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Disclosures

• Bard Access Systems, Inc. sponsored speaker
• Opinions and experiences presented herein are for informational purposes only
• The results from the speaker’s single center experience may not be predictive for other institutions
Objectives

• Discuss pathogenesis of CLABSI
• Understand components of a “bundle”
• Identify bundle implementation strategies
• Is getting to Zero CLABSI possible?
• Is Zero CLABSI sustainable?
• HOW?
Impact on Hospitals...

48% ICU patients have central lines\(^1\)

11 million central venous catheter-days per year in ICUs\(^2\)

10.4 day increase in hospital length of stay\(^3\)

$45,814 estimated cost per case\(^3\)

23.8% mortality rate with CLABSI\(^4\)

\(^1\)Institute for Healthcare Improvement. How to guide
\(^3\)Health Care associated Infections: A Meta Analysis
\(^4\)Use of 6 Sigma strategies to pull the line
Why hospitals may fail in achieving zero

• Lack of long-term strategy?

• Lack resources to address HAIs?

• Inappropriate distribution/allocation of resources?

• Prevention/transmission strategy?

• Need executive backing, financial resources?

• Resources stretched by mandatory requirements (e.g., public reporting)?

• Lack data/Lack engagement?
 Failure of Ambition?

Misperceptions: Mentality of the Old Guard

• Infections remain an unavoidable consequence of increasingly sophisticated care in older, sicker patient populations

• Difficulty mounting response due to inconclusive evidence in published literature

• Acceptable to use median national infection rate as institutional performance target

Organizational Culture: Ensuring A Safe Journey

Culture is the collection of values, beliefs and assumptions that guides behaviors.

An organization’s pattern of response to problems and opportunities.

Culture is the way we do things around here!
Surveillance

CLABSI

- Central line-associated blood stream infection is a laboratory-confirmed bloodstream infection (LCBI) where the central line (CL) was in place for >2 calendar days (48 hours) on the date of event\(^1\)
  AND
  a CL was in place on the *date of event* or the day before\(^1\)

Pathogenesis

- **Internal** mechanism of infection occurs with direct contamination of catheter or catheter hub by contact with hands, or contaminated devices or fluids, causing intraluminal colonization\(^2\)
  - This occurs more commonly *with prolonged dwell times*\(^3\)

- **External** mechanism occurs with pathogen migration from skin into the catheter tract along the external surface of the catheter with colonization of the catheter tip\(^2\)
  - Most common route *for shorter duration times*\(^3\)

\(^1\)Center for Disease Control and Prevention. (2015).
\(^2\)CDC Centers for Disease Control. (2011)
\(^3\)Mermel LA. What is the predominant source of intravascular catheter infections?
# Prevention Strategies

## Intraluminal Pathway

### Internal Catheter Wall and Lumen

- **Endogenous Skin Flora**
- **Extrinsic Hands**
- **Contaminated Disinfectant**

## Extraluminal Pathway

### Insertion Site

- **Skin Organisms**
  - **Endogenous Skin flora**
  - **Extrinsic HCW hands**
  - **Contaminated disinfectant**

### Contaminated Infusate

- **Extrinsic**
  - **Fluid Medication**

### Contaminated Catheter Hub

- **Endogenous Skin Flora**
- **Extrinsic HCW Hands**
- **Intrinsic Manufacturer**

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Contamination Pathways

- **Extraluminal Pathway**
  - Micro-organisms Attach To External Catheter Surface With Any Touch
  - Micro-organism Migration With Insertion
  - Physiological Response Forms A Fibrin Sheath On External Catheter Surface
  - Passive Migration Under Dressing/Active Migration With Catheter Pistoning\(^1,2\)

- **Intraluminal Fluid Pathway**
  - Active And Passive Micro-organism Entry
  - Fluid Pathway Design Dead Space
  - Fibrin building Block for Micro-organism Colonization
  - Colonization Occurs As Early As 24 Hours\(^1,2\)

\(^1\)The Joint Commission. (2013). \(^2\)D. Macklin, Technology and Practice
Biofilm: The Root Cause of Infection

According to the NIH, over 80% of microbial infections are caused by biofilms.

