NATIONAL QUALITY FORUM

Measure Evaluation 4.1
January 2010

This form contains the measure information submitted by stewards. Blank fields indicate no information was provided. Attachments also may have been submitted and are provided to reviewers. The sub-criteria and most of the footnotes from the evaluation criteria are provided in Word comments and will appear if your cursor is over the highlighted area (or in the margin if your Word program is set to show revisions in balloons). Hyperlinks to the evaluation criteria and ratings are provided in each section.

TAP/Workgroup (if utilized): Complete all <mark>yellow highlighted</mark> areas of the form. Evaluate the extent to which each sub-criterion is met. Based on your evaluation, summarize the strengths and weaknesses in each section.

Note: *If there is no TAP or workgroup, the SC also evaluates the* sub-criteria (*yellow* highlighted areas).

Steering Committee: Complete all <mark>pink</mark> highlighted areas of the form. Review the workgroup/TAP assessment of the sub-criterion, noting any areas of disagreement; then evaluate the extent to which each major criterion is met; and finally, indicate your recommendation for the endorsement. Provide the rationale for your ratings.

Evaluation ratings of the extent to which the criteria are met
C = Completely (unquestionably demonstrated to meet the criterion)
P = Partially (demonstrated to partially meet the criterion)
M = Minimally (addressed BUT demonstrated to only minimally meet the criterion)
N = Not at all (NOT addressed; OR incorrectly addressed; OR demonstrated to NOT meet the criterion)
NA = Not applicable (only an option for a few sub-criteria as indicated)

(for NQF staff use) **NQF Review #**: PSM-004-10	**NQF Project**: Patient Safety Measures
MEASURE DESCRIPTIVE INFORMATION	

De.1 Measure Title: Central Venous Catheter-related Bloodstream Infections (adult)

De.2 Brief description of measure*: Number of central venous catheter-related bloodstream infections per 1,000 discharges in cases age 18 years and older

1.1-2 Type of Measure: outcome
De.3 If included in a composite or paired with another measure, please identify composite or paired measure Yes, it is included in the AHRQ "Patient Safety for Selected Indicators Composite" (http://qualityindicators.ahrq.gov/downloads/psi/AHRQ_PSI_Workgroup_Final.pdf). This composite measure was endorsed by NQF (#0531) on June 19, 2009. At that time, the Composite Measures Evaluation Steering Committee recommended endorsement of a composite that included "all of the AHRQ Quality Indicators related to in-hospital adverse events for the adult population that are either NQF endorsed or assessed to be acceptable as components of the composite by the appropriate Technical Advisory Panel under the Hospital Care Additional Priorities, 2007 consensus development process." PSI 7 (Central Venous Catheter Related Bloodstream Infections) was determined to meet the latter standard, and was therefore included in the NQF-endorsed composite.

De.4 National Priority Partners Priority Area: safety
De.5 IOM Quality Domain: safety
De.6 Consumer Care Need: Getting Better

CONDITIONS FOR CONSIDERATION BY NQF	
Four conditions must be met before proposed measures may be considered and evaluated for suitability as voluntary consensus standards:	NQF Staff
A. The measure is in the public domain or an intellectual property ([measure steward agreement](#)) is signed. *Public domain only applies to governmental organizations. All non-government organizations must sign a*	A Y ☐ N ☐

measure steward agreement even if measures are made publicly and freely available. **A.1** Do you attest that the measure steward holds intellectual property rights to the measure and the right to use aspects of the measure owned by another entity (e.g., risk model, code set)? Yes **A.2 Indicate if** Proprietary Measure (*as defined in measure steward agreement*): **A.3** Measure Steward Agreement: government entity- public domain- No Agreement **A.4** Measure Steward Agreement attached:	2
B. The measure owner/steward verifies there is an identified responsible entity and process to maintain and update the measure on a schedule that is commensurate with the rate of clinical innovation, but at least every 3 years. Yes, information provided in contact section	B Y☐ N☐
C. The intended use of the measure includes <u>both</u> public reporting <u>and</u> quality improvement. ►**Purpose:** public reporting, quality improvement 0,0,0,	C Y☐ N☐
D. The requested measure submission information is complete. Generally, measures should be fully developed and tested so that all the evaluation criteria have been addressed and information needed to evaluate the measure is provided. Measures that have not been tested are only potentially eligible for a time-limited endorsement and in that case, measure owners must verify that testing will be completed within 12 months of endorsement. **D.1**Testing: Yes, fully developed and tested **D.2** Have NQF-endorsed measures been reviewed to identify if there are similar or related measures? Yes	D Y☐ N☐
(for NQF staff use**)** Have all conditions for consideration been met? Staff Notes to Steward (*if submission returned*):	Met Y☐ N☐
Staff Notes to Reviewers (*issues or questions regarding any criteria*):	
Staff Reviewer Name(s):	

TAP/Workgroup Reviewer Name:	
Steering Committee Reviewer Name:	
1. IMPORTANCE TO MEASURE AND REPORT	
Extent to which the specific measure focus is important to making significant gains in health care quality (safety, timeliness, effectiveness, efficiency, equity, patient-centeredness) and improving health outcomes for a specific high impact aspect of healthcare where there is variation in or overall poor performance. *Measures must be judged to be important to measure and report in order to be evaluated against the remaining criteria.* (evaluation criteria) 1a. High Impact	Eval Rati ng
(for NQF staff use) Specific NPP goal:	
1a.1 Demonstrated High Impact Aspect of Healthcare: affects large numbers, high resource use, patient/societal consequences of poor quality **1a.2** **1a.3 Summary of Evidence of High Impact:** This outcome affects a large number of patients and is associated with high resource use and other consequences. According to the Medicare Patient Safety Monitoring System of the Center for Medicare & Medicaid Services, the percentage of Medicare discharges with central venous catheter placement with associated bloodstream infections rose from 1.66% in 2004 to 2.80% in 2006 (NHQRDRnet, 2010). In total, central venous catheter related bloodstream infections account for about 92,000 of the estimated 1.7 million infections annually in the USA related to health care, with a case fatality rate estimated at 4-25% (CDC, 2000; Klevens et al., 2007; Siempos et al., 2009). The overall rate of this indicator, as defined by AHRQ, was 2.03 per 1,000 eligible discharges in 2007 (HCUPnet, 2010), with approximately 67,961 numerator events reported in 2004, the most recent year for which this figure is available.	1a C☐ P☐ M☐ N☐

