

Tools for Reducing Central Line-Associated Blood Stream Infections

January 2013

Table of Contents

Purpose of the tools	2
Engage: How does this make the world a better place?	2
Educate: How will we accomplish this?	3
Execute: What do I need to do?	5
Evaluate: How will we know that we made a difference?	8
References.....	10

Appendixes

Appendix 1. Weeks Without CLABSIs Banner

Appendix 2. Central Line Associated Bloodstream Infections Fact Sheet

Appendix 3. Vascular Access Device Training Slides

Appendix 4. Line Cart Inventory

Appendix 5. Central Line Insertion Checklist

Appendix 6. Central Line Maintenance Audit Form

Appendix 7. CLABSI Event Report Template

Appendix 8. CLABSI Investigation Nurse Letter

Appendix 9. Back to Basics document

Purpose of the tools

These tools are designed to support your efforts to implement evidence-based practices and eliminate central line-associated blood stream infections (CLABSI) in your unit. When used with the Comprehensive Unit-based Safety Program (CUSP) Toolkit, the tools have nearly eliminated CLABSI in more than 100 participating Michigan intensive care units (ICUs)¹ and have dramatically reduced CLABSI in more than 1,000 hospitals across the country in an AHRQ-funded initiative.

The tools align with the E's found in the CUSP toolkit:

1. **Engage:** How will this make the world a better place?
2. **Educate:** How will we accomplish this?
3. **Execute:** What do I need to do?
4. **Evaluate:** How will we know we made a difference?

Engage: How does this make the world a better place?

CLABSI is associated with significant morbidity, mortality, and costs.^{2,3} Patients in ICUs are at an increased risk for CLABSI because 48 percent of ICU patients have indwelling central venous catheters, accounting for 15 million central line days per year in U.S. ICUs.² Assuming an average CLABSI rate of 5.3 per 1,000 catheter days and an attributable mortality of 18 percent (0-35 percent), as many as 28,000 patients die from CLABSI annually in U.S. ICUs.^{3,4,5} Efforts to decrease the rate of CLABSI and improve the quality of care are paramount.

To engage your colleagues, first make the CLABSI problem real by identifying a patient on your unit who suffered needless harm from a CLABSI and share that patient's story with your colleagues. Once you share the story with your colleagues and leaders, ask them if this is the kind of care they would want for their family, if this is care they are proud of, and if this is the best your unit can do.

Second, post the number, by month, of patients who developed a CLABSI and the total number of CLABSI cases for the previous year on your unit. Post a trend line so nurses and physicians can see at a glance the unit's CLABSI rate and how it changes over time. Post the number of days (or weeks or months) since the unit's last CLABSI. (A banner that shows the number of weeks without a CLABSI is provided at Appendix 1.) Use formal and informal opportunities to talk about the intervention and about unit-specific infection rates.

Third, raise awareness among unit staff members of evidence-based practices to eliminate CLABSI. The biggest barrier to compliance with evidence-based practice is that providers do not know the evidence exists or do not know what they should be doing. To inform providers, give them the Central Line Associated Bloodstream Infections Fact Sheet at Appendix 2 that outlines evidence-based practices to eliminate CLABSI and gives supporting evidence for each practice. Once a week for two consecutive weeks, determine the number of staff members

who received the fact sheet. If fewer than 90 percent of staff members received it, hold a meeting to increase knowledge of evidence-based practices among providers.

Fourth, using baseline data on CLABSI rates on your unit, calculate the potential opportunity to improve the number of preventable CLABSIs, preventable deaths, excess hospital days, and cost savings per year. An [online CLABSI Opportunity Estimator](#) is available to help you calculate this for your unit. Share the results openly with your colleagues.

Make a point of recognizing providers who appropriately follow evidence-based practices. Invite your hospital infection control professional or epidemiologist to become an active part of your unit's CUSP team and draw on their expertise to help with your specific challenges. The goal should be that no patient suffers harm from a preventable complication while on your unit. Finally, make sure your staff members recognize that benchmarking your performance against similar units and striving for the 50th percentile is unacceptable for preventable complications. Your unit's goal should be that no patient suffers harm from a preventable complication while under your care. You can eliminate infections, and any infection should be viewed as a defect.

