the central line. These techniques are addressed in the Centers for Disease Control and Prevention's Healthcare Infection Control Practices Advisory Committee (CDC/HICPAC) *Guidelines for the Prevention of Intravascular Catheter-Related Infections.*[2]

The State of Missouri requires that hospitals electronically report the total number of CLAB infections and the total number of central line-days for each of the following types of ICUs: coronary, medical, surgical, medical/surgical, pediatric, and neonatal. Data collection methods and definitions, in most part, are those established by the CDC National Healthcare Safety Network (NHSN).

B. REQUIREMENTS

1. CLAB infection surveillance will be performed monthly in the following intensive care units.
   - Coronary
   - Medical
   - Surgical
   - Medical/surgical
   - Pediatric
   - Neonatal (NICU/HRN)

2. Reporting To DHSS
   - Total number of central line-days and total number of CLAB infections per ICU will be electronically submitted monthly to the Department of Health and Senior Services (DHSS) using MHIRS.
     http://www.health.mo.gov/data/mhirs/index.php
   - Each ICU's data will be reported separately.
   - Reports must be transmitted to the DHSS, via MHIRS, within 60 days of the end of the reporting month.

3. Optional Tools to Collect Data

   Hospitals may use any appropriate system to capture CLAB related information. The following optional forms may be used to collect the required data:

   - MHIRS Adult and Pediatric ICU Monthly Report Form (Figure CLAB-1) specific to each ICU (this replicates the MHIRS data entry form)

   - MHIRS Adult and Pediatric ICU Daily Worksheet (Figure CLAB-2) specific to each ICU, which will be useful in collecting daily central line-days for each ICU

- MHIRS NICU Monthly Report Form (Figure CLAB-3) specific to each NICU (this replicates the MHIRS data entry form)

- MHIRS NICU Daily Worksheet (Figure CLAB-4) specific to each NICU, which will be useful in collecting daily central line-days, by birth weight, for each NICU.

C. SURVEILLANCE METHODOLOGY

This element requires active, patient-based, prospective surveillance of device-associated infections and their corresponding denominator data by a trained infection control professional (ICP). This means that the ICP shall seek out infections during a patient's stay by screening a variety of data sources, such as laboratory, pharmacy, admission/discharge/transfer, radiology/imaging, and pathology databases; and patient charts, including history and physical exam notes, nurses/physicians notes, temperature charts, etc. Others may be trained to screen data sources for these infections, but the ICP must make the final determination. Laboratory-based surveillance should not be used alone, unless all possible criteria for identifying an infection are solely determined by laboratory evidence. Retrospective chart reviews should be used only when patients are discharged before all information can be gathered. To minimize the ICP's data collection burden, others may be trained to collect the denominator data. These data should be collected at the same time each day (see definition for Central Line-Days). NOTE: It is not required to monitor for CLAB infections after the patient is discharged from the facility, however, if discovered, they should be reported to MHIRS.[3]

D. DEFINITIONS

- **Birthweight:**
  Birthweight is the weight of the infant **at the time of birth** and should not be changed as the infant gains weight. 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 it develops a CLAB infection, the recorded birthweight should still be 1006 grams.

- **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 bloodstream infections and counting central line-days in MHIRS: aorta, pulmonary artery, superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins, common femoral veins, and in neonates, the umbilical artery/vein.

  Note: An introducer is considered an intravascular catheter.

  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 these vessels or in or near the heart to qualify as a central line.

  Note: Pacemaker wires and other nonlumened 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.

- **Central Line-Days:**
  A count of the number of patients with a central line in the observed ICU. The count should be performed each day and at approximately the same time each day. *Example: The count is performed between 10:00 a.m. and noon each day; the number of patients with a central line is recorded. Each patient with a central line is counted as a central line-day. (A patient who has a*

central line inserted at 4:00 p.m. would not be counted as a central line-day until the next day when the count was made between 10:00 a.m. and noon. If the patient expired or was moved prior to the next day's count, there would be zero central line-days counted for that patient. Or, if a patient expired or was moved out of the ICU at 1:00 p.m., that central line-day would already have been counted and remains in the count even though the patient was moved fairly early in the day.) Thus, the central line-days are based on what is in place at the time of the routine daily count. The number of central line-days for the month would be the sum of the daily census of central line patients.