Cases from the US Nationwide Inpatient Sample that were flagged by this PSI in 2000 had 4.3% excess mortality, 9.6 days of excess hospitalization, and $38,700 in excess hospital charges, relative to carefully matched controls that were not flagged (Zhan and Miller, 2003). This finding was confirmed in the Veterans Affairs (VA) hospital system, where cases that were flagged by this PSI in 2001 had 2.7% excess mortality, 4.5-9.5 days of excess hospitalization, and $7,292-$13,816 in excess hospital costs, relative to carefully matched controls that were not flagged (Rivard et al., 2008). A more recent replication using 2007 data, corrected for infections that were reported as "present on admission", estimated 16.1 hospital days and $33,118 in hospital costs attributable to the average case (Foster et al., 2009). In a commercial claims database from 45 large employers in the USA, each event (aggregating this PSI with postoperative sepsis) was associated not just with 3.1% excess mortality, but also with 7.7% excess readmissions, which added $2,594 to the total attributable cost per event (Encinosa and Hellinger, 2008). A case control analysis from England (translating this PSI from ICD-9-CM to ICD-10) estimated excess mortality of 5.7% and 11.4 days of excess hospitaliza¬tion (Raleigh et al., 2008). Using detailed clinical data, the attributable cost of each central venous catheter related bloodstream infection has been estimated at $7,288-$29,156 in 2007, with an aggregate annual cost of $670 million to $2.68 billion (Scott, 2009).

1a.4 Citations for Evidence of High Impact: 1. Centers for Disease Control and Prevention (2009), "Monitoring hospital-acquired infections to promote patient safety - United States, 1990-1999." MMWR, Vol. 49, No. 8, pp. 149-153.
2. Encinosa WE, Hellinger FJ (2008), "The impact of medical errors on ninety-day costs and outcomes: An examination of surgical patients", Health Services Research, Vol. 43, No. 6, pp. 2067-2085.
3. Foster D, Young J, Heller S (2009), "US national estimates of mortality, length of stay, and costs attributable to inpatient complications of care", abstract presented at AcademyHealth 2009 Annual Research Meeting (http://www.academyhealth.org/files/arm/ARM-2009-Posters.pdf).
4. HCUPnet (2010), http://hcupnet.ahrq.gov/HCUPnet.jsp .
5. Klevens RM, Edwards JR, Richards CL Jr, Horan TC, Gaynes RP, Pollock DA, et al. (2007). "Estimating health care-associated infections and deaths in US hospitals, 2002." Public Health Reports, Vol. 122, No. 2, pp. 160-166.
6. NHQRDRnet. (2010), http://nhqrnet.ahrq.gov/nhqrdr/jsp/nhqrdr.jsp?catId=81021002&msridRO=100202 .
7. Raleigh VS, Cooper J, Bremner SA, Scobie S (2008), "Patient safety indicators for England from hospital administrative data: case-control analysis and comparison with US data", BMJ, Vol. 337, pp. 1702.
8. Rivard PE, Luther SL, Christiansen CL, Shibei Z, Loveland S, Elixhauser A, Romano PS, Rosen AK (2008), "Using patient safety indicators to estimate the impact of potential adverse events on outcomes", Medical Care Research and Review, Vol. 65, No. 1, pp. 67-87.
9. Scott RD II, (2009). "The Direct Medical Costs of Healthcare-Associated Infections in US Hospitals and the Benefits of Prevention", http://www.cdc.gov/ncidod/dhqp/pdf/Scott_CostPaper.pdf .
10. Siempos II, Kopterides P, Tsangaris I, Dimopoulou I, Armaganidis AE (2009), "Impact of catheter-related bloodstream infections on the mortality of critically ill patients: a meta-analysis." Critical Care Medicine, Vol. 37, No. 7, pp. 2283-2289
11. Zhan C, Miller MR (2003), "Excess length of stay, charges, and mortality attributable to medical injuries during hospitalization", JAMA, Vol.290, No.14, pp.1868-1874.

1b. Opportunity for Improvement

1b.1 Benefits (improvements in quality) envisioned by use of this measure: This indicator is intended to drive transparency, accountability, and performance improvement for one of the most important types of healthcare-associated infections; specifically, hospital-acquired infections due to central venous catheters. Although robust surveillance systems for these infections have been implemented by the American Nurses Association (i.e., the National Database of Nursing Quality Indicators or NDNQI), the Centers for Disease Control and Prevention (CDC) (i.e., the National Healthcare Safety Network or NHSN), and other stakeholders, with the support of The Joint Commission, these efforts are very costly to implement and remain limited to volunteer hospitals in most states.

1b.2 Summary of data demonstrating performance gap (variation or overall poor performance) across providers:
The incidence of central venous catheter related bloodstream infection can be dramatically reduced by focused efforts to improve adherence with evidence-based guidelines (Berenholtz, et al., 2004; Institute for

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Healthcare Improvement, 2009; Mermel, 2000; CDC, 2005; Yokoe D.S., et al., 2008). In the most dramatic published demonstration of this fact, 67 Michigan hospitals with 85% of intensive care beds in the state (including five out-of-state affiliates) joined a collaborative effort to reduce the rate of catheter-related bloodstream infection (Pronovost et al., 2006). This effort targeted clinicians' use of five evidence-based procedures recommended by the CDC: hand washing, using full-barrier precautions during insertion of central venous catheters, cleaning the skin with clorhexidine, avoiding the femoral site if possible, and removing all unnecessary catheters. The overall mean rate of central venous catheter related bloodstream infection decreased from 7.7 per 1,000 catheter-days at baseline to 2.3 at 0-3 months after implementation to 1.4 over 18 months of follow-up. Multi-level Poisson regression confirmed a 38% reduction in incidence at 0-3 months after implementation, increasing to a 66% reduction at 16-18 months after implementation. This reduction appears to have been sustained for an additional 18 months in at least 90 of the original 103 units (Pronovost et al., 2010).

Despite the demonstrated opportunity for improvement, overall national performance on PSI 7 has barely improved. The risk-adjusted national rate peaked at 2.30 per 1,000 eligible discharges in 2005, and then fell to 2.19 in 2006 and 2.03 in 2007 (HCUPnet, 2010). Similarly, the risk-adjusted rate among Medicare beneficiaries peaked at 2.34 per 1,000 eligible discharges in 2005, and then fell to 2.19 in 2006 and 2.12 in 2007 (HealthGrades, 2009). These declines of roughly 10%, in relative terms, are promising but clearly not optimal. VA data demonstrated a parallel increase in PSI rates between 2001 and 2004, but more recent data have not been reported (Rosen et al., 2006). Private, not-for-profit hospitals have narrowed the performance gap relative to for-profit hospitals (1.94 versus 2.47 per 1,000 eligible discharges in 2007, respectively), and hospitals in the Midwest report lower rates than hospitals in other regions (1.69 versus 2.05-2.28 per 1,000 eligible discharges, respectively). Larger hospitals and teaching hospitals consistently have higher rates of PI 7 than smaller hospitals and non-teaching hospitals, respectively (Thornlow and Stukenborg, 2006; HCUPnet, 2010), although these differences may be due to unmeasured differences in either case mix or documentation and coding practices.

