



Central Line-Associated Bloodstream Infection (CLABSI) Prevention



Basics of Infection Prevention
2-Day Mini-Course
2014

Objectives

- Describe the etiology and epidemiology of central line associated bloodstream infections (CLABSI)
- Identify risks associated with CLABSI
- Identify evidence-based practices for CLABSI prevention
- Describe the development of “bundles” and their impact on CLABSI prevention
- Review CLABSI surveillance

CLABSI Prevention Objectives

- U.S. Health and Human Services (HHS) HAI Action Plan 5-Year Targets
 - Reduce CLABSI by 50% (since 2009 baseline)
 - Achieve 100% compliance with CLIP
- Centers for Medicare and Medicaid Services (CMS) Value-Based Purchasing
 - All US hospitals reporting CLABSI via NHSN by Jan 2011
 - Annual payment update (2%) awarded for hospital participation
 - “Pay-for-performance” began 2013



HHS Action Plan for Prevention of Healthcare-Associated Infections Website:
http://www.health.gov/hai/prevent_hai.asp

Central Line or Central Vascular Catheter

- Intravascular catheter that terminates at or close to the heart or one of the great vessels
 - Nontunneled CVCs (subclavian, jugular)
 - Tunneled CVCs (Broviac, Hickman, Groshong)
 - Dialysis catheter (Quinton)
 - Peripherally inserted central catheters (PICCs)
 - Implanted ports (Permacath)
- Used increasingly to provide long-term venous access in all care settings, including outpatient

Note: midline catheters are not in this category

Pathogenesis of CLABSI

More Common Mechanisms

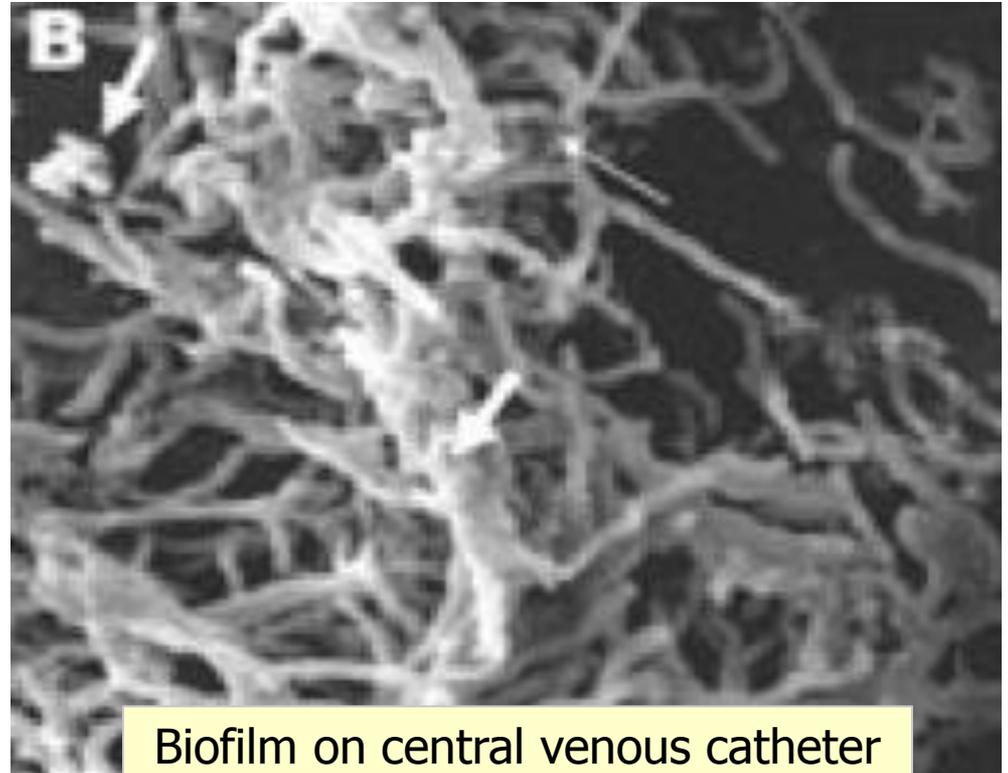
- Extraluminal: Pathogens migrate along external surface of catheter
 - More common in early period following insertion, < 7 days
- Intraluminal: Hub contamination, migration along internal surface
 - More common >7 days, intraluminal colonization