Educate: How will we accomplish this?

Make sure your staff members understand how they can reduce CLABSI. Numerous interventions have reduced the incidence of CLABSI and the ensuing morbidity, mortality, and costs.⁶⁻⁹ In addition, the Centers for Disease Control (CDC), the Society of Critical Care Medicine, the Society of Healthcare Epidemiologists of America (SHEA), the Infectious Disease Society of America (IDSA), and several other organizations have developed evidence-graded guidelines to prevent catheter-related infections.¹⁰ Several of the guideline recommendations are supported by clinical trials or systematic reviews. Interventions to eliminate CLABSI include--

- Appropriate use of hand hygiene
- Chlorhexidine skin preparation
- Full-barrier precautions during central venous catheter insertion
- Avoiding the femoral site when possible
- Maintaining a sterile field while inserting the line²

Improving compliance with these evidence-based practices will result in dramatic reductions in CLABSI rates on your unit. Additionally, partnering with the hospital epidemiologist or an infection control practitioner can help your CUSP team--

1. Ensure you are using National Healthcare Safety Network definitions for CLABSI^{11,12}
2. Educate staff members about how to reduce CLABSI
3. Ensure you have chlorhexidine in your central line kits
4. Post publicly the number of people infected per month and your quarterly infection rates

Using baseline data on CLABSI rates on your unit, you can easily calculate the number of preventable CLABSIs, preventable deaths, excess hospital days, and costs per year. Again, the [online CLABSI Opportunity Estimator](#) will help you calculate these figures for your unit.

Providers often want to know how these calculations are derived:

- If your CLABSI rate is 5.3 per 1,000 catheter days and your unit has 2,500 catheter days per year, you have 13 preventable CLABSIs every year.
 - $5.3/1000 \times 2,500 = 13.25$
- If we assume that the mortality associated with a CLABSI is 18 percent, then there will be 2 preventable deaths per year on your unit.
 - $13 \text{ preventable CLABSIs} \times 0.18 = 2.34$
- If we assume that patients stay in the hospital for an additional 13 days when they develop a CLABSI, then 13 CLABSIs leads to 169 excess hospital days per year.
 - $13 \text{ preventable CLABSIs} \times 13 \text{ hospital days} = 169$
- If we assume the cost of each CLABSI is \$45,254, then your CLABSIs translated into an extra \$588,302 per year.
 - $13 \text{ preventable CLABSIs} \times \$45,254 = \$588,302$

Actual estimates of mortality, length of stay, and costs of care vary by unit, but these estimates are consistent with those published in the literature.¹³

Also provided in this toolkit are Vascular Access Device Training Slides (Appendix 3) that you can use to educate staff. Consider holding staff in-service sessions to review those PowerPoint slides and the Fact Sheet (Appendix 2) and provide answers to staff members' questions. Consider using a quiz to test the providers' knowledge after the in-service and requiring providers to pass the quiz prior to being allowed to insert central lines on your unit. You can also use the training slides to build CLABSI prevention training into physician and nurse orientation in your facility.

An important component of staff education is process standardization. A potential barrier to compliance with evidence-based practices is that clinicians have to go to several different places to collect the equipment they need to comply with guidelines. Establishing well-stocked line insertion carts that contain all the equipment and supplies needed to insert central lines reduces workflow complexity and makes it easy for clinicians to adhere to evidence-based practice.

Gain consensus on what supplies should be included and how the central line cart should be organized for your unit. Johns Hopkins care teams use four-drawer carts, but use what will work best on your unit. Use the Central Line Cart Inventory sheet at Appendix 4 and adjust the cart's content and organization to accommodate providers on your unit.