1b.3 Citations for data on performance gap:
1. Berenholtz SM, Pronovost PJ, Lipsett PA, Hobson D, Earsing K, Farley JE, et al. (2004), "Eliminating catheter-related bloodstream infections in the intensive care unit", Critical Care Medicine, Vol. 32, No. 10, pp. 2014-2020.
2. Centers for Disease Control and Prevention (2005), "Reduction in central line-associated bloodstream infections among patients in intensive care units--Pennsylvania, April 2001-March 2005", MMWR Morbidity and Mortality Weekly Report, Vol. 54, No. 40, pp. 1013-1016.
3. HCUPnet (2010), http://hcupnet.ahrq.gov/HCUPnet.jsp .
4. HealthGrades (2009), "HealthGrades Sixth Annual Patient Safety in American Hospitals Study", http://www.healthgrades.com/media/dms/pdf/PatientSafetyinAmericanHospitalsStudy2009.pdf .
5. Institute for Healthcare Improvement (2009), "Implement the Central Line Bundle", http://www.ihi.org/IHI/Topics/CriticalCare/IntensiveCare/Changes/ImplementtheCentralLineBundle.htm
6. Mermel LA (2000), "Prevention of intravascular catheter-related infections", Annals of Internal Medicine, Vol. 132, No. 5, pp. 391-402.
7. Pronovost P, Needham D, Berenholtz S, Sinopoli D, Chu H, Cosgrove S, et al. (2006), "An intervention to decrease catheter-related bloodstream infections in the ICU", New England Journal of Medicine, Vol. 355, No. 26, pp. 2725-2732.
8. Pronovost P, Goeschel CA, Colantuoni E, Watson S, Lubomski LH, Berenholtz SM, et a. (2010), "Sustaining reductions in catheter related bloodstream infections in Michigan intensive care units: observational study", BMJ, Vol. 340, pp. C309.
9. Rosen AK, Zhao S, Rivard P, Loveland S, Montez-Rath ME, Elixhauser A, Romano PS (2006), "Tracking rates of Patient Safety Indicators over time: Lessons from the Veterans Administration", Medical Care, Vol. 44, No. 9, pp. 850-861.
10. Thornlow DK and Stukenborg GJ (2006), "The association between hospital characteristics and rates of preventable complications and adverse events", Medical Care, Vol. 44, No. 3, pp. 265-269.
11. Yokoe DS, Mermel LA, Anderson DJ, Arias KM, Burstin H, Calfee DP, et al. (2008), "A compendium of strategies to prevent healthcare-associated infections in acute care hospitals", Infection Control and Hospital Epidemiology, Vol. 29, pp. S12-S21.

1b.4 Summary of Data on disparities by population group:

Disparities by population group have been documented (HCUPnet, 2010; NHQRDRnet, 2010). For example, risk-adjusted rates of PSI 7, based on the 2007 Nationwide Inpatient Sample, were 2.58 per 1,000 eligible Medicaid discharges versus 2.16 per 1,000 eligible Medicare discharges and 1.74 per 1,000 eligible privately insured discharges (representing a risk ratio of 1.48 [p<0.001] for Medicaid relative to private insurance). Comparable national rates were 2.87 per 1,000 non-Hispanic blacks, 2.04 per 1,000 Hispanics, and 2.22 per 1,000 non-Hispanic whites, representing a risk ratio of 1.29 [p<0.05] for non-Hispanic blacks relative to non-Hispanic whites. Similar or larger racial/ethnic disparities were reported in prior years (Coffey et al., 2005; Russo et al., 2008). Racial/ethnic disparities appear to be smaller within Veterans Health Administration hospitals (Shimada et al., 2008), and also smaller within the same non-VA hospitals (Gaskin et al., 2008), suggesting that hospital choice may be a contributing factor.

1b.5 Citations for data on Disparities:

1. Coffey RM, Andrews RM, Moy E (2005), "Racial, ethnic, and socioeconomic disparities in estimates of AHRQ Patient Safety Indicators", Medical Care, Vol. 43, No. 3 suppl, pp. I48-I57.
2. Gaskin DJ, Spencer CS, Richard P, Anderson GF, Powe NR, LaVeist TA (2008), "Do hospitals provide lower-quality care to minorities than to whites?" Health Affairs, Vol. 27, No. 2, pp. 518-527.
3. HCUPnet (2010), http://hcupnet.ahrq.gov/HCUPnet.jsp .
4. NHQRDRnet (2010), http://nhqrnet.ahrq.gov/nhqrdr/jsp/nhqrdr.jsp .
5. Russo CA, Andrews RM, Barrett ML (2008), "Racial and Ethnic Disparities in Hospital Patient Safety Events, 2005", HCUP Statistical Brief #53, Agency for Healthcare Research and Quality, Rockville MD, http://www.hcup-us.ahrq.gov/reports/statbriefs/sb53.pdf .
6. Shimada SL, Montez-Rath ME, Loveland SA, Zhao S, Kressin NR, Rosen AK (2008), "Racial disparities in Patient Safety Indicator (PSI) rates in the Veterans Health Administration", in "Advances in Patient Safety: New Directions and Alternative Approaches", AHRQ Publication Nos. 08-0034 (1-4), http://www.ahrq.gov/qual/advances2 .

1c. Outcome or Evidence to Support Measure Focus

1c.1 Relationship to Outcomes (*For non-outcome measures, briefly describe the relationship to desired outcome. For outcomes, describe why it is relevant to the target population*): This outcome is directly relevant to the target population of hospitalized patients, for the reasons specified in sections 1a.3 and 1b.2. It is related to the Institute of Medicine's domain and the National Priorities Partnership's (NPP) priority area of safety, which includes a specific goal that "All healthcare organizations and their staff will strive to ensure a culture of safety while driving to lower the incidence of healthcare-induced harm, disability, or death toward zero." Hospitals are asked to "focus relentlessly on continually reducing and seeking to eliminate all healthcare-associated infections and serious adverse events." The NPP calls on its partners to "develop and endorse standardized individual and composite measures for HAIs and serious adverse events that build on current datasets," and thereby to "develop effective reporting mechanisms and broadly disseminate information to increase consumer understanding of the importance of these measures and how they can be used to choose healthcare organizations."

