Central Line-Associated Bloodstream Infections (CLABSI) in Non-Intensive Care Unit (non-ICU) Settings Toolkit

Activity C: ELC Prevention Collaboratives

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Draft - 1/22111/09 --- Disclaimer: The findings and conclusions in this presentation are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Outline

- **Background**
  - Impact
  - HHS Prevention Targets
  - Pathogenesis
  - Epidemiology
- **Prevention Strategies**
  - Core
  - Supplemental
- **Measurement**
  - Process
  - Outcome
- **Tools for Implementation/Resources/References**

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Background: Impact

- Bloodstream infections (BSIs) are a major cause of healthcare-associated morbidity and mortality
  - Up to 35% attributable mortality
  - BSI leads to excess hospital length of stay of 24 days
- Central Line (CL) use a major risk factor for BSI
- More than 250,000 central line-associated BSIs (CLABSIs) in US yearly
- Rates of CLABSI appear to vary by type of catheter

Pittet et al. JAMA 1994; 271 1598-1601.

Klevens et al. Public Health Reports 2007;122:160-6.

Background:
HHS Prevention Targets

- Prevention of CLABSIs in Intensive Care Units (ICUs) and “other locations” have 2 associated goals in HHS HAI Prevention Plan:
  - -Reduce CLABSIs by 50%
  - -100% adherence with CL insertion practices in non-emergent situations

Background: Impact
Outside the ICU

- Most work aimed at reducing CLABSIs in the hospital has been done in ICUs
- Many CLs are found outside ICUs
  - In one study 55% of ICU patients had CL; 24% of non-ICU patients had CL
  - However, as more patients are located outside of the ICU, 70% of hospitalized patients with CLs were outside the ICU

Climo et al. ICHE 2003; 24:942-5.

Background: Impact
CLABSI Rates

- CLABSI rates outside ICUs may be similar to rates of these infections in ICUs
- Although data are sparse, in one study CLABSI rates were:
  - 5.7 per 1,000 catheter-days in 4 inpatient wards
  - 5.2 per 1,000 catheter-days for medical ICU

Marschall et al. Infect Control Hospital Epidemiol 2007;28:905-9.

Background: Impact National Healthcare Safety Network (NHSN) CLABSI Rates

- From 2006 – 2008 NHSN report, pooled mean CLABSI rates were:
  - Medical-Surgical ICUs = 1.5 to 2.1 per 1,000 catheter-days
  - Medical-Surgical wards = 1.2 per 1,000 catheter-days

Edwards JR, et al. Am J Infect Control 2009;37:783-805.

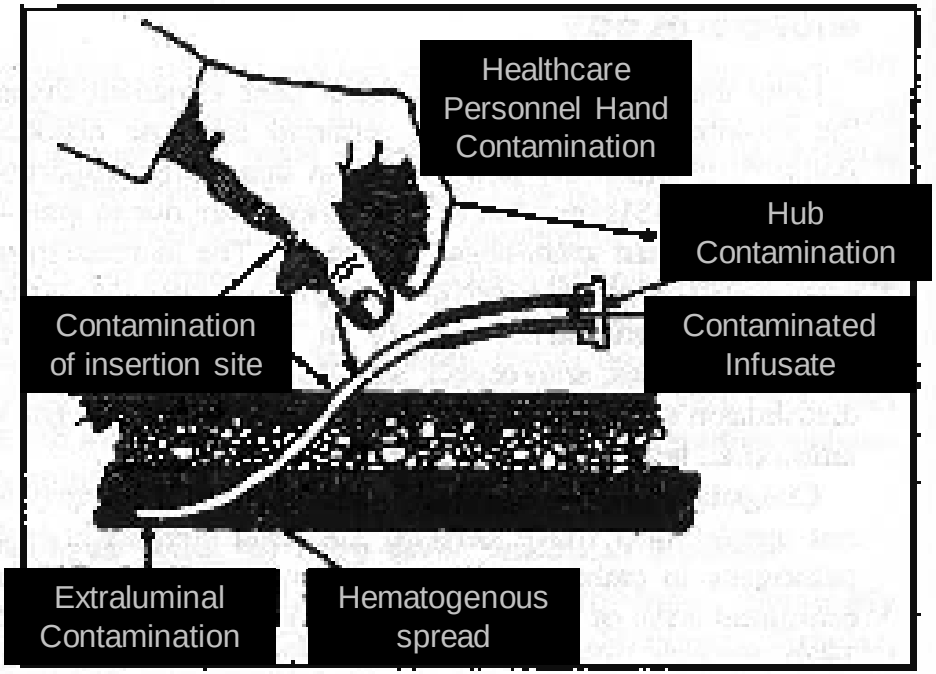
http://www.cdc.gov/nhsn/PDFs/dataStat/2009NHSNReport.PDF