Biofilms are both tenacious and highly resistant to antimicrobial treatment.

Bacteria within biofilms have increased (up to 1,000-fold higher) resistance to antimicrobial compounds.

The CDC states that 30-50% of antibiotic use in hospitals is unnecessary or inappropriate. Antibiotic overuse contributes to the growing problems with antibiotic resistance.

Three principles to apply:

1. Appropriate concentration for chemical kill of biofilm microorganisms
2. Mechanical friction for the disruption and removal of the biofilm
3. Timely removal of the device since risk of biofilm infection increases with time

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BIOFILM & CLABSI

Major Offender
Coagulase-negative Staphylococci*

Staphylococcus biofilm on the inner surface of a needleless connector

*Study conducted at 49 hospitals over a 3-year period

A central venous catheter (CVC) insertion-and-maintenance bundle is a group of evidence-based preventive practices and technologies that produce better outcomes when implemented collectively than when implemented individually.¹

A bundle will only be effective to the degree that it addresses the actual origins of CLABSI. It must include efforts to combat the formation of biofilm, because it is now well established that CLABSI develop as a result of bacteria colonizing on catheter walls.¹

¹D.Macklin Technology and Practice
Guidelines and Recommendations

• Cleaning hubs & Injection ports
Guidelines vs. Bundles

Society for Critical Care Medicine (SCCM) lead society
Infectious Disease Society of America (IDSA)
Society for Healthcare Epidemiology of America (SHEA)
*The Joint Commission*
American College of Chest Physicians (ACCP)
Infusion Nurses Society (INS)
Association for Professionals in Infection Control and Epidemiology (APIC)
Healthcare Infection Control Practice Advisory Committee (HICPAC) of the CDC

Guidelines:

- Tend to be long
- All-inclusive
- Confusing
- Many potential interventions are supported by “some” evidence
- Guidelines are difficult to translate into action
- What if just a few key, actionable interventions, supported by evidence were called GUIDELINES?
Older CVC bundles such as the one recommended by IHI focus on behavioral practices and address primarily the **insertion phase** (first 48 to 72 hours) of catheter care.

Could have additional emphasis on care-and-maintenance

• CVCs may be in place for a week or longer, and will be accessed by nurses numerous times.

• Lines left in place more than 1-2 weeks have a longer care-and-maintenance phase which may present numerous opportunities for infection.

• A comprehensive bundle should address this phase as thoroughly as it does catheter insertion.
The following are relevant highlights. They are not all the recommendations. There are 121.
You are encouraged to read the whole document

Major areas of emphasis include:

1. Using maximal sterile barrier precautions during central venous catheter insertion: (includes cap, mask, sterile gown, sterile gloves, and a sterile full body drape). (Category 1B)

2. Prepare clean skin with a >0.5% chlorhexidine preparation with alcohol before CVC, peripheral arterial catheter insertion, and during dressing changes. Contraindication to chlorhexidine?... tincture of iodine, an iodophor, or 70% alcohol can be used as alternatives (Category 1A).

3. Do not routinely replace CVCs, PICCs, hemodialysis catheters, or pulmonary artery catheters to prevent catheter-related infections.

4. Using antiseptic/antibiotic impregnated short-term central venous catheters and chlorhexidine impregnated sponge dressings (in patients older than 2 months of age) if the CLABSI rate is not decreasing despite adherence to basic prevention measures including education and training, appropriate use of chlorhexidine for skin antisepsis, and MSB.