1c.2-3. Type of Evidence: cohort study, evidence based guideline, expert opinion

1c.4 Summary of Evidence (*as described in the criteria; for outcomes, summarize any evidence that healthcare services/care processes influence the outcome*):

Because of the massive literature on this topic, which is fully summarized in section 1b.2 above and in the guidelines cited below, we do not present a comprehensive summary of the evidence. Suffice it to say that multiple studies have demonstrated that multiple interventions, alone or in combination, can significantly reduce the rate of central venous catheter related bloodstream infection.

1c.5 Rating of strength/quality of evidence (*also provide narrative description of the rating and by whom*):
Not applicable

1c.6 Method for rating evidence: Not applicable

1c.7 Summary of Controversy/Contradictory Evidence: Not applicable

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1c.8 Citations for Evidence (*other than guidelines*): Not applicable

1c.9 Quote the Specific guideline recommendation (*including guideline number and/or page number*):
The NQF's Safe Practice 21 (2009) focuses directly on evidence-based safe practices to reduce the risk of central venous catheter related bloodstream infection:
Before insertion:
1. Educate healthcare personnel involved in the insertion, care, and maintenance of central venous catheters (CVCs) about central line associated bloodstream infection (CLABSI) prevention. [see NQF Safe Practices for references]
At insertion:
1. Use a catheter checklist to ensure adherence with infection prevention practices at the time of CVC insertion.
2. Perform hand hygiene prior to catheter insertion or manipulation.
3. Avoid using the femoral vein for central venous access in adult patients. (Subclavian or internal jugular are the preferred sites, unless contraindicated.)
4. Make available and easily accessible for use a catheter cart or kit that contains all necessary components for aseptic catheter insertion.
5. Use maximal sterile barrier precautions during CVC insertion to include a mask, cap, sterile gown, and sterile gloves worn by all healthcare personnel involved in the procedure. The patient is to be covered with a large sterile drape during catheter insertion.
6. Use chlorhexidine-based antiseptic for skin preparation in patients over two months of age.
After insertion:
1. Use a standardized protocol to disinfect catheter hubs, needleless connectors, and injection ports before accessing the ports.
2. Remove nonessential catheters.
3. Use a standardized protocol for nontunneled CVCs in adults and adolescents for dressing care, such as changing transparent dressings and performing site care with a chlorhexidine-based antiseptic every five to seven days, or earlier if the dressing is soiled, loose, or damp; change gauze dressings every two days, or earlier if the dressing is soiled, loose, or damp.
3. Perform surveillance for CLABSI and report the data on a regular basis to the units, physician and nursing leadership, and hospital administrators overseeing the units.

Similarly, The Joint Commission in 2009 expanded its National Patient Safety Goal #7 to include the implementation of nationally accepted best practices for prevention:
Elements of Performance for NPSG.07.04.01
1. Educate staff and licensed independent practitioners who are involved in managing central lines about central line-associated bloodstream infections and the importance of prevention. Education occurs upon hire, annually thereafter, and when involvement in these procedures is added to an individual's job responsibilities.
2. Prior to insertion of a central venous catheter, educate patients and, as needed, their families about central line-associated bloodstream infection prevention.
3. Implement policies and practices aimed at reducing the risk of central line-associated bloodstream infections. These policies and practices meet regulatory requirements and are aligned with evidence-based standards (for example, the CDC and/or professional organization guidelines).
4. Conduct periodic risk assessments for central line-associated bloodstream infections, monitor compliance with evidence-based practices, and evaluate the effectiveness of prevention efforts. The risk assessments are conducted in time frames defined by the hospital, and this infection surveillance activity is hospital-wide, not targeted.
5. Provide central line-associated bloodstream infection rate data and prevention outcome measures to key stakeholders, including leaders, licensed independent practitioners, nursing staff, and other clinicians.
6. Use a catheter checklist and a standardized protocol for central venous catheter insertion.
7. Perform hand hygiene prior to catheter insertion or manipulation.
8. For adult patients, do not insert catheters into the femoral vein unless other sites are unavailable.
9. Use a standardized supply cart or kit that contains all necessary components for the insertion of central venous catheters.
10. Use a standardized protocol for sterile barrier precautions during central venous catheter insertion.
11. Use a chlorhexidine-based antiseptic for skin preparation during central venous catheter insertion in patients over 2 months of age, unless contraindicated.

12. Use a standardized protocol to disinfect catheter hubs and injection ports before accessing the ports.
13. Evaluate all central venous catheters routinely and remove nonessential catheters.

The most comprehensive recent guidelines were published by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America in 2008:
Before insertion
1. Educate healthcare personnel involved in the insertion, care, and maintenance of CVCs about CLABSI prevention (A-II).
   a. Include the indications for catheter use, appropriate insertion and maintenance, the risk of CLABSI, and general infection prevention strategies.
   b. Ensure that all healthcare personnel involved in catheter insertion and maintenance complete an educational program regarding basic practices to prevent CLABSI before performing these duties.
   c. Periodically assess healthcare personnel knowledge of and adherence to preventive measures.
   d. Ensure that any healthcare professional who inserts a CVC undergoes a credentialing process (as established by the individual healthcare institution) to ensure their competency before they independently insert a CVC.
At insertion
1. Use a catheter checklist to ensure adherence to infection prevention practices at the time of CVC insertion (B-II).
   a. Use a checklist to ensure and document compliance with aseptic technique.
     i. CVC insertion should be observed by a nurse, physician, or other healthcare personnel who has received appropriate education (see above), to ensure that aseptic technique is maintained.
   b. These healthcare personnel should be empowered to stop the procedure if breaches in aseptic technique are observed.
2. Perform hand hygiene before catheter insertion or manipulation (B-II).
   a. Use an alcohol-based waterless product or antiseptic soap and water.
     i. Use of gloves does not obviate hand hygiene.
3. Avoid using the femoral vein for central venous access in adult patients (A-I).
   a. Use of the femoral access site is associated with greater risk of infection and deep venous thrombosis in adults.
     i. Increased risk of infection with femoral catheters may be limited to overweight adult patients with a body mass index higher than 28.
     ii. Femoral vein catheterization can be done without general anesthesia in children and has not been associated with an increased risk of infection in children.
   b. Several nonrandomized studies show that the subclavian vein site is associated with a lower risk of CLABSI than is the internal jugular vein, but the risks and benefits in light of potential infectious and noninfectious complications must be considered on an individual basis when determining which insertion site to use.
   c. The use of peripherally inserted CVCs is not an evidence-based strategy to reduce the risk of CLABSI.
     i. The risk of infection with peripherally inserted CVCs in ICU patients approaches that with CVCs placed in the subclavian or internal jugular veins.
4. Use an all-inclusive catheter cart or kit (B-II).
   a. A catheter cart or kit that contains all necessary components for aseptic catheter insertion is to be available and easily accessible in all units where CVCs are inserted.
5. Use maximal sterile barrier precautions during CVC insertion (A-I).
   a. Use maximal sterile barrier precautions.
     i. A mask, cap, sterile gown, and sterile gloves are to be worn by all healthcare personnel involved in the catheter insertion procedure.
     ii. The patient is to be covered with a large sterile drape during catheter insertion.
   b. These measures must also be followed when exchanging a catheter over a guidewire.
6. Use a chlorhexidine-based antiseptic for skin preparation in patients older than 2 months of age (A-I).43-46
   a. Before catheter insertion, apply an alcoholic chlorhexidine solution containing a concentration of chlorhexidine gluconate greater than 0.5% to the insertion site.
     i. The antiseptic solution must be allowed to dry before making the skin puncture.
     ii. Chlorhexidine products are not approved by the US Food and Drug Administration for children younger than 2 months of age; povidone-iodine can be used for children in this age group.
After insertion
1. Disinfect catheter hubs, needleless connectors, and injection ports before accessing the catheter (B-II).
   a. Before accessing catheter hubs or injection ports, clean them with an alcoholic chlorhexidine preparation