Less Common Mechanisms

- Hematogenous seeding from another source
- Contaminated infusates

Biofilms

- Complex aggregation of microorganisms growing on a solid substrate
- Form on catheter surfaces
- Contribute to risk for CLABSI



source www.cdc.gov

CLABSI Risk Factors

- Multiple catheters and/or multiple lumens
- Emergency insertion
- Prolonged duration of CVC
- Prolonged hospital stay prior to CVC insertion
- Excessive manipulation of the catheter
- Neutropenia
- Prematurity
- Total parenteral nutrition



Dialysis patients have many of these risk factors

Modifiable Factors Vary CLABSI Risk

	Higher CLABSI Risk	Lower CLABSI Risk
Insertion circumstances	Emergency insertion	Elective insertion
Skill of inserter	General clinician	Specialized (eg. PICC team)
Insertion site	Femoral	Subclavian
Skin antisepsis	Alcohol (& povidone iodine)	Chlorhexidine (<i>lowest risk</i>)
Catheter lumens	Multilumen	Single lumen
Duration of use	Temporary (non-tunneled) catheters (including PICCs) left in place long-term	Dialysis fistula (<i>lowest risk</i>) or permanent (tunneled) catheter when long-term use expected
Barriers for insertion	Anything less than maximal	Maximal

What is a Bundle?

- Introduced by the Institute for Healthcare Improvement (IHI)
- Groups of practices with high-level clinical evidence of effectiveness
- When applied together, improvements synergistically greater
- Benefits of a Bundle
 - Treatment variation is minimized
 - Reliability is enhanced

The whole is greater than the sum of its parts!

IHI Bundle – Central Line Insertion Practices (CLIP)

Five practices supported by high-level evidence

- Hand Hygiene
- Maximal barrier precautions
- Chlorhexidine skin antisepsis
- Optimal catheter site selection
- Daily review of line necessity

Review of IHI Bundle Components

1. Hand Hygiene

- Before and after palpating* catheter insertion sites
- Before and after inserting, replacing, accessing, repairing, or dressing a catheter
- When hands obviously soiled or contamination suspected
- Before and after invasive procedures
- Between patients
- Before donning and after removing gloves

* Note: palpation of insertion site should **not** be performed after application of antiseptic unless aseptic technique maintained

Bundle Components – continued

2. Maximal barrier precautions

- Wear cap, mask, sterile gown and sterile gloves
 - Both the line inserter AND immediate assistant
- Cover patient from head to toe with sterile drape with small opening for site of insertion

3. Chlorhexidene skin antisepsis

- Allow time to dry completely before puncturing site

4. Optimal catheter site selection

- Subclavian vein the preferred site for non-tunneled catheters in adults

Empower nurses and others to
“STOP THE LINE”
if any of bundle components are missing

Bundle Components – continued

5. Daily review of central line necessity with prompt removal of unnecessary lines
 - Risk of infection increases with duration of line
 - Examples of appropriate uses: receipt of TPN, chemotherapy, extended use of antibiotics, or hemodialysis

To review

CDC Prevention Strategies

Core Strategies

High levels of scientific evidence

Demonstrated feasibility

- Should become standard practice

Supplemental Strategies

Some scientific evidence

Variable levels of feasibility

- Consider implementing in addition to Core when infections persist or rates are high

CLABSI Prevention Strategies

Core (ALWAYS, every time)

- Remove unnecessary central lines
- Proper insertion practices
- Hand hygiene
- Skin antisepsis
- Lower risk insertion sites
- Hub and access port disinfection
- Educate on central line insertion and maintenance

Supplemental

- Chlorhexidine bathing
- Antimicrobial-impregnated catheters
- Chlorhexidine-impregnated dressings

Considerations for **Supplemental** Prevention Strategies

Chlorhexidine bathing

- Daily bathing with 2% chlorhexidine decreased BSI rate in ICU compared to soap and water (single study)
- No data outside the ICU

Chlorhexidine dressings

- Chlorhexidine dressings have been shown to decrease CLABSI rates in some studies, not in others
- May be an option when Core interventions have not decreased CLABSI rates to established goals