Background: Impact

CLABSI in Outpatient Settings

- A number of patient groups may have long-term CLs as outpatients
  - Hemodialysis
  - Malignancy
  - Gastrointestinal tract disorders
  - Pulmonary hypertension
- Rates of CLABSI may be as high as those seen in ICUs
  - In hemodialysis - 1 to 4 per 1,000 catheter-days

Background: Pathogenesis
CLABSI



HICPAC. Guideline for Prevention of Intravascular Device-Related Infections. 1996

More Common Mechanisms

1. Pathogen migration along external surface
   - more common early (< 7days)
2. Hub contamination with intraluminal colonization
   - more common >10 days

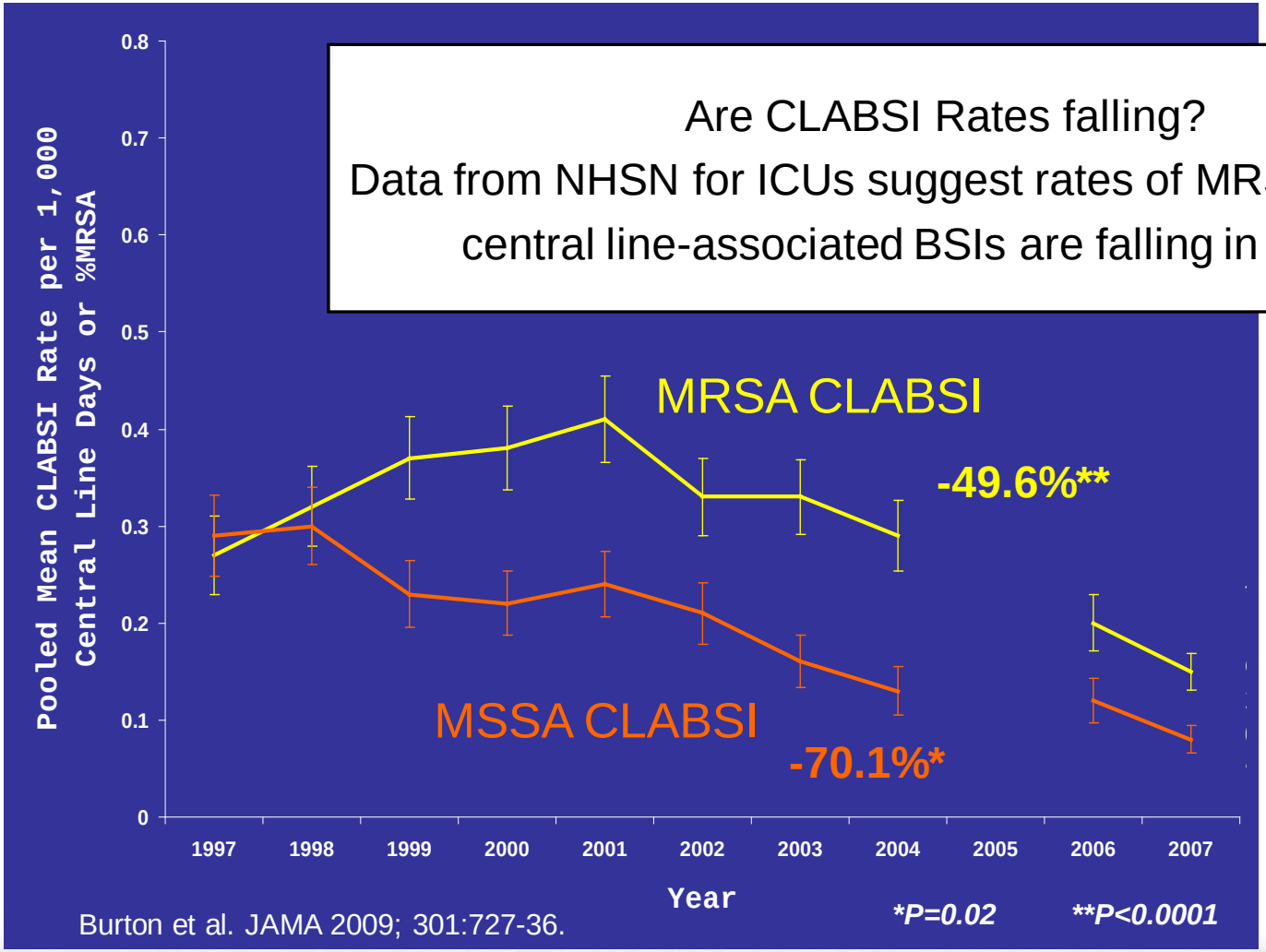
Less Common Mechanisms

1. Hematogenous seeding from another source
2. Contaminated infusates

Background: Epidemiology
ALL ICU TYPES: Rates of Methicillin-Resistant and Methicillin-Susceptible *Staphylococcus aureus* CLABSIs—United States, 1997-2007

Are CLABSI Rates falling?

Data from NHSN for ICUs suggest rates of MRSA and MSSA central line-associated BSIs are falling in the U.S.



Burton et al. JAMA 2009; 301:727-36.

Background: Epidemiology

Modifiable Risk Factors

Characteristic	Risk Factor Hierarchy
Insertion circumstances	Emergency > elective
Skill of inserter	General > specialized
Insertion site	Femoral > subclavian
Skin antisepsis	70% alcohol, 10% povidone-iodine > 2% chlorhexidine
Catheter lumens	Multilumen > single lumen
Duration of catheter use	Longer duration of use greater risk
Barrier precautions	Submaximal > maximal

Background: Prevention Strategies
Interventions

- Pittsburgh Regional Health Initiative – Decrease in CLABSIs in 66 ICUs (68% decrease)
  - Interventions
    - Promotion of best practices
      - » Maximal barrier precautions
      - » Use of chlorhexidine for skin cleansing prior to insertion
      - » Avoidance of femoral site for CL
      - » Use of recommended insertion-site dressing practices
      - » Removal of CL when no longer needed
    - Educational module about BSI prevention
    - Engagement of leadership and clinicians
    - Standard tools for recording adherence to best practices
    - Standardizing catheter insertion kits
    - Measurement of CLABSI and reporting of rates back to facilities

CDC. MMWR 2005;54:1013-6.

Background: Prevention Strategies
Interventions

- Michigan Keystone Project