- **Healthcare-Associated Infection (HAI):**
  A healthcare-associated infection is **a localized or systemic condition resulting from an adverse reaction to the presence of an infectious agent(s) or its toxin(s)**. There must be no evidence that the infection was present or incubating at the time of admission to the care setting. Clinical evidence may be derived from direct observation of the infection site or review of information in the patient chart or other clinical records.

  For certain, but not all, infection sites, a physician's or surgeon's diagnosis of infection derived from direct observation during a surgical operation, endoscopic examination, or other diagnostic studies or from clinical judgment may be an acceptable criterion for a MHIRS infection, unless there is compelling evidence to the contrary.

  (See "Identifying Healthcare-Associated Infections [HAIs] in MHIRS" at http://health.mo.gov/data/mhirs/lawsregs.php)

- **INFECTIONS**

❖ **Central Line-Associated Bloodstream (CLAB) Infection:** A primary bloodstream infection (BSI) in a patient that had a central line within the 48-hour period before the development of the BSI and that is not related to an infection at another site.
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.

❖ **Primary Bloodstream Infections (BSI)** are classified according to the criteria used, either as laboratory-confirmed bloodstream infection (LCBI).
Report BSIs that are central line-associated (i.e., a central line or umbilical catheter 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.

❖ **Location of Attribution:** The location where the patient was assigned on the date of the BSI event, 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.

- Example: Patient has a central line inserted in the Emergency Department and then is admitted to the medical ICU. Within 24 hours of admission to the medical ICU, patient meets criteria for BSI. This is reported to MHIRS as a CLAB infection for the medical ICU, because the Emergency Department is not an inpatient location and no denominator data are collected there.

- Example: Patient in the surgical ICU of Hospital A had the central line removed and is discharged home a few hours later. The ICP from Hospital B calls the next day to report that this patient has been admitted to Hospital B with a BSI. This CLAB infection should be reported to MHIRS for Hospital A and attributed to the surgical ICU.

- EXCEPTION: If a CLAB infection develops within 48 hours of transfer from one ICU location to another in the same facility, the infection is attributed to the transferring location. This is called the **Transfer Rule,** and examples are shown below:
  - Patient with a central line in place in the medical ICU is transferred to the coronary ICU. Thirty-six (36) hours later, the patient meets the criteria for BSI. This is reported to MHIRS as a CLAB infection for the medical ICU.

  - Patient is transferred to the coronary ICU from the medical ICU after having the central line removed. Within 24 hours, patient meets criteria for a BSI. This is reported to MHIRS as a CLAB infection for the medical ICU.

  - Patient with a central line in place is transferred from the medical ICU to the coronary ICU. After 4 days in the coronary ICU, the patient meets criteria for a BSI. This is reported to MHIRS as a CLAB infection for the coronary ICU.

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

Criterion 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 Notes 1 and 2 below).

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 infection at another site
and
common skin contaminant (e.g., diphtheroids [*Corynebacterium* spp.], *Bacillus* [not *B. anthracis]* spp., *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 ≤ 1 year of age has at least **one** of the following signs or symptoms: fever (>38°C core*)*, hypothermia (<36°C core), apnea, or bradycardia
and
signs and symptoms and positive laboratory results are **not** related to an *i*nfection at another **si**te

and

common skin contaminant (e.g., diphtheroids [*Corynebacterium spp*.], *Bacillus* [not *B. anthracis]* spp., *Propionibacterium* spp., coagulase-negative staphylococci [including *S. epidermidis]*, veridans group streptococci, *Aerococcus* spp., *Micrococcus* spp.*)* is cultured from **two** or more blood cultures drawn on separate occasions.

NOTES:

1. In criterion 1, the phrase "one or more blood *c*ultures" means tha*t* at least one bottl*e* from a blood draw is reported by the laboratory as having grown organisms (i.e., is a positive blood culture).

2. In criterion 1, the term "recognized pathogen" doe**s not** include organisms considered common skin contaminants (see criteria 2 and 3 for a list of common skin contaminants). A few of the recognized pathogens are *S. aureus, Enterococcus* spp., *E. coli, Pseudomonas* spp., *Klebsiella* spp., *Candida* spp., etc.