5. Performance improvement by implementing bundled strategies, and documenting and reporting rates of compliance with all components of the bundle as benchmarks for quality assurance and performance improvement.
**CURRENT SHEA CLABSI GUIDELINES 2014**
(a partial list)

Antiseptic or antimicrobial catheters should be reserved for:

- CLABSI rates are above goal despite implementation of “basic” CLABSI prevention practices
- Patients have limited access and a history of recurrent CLABSI
- Patients at heightened risk of severe consequences from a CLABSI (eg. Patients with intravascular device or graft) ¹

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**CDC GUIDELINES 2011**
(continued)

**Category 1A Recommendations: Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies**

Educate healthcare personnel regarding the indications for intravascular catheter use, proper procedures for the insertion and maintenance of intravascular catheters.

Periodically assess knowledge of and adherence to guidelines for all persons who are involved in the insertion and maintenance of intravascular catheters.

Designate only trained personnel who demonstrate competence for the insertion and maintenance of peripheral and central intravascular catheters.

¹Marschall, J. et al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals. 2014 update


### Compliance to guidelines can be challenging...

<table>
<thead>
<tr>
<th>CLABSI Prevention</th>
<th>Presence of a Policy</th>
<th>Adherence to Policy, Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion Checklist</td>
<td>92%</td>
<td>52%</td>
</tr>
<tr>
<td>Hand Hygiene Monitoring</td>
<td>94%</td>
<td>62%</td>
</tr>
<tr>
<td>Maximal Barrier for Insertion</td>
<td>96%</td>
<td>62%</td>
</tr>
<tr>
<td>Chlorhexidine</td>
<td>97%</td>
<td>71%</td>
</tr>
<tr>
<td>Selecting optimal site</td>
<td>91%</td>
<td>46%</td>
</tr>
<tr>
<td>Daily necessity checks</td>
<td>87%</td>
<td>37%</td>
</tr>
</tbody>
</table>

The “Overall” column presents the variation in adherence to policies across all ICU types (n = 1534)

Why Standardize the Process of Care?

- Variation in processes of care is problematic because it leads to increased rates of error.

- When standardized care is used, quality increases, variation decreases, and cost decreases.

- Protocols and checklists have been shown to reduce patient harm through improved standardization and communication.
Facility’s Bundle Development

- CDC, SHEA, & IHI Recommendations
- Research
- Impact extraluminal catheter tract
- Impact intraluminal fluid pathway
- New product technology
- Minimal bedside change
- Product ease of use
Focus on Maintenance

IHI Central Line Bundle

- Hand Hygiene
- Maximal Barrier Precautions
- Chlorhexidine Antisepsis
- Optimal Catheter Site Selection
- Daily Monitoring

Comprehensive Central Line Bundle

- Ultrasound Guided
  - Aids appropriate venous location
- Maximal Barrier Precautions
  - Limits provider-to-patient transmission through use of glove, gown, mask, drape, etc
- CL Kit Revision
- Change from Positive Pressure Connector
- IV Connector Septum Disinfection
- Flushing Protocols
- Daily Monitoring
  - Routine 8 hourly, 10ml saline flush
  - Ongoing evaluation of line necessity
  - Vigilant cleaning of septum and change after each blood draw
  - Neutral connector system prevents line blood-reflux, reducing colony opportunity
  - Expanded to include Chloraprep®, securement device, CHG patch

Review of Facility’s Seven Bundle Components

Interventions and Rationale
#1 Maximum Barrier Precautions

**Intervention**

Maximum barrier precautions, including addition of full body drape for all central line insertions

**Rationale**

CDC recommends full barrier precautions with CVC insertion: cap, mask, sterile gown, drape to fully cover patient.
Our Custom Central Line Insertion Kit

Kit Contents
Bouffant Cap, Mask, Gown, Alcohol swab sticks, CHG skin prep, CHG containing sponge, O.R. Towel, and Drapes.
#2 Ultrasound Guided PICC Placement