- Decrease in CLABSI in 103 ICUs in Michigan (66% reduction)
- Basic interventions:
  - Hand hygiene
  - Full barrier precautions during CL insertion
  - Skin cleansing with chlorhexidine
  - Avoiding femoral site
  - Removing unnecessary catheters
  - Use of insertion checklist
  - Promotion of safety culture

Pronovost et al. NEJM 2006;355:2725-32.

Background: On the CUSP: Stop BSI project

- This national program is a collaboration between
  - Health Research and Educational Trust
  - Johns Hopkins University Quality and Safety Research Group
  - Michigan Health and Hospital Association Keystone Center for Patient Safety and Quality
- Builds on successes in Michigan Keystone project
  - CLABSI prevention bundle
  - Collaborative model
  - Promotion of safety culture
- Hospitals in all 50 states, the District of Columbia, and Puerto Rico are eligible to participate

Prevention Strategies

- **Core Strategies**
  - High levels of scientific evidence
  - Demonstrated feasibility
- **Supplemental Strategies**
  - Some scientific evidence
  - Variable levels of feasibility

*The Collaborative should at a minimum include core prevention strategies. Supplemental prevention strategies also may be used. Most core and supplemental strategies are based on HICPAC guidelines. Strategies that are not included in HICPAC guidelines will be noted by an asterisk (*) after the strategy. HICPAC guidelines may be found at www.cdc.gov/hicpac

Prevention Strategies: Core

- Removing unnecessary CL
- Following proper insertion practices
- Facilitating proper insertion practices*
- Complying with hand hygiene recommendations
- Adequate skin antisepsis
- Choosing proper CL insertion sites
- Performing adequate hub/access port disinfection
- Providing education on CL maintenance and insertion

* Not part of 2002 HICPAC Guidelines for the Prevention of Intravascular Catheter-Related Infections

Prevention Strategies: Core
Removing Unnecessary CL

- In one study, 9% of CLs outside of ICU deemed inappropriate
- Perform daily assessment of the need for the CL and promptly discontinue CLs that are no longer required
- Nursing staff should be encouraged to notify physicians of CLs that are unnecessary
- Use peripheral catheters instead
  - These generally have lower rates of BSIs than CL

Trick et al. Infect Control Hospital Epidemiol 2004;25:266-8.

