

INSTRUCTIONS

Selected Best Practices and Suggestions for Improvement

What is this tool? The purpose of this tool is to provide:

- Detailed description of best practices, including supporting evidence, suggestions for improvement, prescribed process steps, and additional resources.
- Sufficient information to complete a Gap Analysis (Tool D.5), make a decision to implement (or not to implement) a process, and develop an Implementation Plan (Tool D.6).

These tools provide information on evidence-based best practices when available, as well as information gathered from real-world experience in working with hospitals. These tools are not meant to replace validated guidelines. Rather, these documents are meant to supplement various improvement process projects related to the AHRQ Quality Indicators.

The information used to populate these documents is derived from professional association guidelines, the research literature, and experience and lessons learned from hospitals' work on previous AHRQ Quality Indicator implementation efforts. The references cited were not derived from a full systematic evidence-based literature review. Rather, the list includes more well-known research and publications on the subject, where available.

The information contained in these documents should be used to review and compare against your organization's current processes to determine where gaps may exist. As always, the final decision regarding whether to implement the guidance provided in this document should be made by a multidisciplinary quality improvement team in your hospital and should be based on information specific to your organization.

Who are the target audiences? The primary audiences include quality improvement leaders, clinical leaders, and multidisciplinary frontline staff members.

How can the tool help you? The Best Practices and Suggestions for Improvement Tool details each of the following components of a best practice and its implementation:

- Indicator Specifications
- Literature Support
- Best Processes/Systems of Care
- Additional Resources
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How does this tool relate to others? The Best Practices and Suggestions for Improvement Tools are used to prepare the Gap Analysis (Tool D.5) and the Implementation Plan (Tool D.6).

Instruction Steps

1. See instructions for Gap Analysis (Tool D.5).
2. Use the appropriate Selected Best Practices and Suggestions for Improvement Tool to populate the Gap Analysis (Tool D.5).

Selected Best Practices and Suggestions for Improvement

Patient Safety Indicator Specifications **PSI 7: Central Venous Catheter (CVC)-Related Bloodstream Infections (BSIs) Numerator:** Discharges with selected infections defined by specific International Classification of Diseases (ICD)-9 codes and secondary diagnosis field among cases meeting the inclusion and exclusion rules for the denominator.

Denominator: All surgical and medical discharges, 18 years and older **or** major diagnostic category (MDC) 14 (Pregnancy, Childbirth, and Puerperium), defined by specific diagnosis-related groups (DRGs) or Medicare Severity (MS)-DRGs.

Exclude:

- Principal diagnosis of selected infections or secondary diagnosis present on admission.
- Length of stay less than 2 days.
- Any diagnosis or procedure code for immunocompromised state.
- Any diagnosis of cancer.
- Missing gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing).

Reference: AHRQ Patient Safety Indicators Technical Specifications, Version 4.3, August 2011.

Recommended Practice	Details of Recommended Practice
Central Line Checklist	A central line insertion checklist should be used to document that the insertion protocol was followed during insertion of a central line. The following elements, at a minimum, should be found on the checklist: Date, start time, end time, hands washed prior to insertion, sterile gloves, sterile gown, cap, mask for providers inserting and assisting with insertion, full-body sterile drape for patient, chlorhexidine skin prep, insertion site, type of catheter used, circumstances for insertion, dressing type, followup chest x ray complete, and provider inserting procedure note. ^{1, 2, 4}
Site Selection	The subclavian site is the preferred site for central line insertion while the femoral site should be avoided except in an emergency. ¹⁻⁴
Maximal Barrier Precautions and Skin Preparation	To prevent catheter-related BSI, providers must ¹⁻⁴ : <ul style="list-style-type: none"> • Wash hands before and after central line insertion. • Apply maximal barrier precautions. • Use chlorhexidine skin prep unless contraindicated.
Daily Monitoring and Assessment	All central lines should be accessed daily for need and removed promptly if the line is no longer needed for care of the patient. Central lines should also be assessed daily for the presence of infection and to ensure that the dressing is intact. ^{1, 3, 4}

Literature Support

Central Line Checklist

“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.”

5 Million Lives Campaign. Getting started kit: prevent central line infections how-to guide. Cambridge, MA: Institute for Healthcare Improvement; 2008. Available at: www.ihl.org.

