



How-to Guide: Prevent Central Line- Associated Bloodstream Infections (CLABSI)

Prevent central line-associated bloodstream infections by implementing the five components of care called the “central line bundle.”

Copyright © 2012 Institute for Healthcare Improvement

All rights reserved. Individuals may photocopy these materials for educational, not-for-profit uses, provided that the contents are not altered in any way and that proper attribution is given to IHI as the source of the content. These materials may not be reproduced for commercial, for-profit use in any form or by any means, or republished under any circumstances, without the written permission of the Institute for Healthcare Improvement.

How to cite this material:

How-to Guide: *Prevent Central Line-Associated Bloodstream Infections (CLABSI)*. Cambridge, MA: Institute for Healthcare Improvement; 2012. (Available at www.ihp.org)

Contents

Introduction	4
What is the Institute for Healthcare Improvement (IHI)?	4
What is a How-to Guide?.....	4
Contributors	5
Defining the Problem of Interest	6
The Case for Preventing Central Line-Associated Bloodstream Infections	7
The Central Line Bundle	8
Potential Impact of the Central Line Bundle	9
Preventing Central Line-Associated Bloodstream Infections: Five Components of Care	11
1. Hand hygiene	11
2. Maximal barrier precautions	13
3. Chlorhexidine skin antisepsis	14
4. Optimal catheter site selection, with avoidance of using the femoral vein for central venous access in adult patients.....	15
5. Daily review of central line necessity with prompt removal of unnecessary lines	17
Forming the Team	18
Setting Aims	18
Using the Model for Improvement	19
PDSA Worksheet.....	20
Getting Started.....	21
First Test of Change	21
Measurement	22
Track Measures Over Time	23
Barriers That May Be Encountered	24
Work To Achieve a High Level of Compliance	24
Tips for Gathering Data.....	25
Tips And Tricks: Central Line Infection.....	26
Frequently Asked Questions: Central Line Infection	28
A Fact Sheet for Patients and Their Family Members.....	32
Appendix A: Central Line Insertion Checklist	34

How-to Guide: Prevent Central Line-Associated Bloodstream Infections

Appendix B: Daily Goals 37

Appendix C: Recommended Intervention-Level Measures 39

 Process Measure(s) 39

 Outcome Measure(s) 39

 Alignment with Other Measure Sets 40

Introduction

What is the Institute for Healthcare Improvement (IHI)?

The Institute for Healthcare Improvement (IHI) is a not-for-profit organization leading the improvement of health care throughout the world. IHI helps accelerate change by cultivating promising concepts for improving patient care and turning those ideas into action. Thousands of health care providers participate in IHI’s groundbreaking work.

What is a How-to Guide?

IHI’s How-to Guides address specific healthcare interventions hospitals and/or entire health systems can pursue to improve the quality of healthcare while reducing unnecessary death, medical error, and cost. These interventions align with several national initiatives of the Institute of Medicine (IOM), Agency for Healthcare Research and Quality (AHRQ), Centers for Medicare & Medicaid Services (CMS), the Joint Commission (JC), and Centers for Disease Control and Prevention (CDC), as well as the Department of Health and Human Services’ “Partnership for Patients” initiative.

This material was first developed for the IHI 5 Million Lives Campaign, a voluntary initiative to protect patients from five million incidents of medical harm from December 2006 to December 2008. The 5 Million Lives Campaign was built on the 2004-2006 IHI 100,000 Lives Campaign. Both Campaigns involved thousands of hospitals and communities from around the United States in specific interventions. “Mentor Hospitals” showed marked improvement in one or more of the Campaign interventions and volunteered to teach other hospitals. Many of their successful implementation stories and data have been included in this How-to Guide.

5 Million Lives Campaign Donors

- Blue Cross and Blue Shield health plans
- Cardinal Health Foundation
- Blue Shield of California Foundation
- Rx Foundation
- Aetna Foundation
- Baxter International, Inc.
- The Colorado Trust
- Abbott Point-of-Care

100,000 Lives Campaign Donors

- Blue Cross Blue Shield of Massachusetts
- Cardinal Health Foundation
- Rx Foundation
- Gordon and Betty Moore Foundation
- The Colorado Trust
- Blue Shield of California Foundation
- Robert Wood Johnson Foundation
- Baxter International, Inc.
- The Leeds Family
- David Calkins Memorial Fund

How-to Guide: Prevent Central Line-Associated Bloodstream Infections

Contributors

The work of leading organizations has informed the development of this guide. These include the Association for Professionals in Infection Control and Epidemiology (APIC), Association for Vascular Access (AVA), Centers for Disease Control and Prevention (CDC), Society for Healthcare Epidemiology of America (SHEA), and Society of Critical Care Medicine (SCCM).

Defining the Problem of Interest

Typically, most experts and improvement teams have relied upon definitions provided by the National Nosocomial Infections Surveillance System (NNIS) at the Centers for Disease Control (CDC) to define central lines and central line-associated bloodstream infections. This program has been replaced recently by a new initiative, the National Healthcare Safety Network (NHSN). The problem of interest is that of *primary central line-associated bloodstream infections*. These are bloodstream infections in which the specific site is *either* a laboratory-confirmed bloodstream infection *or* clinical sepsis. NHSN has defined a central line as a catheter whose tip terminates in a great vessel (*NHSN Manual: Patient Safety Component Protocols*, page 7). The great vessels include the aorta, pulmonary artery, superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins, and common femoral veins. Femoral lines are therefore considered central lines. Similarly, peripherally inserted central catheter (PICC) lines are also central catheters. Please note that an introducer, as used for a right heart catheterization, is considered an intravascular catheter. In neonates, the umbilical artery/vein is considered a great vessel. Pacemaker wires and other non-lumened devices are not considered central lines. (For details on the required definitions, please refer to Appendix C: Recommended Intervention-Level Measures.)

Note that several phrases are used, mostly interchangeably, to describe central line infections:

- Central Line Bloodstream Infections (CLBSI)
- Central Line-Associated Bloodstream Infections (CLABSI)
- Catheter-Related Bloodstream Infections (CR-BSI)

Here we use Central Line-Associated Bloodstream Infections (CLABSI).

The Case for Preventing Central Line-Associated Bloodstream Infections

- Central lines are being used increasingly in the inpatient and outpatient setting to provide long-term venous access. Central lines disrupt the integrity of the skin, making infection with bacteria and/or fungi possible. Infection may spread to the bloodstream and hemodynamic changes and organ dysfunction (severe sepsis) may ensue, possibly leading to death. Approximately 90% of central line-associated bloodstream infections (CLABSIs) occur with central lines.¹
- Forty-eight percent of intensive care unit (ICU) patients have central lines, accounting for about 15 million central-venous-catheter-days per year in ICUs. Central line-associated bloodstream infections cause considerable morbidity, mortality, and health care costs.^{2,3} An estimated 82,000 central line-associated bloodstream infections and up to 28,000 attributable deaths occur in ICUs annually.⁴ Central line-associated bloodstream infections are common, costly, and kill approximately 31,000 people in the United States annually.⁵
- In addition, nosocomial bloodstream infections prolong hospitalization by a mean of 7 days. Estimates of attributable cost per bloodstream infection are estimated to be between \$3,700 and \$29,000.⁶
- A recent Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals, published by SHEA-IDSa (in partnership with The Joint Commission, Association for Professionals in Infection Control and Epidemiology (APIC), and the American Hospital Association), emphasizes the importance of reducing these infections and includes a guideline of practice recommendations to address them.^{7,8}

¹ Mermel LA. Prevention of intravascular catheter-related infections. *Ann Intern Med.* 2000;132(5):391-402.