or 70% alcohol to reduce contamination.
2. Remove nonessential catheters (A-II).
  a. Assess the need for continued intravascular access on a daily basis during multidisciplinary rounds. Remove catheters not required for patient care.
3. For nontunneled CVCs in adults and adolescents, change transparent dressings and perform site care with a chlorhexidine-based antiseptic every 5-7 days or more frequently if the dressing is soiled, loose, or damp; change gauze dressings every 2 days or more frequently if the dressing is soiled, loose, or damp (A-I).
4. Replace administration sets not used for blood, blood products, or lipids at intervals not longer than 96 hours (A-II).
5. Perform surveillance for CLABSI (B-II).
  a. Measure unit-specific incidence of CLABSI (CLABSIs per 1,000 catheter-days) and report the data on a regular basis to the units, physician and nursing leadership, and hospital administrators overseeing the units.
  b. Compare CLABSI incidence with historical data for individual units and with national rates (ie, data from the National Healthcare Safety Network).
  c. CLABSI has been documented in large numbers of non-ICU patients with CVCs. Surveillance for CLABSI in these settings requires additional resources.

Five evidence-based recommendations from these guidelines were assembled by the Institute for Healthcare Improvement into a "Central Line Bundle," which was a key component of its "Protecting 5 Million Lives from Harm" campaign. Percentage daily compliance with this bundle among patients in intensive care units with central lines was endorsed by the NQF (#0298) in November 2007:
1. Hand hygiene
2. Maximal barrier precautions upon insertion
3. Chlorhexidine skin antisepsis
4. Optimal catheter site selection, with avoidance of the femoral vein for central venous access in adult patients (subclavian vein is the preferred site for non-tunneled catheters in adult patients)
5. Daily review of line necessity with prompt removal of unnecessary lines.
Compliance with a similar Central Venous Catheter Insertion Protocol was endorsed (#0464) as a measure in Anesthesiology and Critical Care (sponsored by the American Medical Association's Physician Consortium for Performance Improvement) in July 2008: "percentage of patients who undergo CVC insertion for whom CVC was inserted with all elements of maximal sterile barrier technique (cap AND mask AND sterile gown AND sterile gloves AND a large sterile sheet AND hand hygiene AND 2% chlorhexidine for cutaneous antisepsis). The CDC's National Healthcare Safety Network has implemented a similar program for "Central Line Insertion Practices (CLIP) Adherence Monitoring" (http://www.cdc.gov/nhsn/PDFs/pscManual/5psc_CLIPcurrent.pdf).

1c.10 Clinical Practice Guideline Citation: 1. Ducel G, Fabry J, Nicolle L (2002), "Prevention of hospital-acquired infections: A practical guide, 2nd edition", WHO/CDS/CSR/EPH/2002.12, World Health Organization. Available at: http://www.who.int/csr/resources/publications/whocdscsreph200212.pdf .
2. 5 Million Lives Campaign. Getting Started Kit: Prevent Central Line Infections How-to Guide (2008), Cambridge, MA: Institute for Healthcare Improvement. Available at:
http://www.ihi.org/IHI/Topics/CriticalCare/IntensiveCare/Changes/ImplementtheCentralLineBundle.htm .
3. Marschall J, Mermel LA, Classen D, Arias KM, Podgorny K, Anderson DJ, et al. (2008), "Strategies to prevent central line–associated bloodstream infections in acute care hospitals", Infection Control and Hospital Epidemiology, Vol. 29, Suppl. 1, pp. S22-S30
4. National Quality Forum (2009), "Safe Practices for Better Healthcare-2009 Update: A Consensus Report", Washington, DC: NQF.
5. O'Grady NP, Alexander M, Dellinger EP, Gerberding JL, Heard SO, Maki DG, et al. (2002), "Guidelines for the prevention of intravascular catheter-related infections", Morbidity and Mortality Weekly Report, Vol. 51, No. RR-10, pp. 1-26.
6. Saint S (2001, "Prevention of intravascular catheter-associated infections. In: Making Health Care Safer: A Critical Analysis of Patient Safety Practices. Evidence report/technology assessment, no. 43", AHRQ publication no. 01-E058. Rockville, MD: Agency for Healthcare Research and Quality. Available at: http://www.ahrq.gov/clinic/ptsafety/ .
7. The Joint Commission (2010), "2010 National Patient Safety Goals", available at: http://www.jointcommission.org/patientsafety/nationalpatientsafetygoals .

1c.11 National Guideline Clearinghouse or other URL: See 1c.10 above.

1c.12 Rating of strength of recommendation (*also provide narrative description of the rating and by whom*):
This is an outcome measure; the strength of recommendation for related measures varies, as described in section 1c.10. The recommendations in the guidelines published by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America range from A-I to B-II.

1c.13 Method for rating strength of recommendation (*If different from* USPSTF system, *also describe rating and how it relates to USPSTF*):
The Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America used a category/grade system adapted from the Canadian Task Force on the Periodic Health Examination:
Strength of recommendation
A Good evidence to support a recommendation for use
B Moderate evidence to support a recommendation for use
C Poor evidence to support a recommendation
Quality of evidence
I Evidence from 1 properly randomized, controlled trial
II Evidence from 1 well-designed clinical trial, without randomization; from cohort or case-control analytic studies (preferably from >1 center); from multiple time series; or from dramatic results of uncontrolled experiments
III Evidence from opinions of respected authorities, based on clinical experience, descriptive studies, or reports from expert committees.