Prevention Strategies: Core

Proper Insertion Practices

- Ensure utilization of insertion bundle:
  - Chlorhexidine for skin antisepsis
  - Maximal sterile barrier precautions (e.g., mask, cap [i.e., similar to those worn in the O.R.], gown, sterile gloves, and large sterile drape)
  - Hand hygiene
- Many CLs in patients on non-ICU hospital wards are placed outside those wards (Emergency room, ICU, Operating room, or Pre-operative areas)
- In one study, 49% of CLs were present on admission to the ward. Rates of BSI in this study were higher in CLs placed in Emergency Room
- Define where placement occurs and review technique in those areas

Trick et al. Am J Infect Control 2006;34:636-41.

Facilitating Proper Insertion Practices*

- "Bundling" all needed supplies in one area (e.g., a cart or a kit) helps ensure items are available for use
- Use of a "checklist" to ensure all insertion practices are followed may be beneficial
- Empowering staff to stop a non-emergent CL insertion if proper procedures are not followed
- Promoting safety culture

* Not part of 2002 HICPAC Guidelines for the Prevention of Intravascular Catheter-Related Infections

Prevention Strategies: Core

Hand Hygiene

- Hand hygiene should be a cornerstone of CLABSI prevention efforts
  - For both insertion and maintenance
- As part of a hand hygiene intervention, consider:
  - Ensuring easy access to soap and water and alcohol-based hand gels
  - Education for HCP and patients
  - Observation of practices - particularly around high-risk procedures (before and after contact with CL)
  - Feedback – “Just in time” feedback if failure to perform hand hygiene observed

Prevention Strategies: Core

Chlorhexidine Skin Cleansing

- Chlorhexidine is the preferred agent for skin cleansing for both CL insertion and maintenance
  - Tincture of iodine, an iodophor, or 70% alcohol are alternatives
  - Recommended application methods and contact time should be followed for maximal effect
- Prior to use should ensure agent is compatible with catheter
  - Alcohol may interact with some polyurethane catheters
  - Some iodine-based compounds may interact with silicone catheters

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Prevention Strategies: Core

CL Site Choice

- For adult patients receiving non-tunneled CL, femoral site should be avoided due to an increased risk of infection and deep venous thrombosis
- Note:
  - In patients with renal failure, subclavian site should be avoided to minimize stenosis which may limit future vascular access options

Prevention Strategies: Core

Hub/access port cleansing

- BSI “outbreaks” have been associated with failure to adequately decontaminate catheter hubs or failure to change them at appropriate intervals
- Cleanse hubs prior to use with an appropriate antiseptic (e.g., 70% alcohol)
- Manufacturer recommendations regarding cleansing and changing connectors should be followed

CL Maintenance and Insertion: Education

- Personnel responsible for insertion and maintenance of catheters should be trained and demonstrate competence
- Recurrent educational sessions for staff who care and/or insert CLs

Prevention Strategies: Supplemental

- Supplemental strategies include:
  - Chlorhexidine bathing*
  - Antimicrobial-impregnated catheters
  - Chlorhexidine-impregnated dressings*

* Not part of 2002 HICPAC Guidelines for the Prevention of Intravascular Catheter-Related Infections

Prevention Strategies: Supplemental

Chlorhexidine Bathing*

- In an ICU at a single center, daily bathing with 2% chlorhexidine-impregnated cloths decreased the rate of BSIs compared to soap and water
- No data outside the ICU

Bleasdale, et al. Arch Intern Med 2007;167:2073-9.

* Not part of 2002 HICPAC Guidelines for the Prevention of Intravascular Catheter-Related Infections

Antimicrobial-Impregnated Catheters

- 2 types with most supporting evidence:
  - Minocycline-Rifampin
  - Chlorhexidine–Silver Sulfadiazine
- Platinum-Silver catheter available but less evidence to support use
- These may be appropriate for patients whose catheter is expected to be used for more than 5 days and when Core strategies have not decreased rates of CLABSI to established goals.

