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 - 1/2211/09 --- 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**
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

Background: HHS Prevention Targets

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

- Most work aimed at reducing CLABSI is 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

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

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

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

Less Common Mechanisms
1. Hematogenous seeding from another source
2. Contaminated infusates

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

![Graph showing CLABSI rates for MRSA and MSSA from 1997 to 2007.](image)

MRSA CLABSI

-49.6%**

MSSA CLABSI

-70.1%*

*P=0.02 **P<0.0001

### Background: Epidemiology

#### Modifiable Risk Factors

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

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

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

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

Prevention Strategies: Core
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
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
Prevention Strategies: Core

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


* Not part of 2002 HICPAC Guidelines for the Prevention of Intravascular Catheter-Related Infections
Prevention Strategies: Supplemental 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 CLABSI 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

CLABSI Rate* = \[ \frac{\# \text{ CLABSI} \text{s identified}}{\# \text{ central line-days}} \times 1000 \]

* 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)
Measurement: Outcome
Device Utilization (DU) Ratio

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.
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

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.
Evaluation Considerations

• Assess baseline policies and procedures

• Areas to consider
  – Surveillance
  – Prevention strategies
  – Measurement

• Coordinator should track new policies/practices implemented during collaboration
References


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