3. In 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 within two days of each other (e.g., blood draws 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 skin contaminant organism (i.e., is a positive blood culture). (See Note 4 for determining sameness of organisms.)

    a. For example, an adult patient has blood drawn at 8:00 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 skin contaminant. 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 criterion 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 skin contaminant.

4. There are several issues to consider when determining sameness of organisms.
    a. If the common skin contaminant is identified to the species level from one culture, and a companion culture is identified with only a descriptive name (i.e., to the genus level), then it is assumed that the organisms are the same. The speciated organism should be reported as the infecting pathogen (see examples below).

Table 1, Examples of how to report speciated and unspeciated common skin contaminate organisms

Culture Report	Companion Culture Report	Report as …
S. epidermidis	*Coagulase-negative staphylococci*	*S. epidermidis*
*Bacillus spp.(*not a*nthracis*)	*B. cereus*	*B. cereus*
S. salivarius	*Strep* viridans	*S. salivarius*

Table 2, Examples of how to interpret the sameness of two skin contaminate isolates by comparing antimicrobial susceptibilities

Culture Report	Isolate A	Isolate B	Interpret as …
S. epidermidis	All drugs **S**	All drugs **S**	Same
S. epidermidis	OX **R** GENT **R**	OX **S** GENT **S**	Different
Corynebacterium spp.	PEN G **R** CIPRO **S**	PENG **S** CIPRO **R**	Different
Strep viridans	All drugs **S**	All drugs **S** except ERYTH (**R**)	Same

b. If common skin contaminant organisms from the cultures are speciated but no antibiograms are done or they are done for only one of the isolates, it is assumed that the organisms are the same.

c. If the common skin contaminants from the cultures have antibiograms that are different for two or more antimicrobial agents, it is assumed that the organisms are **not** the same (see table above).

d. For the purpose of MHRS reporting, the category interpretation of intermediate (I) should **not** be used to distinguish whether two organisms are different.

5. LCBI criteria 1 and 2 may be used for patients of any age, including patients ≤ 1 year of age.

6. Specimen Collection Considerations

Ideally, blood specimens for culture should be obtained from two to four blood draws from separate venipuncture 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).[4 5] If your facility does not currently obtain specimens using this technique, you may still report BSIs using the criteria and notes above, but you should work with appropriate personnel to facilitate better specimen collection practices for blood cultures.

Reporting Instructions

- 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.

- Report organisms cultured from blood as BSI-LCBI when no other site of infection is evident.

- 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 matching pathogen from pus and blood). In this situation, it will **not** be entered as a "Yes" for infection. You should, however, count the patient's central line-days.

- **Infection Date (month/day/year):**
  The date when the first signs or symptoms of infection (clinical evidence) appeared, or the date the specimen used to meet the infection criterion was collected, whichever came first.

- **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.

- **Intensive Care Unit:**
  A nursing care area that provides intensive observation, diagnosis, and therapeutic procedures for adults and/or children who are critically ill. An ICU excludes nursing areas that provide step-down, intermediate care or telemetry only. Specialty care areas are also excluded (see definition). The type of ICU is determined by the kind of patients cared for by the unit. That is, if 80% of patients are of a certain type (e.g., patients with trauma), then that ICU is designated as that type of unit (in this case, trauma ICU). When an ICU houses roughly equal populations of medical and surgical patients, it is called a medical/surgical ICU. For reporting purposes in MHIRS, ICUs will include coronary, medical, surgical, medical/surgical, pediatric, and neonatal.

- **Neonatal Intensive Care Unit (NICU):**
  - **NICU (Level II/III):** Combined nursery housing both Level II and III newborns and infants.

  NOTE: Level II provides care for preterm infants with birth weight ≥ 1500g. Care provided includes resuscitation and stabilization of preterm and/or ill infants before transfer to a facility at which newborn intensive care is provided.

  - **NICU (Level III):** A hospital unit organized with personnel and equipment to provide continuous life support and comprehensive care for extremely high-risk newborn infants and those with complex and critical illness. Level III is subdivided into 4 levels differentiated by the capability to provide advanced medical and surgical care.