² Burke JP. Infection control—a problem for patient safety. *New Engl J Med.* 2003;348:651-656.

³ Mermel LA. Prevention of intravascular catheter-related infections. *Ann Intern Med.* 2000;132:391-402.

⁴ Klevens RM, Edwards JR, Richards CL Jr, Horan TC, Gaynes RP, Pollock DA, et al. Estimating health care-associated infections and deaths in US hospitals, 2002. *Public Health Rep.* 2007;122:160-166.

⁵ Klevens RM, Edwards JR, Richards CL Jr, et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. *Public Health Rep.* 2007;122:160-166.

⁶ Soufir L, Timsit JF, Mahe C, Carlet J, Regnier B, Chevret S. Attributable morbidity and mortality of catheter-related septicemia in critically ill patients: a matched, risk-adjusted, cohort study. *Infect Control Hosp Epidemiol.* 1999;20(6):396-401.

⁷ Yokoe DS, Mermel LA, Classen, D, et al. A compendium of strategies to prevent healthcare-associated infections in acute care hospitals. *Infect Control Hosp Epidemiol.* 2008; 29:S12-S21.

⁸ Compendium of Strategies to Prevent HAIs. <http://www.shea-online.org/about/compendium.cfm>.

The Central Line Bundle

The central line bundle is a group of evidence-based interventions for patients with intravascular central catheters that, when implemented together, result in better outcomes than when implemented individually. The science supporting each bundle component is sufficiently established to be considered the standard of care.

The central line bundle has five key components:

- Hand hygiene;
- Maximal barrier precautions;
- Chlorhexidine skin antisepsis;
- Optimal catheter site selection, with avoidance of using the femoral vein for central venous access in adult patients; and
- Daily review of line necessity, with prompt removal of unnecessary lines.

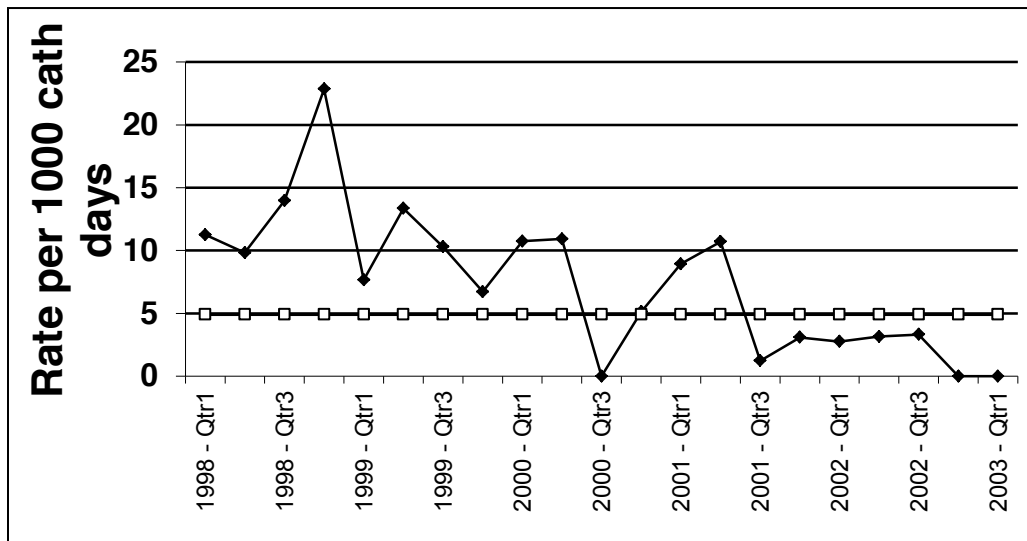
This is not intended to be a comprehensive list of all elements of care related to central lines; rather, the bundle approach to a small group of interventions promotes teamwork and collaboration. Other elements of care, such as daily site care and selection of dressing material, may be recommended in guidelines from the CDC and others. These are not excluded for any purpose other than to have a bundle that is focused.

Initial testing of the central line bundle occurred in adult intensive care units. Many hospitals have since spread the work to other areas of the hospital where central lines are inserted. Teams should check for guidelines from clinical expert panels for other areas before spreading the bundle. For example, the American Society of Anesthesiologists has published guidelines for insertion of lines in the operating room; these contain many of the same elements as the bundle.

Compliance with the central line bundle can be measured by simple assessment of the completion of each item. The approach has been most successful when all elements are executed together, an “all-or-none” strategy.

Potential Impact of the Central Line Bundle

Application of the central line bundle has demonstrated striking reductions in the rate of central line infections in many hospitals. Berenholtz et al. demonstrated that ICUs that have implemented multifaceted interventions similar to the central line bundle have nearly eliminated CLABSIs. Additional results showing a 66% reduction in central line-associated bloodstream infection rates over an 18-month period in a state-wide effort in Michigan have recently been reported by Pronovost et al.^{9,10,11} Further evidence from a 30-month Rhode Island ICU Collaborative demonstrates that implementing bundles of effective best practices for CLABSI reduced the CLABSI rate by 74% statewide.¹² Similarly, in Hawaii, a statewide ICU Collaborative focusing on comprehensive CLABSI prevention efforts reduced the mean CLABSI rate from 1.5 infections per 1000 catheter days to 0.6 infections per 1000 catheter days 16-18 months post-intervention.¹³



⁹ Berenholtz SM, Pronovost PJ, Lipset PA, et al. Eliminating catheter-related bloodstream infection in the intensive care unit. *Critical Care Medicine*. 2004;32:2014-2020.

¹⁰ Pronovost P, Needham D, Berenholtz S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU. *N Engl J Med*. 2006 Dec 28;355(26):2725-2732. Erratum in: *N Engl J Med*. 2007 Jun 21;356(25):2660.

¹¹ Pronovost PJ, Goeschel CA, et al. Sustaining reductions in catheter related bloodstream infections in Michigan intensive care units: observational study. *BMJ*. 2010;340: c309.

¹² DePalo VA, McNicoll L, et al. The Rhode Island ICU collaborative: a model for reducing central line-associated bloodstream infection and ventilator-associated pneumonia statewide. *Qual Saf Health Care*. 2010;19(6): 555-561

¹³ Lin DM, Weeks K, et al. Eradicating central line-associated bloodstream infections statewide: The Hawaii experience. *Am J Med Qual*. 2011.

The success of these interventions is perhaps due to a combination of the mindfulness that develops when regularly applying the elements of the bundle and the particular bundle elements themselves. For example, two studies have shown that the application of maximal barrier precautions substantially reduces the odds of developing a bloodstream infection.

Author/Date	Design	Catheter	Odds Ratio for infection w/o MBR
Mermel 1991	Prospective Cross-sectional	Swan-Ganz	2.2 (p<0.03)
Raad 1994	Prospective Randomized	Central	6.3 (p<0.03)

Mermel et al. demonstrated that the odds ratio was 2.2 times greater for infection without maximal barrier precautions, while Raad et al. demonstrated a 6.3 times greater likelihood for infection without precautions.^{14,15}

¹⁴ Mermel LA, McCormick RD, Springman SR, Maki DG. The pathogenesis and epidemiology of catheter-related infection with pulmonary artery Swan-Ganz catheters: a prospective study utilizing molecular subtyping. *Am J Med.* 1991;91(3B):197S-205S.

¹⁵ Raad, II, Hohn DC, Gilbreath BJ, et al. Prevention of central venous catheter-related infections by using maximal sterile barrier precautions during insertion. *Infect Control Hosp Epidemiol.* 1994;15(4 Pt 1):231-238.