“Develop and implement a catheter insertion checklist. Educate nurses, physicians, and other healthcare personnel involved in catheter insertion, regarding the use of the catheter insertion checklist.”

Marschall J, Mermel LA, Classen D, et al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals. *Infect Control Hosp Epidemiol* 2008 Oct;29 Suppl 1:S22-30.

Site Selection

“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.”

5 Million Lives Campaign. Getting started kit: prevent central line infections how-to guide. Cambridge, MA: Institute for Healthcare Improvement; 2008. Available at: www.ihl.org.

“Use a subclavian site, rather than a jugular or a femoral site, in adult patients to minimize infection risk for nontunneled CVC placement.”

O’Grady NP, Alexander M, Burns LA, et al. Guidelines for the prevention of intravascular catheter-related infections, 2011. Atlanta: Centers for Disease Control and Prevention; 2011. Available at: www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf. Accessed September 19, 2011.

“Use of the femoral access site is associated with greater risk of infection and deep venous thrombosis in adults.”

Marschall J, Mermel LA, Classen D, et al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals. *Infect Control Hosp Epidemiol* 2008 Oct;29 Suppl 1:S22-30.

Maximal Barrier Precautions and Skin Preparation

“Hand hygiene should be performed before and after palpating catheter insertion sites as well as before and after inserting, replacing, accessing, repairing, or dressing an intravascular catheter.”

O’Grady NP, Alexander M, Burns LA, et al. Guidelines for the prevention of intravascular catheter-related infections, 2011. Atlanta: Centers for Disease Control and Prevention; 2011. Available at: www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf. Accessed September 19, 2011.

“Use a chlorhexidine-based antiseptic for skin preparation in patients older than 2 months of age.

- Before catheter insertion, apply an alcoholic chlorhexidine solution containing a concentration of chlorhexidine gluconate greater than 0.5% to the insertion site.
- The antiseptic solution must be allowed to dry before making the skin puncture.”

Marschall J, Mermel LA, Classen D, et al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals. *Infect Control Hosp Epidemiol* 2008 Oct;29 Suppl 1:S22-30.

“Use maximal sterile barrier precautions, including the use of a cap, mask, sterile gown, sterile gloves, and a sterile full body drape, for the insertion of CVCs, PICCs,ⁱ or guidewire exchange.”

O’Grady NP, Alexander M, Burns LA, et al. Guidelines for the prevention of intravascular catheter-related infections, 2011. Atlanta: Centers for Disease Control and Prevention; 2011. Available at: www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf. Accessed September 19, 2011.

Daily Monitoring and Assessment

“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.”

5 Million Lives Campaign. Getting started kit: prevent central line infections how-to guide. Cambridge, MA: Institute for Healthcare Improvement; 2008. Available at www.ihl.org.

“Promptly remove any intravascular catheter that is no longer essential.”

O’Grady NP, Alexander M, Burns LA, et al. Guidelines for the prevention of intravascular catheter-related infections, 2011. Atlanta: Centers for Disease Control and Prevention; 2011. Available at: www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf. Accessed September 19, 2011.

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key nurses, physicians, hospitalists, and pharmacists from infection control, intensive care, and inpatient units including operating room; and representatives from quality improvement, radiology, and information services to develop time-sequenced guidelines,

ⁱ PICC = peripherally inserted central catheter.

care paths, or protocols for the full continuum of care for placement and maintenance of central line catheters.