**Rationale**

Normal skin bacteria counts
- Subclavian/jugular 10,000 cfu/cm²
- Anticubital fossa 10 cfu/cm²

Evidence indicates increased safety

Recommended by
- Agency for Healthcare Research Quality
- American College of Emergency Physicians

**Intervention**

All PICCs placed by ultrasound guidance/basilic vein, upper arm vein of choice
Our ECG Experience

- Application of ECG placement/confirmation performed during insertion:
- Reducing time wasted waiting for PICC tip confirmation using alternative post placement methods
- Immediately releasing the line to provide life sustaining therapy
- In our facility, we were able to eliminate confirmatory chest x-ray and radiation exposure

P-wave is present, identifiable, and consistent
Intact dressings? Contamination Sources-Obvious
#3 Antimicrobial Interventions

**Intervention**

Central line dressing kit revised to include Chlorhexidine-containing sponge and chlorhexidine swabs in each kit

*Securement device* added by PICC Nurse

**Rationale**

*Alcohol Chlorhexidine Swab Sticks* and Chlorhexidine-containing sponge dressing around catheter at the insertion site reduces colonization

Supports current weekly dressing change practice

Readily available kit helped improve efficiency and helped achieve compliance
Our Custom Central Line Dressing Kit

Kit Contents

Mask, Cap, Gloves, Alcohol swabs, Alcohol Chlorhexidine Swab Sticks, Chlorhexidine-Containing Sponge, Tape Measure, 4X4’s, Dressing, Tape, Skin Protectant, and Drape.
#4 Zero Fluid Displacement Device

**Intervention**
- Zero Fluid Displacement Connector for all central lines

**Rationale**
- Supports Successful Septum Disinfection
- Minimal priming volume and no dead space
- Eliminates blood reflux in lines
- No clamping required
- Saline Flush only
Rationale

SHEA recommends cleaning with an alcohol chlorhexidine preparation or 70% alcohol prior to each access.

Intervention

We Cleanse IV connector threads/septum with 70% isopropyl alcohol or alcohol CHG for 10-15 seconds (squeeze an orange). Apply friction and scrub!!!

Vigorously scrub threads and septum of needleless connector prior to EVERY access.
Scrub The Hub Campaign

- Scrub the needleless connector with an alcohol prep for 15 seconds using friction, as if you were juicing an orange, before each access.

- Purpose: Time + Friction = Disinfection
#6 Catheter Flushing

**Rationale**

Effective cleaning of intraluminal surface removes fibrin

Minimizes bacterial opportunity for adherence

Prevents mixing of incompatible medications

**Intervention**

We flush all CVC lumens (except implanted port and dialysis) with 10 ml normal saline every 8 hours as needed, utilizing a push-pause technique\(^1\)

\(^1\)Follow device manufacturers’ flushing recommendations and IFUs
**Clinical Practice Standards**