Preventing Central Line-Associated Bloodstream Infections: Five Components of Care

1. Hand hygiene

One way to decrease the likelihood of central line infections is to use proper hand hygiene. Washing hands or using an alcohol-based waterless hand cleaner helps prevent contamination of central line sites and resultant bloodstream infections.¹⁶

When caring for central lines, appropriate times for hand hygiene include:

- Before and after palpating catheter insertion sites (Note: Palpation of the insertion site should not be performed after the application of antiseptic, unless aseptic technique is maintained.)
- Before and after inserting, replacing, accessing, repairing, or dressing an intravascular catheter
- When hands are obviously soiled or if contamination is suspected
- Before and after invasive procedures
- Between patients
- Before donning and after removing gloves
- After using the bathroom

What changes can we make that will result in improvement?

Hospital teams across the United States have developed and tested process changes that allowed them to improve performance on hand hygiene. These changes, taken together, support the implementation of the central line bundle. Some of these changes are:

- Empower nursing to enforce use of a central line checklist to be sure all processes related to central line placement, including hand hygiene, are executed for each line placement.
- Include hand hygiene as part of your checklist for central line placement.
- Keep soap/alcohol-based hand hygiene dispensers prominently placed and make universal precautions equipment, such as gloves, only available near hand sanitation equipment.
- Post signs at the entry and exits to the patient room as reminders.

¹⁶ O'Grady NP, Alexander M, Dellinger EP, et al. [Guidelines for the prevention of intravascular catheter-related infections](#). Centers for Disease Control and Prevention. *MMWR Recomm Rep*. Aug 9 2002;51(RR-10):1-29.

- Initiate a campaign using posters including photos of celebrated hospital doctors/employees recommending hand hygiene.
- Create an environment where reminding each other about hand hygiene is encouraged.
- Finally, note that when measuring bundle compliance, the intent is to capture whether appropriate hand hygiene was completed at the time of line insertion. It is not necessary to look for documentation that every patient encounter had appropriate hand hygiene when measuring bundle compliance, even though that is an appropriate goal.

2. Maximal barrier precautions

A key change to decrease the likelihood of central line infections is to apply maximal barrier precautions in preparation for line insertion.

For the operator placing the central line and for those assisting in the procedure, maximal barrier precautions means strict compliance with hand hygiene and wearing a cap, mask, sterile gown, and sterile gloves. The cap should cover all hair and the mask should cover the nose and mouth tightly. These precautions are the same as for any other surgical procedure that carries a risk of infection.

For the patient, applying maximal barrier precautions means covering the patient from head to toe with a sterile drape, with a small opening for the site of insertion.

In two studies, the odds of developing a central line infection increased if maximal barrier precautions were not used. For pulmonary artery catheters, the odds ratio for developing infection was more than two times greater for placement without maximal barrier precautions. A study of similar design found that this rate was six times higher for placement of central line catheters.^{17,18}

What changes can we make that will result in improvement?

Hospital teams across the United States have developed and tested process changes that allowed them to improve performance on maximal barrier precautions. These measures, taken together, support the implementation of the central line bundle. Some of these changes include:

- Empower nursing to enforce use of a central line checklist to be sure all processes related to central line placement are executed for each line placement.
- Include maximal barrier precautions as part of your checklist for central line placement.
- Keep equipment stocked in a cart for central line placement to avoid the difficulty of finding necessary equipment to institute maximal barrier precautions.
- If a full-size drape is not available, apply two drapes to cover the patient. Or consult with the operating room staff to determine how to procure full-size sterile drapes, since these are routinely used in surgical settings.

¹⁷ Mermel LA, McCormick RD, Springman SR, Maki DG. The pathogenesis and epidemiology of catheter-related infection with pulmonary artery Swan-Ganz catheters: a prospective study utilizing molecular subtyping. *Am J Med.* Sep 16 1991;91(3B):197S-205S.

¹⁸ Raad, II, Hohn DC, Gilbreath BJ, et al. Prevention of central venous catheter-related infections by using maximal sterile barrier precautions during insertion. *Infect Control Hosp Epidemiol.* Apr 1994;15(4 Pt 1):231-238.

3. Chlorhexidine skin antisepsis

Chlorhexidine skin antisepsis has been proven to provide better skin antisepsis than other antiseptic agents such as povidone-iodine solutions.^{19,20}

The technique, for most kits, is as follows:

- Prepare skin with antiseptic/detergent chlorhexidine 2% in 70% isopropyl alcohol.
- Pinch wings on the chlorhexidine applicator to break open the ampule (when ampule is included). Hold the applicator down to allow the solution to saturate the pad.
- Press sponge against skin, and apply chlorhexidine solution using a back-and-forth friction scrub for at least 30 seconds. Do not wipe or blot.
- Allow antiseptic solution time to dry completely before puncturing the site (~ 2 minutes).

What changes can we make that will result in improvement?

Hospital teams across the United States have developed and tested process and changes that allowed them to improve performance on chlorhexidine skin antisepsis. These measures, taken together, support the implementation of the central line bundle. Some of these changes include:

- Empower nursing to enforce use of a central line checklist to be sure all processes related to central line placement are executed for each line placement.
- Include chlorhexidine antisepsis as part of your checklist for central line placement.
- Include chlorhexidine antisepsis kits in carts or grab bags storing central line equipment. Many prepared central line kits include povidone-iodine kits and these must be avoided.
- Ensure that solution dries completely before attempting to insert the central line.
- If there is good reason not to use chlorhexidine, such as a patient allergy, one should not feel forced into using it or fear being hurt on bundle compliance statistics if it is not used. If there is a good reason for an exception and it is documented, the intent has been met and teams should feel comfortable assigning compliance for that item.

¹⁹ 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 Aug 10;338(8763):339-343.

²⁰ Chaiyakunapruk N, Veenstra DL, Lipsky BA, Saint S. Chlorhexidine compared with povidone-iodine solution for vascular catheter-site care: a meta-analysis. *Ann Intern Med*. 2002 Jun 4;136(11):792-801.

4. Optimal catheter site selection, with avoidance of using the femoral vein for central venous access in adult patients

Percutaneously inserted catheters are the most commonly used central catheters. In a recent prospective observational study assessing catheters placed by a critical care medicine department in a university teaching hospital, the site of insertion did not alter the risk of infection. The authors concluded that the site of insertion was not a risk factor for infection when experienced physicians insert the catheters, strict sterile technique is used, and trained intensive care unit nursing staff perform catheter care.²¹

Other studies have shown that in less controlled environments, the site of insertion is a risk factor for infection. Mermel et al. were able to demonstrate that the great majority of infections develop at the insertion site. Other risk factors included use of the jugular insertion site over the subclavian site. In addition, for use of total parenteral nutrition, McCarthy demonstrated a similar effect.^{22,23}

Several non-randomized studies show that the subclavian vein site is associated with a lower risk of CLABSI than the internal jugular vein. However, the risk and benefit of infectious and non-infectious complications must be considered on an individual basis when determining which insertion site to use. The femoral site is associated with greater risk of infection in adults; however, this may be limited to overweight adult patients.^{24,25,26,27,28}

Given that teams undertaking this initiative may not yet have the processes in place to duplicate the conditions found in the Deshpande study, whenever possible the femoral site should be avoided and the subclavian line site may be preferred over the jugular site for non-tunneled catheters in adult patients. This recommendation is based solely on the likelihood of reducing infectious complications. Subclavian placement may have other associated risks. The bundle requirement for *optimal site selection* suggests

²¹ Deshpande KS, Hatem C, Ulrich HL, et al. The incidence of infectious complications of central venous catheters at the subclavian, internal jugular, and femoral sites in an intensive care unit population. *Crit Care Med.* 2005;33:13.