Prevention Strategies: Supplemental

Chlorhexidine Dressings*

- Chlorhexidine-impregnated sponge dressings have been shown to decrease rates of CLABSIs in some studies and not in others.
- These dressings may be an option when Core interventions have not decreased rates of CLABSI to established goals

* Not part of 2002 HICPAC Guidelines for the Prevention of Intravascular Catheter-Related Infections

Summary of Prevention Strategies*

Core Measures

- Removing unnecessary CL
- Following proper insertion practices
- Facilitating proper insertion practices*
- Complying with hand hygiene recommendations
- Performing adequate skin cleaning
- Choosing proper CL insertion sites
- Performing adequate hub/access port cleaning
- Providing education on CL maintenance and insertion

Supplemental Measures

- Implementing chlorhexidine bathing*
- Using antimicrobial-impregnated catheters
- Applying chlorhexidine site dressings*

* Not part of 2002 HICPAC Guidelines for the Prevention of Intravascular Catheter-Related Infections

Measurement

- With CLABSI measurement it is important to
  - Have a definition that is consistent between sites
  - Collecting blood cultures in a similar fashion
    - For recommended indications
    - Via a peripheral venipuncture vs. via a CL

Measurement: Process Measures

- Process measures can help determine if interventions are being fully implemented
  - Ensuring interventions are being performed is itself a “core” intervention
- Potentially important process measures to consider are:
  - Hand hygiene adherence
  - Proportion of patients with CLs, and/or duration of CL use
  - Proportion of CL insertions in which maximal barrier precautions were used
- Consider using NHSN Central Line Insertion Practices (CLIP) option

Measurement: Outcome
Calculating CLABSI Rates

$$\text{CLABSI Rate}^{*} = \frac{\#\ \textbf{CLABSIs identified}}{\#\ \textbf{central line-days}} \times 1000$$

* Stratify by:

- Type of ICU/Other Location
- For special care areas
  - Catheter type (temporary or permanent)
- For neonatal intensive care units
  - Birthweight category
  - Catheter type (umbilical or central)

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Measurement: Outcome
Device Utilization (DU) Ratio

$$\text{CL DU Ratio} = \frac{\text{\# central line-days}}{\text{\# patient-days}}$$

DU Ratio measures the proportion of total patient-days in which central lines were used.

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Measurement: Process CLIP Adherence Rates