Considerations for **Supplemental** Prevention Strategies

Antimicrobial catheters

- May be appropriate for
 - Patient's catheter expected to be used for >5 days **AND**
 - when Core strategies have not decreased CLABSI rates to established goals
- Studies show some supporting evidence for catheters with Minocycline-Rifampin and Chlorhexidine–Silver Sulfadiazine
- Platinum-Silver catheters available but less evidence to support use

Measuring Prevention

Requires monitoring for

1. compliance with practices known to reduce infections (**Process** measures)
2. changes in infection rates (**Outcome** measures)



Gould C., Catheter-Associated
Urinary Tract infection (CAUTI)
Toolkit, CDC

CLABSI Prevention Process Measures

Monitor for sustainability

- Central line insertion practices (CLIP)
- Hand hygiene
- Proportion of patients with central lines
- Duration of use
- Central line associated maintenance practices (CLAMP)

Ensuring prevention practices are being performed is itself a “core” prevention strategy

Monitoring Central Line Insertion Practices (CLIP)

Facility ID: _____	Event# _____
*Patient ID: _____	Social Security#: _____ - _____ - _____
Secondary ID: _____	
Patient Name, Last: _____	First: _____ Middle: _____
*Gender: <input type="checkbox"/> F <input type="checkbox"/> M	*Date of Birth: ____/____/____ (mm/dd/yyyy)
Ethnicity (specify): _____	Race (specify): _____
*Event Type: CLIP	*Location: _____ *Date of Insertion: ____/____/____ (mm/dd/yyyy)
*Person recording insertion practice data: <input type="checkbox"/> Inserter <input type="checkbox"/> Observer	
Central line inserter ID: _____	Name, Last: _____ First: _____
*Occupation of inserter:	
<input type="checkbox"/> Fellow	<input type="checkbox"/> IV Team <input type="checkbox"/> Medical Student <input type="checkbox"/> Other medical staff
<input type="checkbox"/> Physician assistant	<input type="checkbox"/> Attending physician <input type="checkbox"/> Intern/Resident <input type="checkbox"/> Other student
<input type="checkbox"/> PICC Team	<input type="checkbox"/> Other (specify) _____
*Reason for insertion:	
<input type="checkbox"/> New indication for central line (e.g., hemodynamic monitoring, fluid/medication administration, etc.)	
<input type="checkbox"/> Replace malfunctioning central line	
<input type="checkbox"/> Suspected central line-associated infection	
<input type="checkbox"/> Other (specify) _____	
If Suspected central line-associated infection, was the central line exchanged over a guidewire? <input type="checkbox"/> Y <input type="checkbox"/> N	
*Inserter performed hand hygiene prior to central line insertion: <input type="checkbox"/> Y <input type="checkbox"/> N (if not observed directly, ask inserter)	
*Maximal sterile barriers used:	
Mask <input type="checkbox"/> Y <input type="checkbox"/> N	Sterile gown <input type="checkbox"/> Y <input type="checkbox"/> N
Large sterile drape <input type="checkbox"/> Y <input type="checkbox"/> N	Sterile gloves <input type="checkbox"/> Y <input type="checkbox"/> N
Cap <input type="checkbox"/> Y <input type="checkbox"/> N	
*Skin preparation (check all that apply): <input type="checkbox"/> Chlorhexidine gluconate <input type="checkbox"/> Povidone iodine <input type="checkbox"/> Alcohol	
<input type="checkbox"/> Other (specify): _____	
*Was skin preparation agent completely dry at time of first skin puncture? <input type="checkbox"/> Y <input type="checkbox"/> N (if not observed directly, ask inserter)	
*Insertion site: <input type="checkbox"/> Femoral <input type="checkbox"/> Jugular <input type="checkbox"/> Lower extremity <input type="checkbox"/> Scalp <input type="checkbox"/> Subclavian	
<input type="checkbox"/> Umbilical <input type="checkbox"/> Upper extremity	
Antimicrobial coated catheter used: <input type="checkbox"/> Y <input type="checkbox"/> N	
*Central line catheter type:	
<input type="checkbox"/> Dialysis non-tunneled	<input type="checkbox"/> PICC
<input type="checkbox"/> Dialysis tunneled	<input type="checkbox"/> Umbilical
<input type="checkbox"/> Non-tunneled (other than dialysis)	<input type="checkbox"/> Other (specify): _____
<input type="checkbox"/> Tunneled (other than dialysis)	(*Other' should <u>not</u> specify brand names or number of lumens; most lines can be categorized accurately by selecting from options provided)

If a patient develops a CLABSI, assess CLIP adherence for his/her central line!