²² Mermel LA, McCormick RD, Springman SR, Maki DG. The pathogenesis and epidemiology of catheter-related infection with pulmonary artery Swan-Ganz catheters: a prospective study utilizing molecular subtyping. *Am J Med.* Sep 16 1991;91(3B):197S-205S.

²³ McCarthy MC, Shives JK, Robison RJ, Broadie TA. Prospective evaluation of single and triple lumen catheters in total parenteral nutrition. *J Parenter Enteral Nutr.* 1987 May-Jun;11(3):259-262.

²⁴ Goetz AM, Wagener MM, Miller JM, Muder RR. Risk of infection due to central venous catheters: effect of site of placement and catheter type. *Infect Control Hosp Epidemiol.* 1998;19:842-845.

²⁵ Parienti JJ, Thirion M, Mégarbane B, et al. Femoral versus jugular central catheterization in patients requiring renal replacement therapy: A randomized controlled study. *JAMA.* 2008;299:2413-2422.

²⁶ Richet H, Hubert B, Nitemberg G, et al. Prospective multicenter study of vascular-catheter-related complications and risk factors for positive central-catheter cultures in intensive care unit patients. *J Clin Microbiol.* 1990;28:2520.

²⁷ Collignon P, Soni N, Pearson I, et al. Sepsis associated with central vein catheters in critically ill patients. *Intensive Care Med.* 1988;14:227.

²⁸ Merrer J, Jonghe BD, Golliot F, et al. Complications of femoral and subclavian venous catheterization in critically ill patients. A randomized controlled trial. *JAMA.* 2001;286:700.

that other factors (e.g., the potential for mechanical complications, the risk of subclavian vein stenosis, and catheter-operator skill) should be considered when deciding where to place the catheter. In these instances, teams are considered compliant with the bundle element as long as they use a rationale construct to choose the site.

The core aspect of site selection is the risk/benefit analysis by a physician as to which vein is most appropriate for the patient. The physician must determine the risks and benefits of using any vein. For the purposes of bundle compliance, if there is dialogue among the clinical team members as to the selection site and rationale, and there is documentation as to the reasons for selecting a specific vessel, this aspect of the bundle should be considered as in compliance. It is not the intent of the bundle to force a physician to take an action that he or she feels is not clinically appropriate.

What changes can we make that will result in improvement?

Hospital teams across the United States have developed and tested process changes that allowed them to improve performance on optimal insertion site. These measures, taken together, support the implementation of the central line bundle. Some of these changes include:

- Empower nursing to enforce use of a central line checklist to be sure all processes related to central line placement are executed for each line placement.
- Include optimal site selection as part of your checklist for central line placement with room to note appropriate contraindications, e.g., bleeding risks.

5. Daily review of central line necessity with prompt removal of unnecessary lines

Daily review of central line necessity will prevent unnecessary delays in removing lines that are no longer clearly needed for the care of the patient. Many times, central lines remain in place simply because they provide reliable access and because personnel have not considered removing them. However, it is clear that the risk of infection increases over time as the line remains in place and that the risk of infection decreases if the line is removed.

The CDC guidelines state that "catheter replacement at scheduled time intervals as a method to reduce CR-BSI has not lowered rates of infection." Additionally, routine replacement is "not necessary for catheters that are functioning and have no evidence of causing local or systemic complications." The guidelines further note that "replacement of temporary catheters over a guidewire in the presence of bacteremia is not an acceptable replacement strategy, because the source of infection is usually colonization of the skin tract from the insertion site to the vein."²⁹

What changes can we make that will result in improvement?

Hospital teams across the United States have developed and tested process changes that allowed them to improve performance on daily review of necessity. These measures, taken together, support the implementation of the central line bundle. Some of these changes include:

- Include daily review of line necessity as part of your multidisciplinary rounds.
- State the line day during rounds to remind all as to how long the line has been in, e.g., "Today is line day 6."
- Include assessment for removal of central lines as part of your daily goal sheets.
- Record time and date of line placement for record-keeping purposes and evaluation by staff to aid in decision making.
- Define an appropriate timeframe for regular review of necessity, such as weekly, when central lines are placed for long-term use (e.g., chemotherapy, extended antibiotic administration, etc.). Daily review was designed for the intensive care population and may not be appropriate when long-term use over weeks or months is planned.

²⁹ O'Grady NP, Alexander M, Dellinger EP, et al. Guidelines for the prevention of intravascular catheter-related infections. Centers for Disease Control and Prevention. *MMWR Recomm Rep*. Aug 9 2002;51(RR-10):10.

Forming the Team

IHI recommends a multidisciplinary team approach to patient care in the ICU. Improvement teams should be heterogeneous in make-up, but homogeneous in mindset. The value of bringing diverse personnel together is that all members of the care team are given a stake in the outcome and work to achieve the same goal.

All the stakeholders in the process must be included, in order to gain the buy-in and cooperation of all parties. For example, teams without nurses are bound to fail. Teams led by nurses may be successful, but often lack leverage; physicians must also be part of the team.

Some suggestions to attract and retain excellent team members include using data to define and solve the problem; finding champions within the hospital who are of sufficiently high profile and visibility to lend the effort immediate credibility; and working with those who want to work on the project rather than trying to convince those that do not.

The team needs encouragement and commitment from an authority in the intensive care unit. Identifying a champion increases a team's motivation to succeed. When measures are not improving fast enough, the champion re-addresses the problems with staff and helps to keep everybody on track toward the aims and goals.

Eventually, the changes that are introduced become established. At some point, however, changes in the field or other changes in the ICU will require revisiting the processes that have been developed.

Identifying a "process owner," a figure who is responsible for the functioning of the process now and in the future, helps to maintain the long-term integrity of the effort.

Setting Aims

Improvement requires setting aims. An organization will not improve without a clear and firm intention to do so. The aim should be time-specific and measurable; it should also define the specific population of patients that will be affected. Agreeing on the aim is crucial; so is allocating the people and resources necessary to accomplish the aim.

An example of an aim that would be appropriate for reducing CLABSI can be as simple as, "Decrease the rate of CLABSI by 50% within one year by achieving greater than 95% compliance with the central line bundle."

Teams are more successful when they have unambiguous, focused aims. Setting numerical goals clarifies the aim, helps to create tension for change, directs measurement, and focuses initial changes. Once the aim has been set, the team needs to be careful not to back away from it deliberately or "drift" away from it unconsciously.

Using the Model for Improvement

In order to move this work forward, IHI recommends using the Model for Improvement. Developed by Associates in Process Improvement, the Model for Improvement is a simple yet powerful tool for accelerating improvement that has been used successfully by hundreds of health care organizations to improve many different health care processes and outcomes.

The model has two parts:

- Three fundamental questions that guide improvement teams to 1) set clear aims, 2) establish measures that will tell if changes are leading to improvement, and 3) identify changes that are likely to lead to improvement.
- The Plan-Do-Study-Act (PDSA) cycle to conduct small-scale tests of change in real work settings — by planning a test, trying it, observing the results, and acting on what is learned. This is the scientific method, used for action-oriented learning.

Implementation: After testing a change on a small scale, learning from each test, and refining the change through several PDSA cycles, the team can implement the change on a broader scale — for example, test medication reconciliation on admissions first.

Spread: After successful implementation of a change or package of changes for a pilot population or an entire unit, the team can spread the changes to other parts of the organization or to other organizations.