Recommended Practice: Central Line Checklist

- The above team must develop the central line insertion checklist. The checklist should have all of the following^{1, 2, 4}:
 - Date, start time, end time, hands washed prior to insertion, sterile gloves, sterile gown, cap, mask, full-body sterile drape, chlorhexidine skin prep, insertion site, type of catheter, circumstances for insertion, dressing type, followup chest x ray complete, person inserting, cart used, and procedure note.
- A central line insertion cart should include all the components and equipment needed to insert a central line. The cart should be available on all units/areas where central lines are inserted and should be brought into the room. The central line cart, at a minimum, should include all of the following^{2, 4}:
 - Supplies for maximal barrier precautions: sterile gloves, masks, sterile gowns, and caps for any provider inserting or assisting in the insertion of a central line. For the patient, a full-length sterile drape. (if Pyxis is used, replenish cart and charge patient).
 - Chlorhexidine for skin prep.
 - Central venous catheter insertion kit.
 - Central venous catheters (triple lumens, swans, PICCs, etc.).
 - Supplies to dress the catheter site (sterile, transparent, semipermeable dressings are preferred but if the site is bleeding or oozing or the patient is diaphoretic, a gauze dressing is preferred).
 - Central line insertion checklist.
- The time-sequenced protocol includes the following for all insertions of central venous catheters:
 - Identify indications for catheter insertion and use. Patients must meet criteria for insertion, set by institution.²
 - Define competency criteria to identify staff eligible to insert central lines and remove central lines within the institution. These procedures should be done by a nurse, physician, or other health care professional who has received appropriate education to ensure that the proper procedures are followed.²
 - Start by first bringing the central line cart into the patient's room or within proximity of patient's room.
 - The clinician assisting the procedure starts with the checklist. The health care professional assisting with the insertion completes the checklist and is empowered to stop the procedure if the central line protocol is not followed.¹

- Obtain informed consent from patient to insert the central line and put the consent in the medical record.
- Educate the patient and if needed, the family, about central line associated bloodstream infections.⁴
- Ensure that the person inserting and anyone assisting wash their hands with antiseptic soap and water or use an alcohol-based hand rub prior to starting to prep the patient (the use of gloves does not obviate hand hygiene).⁴

Recommended Practice: Site Selection

- Select appropriate site for insertion of central line²⁻⁴:
 - The subclavian vein is the preferred site for nontunneled catheters in adults.³
 - Use of the femoral vein should be avoided except in an emergency.³
 - The risks and benefits of a particular site must always be considered on an individual basis and clinician discretion should always be used.
 - Providers (including any assistants) should wash their hands before and after palpating catheter insertion sites (palpation of the insertion site should not be performed after the application of antiseptic, unless performed with sterile gloves).
 - The patient should be positioned for the procedure.

Recommended Practice: Maximal Barrier Precautions and Skin Preparation

- Prep skin:
 - Prepare skin with chlorhexidine skin antiseptic by first breaking the central core. Let the solution saturate the pad.
 - Apply with a back and forth motion for at least 30 seconds. Do not wipe or blot.¹
 - Allow antiseptic solution to dry completely before puncturing the site.^{1,3}
 - If patient is allergic to chlorhexidine, apply substitute antiseptic (tincture of iodine, an iodophor, or 70% alcohol can be used as a substitute).
 - Apply maximal barrier precautions.¹⁻⁴
 - The clinician and anyone assisting with insertion should wear a cap, mask, sterile gown, and sterile gloves.
 - The patient should be covered from head to toe with a sterile drape, leaving a small opening for the insertion site.
 - Perform time-out to verify the patient ID x2, announce procedure to be performed, and verify that all medication and syringes are labeled. Clinician assisting is empowered to stop procedure if central line protocol is not followed.¹
 - Select appropriate catheter for insertion. Use the minimum number of ports or lumens essential for management of patient.
 - Insert central line:

- Consider placing central line via guided ultrasound if available.³
- Place caps on lumens.
- Suture in place or use sutureless securement device.
- Dress central line insertion site with a sterile, transparent, semipermeable dressing to cover the catheter site. If the site is bleeding or oozing or the patient is diaphoretic, a gauze dressing is preferred. Consider use of a chlorhexidine-impregnated sponge dressing.^{2,3}
 - Date and time the dressing.
 - Do not routinely apply prophylactic topical antimicrobial or antiseptic ointment or cream to the insertion site of peripheral venous catheters.
- After inserting and dressing the catheter site, remove gown and gloves and then wash hands.
 - Confirm catheter placement via x ray after placement.
 - Clinician inserting central line completes progress note on checklist, signs, and puts in chart.

Recommended Practice: Daily Monitoring and Assessment

- Review necessity of central line daily²⁻⁴:
 - During multidisciplinary rounds, review necessity of line and record date and time of line placement. If the patient has a long-term CVC (tunneled or totally implantable), determine a timeframe to review necessity, such as weekly.
 - Remove promptly if line is unnecessary.
 - Inspect central line site daily for signs of infection.
 - Do not replace catheter at scheduled time intervals.
 - Do not replace catheters over a guide wire if the patient is suspected of having catheter-related infection.
 - For nontunneled catheters, change the transparent dressing and perform site care with a chlorhexidine-based antiseptic every 5 to 7 days or more frequently if the dressing is soiled, loose, or damp; change gauze dressing every 2 days or more frequently if the dressing is soiled, loose, or damp.
 - Clean all injection ports with 70% alcohol or an iodophor before accessing the system. Also cap all stopcocks when not in use.
 - Ensure patency of central line by flushing after every central line use.
 - When removing central lines, follow these steps:
 - Explain procedure to patient.
 - Position patient.
 - Perform hand hygiene and put on clean gloves.
 - Remove the dressing and discard along with gloves.
 - Repeat hand hygiene and don sterile gloves.