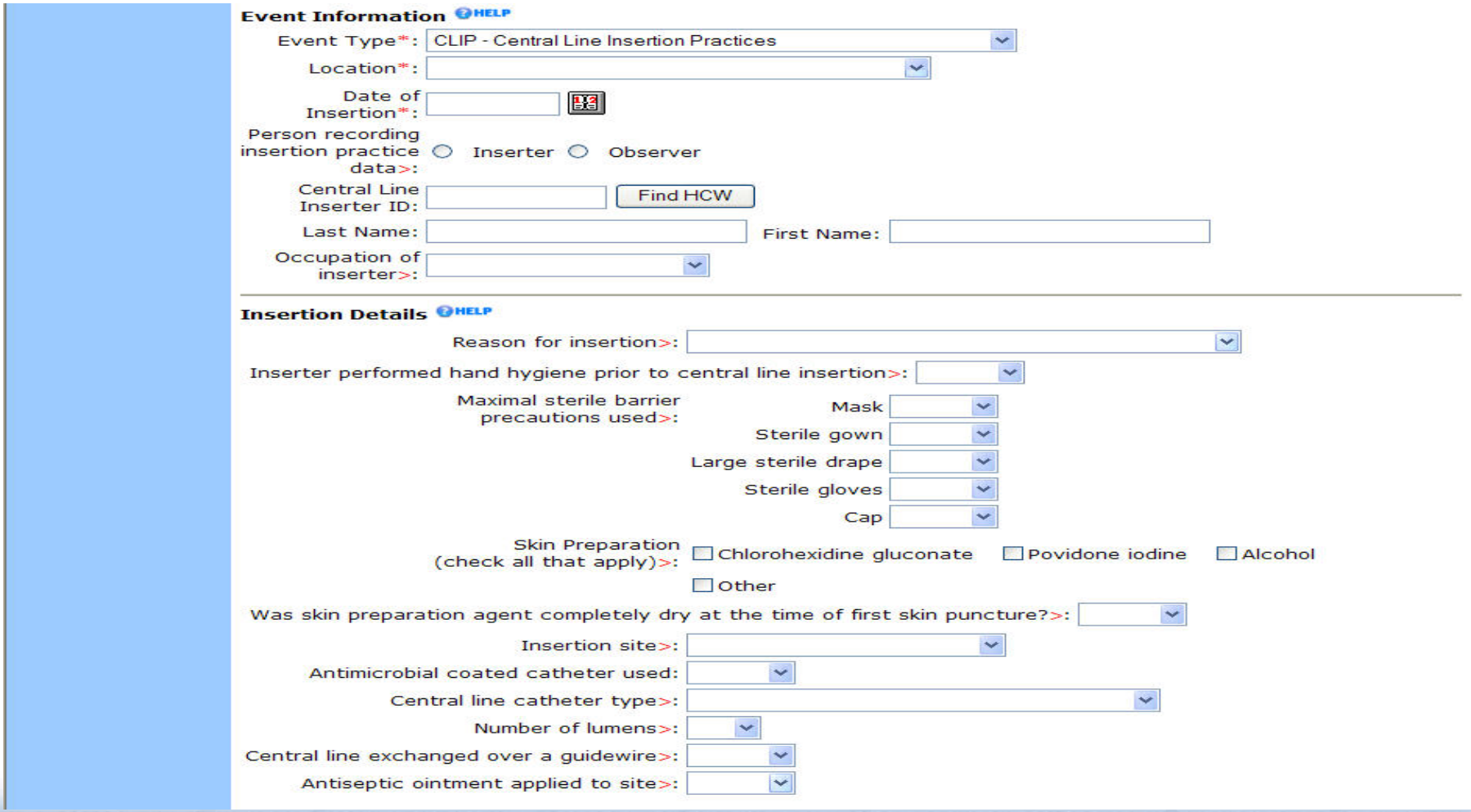
- **Using NHSN, adherence rates can be calculated for:**
  - Hand hygiene
  - Barrier precautions used including masks, sterile drape, gowns and sterile gloves
  - Skin preparation including type of agent and whether agent was allowed to dry
- **Other measures collected in the NHSN CLIP option that can be summarized include:**
  - CL type, location, and number of lumens
  - Antiseptic ointment applied to site

Measurement: Process
Calculating CLIP Adherence Rates

$$\text{Hand Hygiene Adherence Rate} = \frac{\text{\# hand hygiene performed for CL insertion}}{\text{\# CL insertions records completed}}$$

Adherence rates can also be measured for each of the barrier and prevention practices by using the number of CLIP records completed as the denominator.

Tools for Implementation
NHSN CLIP Option: Insertion Practices



Event Information HELP

Event Type*: CLIP - Central Line Insertion Practices

Location*:

Date of Insertion*:

Person recording insertion practice data>: Inserter Observer

Central Line Inserter ID: Find HCW

Last Name: First Name:

Occupation of inserter>:

Insertion Details HELP

Reason for insertion>:

Inserter performed hand hygiene prior to central line insertion>:

Maximal sterile barrier precautions used>:
- Mask
- Sterile gown
- Large sterile drape
- Sterile gloves
- Cap

Skin Preparation (check all that apply)>: Chlorohexidine gluconate Povidone iodine Alcohol Other

Was skin preparation agent completely dry at the time of first skin puncture?>:

Insertion site>:

Antimicrobial coated catheter used:

Central line catheter type>:

Number of lumens>:

Central line exchanged over a guidewire>:

Antiseptic ointment applied to site>:

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Evaluation Considerations

- **Assess baseline policies and procedures**
- **Areas to consider**
  - **Surveillance**
  - **Prevention strategies**
  - **Measurement**
- **Coordinator should track new policies/practices implemented during collaboration**

References

- Bleasdale SC, Trick WE, Gonzalez IM, et al. Effectiveness of chlorhexidine bathing to reduce catheter-associated bloodstream infections in medical intensive care unit patients. Arch Intern Med 2007; 67:2073-9.

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