You can learn more about the Model for Improvement on www.ihl.org.

PDSA Worksheet

CYCLE: 1

DATE: 1/15/2012



Project: Reducing Central Line Infections

Objective for this PDSA Cycle: Test the use of a central line bundle checklist to increase compliance with central line bundle elements.

Plan:

Questions: How can we ensure total compliance with the central line bundle?

Predictions: Using a central line bundle checklist will help ensure total compliance with all elements of the central line infection bundle appropriate for patient.

Plan for change or test – who, what, when, where:

What: Use a central line bundle checklist.

Who: Bonnie (nurse), Stan (physician)

Where: Patient chart

When: Tomorrow

Plan for collection of data – who, what, when, where:

Who: Bonnie (nurse)

What: Compliance with all central line bundle elements.

When: At line insertion

Where: Patient chart

Do:

Carry out the change or test. Collect data and begin analysis.

Study:

Complete analysis of data:

How did or didn't the results of this cycle agree with the predictions that we made earlier?

Summarize the new knowledge we gained by this cycle:

Act:

List actions we will take as a result of this cycle:

Plan for the next cycle (adapt change, another test, implementation cycle?):

Getting Started

Hospitals will not successfully implement the central line bundle overnight. If you do, chances are that you are doing something sub-optimally. A successful program involves careful planning, testing to determine if the process is successful, making modifications as needed, re-testing, and careful implementation.

- Select the team and the venue. It is often best to start in one ICU. Many hospitals will have only one ICU, making the choice easier.
- Assess where you stand presently. What precautions are taken presently when placing lines? Is there a process in place? If so, work with staff to begin preparing for changes.
- Contact the infectious diseases/infection control department. Learn about your catheter-related bloodstream infection rate and how frequently the hospital reports it to regulatory agencies.
- Ensure that all of the needed equipment and supplies for compliance with the bundle are available at the point of care before testing.
- Organize an educational program. Teaching the core principles to the ICU staff will open many people's minds to the process of change.
- Introduce the central line bundle to the staff.

First Test of Change

Once a team has prepared the way for change by studying the current process and educated the affected parties, of the next step is to begin testing the central line bundle at your institution.

- Begin using the bundle with one patient from the time of catheter placement.
- Work with each nurse who cares for the patient to be sure they are able to follow the bundle and implement the checklist and daily goals sheet.
- Make sure that the approach can be carried over from shift to shift to eliminate gaps in teaching and utilization.
- Process feedback and incorporate suggestions for improvement.
- Once the bundle has been applied to one patient and subsequent shifts, increase utilization to the remainder of the ICU.
- Engage in additional PDSA cycles to refine the process and make it more reliable.

After achieving reduction in CLABSI in the pilot ICU, spread the changes to other ICUs, and eventually to other places in the hospital where central lines are inserted.

Measurement

See Appendix C for specific information regarding the recommended process and outcomes measures for preventing central line infections.

Measurement is the only way to know whether a change represents an improvement. There are two measures of interest for central line catheter-related bloodstream infections.

1. Central line-associated bloodstream infection rate per 1000 central line days

The first measure is a rate. In this case, for a particular time period, we are interested in the total number of cases of CLABSI. For example, if in February there were 12 cases of CLABSI, the number of cases would be 12 for that month. We want to be able to understand that number as a proportion of the total number of days that patients had central lines. Thus, if 25 patients had central lines during the month and each, for purposes of example, kept their line for 3 days, the number of catheter days would be $25 \times 3 = 75$ for February. The CLABSI Rate per 1000 catheter days then would be $(12/75) \times 1000 = 160$.

$$\frac{\text{Total no. of CLABSI cases}}{\text{No. of catheter days}} \times 1000 = \text{CLABSI rate per 1000 central line days}$$

2. Central line bundle compliance

The second measure is an assessment of how reliably the team is adhering to the central line bundle. Our experience has been that teams begin to demonstrate improvement in outcomes when they provide all five components of the central line bundle. Therefore, we choose to measure the compliance with the entire central line bundle, not just parts of the bundle.

On a given day, select all the patients with central lines and assess them for compliance with the central line bundle; or, if you are using data collection cards, review all cards (or a random sample, if there are many). If even one element is missing, the case is not in compliance with the bundle. For example, if there are 7 patients with central lines, and 6 have all 5 bundle elements completed, then $6/7$ (86%) is the compliance with the central line bundle. If all 7 had all 5 elements completed, compliance would be 100%. If all 7 were missing even a single item, compliance would be 0%. This measure is always expressed as a percentage.

$$\frac{\text{No. with ALL 5 elements of central line bundle}}{\text{No. with central lines on the day of the sample}} = \text{central line bundle compliance}$$

How-to Guide: Prevent Central Line-Associated Bloodstream Infections

If you are starting your bundle work in one intensive care unit, which is recommended, then initially collect data on this measure for that ICU only. Remember that this is data for improvement, not hospital-wide infection surveillance, so it is acceptable to collect data for one unit or even a random sample within that unit to start.

Track Measures over Time

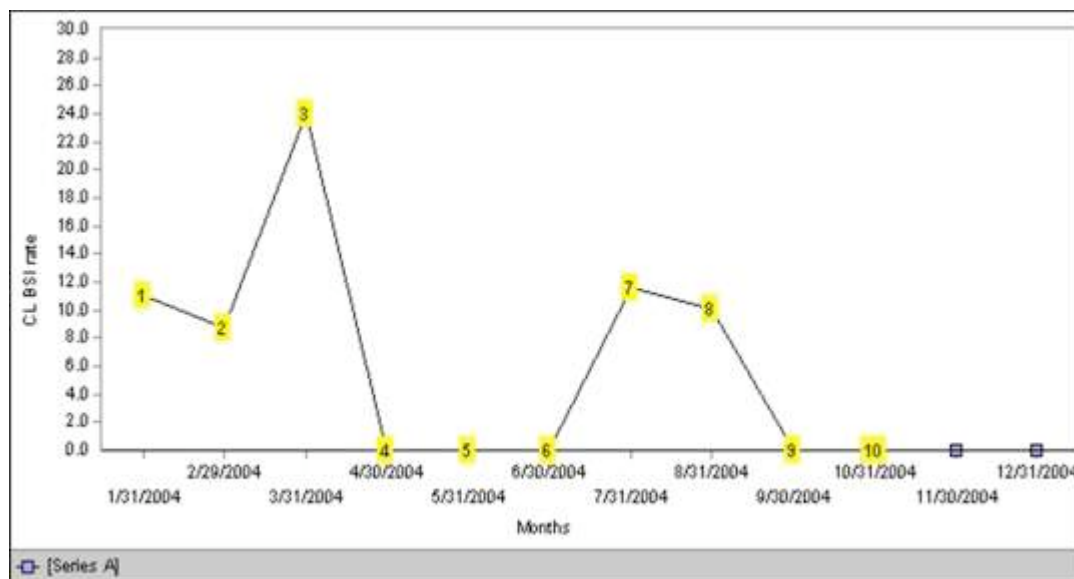
Improvement takes place over time. Determining if improvement has really occurred and if it is a lasting effect requires observing patterns over time. Run charts, graphs of data over time, are one of the single most important tools in performance improvement. Using run charts has a variety of benefits:

- They help improvement teams formulate aims by depicting how well (or poorly) a process is performing.
- They help in determining when changes are truly improvements by displaying a pattern of data that you can observe as you make changes.
- They give direction as you work on improvement and information about the value of particular changes.

An Example from...