**INTRAVENTOUS CATHETERS - Flushing, Blood Withdrawal Guidelines, and Catheter Descriptions**

<table>
<thead>
<tr>
<th>Type of Catheter</th>
<th>Routine flush when NOT used for medication*</th>
<th>Frequency of routine flush when not used for medications</th>
<th>Flush prior to medication administration</th>
<th>Flush after medication administration</th>
<th>Flush prior to blood withdrawal and discard amounts</th>
<th>Flush after blood Withdrawal ***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peripheral IV Catheters</td>
<td>5 ml NS</td>
<td>Every 8 hours and as needed</td>
<td>5 ml NS</td>
<td>5 ml NS</td>
<td>*Discard 2 ml if no extension tubing attached; obtain sample</td>
<td>10 ml NS for Saline lock IVs</td>
</tr>
<tr>
<td>Peripherally Inserted Central Catheters (PICC)</td>
<td>10 ml NS</td>
<td>Every 8 hours and as needed</td>
<td>10 ml NS</td>
<td>10 ml NS</td>
<td>Flush each lumen with 10 ml NS discard 5 ml, obtain sample</td>
<td>20 ml NS (flush each lumen of multilumen catheter prior to resuming infusions)</td>
</tr>
<tr>
<td>Non-tunneled Single or Multi-Lumen Central Catheters</td>
<td>10 ml NS</td>
<td>Every 8 hours and as needed</td>
<td>10 ml NS</td>
<td>10 ml NS</td>
<td>Flush each lumen with 10 ml NS discard 5 ml, obtain sample (use proximal lumen for blood withdrawal)</td>
<td>20 ml NS (flush each lumen of multilumen catheter prior to resuming infusions)</td>
</tr>
<tr>
<td>Tunneled Catheters</td>
<td>10 ml NS</td>
<td>Every 24 hours and as needed</td>
<td>10 ml NS</td>
<td>10 ml NS</td>
<td>Flush each lumen with 10 ml NS discard 5 ml, obtain sample</td>
<td>20 ml NS (flush each lumen of multilumen catheter prior to resuming infusions)</td>
</tr>
<tr>
<td>Implanted Ports</td>
<td>10 ml NS then Heparin 1000units/ml – 5 ml</td>
<td>Every month and with dis-accordance</td>
<td>10 ml NS</td>
<td>10 ml NS</td>
<td>Flush each lumen with 10 ml NS discard 5 ml, obtain sample</td>
<td>20 ml NS (each lumen)</td>
</tr>
</tbody>
</table>

*Use 10 or 12ml syringe for all central line administrations.

**Turn off infusions for 1 minute (minimum) before withdrawing blood samples, flush with 20 ml saline prior to resuming anticoagulation.

**Change needless connector after each blood withdrawal.

*** Standard heparin concentration for hemodialysis catheters is 1000units/ml. Obtain physician’s order for instillation volume. Always aspirate instilled heparin prior to flushing using catheter.

*A Blood may be drawn through a peripheral IV catheter only at the time of initial insertion of a 20 gauge or larger catheter before flushing. Peripheral IV catheters are not to be used for routine lab draws thereafter.

**Exception:** Cardiac patients who have received hemodialysis may have their blood drawn through a peripheral catheter.
#7 Catheter Maintenance

**Intervention**
Daily monitoring of **ALL** Central lines by PICC team

**Rationale**
Continuous monitoring of practice decreases complications and increases compliance with bundle
Tracking Patients

**Data Collection Tool**

**White Board**

- White board tracks patients with CVCs: type of line and insertion site.

- Data Collection Tool: tracks all patients with CVCs, type of line, site of insertion, dressing change, and possible complications.
Check lists:
Central Line Insertion Practices (CLIP)

Central Line Insertion Practices (CLIP)

Adherence Form/ Checklist

- Hand hygiene performed
- Appropriate skin prep
- Skin prep agent has been allowed to dry
- All 5 maximal sterile barriers used
  - Sterile gloves
  - Sterile gown
  - Large sterile drape
  - Cap
  - Mask worn

Checklists:
Central Line Insertion Practices (CLIP)

Form Approved OMB No. 0920-0666 Exp. Date: 12/31/2017
www.cdc.gov/nhsn

Central Line Insertion Practices (CLIP) Adherence Monitoring; National Healthcare Safety Network
Incidence of CLABSI in all Central Line


CLABSI indicated in graph above was inserted and maintained by contracted agency that did not follow the facility’s policies or bundle.
Team Collaboration

Communication
Cooperation
Commitment

Organizational commitment to patient safety:

Visibility, support, and involvement of senior leadership
Recognition that all clinicians can not be vascular access experts

Identify super-user’s, multidisciplinary champions, expert facilitator, and leaders (possibly one from each discipline)

To minimize infections, nurses and physicians must work together in a team fashion, with nurses empowered to stop unsafe procedures by physicians
Partnerships

- Physician
- Nursing
- Infection Preventionist
- Administration
- Financial
- Products
### Potential Partnership Considerations