- Remove sutures.
 - Ask the patient to take a deep breath, hold it, and bear down (if applicable).
 - Pull the catheter slowly and gently while covering the site with sterile gauze to prevent air embolism. Stop if there is any resistance.
 - Once catheter is removed, hold pressure until bleeding stops and apply a sterile occlusive dressing.
 - Inspect the integrity of the central line to make sure it did not break off inside the vein.
- Establish standing order sets for inserting central lines, to include chest x-ray to confirm placement, type of dressing to be used, dressing changes, and daily monitoring. Mandate the use of these standing orders anytime a central line is placed.
 - Assign responsibility for appropriate placement of standing orders on units (decisions based on accessibility via electronic medical record versus paper).

Educational Recommendation

- Plan and provide education on protocols and standing orders to physician, nurses, and all other staff involved in inserting central lines (emergency department, intensive care unit, other medical units, ancillary departments, etc). Education should occur upon hire, annually, and when this protocol is added to job responsibilities.

Effectiveness of Action Items

- Track compliance with elements of established protocol steps by using insertion checklist, appropriate documentation, and other required procedures.
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement.
- Mandate that all personnel follow the central line protocol and develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physician, nursing, and ancillary staff; senior medical staff; and executive leadership) on level of compliance with process.
- Conduct surveillance and prevalence of bloodstream infections (using Centers for Disease Control and Prevention definitions) to evaluate outcomes of new process.
- Monitor and evaluate performance regularly to sustain improvements achieved.

Additional Resources

Systems/Processes

- --How-to guide: getting started kit: prevent central line infections (available at www.premierinc.com/safety/topics/bundling/downloads/01-central-lines-how-to-guide.pdf)
- [--Preventing central venous catheter-related bloodstream infections toolkit](#)
- [--How-to guide: improving hand hygiene. A guide for improving practices among health care workers](#)

- [--Guideline for hand hygiene in health-care settings. Centers for Disease Control and Prevention](#)

Policies/Protocols

- [Montana State hospital policy and procedure-handwashing](#)
- [Policy for the care of patients with central venous catheters \(CVC\). Birmingham East and North National Health Service \(United Kingdom\)](#)

Tools

- [Central line insertion checklist. Johns Hopkins University](#)
- CVC audit summary: safer systems saving lives
- [CVC audit tool: safer systems saving lives](#)

Staff Required

- Physicians trained in inserting central lines
- Specially trained nurse to provide assistance with insertion of central line
- Multidisciplinary team rounding on patient

Equipment

- Antibacterial soap or alcohol-based hand rub
- Chlorhexidine skin antiseptic
- Maximal barrier precautions
- Central line catheters

Communication

- Systemwide education on protocol
- Time-out to verify hand washing before central line insertion

Authority/Accountability

- Senior leadership mandating protocol for all providers²
- Providers inserting and assisting insertion of central lines held accountable for following protocol
- RN empowered to stop procedure¹

Supporting Literature

1. 5 Million Lives Campaign. Getting started kit: prevent central line infections how-to guide. Cambridge, MA: Institute for Healthcare Improvement; 2008. Available at www.ihl.org.

2. Marschall J, Mermel LA, Classen D, et al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals. *Infect Control Hosp Epidemiol* 2008 Oct;29 Suppl 1:S22-30.
3. O'Grady NP, Alexander M, Burns LA, et al. Guidelines for the prevention of intravascular catheter-related infections, 2011. Atlanta: Centers for Disease Control and Prevention; 2011. Available at: www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf. Accessed September 19, 2011 at
4. Hospital: 2011 National Patient Safety Goals. Oakbrook Terrace, IL: The Joint Commission; 2011. Available at: www.jointcommission.org/hap_2011_npsgs/.