Our Lady of Lourdes Hospital – Binghamton, NY

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



Barriers That May Be Encountered

- Fear of change

All change is difficult. The antidote to fear is knowledge about the deficiencies of the present process and optimism about the potential benefits of a new process.

- Communication breakdown

Organizations have not been successful when they failed to communicate with staff about the importance of central line care, as well as when they failed to provide ongoing teaching as new staff become involved in the process.

- **Physician and staff “partial buy-in” (i.e., “Is this just another flavor of the week?”)**

In order to enlist support and engage staff, it is important to share baseline data on CLABSI rates and to share the results of improvement efforts. If the run charts suggest a large decrease in CLABSIs compared to baseline, issues surrounding “buy-in” tend to fade.

Work To Achieve a High Level of Compliance

The experience of the hospitals that have used the central line bundle thus far has been that the greater the level of compliance with all of the items in the bundle, the better the reduction in the CLABSI rate.

Of course, compliance is only as good as the element that is least adhered to in the bundle. The Johns Hopkins Hospital’s experience with compliance with some elements of central line care analogous to the central line bundle is depicted below:³⁰

³⁰ Berenholtz SM, Pronovost PJ, Lipsett PA, et al. Eliminating catheter-related bloodstream infections in the intensive care unit. *Crit Care Med*. Oct 2004;32(10):2014-2020.

How-to Guide: Prevent Central Line-Associated Bloodstream Infections

Intervention:	Compliance:
Hand hygiene	62%
Chlorhexidine antiseptic at the procedure site	100%
Draped the entire patient in a sterile fashion	85%
Used a hat, mask, and sterile gown	92%
Used sterile gloves	100%
Sterile dressing applied	100%

Note that, for Johns Hopkins Hospital, bundle compliance cannot be higher than 62%, given the score obtained for hand-washing. Aiming for a high level of compliance will improve outcomes and prevent infections.

Tips for Gathering Data

Implementing a central line checklist at the time of insertion will help to ensure a reliable process. Nurses should be empowered to supervise the preparations using the checklist prior to line insertion and to stop the process if necessary. (See Appendix A.)

Use a form that allows you to record your efforts and track your success. In addition to helping improvement teams create run charts each month, a contemporaneous record documenting line placement and site care can help with prompting early removal. The decision as to whether the form becomes a permanent part of the medical record, or is simply used as a data collection tool, must be made locally at each hospital.

These strategies are particularly effective if used in conjunction with a Daily Goals assessment sheet. (See Appendix B.) This form can be completed during daily rounds on the patient. Many organizations implement the central line bundle in tandem with the ventilator bundle to improve systematic care to patients in ICUs. (For information on the ventilator bundle, see the [How-to Guide: Prevent Ventilator-Associated Pneumonia](#).)

Tips and Tricks: Central Line Infection

More than 3,000 hospitals across the US have been working hard to implement these interventions. Here are some of the "tips and tricks" for successful testing and implementing of each intervention that we have gathered from our site visits, our calls, and our Discussion Groups on www.ihi.org.

- **Customize the program.**

Making this initiative fit into the patterns and habits at your institution is essential. Teams will be most effective if they engage doctors, nurses, and other staff to work with them to develop key aspects of implementation. For example, it is critical that teams make the review of daily necessity a part of daily documentation, such as goal sheets, rounding sheets or nursing flow sheets. In order to know if a line is truly necessary, the best-performing teams will develop their own standard criteria and work to apply this routinely to all cases in their institution. Once this has been established, all stakeholders will share a common understanding of exactly when a line is truly necessary or simply a convenience. Similar arrangements and customizations can be made for other aspects of the bundle, such as criteria for optimal site selection.

- **Measure, but do not become preoccupied with measurement.**

Working on preventing central line infections (or any clinical performance program) requires measurement, but measurement should not become the preoccupation of the teams engaging in the work. While feedback on performance and compliance may drive further efforts forward, if teams become too focused on measurement details it can hinder the overall program. It is best to design rules that assist your team in making your plans work; for example, assign credit for completion of bundle elements in cases where your team has determined there are true contraindications to bundle elements. Undue attention to unusual cases or special circumstances will impede success. Plan for the majority.

- **Decide early about the method of data collection you will use.**

Some teams have preferred to use a sampling approach to assess compliance with the central line bundle; for example, some teams use spot checks of compliance three times per week, whereas other teams have chosen daily assessments of compliance at designated times. Regardless of the method, be sure to maintain the standard over time for accurate results.

How-to Guide: Prevent Central Line-Associated Bloodstream Infections

- Emphasize compliance with all elements of the bundle.

Approach this work with the knowledge that “picking and choosing” bundle elements will not work. Discourage the tendency to select interventions that seem easy at the expense of more difficult options also included in the bundle. Your aim is 100% compliance with every bundle element for every patient; partial compliance is the equivalent of non-compliance.

- Post updates to results regularly and prominently.

Enthusiasm for the project will wane over time if clinical staff perceives that the leadership’s enthusiasm has diminished. It is essential to update all involved staff on the work on the monthly level of compliance and the monthly change in central line infection rates. Not only will this show dedication to the project, but when momentum becomes apparent, clinical staff will be aware of the progress.

- Apply the bundle elements in a way that makes sense.

The goal of the bundle is not to force a clinician to do anything that may be clinically inappropriate or cause harm in a unique situation. The elements apply to most patients, but there will always be exceptions. Deal with these in a way that makes sense. For example, if a patient is claustrophobic and panics about being under drapes, then modify the placement of drapes so that the patient is at ease and the site is protected; it’s not beneficial to the patient to induce a panic attack. When exceptional situations arise, the key is for the team to discuss the elements, devise a sensible plan, and document it accordingly. Give credit for meeting the bundle element in such cases.

Frequently Asked Questions: Central Line Infection

Can I implement most of the central line bundle but exclude some items?

While this is possible, it is not recommended. In fact, the goal of bundling therapies together aims to create a linkage between practices that makes the overall process more effective. Certainly, in terms of monitoring compliance with the ventilator bundle, “picking and choosing” items would be unwise.

The definition of a primary central line infection is confusing. What is the standard definition?

The definition used in the rate measure is well described in the Measure Information Forms (MIFs) at the end of this document. The key to the numerator is to track primary central line-associated bloodstream infections. Bloodstream infections are considered to be associated with a central catheter if the line was in use during the 48-hour period before development of the bloodstream infection. These central line-associated bloodstream infections must be either laboratory confirmed or the patient must meet criteria for clinical sepsis. Specific definitions of laboratory confirmed infections are noted in the MIFs. Clinical sepsis can be defined as a site of suspected infection and two or more generalized signs and symptoms of infection (formerly known as SIRS criteria). Clinical sepsis can be distinguished from the syndrome “severe sepsis,” which adds organ dysfunction, such as hypotension or onset of renal failure. In general, the threshold to establish clinical sepsis is lower than that for severe sepsis.

- For more specific definitions of clinical sepsis, see: Levy MM, Fink MP, Marshall JC, Abraham E, Angus D, Cook D, Cohen J, Opal SM, Vincent JL, Ramsay G. SCCM/ESICM/ACCP/ATS/SIS. 2001 SCCM/ESICM/ACCP/ATS/SIS International Sepsis Definitions Conference. *Crit Care Med*. 2003 Apr;31(4):1250-1256.

What is a central line?