Assurance of Confidentiality: The voluntarily provided information obtained in this surveillance system that would permit identification of any individual or institution is collected with a guarantee that it will be held in strict confidence, will be used only for the purposes stated, and will not otherwise be disclosed or released without the consent of the individual, or the institution in accordance with Sections 304, 306 and 308(d) of the Public Health Service Act (42 USC 242b, 242c, and 242m(d)).

Public reporting burden of this collection of information is estimated to average 5 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to CDC, Reports Clearance Officer, 1600 Clifton Rd., MS D-74, Atlanta, GA 30333. ATTN: PRA (0920-0665). CDC 57.125 (Front) Rev. 4, v6.4

Monitoring Line Care and Maintenance

Observation examples

- How long has the line been in?
 - Does the RN know?
- Observe technique in accessing the line
 - Hand hygiene before and after? Cleanse the port?
- Are dressing changes performed using sterile technique?
- Is the dressing transparent, dated, and less than 7 days old?
- How long has the tubing been up?
- Is there documentation of daily review of line necessity?

CLABSI Prevention Outcome Measure

- Perform surveillance for CLABSI using NHSN standardized definitions and methods
- Use central line days to calculate infection rates
$$\frac{\text{\# of CLABSI}}{\text{Central line days}} \times 1000$$
- Compare your CLABSI rates over time to assess prevention progress
- Make comparisons only with similar patient populations (e.g. same unit with same type of patients over time)

CLABSI Surveillance Definition

Patient with a central line must meet one of the following criterion

LCBI 1

Patient of any age

- 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

LCBI 2

Patient of any age

- has common skin commensals cultured from 2 or more blood cultures drawn on separate occasions

and

has **at least one** of the following signs or symptoms

- Fever (> 38°C), chills, or hypotension

and

- Signs and symptoms and (+) lab results are not related to an infection at another site

LCBI 3

Patient \leq 1 year of age

- has common skin commensals cultured from 2 or more blood cultures drawn on separate occasions

and

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 (+) lab results are not related to an infection at another

CLABSI Surveillance

- For LCBI to be considered a CLABSI, central line must be
 - In place for >2 days before all elements of lab-confirmed BSI criterion were first present together
- **AND**
- Still in place on day of event -or- in place on the day prior to the event
- Date of Event is now date that the **last** element used to meet the LCBI criteria occurred
(Previously was date of first symptom or blood culture collection)
- Criterion elements must occur within a timeframe that does not exceed a gap of one calendar day
- See changes in LCBI 3, the additional criteria that can be applied to patients <1 year of age*



*Refer to NHSN Patient Safety Manual, Chapter 4, CLABSI, **updated Jan 2014**

CLABSI Location Attribution

- Location of CLABSI attribution is the location of the patient on the day of event
 - Defined as the date that the **last** element used to meet the BSI criterion occurred
- Transfer rule: if all elements of CLABSI are present within 2 calendar days of transfer from one location to another, the CLABSI is attributed to the transferring location



*Refer to NHSN Patient Safety Manual, Chapter 4, CLABSI, **updated Jan 2014**

CLABSI Surveillance Clarifications

- Timeframe for determining CLABSI due to Common Commensals
 - Criteria elements must occur within one calendar day of each other
 - Example: Blood cultures positive for common commensal organism (e.g. *S. epi*) collected on Mon-Tues meets LCBI 2; cultures collected on Mon-Wed are too far apart
- Extensive clarifications for determining primary vs. secondary BSI
 - Provides specific scenarios to consider when determining if a BSI is primary or secondary to another site of infection and therefore not a CLABSI



Mucosal Barrier Injury BSI (new type of CLABSI)