The use of 2 percent chlorhexidine for skin antisepsis before catheter insertion and during dressing changes is the preferred agent, unless the patient is allergic to chlorhexidine. This is a Category IA CDC recommendation, which means it is strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies. You should meet with your hospital's epidemiologist, infection control practitioner, or senior leadership to ensure your unit has 2 percent chlorhexidine available.

You will also need to determine how often to stock the cart. Depending on the number of lines placed each day, a support associate may need to stock the cart every 4 hours or every 8 hours and sign off on the checklist located on top of the cart; other units may be able to stock the cart less frequently. Adjust the frequency as needed to ensure the cart is stocked at all times.

Execute: What do I need to do?

Implement a checklist

The field of aviation uses checklists extensively to create independent redundancies for key steps in a process. Creating independent redundancies through the use of a checklist is an effective technique to monitor whether or not providers adhere to care processes. Some organizations require a nurse to be present bedside during all central line insertions and to complete a checklist during every central line insertion. Using a checklist allows nurses to serve as an independent, redundant check to encourage physician adherence to evidence-based practices.

Appendix 5 is a Central Line Insertion Checklist that you can adapt for your unit. Pilot test the checklist on your unit for 1 week and interview several nurses regarding the form's clarity, the data collection burden, and any needed modifications.

A powerful strategy that demonstrates the opportunity for improvement on your unit is to establish baseline compliance with evidence-based practices. Consider implementing a 2-week observation-only phase during which nursing staff observe physicians during central line placements and complete the checklist for each procedure. Physicians would not be aware that they were being observed during the observation-only phase. You could then calculate the percent of central line insertions for which providers were compliant with evidence-based practices and share the results with your staff.

You can also audit the percentage of central line insertions for which nurses completed the checklist. Based on the results, you can then modify the form and provide in-service training to the nursing staff.

When Johns Hopkins first introduced the Central Line Insertion Checklist, staff identified the following barriers:

- The nurses' perception that their job was not to police physicians
- The physicians' perception that their credibility and authority would be challenged if nursing staff were to critique or correct them

Unit leaders met with nursing and physician staff to stress the need to focus on patient safety and teamwork. Unit leaders emphasized that not complying with the checklist would be analogous to someone on the health care team entering a patient room and intentionally

inflicting harm. While health care providers would never tolerate harming a patient intentionally, that is, in fact, what occurs when providers are allowed to violate evidence-based infection prevention practices. When presented in this light, physicians and nurses often agree that they need to work together to keep patients safe.

Ask providers daily whether catheters can be removed

One of the most effective strategies for preventing CLABSI is to eliminate, or at least reduce, exposure to central lines. The decision for whether or not a patient needs a central line is complex and difficult to standardize into a practice guideline. Nonetheless, to reduce patient exposure to central lines, units should have a systematic approach to ask providers daily if any can be removed.

Develop a strategy to ensure unit staff members ask providers daily if any catheters or tubes can be removed. To ensure that staff ask the question, add it to a rounding form, called the [Daily Goals Checklist](#) found in the CUSP Toolkit. The [Daily Goals Checklist](#) is used to develop daily care plans for patients. Alternatively, if you have existing reporting mechanisms on your unit (nurse-to-nurse report forms, charge nurse report forms, for example) add the question of whether or not any catheters or tubes can be removed. To decrease the risk for infection, you should also develop a strategy to place tunneled catheters if central access will be required for a long period.

Consider recording the number of central line days or the number of times per week that a provider discontinued a central line. Graph results over time using a run chart. Share the results with providers. If providers are not discontinuing central lines, discuss this situation with unit leaders and providers to find opportunities to decrease the number of central lines used on your unit.

Develop or refine vascular access device policies

As you focus your efforts to eliminate CLABSI, refine existing policies or establish clearly defined policies for caring for patients with central lines. The Johns Hopkins [Vascular Access Device Policy](#) and the Johns Hopkins [Central Venous Access Device Dressing Change Procedure](#) may be useful as templates or as examples. The SHEA/IDSA practice recommendation published in 2008¹⁴ may also be helpful as you revise or develop your protocols.