Typically, most experts and improvement teams have relied upon the definitions provided by the National Nosocomial Infections Surveillance System (NNIS) devised by the Centers for Disease Control (CDC). This program has been replaced recently by a new initiative, the National Healthcare Safety Network (NHSN). NHSN has defined a central line as a catheter whose tip terminates in a great vessel. The great vessels include the aorta, pulmonary artery, superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins, and common femoral veins. Neither the type of line alone nor the site of insertion can determine if a line is a central line. If the line terminates in a great vessel, it is a central line.

Are femoral lines central lines? Are they included in the bundle?

Yes. Femoral lines qualify as central lines because they terminate in a great vessel as defined by NHSN. Their placement should be guided by the parameters of the central line bundle. See above.

How-to Guide: Prevent Central Line-Associated Bloodstream Infections

Are PICC lines central lines? Are they included in the bundle?

Peripherally inserted central catheters (PICC) lines terminate in a great vessel. Because neither the site of insertion nor the type of line alone can determine whether a catheter is a central line, the peripheral site of insertion does not exempt the line from the central line bundle.

Why are PICC lines not the preference, if the standard is lowest infection risk?

Data is still lacking on infection rates for PICC lines in acute care settings as opposed to chronic or home care settings. The most recent evidence suggests that infection rates rival those of subclavian or internal jugular catheters placed in the acute care setting. No head-to-head comparison has yet been done to make a definitive conclusion. In addition, PICCs are more vulnerable to thrombosis and dislodgment, and are less useful for drawing blood specimens. Moreover, PICCs are not advisable in patients with renal failure and impending need for dialysis, in whom preservation of upper-extremity veins is needed for fistula or graft implantation given a possibly greater risk of subclavian vein stenosis.^{31,32}

Does everyone in the room need to gown and glove when a central line is placed, or just the nurse assisting the procedure directly and dropping items onto the sterile field?

The best advice is that the placement of a central line should be considered analogous to a surgical procedure. In the operating room, anyone who comes into contact with the sterile field wears maximal barrier precautions. This includes any assistants in direct contact with the field and most certainly the scrub nurse directly assisting in the procedure. To that end, any assistant in direct contact with or dropping items onto the field should be similarly gowned, gloved, etc., as in a surgical situation.

What are IHI's recommendations regarding central line dressing changes?

We do not have recommendations regarding central line dressing techniques and recommendations regarding changing those dressings in the central line bundle because when it was designed it was focused on insertion technique and then prompt removal. Recommendations for dressing change procedures are available in CDC guidelines and from the Association for Vascular Access.

Why is a full-size drape essential for maximal barrier precautions?

Studies that demonstrate the effectiveness of maximal barrier precautions have employed a full-size drape. These studies show dramatic reductions in risk when maximal barrier precautions are used. It is not possible to clearly parse out the effect of a full-size drape from these trials versus the other components of maximal barrier precautions such as gowns, gloves, eyewear, etc. In the absence of such information and given striking results of interventions that include a full-size drape, not using the larger drape could only

³¹ Safdar N, Maki DG. Risk of catheter-related bloodstream infection with peripherally inserted central venous catheters used in hospitalized patients. *Chest*. 2005 Aug;128(2):489-495.

³² Gonsalves CF, Eschelman DJ, Sullivan KL, DuBois N, Bonn J. Incidence of central vein stenosis and occlusion following upper extremity PICC and port placement. *Cardiovasc Intervent Radiol*. 2003 Mar-Apr;26(2):123-127. Epub 2003 Mar 6.

add an unnecessary element of risk to an otherwise simple procedure. Using the analogy to surgery as cited immediately above, it would be unimaginable for a patient to undergo any surgical procedure in the operating room without a full-size drape in place.

I read that the central line bundle as written is designed to apply only to patients in the ICU. I want to include patients in the emergency room and the PACU. Why do you advise to use the bundle only in the ICU?

The reason for recommending application of the central line bundle only in the ICU has more to do with improvement methods and less to do with the utility of the intervention. It was originally tested with ICU teams working to improve teamwork and communication for improved outcomes. IHI hoped that by starting in the ICU hospitals would become expert in application of the bundle in one location, develop the skill and manpower to translate the practice to other areas of the hospital, and ultimately do so. In general, IHI recommends starting small and spreading changes to larger domains over time. There is no reason not to apply the central line bundle in all areas that central lines are placed and where you can gain the cooperation of staff. However, it may be wiser to perfect the practice in one location than to launch an overly broad initiative that might fail before it begins. Be sure to check for guidelines from clinical expert panels related to other locations before spreading; for example, the American Society of Anesthesiologists has published guidelines for insertion in the operating room that are very similar to this bundle.

How can you compare central line infection rates between institutions?

The practice of comparing rates of disease entities or patterns of therapy across institutions is commonly known as “benchmarking.” Benchmarking, while presently utilized by many oversight agencies to track performance, may not be a valid method to compare performance between facilities because of differences in patient population, resource availability, or severity of illness.

Fortunately, none of the work required to improve the care of patients receiving central lines requires a comparison of rates between institutions. As long as you establish methods in your institution to determine the patterns and methods of your regular data collection, your results will be consistent over time with respect to your own performance and your own improvement, which is our primary interest. Presumably, any improvements you make would be reflected in any benchmarking work that you do for other agencies.

Remember to benchmark based on improvement, rather than just by comparing rates. If you learn of a hospital that has significantly improved, based on data and using the same measure over time, then learn from their work! Even if they are using a different definition from your hospital or treat some different populations, there will still be value in finding out what practices and changes they used to achieve their results.

How-to Guide: Prevent Central Line-Associated Bloodstream Infections

What are the inclusion and exclusion criteria for application of the central line bundle? For the individual bundle elements?

No specific exclusion criteria exist, but good clinical judgment should be exercised in conjunction with a close reading of the evidence cited in the How-to Guide. Likewise, no specific inclusion criteria are available. Instead, teams interested in improving their performance should develop these standards in conjunction with their clinical staff and apply them uniformly over time. In so doing, teams will have an accurate standard whereby they can measure their own progress in comparison to the only standard that is truly meaningful: their own data.

As an example, some institutions have decided that the central line bundle cannot be applied in emergent settings such as the ER. Accordingly, they have created policies and procedures to re-site those lines if a patient is subsequently admitted to a critical care unit. Policies such as this are best left to the discretion of the individual institutions.

Workable inclusion criteria, exclusion criteria, measurement systems, and protocols all require customization at the local level to be effective. The only key factor in all of these decisions is that the standards, once decided, are adhered to over time.

A Fact Sheet for Patients and Their Family Members

Patients who need frequent intravenous (IV) medications, blood, fluid replacement and/or nutrition may have a central line placed into one of their veins. This line can stay in place for days and even weeks.

Central line-associated bloodstream infections (CLABSI):

Lines are often very helpful. But sometimes they cause infections when bacteria grow in the line and spreads to the patient's bloodstream. This is called a "central line-associated bloodstream infection" (CLABSI). It is very serious and 20 percent (or 1 out of 5) of patients who get CLABSI die from it.

A bundle of 5 care steps to prevent CLABSI:

Doctors and nurses can help prevent CLABSI by using a bundle of 5 "care steps." Hospitals find that when all 5 of these steps are done that there are almost no cases of CLABSI. The bundle of care steps are:

- Using proper hand hygiene. Everyone who touches the central line must wash his or her hands with soap and water or an alcohol cleanser, even if gloves are worn.
- Wearing maximal barrier precautions. The person who inserts the line should be in sterile clothing – wearing a mask, gloves, and hair covering. The patient should be fully covered with a sterile drape, except for a very small hole where the line goes in.
- Cleaning the patient's skin with "chlorhexidine" (a type of soap) when the line is put in.
- Finding the best vein to insert the line. Often, this is a vein in the chest, which is not as likely to get an infection as veins in the arm or leg.
- Checking the line for infection each day. The line should be taken out only when needed and not on a schedule.