  NOTE: The categories of Level III, listed below, are classifications from the American Academy of Pediatrics, Definitions of hospital-based newborn services.[6] These classifications are **all** considered Level III nurseries in MHIRS.

  Level IIIA – Hospital or state-mandated restriction on type and/or duration of mechanical ventilation.

  Level IIIB – No restrictions on type or duration of mechanical ventilation. No major surgery.

Level IIIC – Major surgery performed on site (e.g., omphalocele repair, tracheoesophageal fistula or esophageal atresia repair, bowel resection, myelomenigocele repair, ventriculoperitoneal shunt). No surgical repair of serious congenital heart anomalies that require cardiopulmonary bypass and/or ECMO for medical conditions.

Level IIID – Major surgery, surgical repair of serious congenital heart anomalies that require cardiopulmonary bypass, and/or ECMO for medical conditions.

- **Permanent Central Line:** Includes
  - Tunneled catheters, including certain dialysis catheters
  - Implanted catheters (including ports)

- **Speciality Care Area (SCA):**
  Hospital location in which specialized care of the following types is provided:
  Bone marrow transplant
  Solid organ transplant
  Inpatient acute dialysis
  Hematology/oncology
  Long term acute care

- **Surveillance:**
  The ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action to reduce morbidity and mortality and to improve health.

- **Temporary Central Line:**
  A non-tunneled catheter

- **Transfer Rule:**
  If a device-associated infection develops within 48 hours of transfer from one inpatient location (location A) to another in the same facility (location B) the infection is attributed to the transferring location (location A).

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

E. PROTOCOL

The requirements for the CLAB infection surveillance component for ICUs and NICUs are:

- All patients, in a coronary, medical, surgical, medical/surgical, pediatric or neonatal ICU that meet the definition of an ICU or NICU, are monitored for healthcare-associated CLAB infections.

- Numerator (number of infections) data and denominator (number of central line-days) data will be collected on ICUs/NICUs being monitored.

- The patient population of the NICU is made up entirely of infants requiring level III care or, if the population is a combination of level II- and III-care patients, their distribution and placement is such that they cannot readily be separated for denominator data collection purposes.

- A separate monthly report form should be completed for each ICU/NICU surveyed during the month.

1. **Numerator Data**

   a. Infection criteria: see definitions for primary bloodstream infection (BSI), laboratory confirmed bloodstream infection (LCBI).

   b. The infection must have been acquired while the patient was in the ICU/NICU, i.e., it was not present or incubating at the time of arrival to the ICU/NICU.

   c. Infections in NICU patients are reported by birth weight categories.

   d. All patients are followed for CLAB infections for 48 hours after they are transferred from the ICU/NICU to a hospital ward.

   e. If a patient is transferred from the ICU/NICU at the end of a month and a CLAB infection related to the ICU/NICU stay becomes apparent within 48 hours, but in the next month, then the date of transfer is recorded as the infection date. Thus, the infection would be counted for the month that the patient was in the ICU/NICU population being monitored.

2. **Denominator Data**

   a. **Adult and Pediatric ICU:**

      - For each day, at the same time each day, record the number of patients who have one or more central line(s). Some patients may have more than one line, however, for MHIRS purposes **count each patient with a central line once**, regardless of the number of central lines, and record the information. If the patient has only a tunneled or implanted central line, begin recording days on the first day the line was accessed and continuing throughout the entire stay.

      - You may use a recording method of your choice or the MHIRS Adult and Pediatric ICU Daily Worksheet specific to each ICU (Figure CLAB-2).

      - On the last day of the month, the total number of central line-days should be recorded on the monthly report form specific to the ICU. The MHIRS Adult and Pediatric ICU Monthly Report Form (Figure CLAB-1) replicates the MHIRS data entry form and may assist in organizing the data prior to entry.

   b. **NICU:**

- For each day, at the same time each day, record the number of patients who have an umbilical catheter and/or central line(s) for each of the birth weight categories*****. Note: In neonates, the umbilical artery/vein is considered a great vessel. Some patients may have more than one central line; however, for MHIRS purposes **count each patient with a central line once**, regardless of the number of central lines, and record the information by birth weight category. You may use a recording method of your choice or the MHIRS NICU Daily Worksheet specific to each NICU (Figure CLAB-4).