1c.14 Rationale for using this guideline over others:
All relevant guidelines are cited and are consistent with the use of this measure.

TAP/Workgroup: What are the strengths and weaknesses in relation to the sub-criteria for *Importance to Measure and Report?*	1
Steering Committee: Was the threshold criterion, *Importance to Measure and Report*, met? Rationale:	1 Y☐ N☐

2. SCIENTIFIC ACCEPTABILITY OF MEASURE PROPERTIES

Extent to which the measure, <u>as specified</u>, produces consistent (reliable) and credible (valid) results about the quality of care when implemented. (evaluation criteria)	Eval Rating

2a. MEASURE SPECIFICATIONS

S.1 Do you have a web page where current detailed measure specifications can be obtained?
S.2 If yes, provide web page URL:

2a. Precisely Specified

2a.1 Numerator Statement (*Brief, text description of the numerator - what is being measured about the target population, e.g. target condition, event, or outcome*):
Discharges with central venous catheter related infections

2a.2 Numerator Time Window (*The time period in which cases are eligible for inclusion in the numerator*):
The numerator event occurs during the inpatient stay. The quantity of time can be determined by the user, but it is generally 1-3 years.

2a.3 Numerator Details (*All information required to collect/calculate the numerator, including all codes, logic, and definitions*):
Discharges with central venous catheter related infections, defined by specific ICD-9-CM codes in any secondary diagnosis field among cases meeting the inclusion and exclusion rules for the denominator.
For discharges on or after October 1, 2007, the ICD-9-CM code for infection due to central venous catheters is

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999.31. This code includes infections due to Hickman catheters, peripherally inserted central catheters (PICC), Portacaths (port-a-cath), triple lumen catheters, umbilical venous catheters, and other central venous catheters. This code excludes infection due to arterial catheters, peripheral venous catheters, urinary catheters, peritoneal or hemodialysis catheters, and spinal or ventriculoperitoneal catheters.

For discharges prior to October 1, 2007, the specified ICD-9-CM codes were 999.3 (complications of medical care, other infections) and 996.62 (infection and inflammatory reaction due to vascular device, implant and graft Infection following infusion, injection, transfusion, or vaccination). However, this definition is provided for historical purposes only.

2a.4 Denominator Statement (*Brief, text description of the denominator - target population being measured*):
All surgical and medical discharges among adults, and all obstetric discharges

2a.5 Target population gender: Female, Male
2a.6 Target population age range: 18 years or over (obstetric patients younger than 18 years of age are permitted)

2a.7 Denominator Time Window (*The time period in which cases are eligible for inclusion in the denominator*):
The denominator event occurs during the inpatient stay. The quantity of time can be determined by the user, but it is generally 1-3 years.

2a.8 Denominator Details (*All information required to collect/calculate the denominator - the target population being measured - including all codes, logic, and definitions*):
All surgical and medical discharges, 18 years of age and older, or MDC 14 (pregnancy, childbirth, and puerperium) at any age. Surgical and medical discharges are defined by DRGs (before 10/1/2007) or MS-DRGs (after 10/1/2007), as prescribed by the Center for Medicare & Medicaid Services.
See Patient Safety Indicators Appendices at
http://qualityindicators.ahrq.gov/downloads/psi/specs/PSI%20Appendices.pdf :
      Appendix B – Medical Discharge DRGs
      Appendix C – Medical Discharge MS-DRGs
      Appendix D – Surgical Discharge DRGs
      Appendix E – Surgical Discharge MS-DRGs

2a.9 Denominator Exclusions (*Brief text description of exclusions from the target population*): Exclusions from the target population include cases:
1. with principal diagnosis of infection due to central venous catheter (ICD-9-CM 999.31)
2. with secondary diagnosis of infection due to central venous catheter (ICD-9-CM 999.31) reported as present on admission
3. with length of stay less than 2 days
4. with any ICD-9-CM diagnosis or procedure code for immunocompromised state
5. with any ICD-9-CM diagnosis of cancer

2a.10 Denominator Exclusion Details (*All information required to collect exclusions to the denominator, including all codes, logic, and definitions*):
Diagnosis and procedure codes for "immunocompromised state" are defined in Appendix I, and diagnosis codes for cancer are defined in Appendix H, at
http://qualityindicators.ahrq.gov/downloads/psi/specs/PSI%20Appendices.pdf .

2a.11 Stratification Details/Variables (*All information required to stratify the measure including the stratification variables, all codes, logic, and definitions*):
Not applicable

2a.12-13 Risk Adjustment Type: Other (specify) statistical risk model

2a.14 Risk Adjustment Methodology/Variables (*List risk adjustment variables and describe conceptual*

models, statistical models, or other aspects of model or method):
Version 4.1 risk-adjustment uses generalized estimating equations to adjust for patient and hospitalization characteristics, while accounting for the hierarchical structure of the data (i.e., discharges clustered within hospitals). A binomial logit link function is employed because the outcome is dichotomous and low-frequency. The candidate risk factors include gender, 10-year age categories, gender-age category interactions, hospitalization characteristics such as transfer-in status, AHRQ-defined comorbidities (i.e., all 29 except "coagulation deficiency" and "fluid and electrolyte disorders," which have been found to include some hospital-acquired complications), major diagnostic categories (MDCs), and aggregated Medicare Severity Diagnosis Related Groups (MS-DRGs). MS-DRGs are aggregated across complication/comorbidity (CC) levels (i.e., major CC, any other CC, no CC) because we rely upon AHRQ-defined comorbidities, which are less confounded by hospital-acquired complications, to capture the effects of comorbid illness.

2a.15-17 Detailed risk model available Web page URL or attachment: Attachment submission_PSI07_attach_detail risk model.xlsx

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2a.18-19 Type of Score: rate/proportion
2a.20 Interpretation of Score: better quality = lower score
2a.21 Calculation Algorithm (*Describe the calculation of the measure as a flowchart or series of steps*):
1. Enumerate the denominator at risk, as described above in 2a.8.
2. Apply the denominator exclusions, as described above in 2a.9.
3. Enumerate the numerator events, as described above in 2a.3.
4. Estimate the numerator divided by the denominator, multiplied by 1,000.

2a.22 Describe the method for discriminating performance (*e.g., significance testing*):
Significance testing

2a.23 Sampling (Survey) Methodology *If measure is based on a sample (or survey), provide instructions for obtaining the sample, conducting the survey and guidance on minimum sample size (response rate)*:
The application of this indicator uses inpatient administrative data. All patient discharges are used without sampling.