How patients and family members can help:

- Watch the hospital staff to make sure they wash their hands before and after working with the patient. Do not be afraid to remind them to wash their hands!
- Ask the doctors and nurses lots of questions before you agree to a line. Questions can include: Which vein will you use to put in the line? How will you clean the skin when the line goes in? What steps are you taking to lower the risk of infection?
- Make sure the doctors and nurses check the line every day for signs of infection. They should only replace the line when needed and not on a schedule.

How-to Guide: Prevent Central Line-Associated Bloodstream Infections

Information provided in this Fact Sheet is intended to help patients and their families in obtaining effective treatment and assisting medical professionals in the delivery of care. The IHI does not provide medical advice or medical services of any kind, however, and does not practice medicine or assist in the diagnosis, treatment, care, or prognosis of any patient. Because of rapid changes in medicine and information, the information in this Fact Sheet is not necessarily comprehensive or definitive, and all persons intending to rely on the information contained in this Fact Sheet are urged to discuss such information with their health care provider. Use of this information is at the reader's own risk.

Appendix A: Central Line Insertion Checklist

(From Virginia Mason Medical Center)

Central Line Insertion Standard Work and Safety Checklist

Date: ____/____/____ **Start time:** _____

Location: _____

Catheter Type: Dialysis Central Venous PICC Pulmonary Artery

Number of Lumens: 1 2 3 4

Insertion Site: **Jugular:** R L **Upper Arm:** R L

Subclavian: R L **Femoral:** R L

Reason for Insertion: New Indication Elective Emergent Replace Malfunctioning Catheter

Procedure Provider: _____ **Procedure Assistant:** _____

Standard Work Before, During, and After Procedure		YES Or True	YES (After Reminder)	NA
P R O C E D U R E P R E P	Patient has NO allergy to Heparin	<input type="checkbox"/>		
	Patient's latex allergy assessed & procedure plan modified PRN	<input type="checkbox"/>		
	Consent form completed & in chart (exception Code 4)	<input type="checkbox"/>		
	Perform Procedural Pause	<input type="checkbox"/>	<input type="checkbox"/>	
	Announce the procedure to be performed	<input type="checkbox"/>	<input type="checkbox"/>	
	Mark / assess site	<input type="checkbox"/>	<input type="checkbox"/>	
	Position patient correctly for procedure	<input type="checkbox"/>	<input type="checkbox"/>	
	Assemble equipment/verify supplies (including ultrasound, unless insertion is subclavian)	<input type="checkbox"/>	<input type="checkbox"/>	
	Verify all medication & syringes are labeled	<input type="checkbox"/>	<input type="checkbox"/>	
	Perform patient ID X 2	<input type="checkbox"/>	<input type="checkbox"/>	
Confirm that all persons in room cleanse hands? (ASK, if unsure)	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
Central line cart utilized?	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

How-to Guide: Prevent Central Line-Associated Bloodstream Infections

	Prep Procedure site Chloraprep 10.5 ml applicator used	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Dry: 30 second scrub + 30 second dry time <u>OR</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Wet: 2 minute scrub + 1 minute dry time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Used large drape to cover patient?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	Transducer set-up for all jugular and subclavian line insertions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D U R I N G	Wear sterile gloves, hat, mask with eyeshield, <u>and</u> sterile gown? (all must be worn)			
	Procedure provider	<input type="checkbox"/>	<input type="checkbox"/>	
	Procedure assistant	<input type="checkbox"/>	<input type="checkbox"/>	
	Did patient and all other persons in the room wear a mask?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
	Maintain sterile field?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
	Was ultrasound guidance used for all jugular & femoral insertions?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/> subclavian
	Venous placement confirmation via: pressure transducer w/ monitor <u>OR</u> manometry	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
	Type of solution used to flush/dosage: _____			
	Catheter caps placed on lumens?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
	Catheter sutured in place?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Position confirmation ray <u>ordered</u>	Fluoroscopy <u>OR</u> Chest X-	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> femoral	

Attending MD Housestaff IV Therapist IV Therapist RN

A F T E R	<i>Was sterile technique maintained when applying dressing?</i>	<input type="checkbox"/>	<input type="checkbox"/>	
	Was dressing dated?	<input type="checkbox"/>	<input type="checkbox"/>	
	Catheter position confirmed by:			
	Already confirmed during procedure via fluoroscopy (see above), <u>OR</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Chest X-ray <u>findings</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> femoral

RN Procedure Note:

MD Procedure Note:

PATIENT Label

VIRGINIA MASON MEDICAL CENTER
 Central Line Insertion Standard Work
 and Safety Checklist

Appendix B: Daily Goals

DAILY GOALS

PATIENT NAME _____ ROOM NUMBER _____
 DATE ____/____/____

---Initial as goals are reviewed ---

GOAL	NOTES	0700-1500	1500-2300	2300-0700
What needs to be done for the patient to be discharged from the ICU?				
What is this patient's greatest safety risk?				
Pulmonary/Ventilator: HOB 30 degrees or greater				
Sedation Vacation and Assessment of Readiness to Extubate				
PUD Prophylaxis				
DVT Prophylaxis				
Cardiac Rhythm, Hemodynamics				
Volume Status, net goal for 12 MN				
Neuro/Pain Mgt/Sedation				
GI/ Nutrition/Bowel Regimen				
Mobilization/OOB				
ID, Cultures, Drug levels				
Medication changes (Can any be discontinued?)				
Tests/Procedures Today				
Review scheduled labs. Can any be discontinued?				

Morning labs and PCXR				
Consultations				
Can central lines or other catheters/tubes be DC'd?				
Attending up to date?				
Family Updated?				
Any social issues to address?				
Emotional/spiritual issues addressed?				
Skin Care Addressed?				
Code Status Addressed?				
Advanced Directive in place?				
Parameters for calling MD				

Appendix C: Recommended Intervention-Level Measures

The following measures are relevant for this intervention. We recommend that you use some or all of them, as appropriate, to track the progress of your work in this area. In selecting your measures, we offer the following advice:

Whenever possible, use measures you are already collecting for other programs.

Evaluate your choice of measures in terms of the usefulness of the results they provide and the resources required to obtain those results; try to maximize the former while minimizing the latter.

Try to include both process and outcome measures in your measurement scheme.

You may use measures not listed here, and, similarly, you may modify the measures described below to make them more appropriate and/or useful to your particular setting; however, be aware that modifying measures may limit the comparability of your results to others’.

Remember that posting your measure results within your hospital is a great way to keep your teams aware of progress and motivated. Try to include measures that your team will find meaningful, and that they would be excited to see.

Process Measure(s)

Central Line Bundle Compliance
<u>Measure Information</u>

Outcome Measure(s)

Central Line-Associated Primary Bloodstream Infection (CLABSI) Rate per 1000 Central Line-Days
<u>Measure Information</u>

Alignment with Other Measure Sets

Measure Name	JC	CDC
Central Line Bundle Compliance		
Central Line-Associated Primary Bloodstream Infection (BSI) Rate per 1000 Central Line-Days	√1	√2

√1 Matches a measure in the Joint Commission National Hospital Quality Measures ICU Measure Set: ICU-4.

√2 The number of central-line catheter-related bloodstream infections per 1000 central-line days is the standard measure for surveillance by the CDC, and the definitions used in our measure match those in the CDC’s NHSN Central Line-Associated Bloodstream Infection (CLABSI) Event definition.