- On the last day of the month, the total number of central line-days, by birth weight category, should be recorded on the monthly report form specific to the NICU. The MHIRS NICU Monthly Report Form (Figure CLAB-3) replicates the MHIRS data entry form and may assist in organizing the data prior to entry.

*****Birth weight categories are: ≤750 grams, 751-1000 grams, 1001-1500 grams, 1501-2500 grams, and >2500 grams.

F. INSTRUCTIONS FOR COMPLETING THE OPTIONAL MHIRS FORMS

1. **MHIRS Adult and Pediatric ICU Daily Work Sheet** (Figure CLAB-2)

The information on this form will provide you with the monthly central line-days needed to complete the MHIRS Adult and Pediatric ICU Monthly Report Form (Figure CLAB-1) and/or MHIRS data entry form.

- Record the month and year for the data being collected.

- Check the type of ICU being monitored.

- For each day of the month record the number of patients with one or more central line(s) (count one line per patient).

- Establish a routine so that you obtain a count of the number of patients with one or more central line(s) every day at the same time of day.

- At the end of the month, sum the numbers to obtain the total number of central line-days. Enter these totals into the MHIRS Adult and Pediatric Intensive Care Unit Monthly Report Form (Figure CLAB-1) and/or MHIRS.

2. **MHIRS NICU Daily Worksheet** (Figure CLAB-4)

The information on this form will provide you with the monthly umbilical catheter and/or central line-days by birth weight needed to enter into the MHIRS NICU Monthly Report Form (Figure CLAB-3) and/or MHIRSs.

- Record the month and year for the data being collected.

- For each day of the month, record in each birth weight category column the number of patients with one or more umbilical catheter and/or central line(s) (count one line per patient - i.e., if a patient has an umbilical catheter and a central line, the central line count for that patient is "1").

- Establish a routine so that you obtain a count of the number of patients with one or more umbilical catheter and/or central line(s) every day at the same time of day.

- At the end of the month, sum the numbers in each of the columns to obtain the total number of umbilical catheter and/or central line-days for each birth weight category. Enter these totals into the MHIRS NICU Monthly Report Form (Figure CLAB-3) and/or MHIRS.

3. **MHIRS Adult and Pediatric ICU Monthly Report Form** (Figure CLAB-1)
This form replicates the data entry fields in MHIRS.

- Record the month and year for the data being reported.

- Check the type of ICU being monitored.

- Enter the total number of central line-days for the month from the MHIRS Adult and Pediatric Intensive Care Unit Daily Worksheet (Figure CLAB-2) or other data collection form of your choice.

- Enter the total number of CLAB infections that occurred during the month for the specified ICU.

- Enter all data into MHIRS and submit.

4. **MHIRS NICU Monthly Report Form** (Figure CLAB-3)
This form replicates the data entry fields in MHIRS.

- Record the month and year for the data being reported.

- Enter the total number of umbilical catheter and/or central line-days days by birth weight category from the MHIRS NICU Daily Worksheet (Figure CLAB-4).

- Enter the total number of CLABs for each of the birth weight categories that occurred during the month.

- Enter all data into MHIRS and submit.

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[1] Klevens RM, Edward JR, et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. Public Health Reports 2007;122:160-166.
[2] O'Grady NP, Alexander M, Dellinger EP, Gerberding JL, Heard SO, Maki DG, et al. Guidelines for the prevention of intravascular catheter-related infections. *MMWR* 2002;51(No. RR-10:1-26).
[3] Centers for Disease Control and Prevention, Department of Health and Human Services, Division of Healthcare Quality Promotion. *National Healthcare Safety Network (NHSN) Manual, Patient Safety Component Protocol. Updated March 2009*

[4] 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 19087-1898 USA, 2007.
[5] Baron EJ, Weinstein MP, Dunne Jr WM, Yagupsky P, Welch DF, and Wilson DM. Blood Cultures IV. ASM Press: Washington, DC; 2005.
[6] American Academy of Pediatrics, Policy Statement: Levels of neonatal care. Pediatrics, 2004;114 (5):1341-1347.

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