- Resulted from need for more specific BSI definition in oncology patients
 - Misclassification of BSI resulting from translocation of intestinal organisms inflates CLABSI rates
- Pertains only to patients who are post allogeneic hematopoietic stem cell transplant or severely neutropenic (**definitions provided in protocol***)
- Review three criteria as applicable to your facility
 - Table 3: MBI-LCBI Eligible Enterobacteriaceae
 - Table 4: Examples Illustrating MBI-LCBI Criteria for Neutropenia



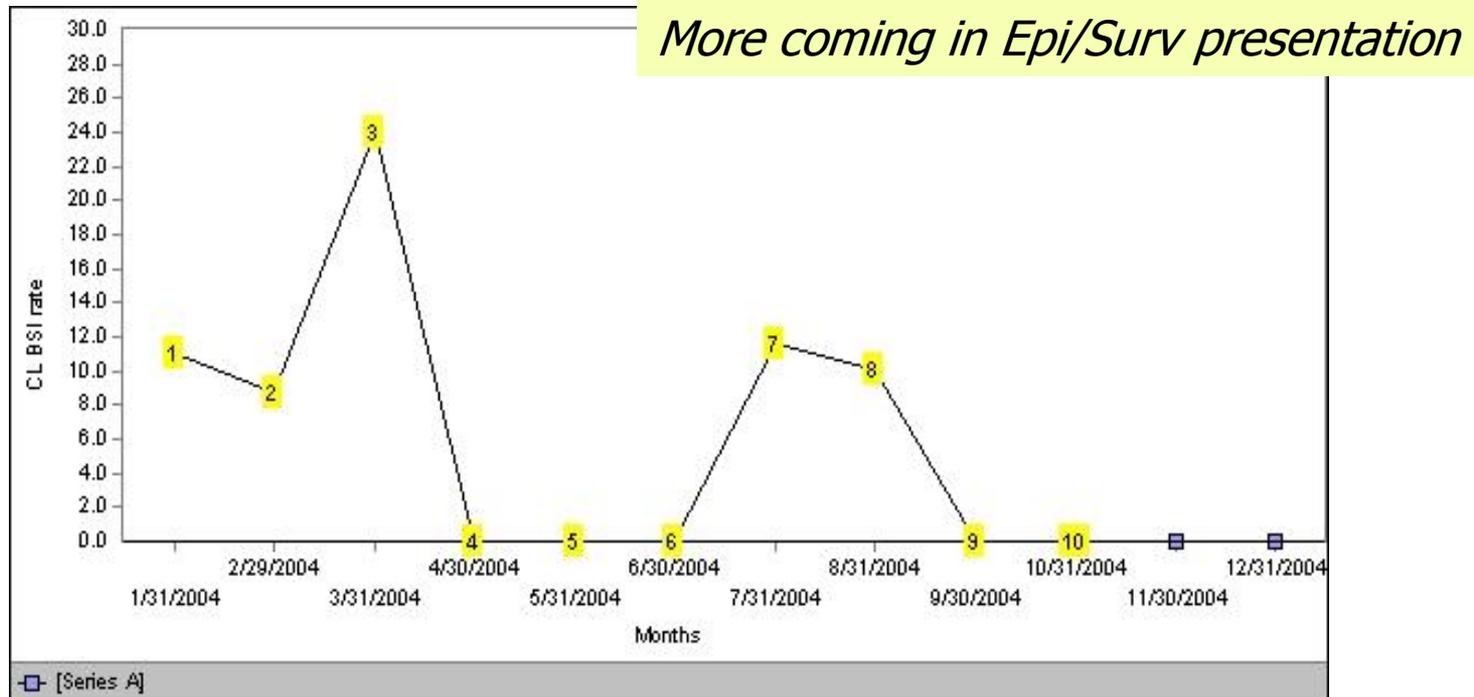
Mucosal Barrier Injury BSI (new type of CLABSI)

- 2014 – CLABSI reporting in NHSN now requires facilities to indicate if MBI–LCBI or LCBI conditions are met
 - Both MBI-LCBI & LCBI must be reported as part of the NHSN Monthly reporting plan for BSI reporting



Measure CLABSI Prevention SUCCESS!

Example: Our Lady of Lourdes Hospital (Binghamton, NY)



IHI 100,000 Lives Campaign, How-to Guide

The reductions here are clearly visible over time. During the course of one year, the rate of CR-BSIs decreased three-fold.