<table>
<thead>
<tr>
<th>Products</th>
<th>Nursing</th>
<th>Physician</th>
<th>Administration</th>
<th>Infection Prevention</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Product selection is based on infection process impact, nursing practice, and zero CLABSI goal.</td>
<td>• Engage nursing to support early assessment for the appropriate VAD AND daily assessment of need for VAD</td>
<td>• Understand your Medical Staff structure</td>
<td>• Identify who in your organization monitors Never Events, NPSG and similar “no pay” events</td>
<td>• Responsible for identifying patients with CLABSI’s</td>
<td>• Be knowledgeable and prepared to discuss benefits to patient and facility, costs and cost effectiveness, equipment and staffing needs</td>
</tr>
<tr>
<td>• Focus on both intraluminal/ extraluminal</td>
<td>• Consistently apply meticulous care and maintenance for all VAD’s. Support with education and rounding</td>
<td>• Engage with the Medical staff leadership in Critical Care, ED and Infectious Disease</td>
<td>• Provide data demonstrating improved Patient and Physician satisfaction if you have a dedicated PICC team.</td>
<td>• Conducts daily review of all culture reports according to NHSN criteria</td>
<td>• Track productivity, provide summaries and graphs of data to demonstrate the value of a PICC team. Additional resources may come with increased volumes, productivity, positive outcomes</td>
</tr>
<tr>
<td>• Focus on ease of use/failsafe products that improve nursing success.</td>
<td>• Support PICC team program</td>
<td>• Recruit them to be your clinical champion to work with your team to reduce CLABSI.</td>
<td>• Organizational commitment to patient safety</td>
<td>• Runs quarterly data of all completed blood cultures to review for primary BSI’s related to the central line per NHSN definition</td>
<td></td>
</tr>
<tr>
<td>• Stay apprised of new products and related supporting evidence that demonstrates improved outcomes</td>
<td>• Identify/communicate CVC complications to PICC team or designated RN caring for patient for early intervention</td>
<td>• Share data with medical staff, gain Physician endorsement to support bundle compliance consistently</td>
<td>• Recognition that ALL clinicians can not be Vascular Access experts. Focus on Comprehensive Vascular Access.</td>
<td>• Tracks CVC days in ICU/floor patients</td>
<td></td>
</tr>
</tbody>
</table>

**Tools for Success**

**Data Collection Tool**

Application of ECG placement confirmation performed during insertion

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**Alert**

*NO BP*
*NO PERIPHERAL BLOOD DRAWS*
*Use InVision-Plus (Green) valve*
*Saline Flush 10ml each lumen Q 8hrs&prn use*
*Clamp each lumen when not in use*

**Catheter Length**

- Internal: ___ cm
- External: ___ cm

**Arm Circumference:** 10 cm above insertion site ___ cm
Key Points

- A central line bundle should be both evidence-based and comprehensive so that every possible source of bacterial contamination is addressed.
- Technologies/practices required of nurses should be easy, user friendly, and as failsafe as possible.
- A dedicated Vascular Access team is as crucial as an evidence-based bundle to minimizing bloodstream infections.
- Collect DATA, evidenced based studies, and patient information to support change.
Key Points

• Are clinical processes standardized where practice variation may lead to increased risk of CLABSI?

• Is there a consistent system in place to identify/assess patients with indwelling central lines?

• Do you have a long term plan in place for infection prevention ex. (CLABSI prevention)?

• Do you have dedicated time for evaluation of and practice improvement post CLABSI determination?
How We Maintained Zero

• I have learned that the biggest challenge isn’t getting to zero, it is maintaining zero.

• The institution of the bundle not only ensured the success and continued growth of the team, but also ensures every patient experiences a ‘safe journey’ through our hospital.

• What started out as an innovative idea has proven to be game changing.
Determined…Relentless…Tenacious