2a.24 Data Source (*Check the source(s) for which the measure is specified and tested*)
Electronic adminstrative data/claims

2a.25 Data source/data collection instrument (*Identify the specific data source/data collection instrument, e.g. name of database, clinical registry, collection instrument, etc.*):
The user supplies an inpatient electronic claims data set for the calculation of the measures. The measure was developed and tested on the Nationwide Inpatient Sample and the State Inpatient Databases of the AHRQ Healthcare Cost and Utilization Project (HCUP).

2a.26-28 Data source/data collection instrument reference web page URL or attachment: URL http://qualityindicators.ahrq.gov/downloads/psi/psi_sas_documentation_v41.pdf

2a.29-31 Data dictionary/code table web page URL or attachment: URL http://www.hcup-us.ahrq.gov/db/nation/nis/nisdbdocumentation.jsp A description of data elements is at the specified URL; however, only a limited number of these data sets are required for estimation of PSI 7.

2a.32-35 Level of Measurement/Analysis (*Check the level(s) for which the measure is specified and tested*)
Facility/Agency

2a.36-37 Care Settings (*Check the setting(s) for which the measure is specified and tested*)
Hospital

2a.38-41 Clinical Services (*Healthcare services being measured, check all that apply*)
Clinicians: Nurses, Clinicians: Physicians (MD/DO)

TESTING/ANALYSIS

2b. Reliability testing

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2b.1 Data/sample *(description of data/sample and size)*: Reliability testing was conducted on the 1995-1997 Nationwide Inpatient Sample (NIS) and State Inpatient Databases (SID) for 5 large states (CA, FL, IL, NY, PA).

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2b.2 Analytic Method *(type of reliability & rationale, method for testing)*:
The technique used for reliability testing on this indicator is signal extraction. This technique is designed to "clean' or "smooth" the data of noise and extract the actual signal associated with hospital performance. We used two techniques for signal extraction to potentially improve the precision of the indicator. First, univariate methods estimated the "true" quality signal of an indicator based on information from the specific indicator and one year of data. Second, multivariate signal extraction (MSX) methods estimated the signal based on information from multiple years of data. The MSX signal ratio represents the share of observed hospital-level variation, after risk-adjustment, that is statistically attributable to "signal" (versus noise).

2b.3 Testing Results *(reliability statistics, assessment of adequacy in the context of norms for the test conducted)*:
The MSX signal ratio was moderately high at 0.71 (relative to a range among all accepted AHRQ PSIs of 0.09 to 0.94). Similarly, the Spearman rank order correlation coefficient for hospital-specific performance between adjacent years, using SID data from Florida, was 0.613-0.614, which was second highest among all accepted AHRQ PSIs. Very high year-to-year reliability at the national level was also demonstrated in the Organisation for Economic Cooperation and Development (OECD) analysis of data from 14 countries (Spearman r=0.994, p<0.01).

References:
McDonald KM, Romano PS, Geppert J, et al. (2002), "Measures of Patient Safety Based on Hospital Administrative Data: The Patient Safety Indicators", Technical Review Number 5, AHRQ Publication No. 02-0038, http://qualityindicators.ahrq.gov/psi_download.htm .

2c. Validity testing

2c.1 Data/sample *(description of data/sample and size)*: Multiple data sets have been used, as described fully in 2c.3 below.

2c.2 Analytic Method *(type of validity & rationale, method for testing)*:
The validity of this indicator has been evaluated in three ways: face validity, construct validity, and criterion validity. In addition, predictive validity was established through the studies described in 1a.3.

2c.3 Testing Results *(statistical results, assessment of adequacy in the context of norms for the test conducted)*:
The face validity of PSI 7 was established through a nationally representative, multispecialty expert panel, which included two surgeons, two hospitalist physicians, two critical care physicians, one geriatrician, and one general internist (all nominated by national specialty organizations). Through a two-round modified Delphi process, also known as the RAND Appropriateness Method, panelists were asked to rate PSI 7 on a 1-9 scale, based on its overall usefulness, its preventability, the likelihood of medical error, the likelihood that it is documented given that it occurs; and its susceptibility to bias. The median ratings of this indicator were 8 on "usefulness" and 7 on "preventability," with indeterminate agreement on both dimensions, leading to a classification of "acceptable". The median ratings were also 7 on "likelihood that complication is charted" and 3.5 (low) on susceptibility to bias, supporting use of the indicator. Through similar processes, this PSI was endorsed by the Organization for Economic Cooperation and Development's Patient Safety Panel (Millar et al., 2004; McLoughlin et al., 2006), but rejected by the SimPatIE (Safety Improvement for Patients in Europe) project as "not suitable for implementation" due to potential casemix bias (Kristensen et al., 2009). A 47-member Delphi panel convened by RAND rated this indicator "low" in importance, although an otherwise identical indicator based on the Medicare Patient Safety Monitoring System was rated "moderate" in importance and "close to ready for use" (Farley et al., 2008). More generally, the concept of tracking central venous catheter related infections has well-established face validity, as it underlies several other indicators that have been endorsed by expert groups, including Iezzoni et al.'s (1994) "Complications Screening Program," Miller et al.'s (2001) "Patient Safety Indicator Algorithms and Groupings," the American Nurses Association's NDNQI, and the CDC's NHSN. The NDNQI/CDC indicator, "Central line catheter-associated blood stream infection rate for ICU and high-risk nursery patients," has been endorsed by the NQF (#0139), with an

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implementation guide developed by The Joint Commission (2005).

Construct validity was established by demonstrating associations between PSI 7 and other indicators of quality and safety. A correlational study based on the 1997-2002 Nationwide Inpatient Sample labeled PSI 7 as a "canary measure" because it was significantly and consistently associated with at least nine other AHRQ PSIs (including six NQF-endorsed PSIs) at the hospital level (Yao et al., 2009). For both Medicare and Veterans Health Administration patients, this indicator loaded strongly with two other PSIs (iatrogenic pneumothorax and postoperative DVT/PE) on a common factor (Rosen et al., 2009). A previous factor analysis limited to VA data also demonstrated strong shared variance with iatrogenic pneumothorax, foreign body left in, and accidental puncture or laceration, all of which are NQF-endorsed measures (Rosen et al., 2005). PSI 7 was significantly associated with readmission within three months (risk ratio=1.29), but not within one month (risk ratio=1.00), after adjusting for patient characteristics using 2004 surgical data from seven US states (Friedman et al., 2009). Unadjusted data from England confirm the association between PSI 7 and readmission (Bottle and Aylin, 2009). Smoothed rates of this PSI among 2,116 hospitals surveyed by the Joint Commission in 1997-1999 were not associated with summary process evaluation scores (Miller et al., 2005), but a later study of 115 hospitals surveyed in 2002 found a significant association with one patient safety practice subscore on "assessing patient needs" (Thornlow and Merwin, 2009). Rates of PSI 7 were inversely associated with adoption of electronic medical record (EMR) systems among 2,707 hospitals serving Medicare enrollees in 1999-2002, after adjusting for patient risk factors and hospital fixed effects (Parente and McCullough 2009). Two far smaller studies including 66 Georgia hospitals (Culler et al., 2007) and 98 Florida hospitals (Menachemi et al., 2007) generated conflicting results.