Strategies to Prevent Central Line–Associated Bloodstream Infections in Acute Care Hospitals

Jonas Marshall, MD; Leonard A. Mermel, D.O., ScM; David Classen, MD, MS; Kathleen M. Arias, MS, CIC; Kelly Podgorny, RN, MS, CPHQ; Deverick J. Anderson, MD, MPH; Helen Burstin, MD; David P. Calfee, MD, MS; Susan E. Coffin, MD, MPH; Erik R. Dubberke, MD; Victoria Fraser, MD; Dale N. Gerding, MD; Frances A. Griffin, RRT, MPA; Peter Gross, MD; Keith S. Kaye, MD; Michael Klompas, MD; Evelyn Lo, MD; Lindsay Nicolle, MD; David A. Pegues, MD; Trish M. Perl, MD; Sanjay Saint, MD; Cassandra D. Salgado, MD, MS; Robert A. Weinstein, MD; Robert Wise, MD; Deborah S. Yokoe, MD, MPH

PURPOSE

Previously published guidelines are available that provide comprehensive recommendations for detecting and preventing healthcare-associated infections. The intent of this document is to highlight practical recommendations in a concise format designed to assist acute care hospitals in implementing and prioritizing their central line–associated bloodstream infection (CLABSI) prevention efforts. Refer to the Society for Healthcare Epidemiology of America/Infectious Diseases Society of America “Compendium of Strategies to Prevent Healthcare-Associated Infections” Executive Summary and Introduction and accompanying editorial for additional discussion.

placed in emergency circumstances, repeatedly accessed each day, and often needed for extended periods.^{1a}

b. Non-ICU population: Although the primary focus of attention over the past 2 decades has been the ICU setting, recent data suggest that the greatest numbers of patients with central lines are in hospital units outside the ICU, where there is a substantial risk of CLABSI.^{1a}

2. Outcomes associated with hospital-acquired CLABSI

- Increased length of hospital stay^{2,10}
- Increased cost; the non-inflation-adjusted attributable cost of CLABSI has been found to vary from \$3,700 to \$29,000 per episode^{2,10,11}

SHEA Compendium 2008

An update to the compendium is currently underway and expected to be released in 2014.



Guidelines for the Prevention of Intravascular Catheter-Related Infections, 2011

Naomi P. O'Grady, M.D.¹; Mary Alexander, R.N.²; Lillian A. Burns, M.T., M.P.H., C.I.C.³; Patchen Dellinger, M.D.⁴; Jeffery Garland, M.D., S.M.⁵; Stephen O. Heard, M.D.⁶; Pame A. Lipsett, M.D.⁷; Henry Masur, M.D.¹; Leonard A. Mermel, D.O., Sc.M.⁸; Michele L. Pearson, M.D.⁹; Issam I. Raad, M.D.¹⁰; Adrienne Randolph, M.D., M.Sc.¹¹; Mark E. Rupp, M.D.¹²; Sanjay Saint, M.D., M.P.H.¹³ and the Healthcare Infection Control Practices Advisory Committee (HICPAC)¹⁴.

¹National Institutes of Health, Bethesda, Maryland

²Infusion Nurses Society, Norwood, Massachusetts

³Greenwich Hospital, Greenwich, Connecticut

⁴University of Washington, Seattle, Washington

⁵Wheaton Franciscan Healthcare-St. Joseph, Milwaukee, Wisconsin

⁶University of Massachusetts Medical School, Worcester, Massachusetts

⁷Johns Hopkins University School of Medicine, Baltimore, Maryland

⁸Warren Alpert Medical School of Brown University and Rhode Island Hospital, Providence, Rhode Island

⁹Office of Infectious Diseases, CDC, Atlanta, Georgia

¹⁰MD Anderson Cancer Center, Houston, Texas

¹¹The Children's Hospital, Boston, Massachusetts

¹²University of Nebraska Medical Center, Omaha, Nebraska

¹³Ann Arbor VA Medical Center and University of Michigan, Ann Arbor, Michigan

CDC / HICPAC Guideline 2011

www.cdc.gov/hicpac/

Questions?

For more information, please contact any
HAI Liaison Team member.

Thank you