Empower nurses to stop procedures

Although efforts to improve interpersonal communication improved aviation safety, the same is not yet true in health care's hierarchical culture. Successful checklist implementation requires

effective interpersonal communication skills and provides a means to learn teamwork skills experientially.

Units should require nurses to complete the checklist at bedside during central line placement. Tell the physician staff that the checklist is being implemented after the observation-only phase ends. Empower nurses to stop the procedure, absent an emergency, if they observe a violation of evidence-based practices. Have the nurses indicate on the checklist if the procedure was stopped.

Develop a unit strategy and support system for nurses to minimize the risk of an undesirable encounter. For example, Johns Hopkins instructed nurses to page the unit director at any time if a physician failed to correct a violation that nurses identified.

Audit the number of checklists completed per central line insertions and calculate the percentage. Audit compliance with evidence-based practice and the number of corrections required and calculate the percentage. Share the results with providers.

Use the Central Line Maintenance Audit Form

Unit teams can use the 11-question Central Line Maintenance Audit Form (Appendix 6) as a checklist for rounding and as a reminder of best practices for central line maintenance to prevent CLABSI. Seven questions on the audit form address line placement and maintenance, including the need for the central line, hand hygiene, site of line placement, dressing and tubing changes, and use of chlorhexidine for skin preparation. Four questions on the form address the use of advanced technologies, such as Biopatch® or chlorhexidine-impregnated occlusive dressings. To streamline and ensure use of the audit form, bundle it with the CUSP Toolkit's [Observing Patient Care Rounds](#) tool that provides a structured approach to improving teamwork and communication.

Use the Event Report Template and Nurse Letter

If a CLABSI occurs on your unit, your team should investigate process defects that may have occurred during line placement or line maintenance. The CLABSI Event Report Template (Appendix 7) catalogs defects that contribute to a CLABSI. The template can be used with the CUSP Toolkit's [Identify Defects Through Sensemaking](#) module, and it uses the same principles as that module's [Learn from Defects Tool](#). With an interdisciplinary team that includes nurses and infection prevention staff, answer the list of questions contained in the template to identify potential system defects and develop a plan to prevent those defects from reoccurring. Then, implement the plan and monitor your results. If there is little or no improvement after implementing the plan, consult the Back to Basics checklist (Appendix 9) described in the next section.

Nurses' input is critical to a complete investigation of process defects that contribute to a CLABSI. Use the CLABSI Investigation Nurse Letter (Appendix 8) to invite input from frontline nurses in the investigation. The letter includes a list of 13 questions to help elicit thorough, thoughtful responses from frontline caregivers on central line insertion and maintenance.

Go Back to Basics

The Johns Hopkins Armstrong Institute's Back to Basics document (Appendix 9) defines 12 characteristics of units that are successful in reducing or eliminating CLABSI. The document is a set of guidelines for teams that are struggling with persistent CLABSI rates and was developed after assessing the experiences of unit teams, site visits, and interactions with hospitals.

You may also consider using advanced technology (i.e., Biopatch®, chlorhexidine-impregnated occlusive dressings, etc.) but only after your unit has achieved 100 percent compliance with evidence-based guidelines and thoroughly explored the practices identified in the Back to Basics document.

Evaluate: How will we know that we made a difference?

The first step in evaluating the success of your CLABSI prevention efforts is to collect unit baseline CLABSI rates for the past 12 months. The second step is to track unit CLABSI rates over time. Enter your data into a State-level database or to [CDC's National Healthcare Safety Network](#).¹¹⁻¹² Although all units are urged to adopt the CDC's standardized definitions for CLABSI, definitions may still vary among hospitals. As long as your definition of a CLABSI remains constant, you can evaluate trends over time in infection rates. The team leader should discuss these issues with the director of hospital epidemiology or infection control.

Communicate your results widely with caregivers and patients and their families. Put the incidence of CLABSI in clear, real terms and present the actual number of infections over a period of time, not just a rate or ratio. Remember that zero infections is the goal and not a benchmark rate. Use the Weeks Without CLABSI Banner (Appendix 1) to announce your successes in reducing CLABSI. The PowerPoint® file offers a banner that is 48 inches wide by 12 inches high. You can add your facility's logo and send the file to a local print shop to be printed in color on a large-format printer.

Communicating successes and stumbles to your unit team is a powerful way to energize clinicians in their commitment to evidence-based practice. When one unit succeeds in eliminating CLABSI for an extended period of time, communicating this success across the facility helps to spread improvement to other units.

References

1. Pronovost P, Needham D, Berenholtz S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU. *New England Journal of Medicine* 2006;355(26):2725-32. <http://www.nejm.org/doi/pdf/10.1056/NEJMoa061115>. Accessed September 11, 2012.
2. Mermel LA. Prevention of intravascular catheter-related infections. *Annals of Internal Medicine* 2000;132(5):391-402.
3. Pittet D, Tarara D, Wenzel RP. Nosocomial bloodstream infection in critically ill patients. Excess length of stay, extra costs, and attributable mortality. *Journal of the American Medical Association* 1994;271(20):1598-1601.
4. Centers for Disease Control and Prevention. National nosocomial infections surveillance (NNIS) System report, data summary from October 1986-April 1998, issued June 1998. *American Journal of Infection Control* 1998;26:522-533. <http://download.journals.elsevierhealth.com/pdfs/journals/0196-6553/PIIS0196655398700264.pdf>. Accessed September 11, 2012.
5. Heiselman D. Nosocomial bloodstream infections in the critically ill. *Journal of the American Medical Association* 1994;272:1819-1820.
6. Goetz AM, Wagener MM, Miller JM, et al. Risk of infection due to central venous catheters: effect of site of placement and catheter type. *Infection Control and Hospital Epidemiology* 1998;19(11):842-845.
7. Raad II, Hohn DC, Gilbreath BJ, et al. Prevention of central venous catheter-related infections by using maximal sterile barrier precautions during insertion. *Infection Control and Hospital Epidemiology* 1994; 5(4 Pt 1):231-238.
8. Mermel LA, McCormick RD, Springman SR, et al. The pathogenesis and epidemiology of catheter-related infection with pulmonary artery Swan-Ganz catheters: a prospective study utilizing molecular subtyping. *American Journal of Medicine* 1991;91(3B):197S-205S.
9. Maki DG, Ringer M, Alvarado CJ. Prospective randomised trial of povidone-iodine, alcohol, and chlorhexidine for prevention of infection associated with central venous and arterial catheters. *Lancet* 1991;338(8763):339-343.
10. Mermel LA, Farr BM, Sherertz RJ, et al. Guidelines for the management of intravascular catheter-related infections. *Infection Control and Hospital Epidemiology* 2001;22(4):222-242.

11. Central Line-Associated Bloodstream Infection (CLABSI) Event. Atlanta, GA: Centers for Disease Control and Prevention, January 2012.
http://www.cdc.gov/nhsn/PDFs/pscManual/4PSC_CLABScurrent.pdf. Accessed September 11, 2012.
12. National Healthcare Safety Network Patient Safety Component Manual. Atlanta, GA: Centers for Disease Control and Prevention, February 2012.
http://www.cdc.gov/nhsn/TOC_PSCManual.html. Accessed September 11, 2012.
13. O'Grady NP, Alexander M, Dellinger P, et al. 2002 Guidelines for the prevention of intravascular catheter-related infections. *Infection Control and Hospital Epidemiology* 2002;23(12):759-769.
14. Marschall J, Mermel LA, Classen D, et al. Strategies to Prevent Central Line-Associated Bloodstream Infections in Acute Care Hospitals. *Infection Control and Hospital Epidemiology* 2008;29:S22-S30.
<http://www.jstor.org/stable/pdfplus/10.1086/591059.pdf?acceptTC=true>. Accessed September 11, 2012.