The best recent evidence about the criterion validity of this indicator comes from the 47 hospitals participating in the AHRQ PSI Validation Pilot Project (N=191). In this study, 20% of the events flagged by PSI 7 were present at admission, 21% lacked clear documentation of an eligible infection (per CDC/National Healthcare Safety Network definitions), and 4% had an unreported disqualifying condition (i.e., cancer, severe malnutrition, immunodeficiencies), leaving 54% that were confirmed as iatrogenic complications (Zrelak et al., 2009). All of the confirmed events were attributable to a vascular device. AHRQ responded to these findings by recommending use of "present at admission" in the definition of PSI 7, as described above, which would increase the positive predictive value (PPV) from 54% (104/191) to 68% (104/153). AHRQ further changed the numerator definition to focus exclusively on infections due to central venous catheters, excluding infections due to other vascular catheters. This change was operationalized using a new ICD-9-CM code, 999.31, which is specifically limited to such infections (as proposed by the CDC). This coding change, and the resulting CMS decision to eliminate incremental payment for hospital-acquired central line infections through the Inpatient Prospective Payment System, should improve PPV beyond 68%, although validation data based on the new ICD-9-CM code are not yet available. A similar review of medical records of 168 cases from 18 English NHS (National Health Service) trusts found that 6% of the flagged events were present at admission and 12% were miscoded, leaving 79% that were confirmed (Bottle and Aylin 2008). There is more limited evidence on the sensitivity of PSI 7. Some true events may not be ascertained because they occur after hospital discharge; linking 30-day re-admissions in New York increased the overall rate of this PSI from 2.02 to 2.52 per 1 000 eligible discharges; 56% of the post-discharge events were complications of haemodialysis (Gallagher et al., 2005a). One study from 24 US hospitals participating in a patient safety collaborative reported the sensitivity of this PSI as 9% relative to case ascertainment using NHSN protocols (N=89); however, these authors only considered diagnoses listed in the first 9 secondary diagnosis fields (Stone et al., 2007). The default option in AHRQ software is to capture the first 30 diagnoses, although users may set an even higher number if desired.

References:
1. Bottle A, Aylin P (2008), "How NHS trusts could use patient safety indicators to help improve care", HealthCareRiskReport, May 2008, pp. 12-14.
2. Culler SD, Hawley JN, Naylor V, Rask KJ (2007), "Is the availability of hospital IT applications associated with a hospital's risk adjusted incidence rate for Patient Safety Indicators: Results from 66 Georgia hospitals", Journal of Medical Systems, Vol. 31, pp. 319-327.
3. Farley DO, Greenberg MD, Haviland AM, Lovejoy S (2008), "Prioritizing Patient Safety Outcomes Measures: Results of an Expert Consensus Process", prepared for the Agency for Healthcare Research and Quality, http://192.5.14.110/pubs/working_papers/2008/RAND_WR601.pdf .
4. Friedman B, Encinosa W, Jiang HJ, Mutter R (2009), "Do patient safety events increase readmissions?" Medical Care, Vol. 47, No. 5, pp. 583-590.

5. Gallagher B, Cen L, Hannan EL (2005a), "Readmissions for Selected Infections Due to Medical Care: Expanding the definition of a Patient Safety Indicator", In "Advances in Patient Safety: from Research to Implementation", Agency for Health Care Research and Quality 2005.

6. Iezzoni LI, Daley J, Heeren T, Foley SM, Fisher ES, Duncan C, et al. (1994), "Identifying complications of care using administrative data", Medical Care, Vol. 32, No. 7, pp. 700-15.

7. Kristensen S, Mainz J, Bartels P (2009), "Selection of indicators for continuous monitoring of patient safety: recommendations of the project 'Safety Improvement for Patients in Europe", International Journal for Quality in Health Care, Vol. 21, No. 3, pp. 169-175.

8. McLoughlin V, Millar J, Mattke S, Franca M, Jonsson PM, Somekh D, et al. (2006), "Selecting indicators for patient safety at the health systems level in OECD countries", International Journal for Quality in Health Care, Vol. 18, Suppl 1, pp. 14-20.

9. Menachemi N, Saunders C, Chukmaitov A, Matthews MC, Brooks RG (2007), "Hospital adoption of information technologies and improved patient safety: A study of 98 hospitals in Florida", Journal of Healthcare Management, Vol. 52, No. 6, pp. 398-409.

10. Millar J, Mattke S and the members of the OECD Patient Safety Panel (2004), "Selecting Indicators for Patient Safety at the Health Systems Level in OECD Countries", OECD Health Technical Papers, No. 18.

11. Miller M, Elixhauser A, Zhan C, Meyer G (2001), "Patient Safety Indicators: Using administrative data to identify potential patient safety concerns", Health Services Research, Vol. 36, No. 6 Part II, pp. 110-132.

12. Miller MR, Pronovost P, Donithan M, Zeger S, Zhan C, Morlock L, Meyer GS (2005), "Relationship between performance measurement and accreditation: implications for quality of care and patient safety", American Journal of Medical Quality, Vol.20, No.5, pp.239-252.

13. Parente ST, McCullough JS (2009), "Health information technology and patient safety: Evidence from panel data", Health Affairs, Vol. 28, No. 2, pp. 357-360.

14. Rosen AK, Rivard P, Zhao S, Loveland S, Tsilimingras D, Christiansen CL, et al. (2005), "Evaluating the Patient Safety Indicators: How well do they perform on Veterans Health Administration data?" Medical Care, Vol. 43, No. 9, pp. 873-884.

15. Rosen AK, Loveland SA, Romano PS, Itani KMF, Silber JH, Even-Shoshan OO, et al. (2009), "Effects of resident duty hour reform on surgical and procedural Patient Safety Indicators among hospitalized Veterans Health Administration and Medicare patients", Medical Care, Vol. 47, No. 7, pp. 723-731.

16. The Joint Commission (2005), "National Quality Forum (NQF) Endorsed Nursing-Sensitive Care Performance Measures",
http://www.jointcommission.org/PerformanceMeasurement/MeasureReserveLibrary/nqf_nursing.htm

17. Thornlow DK, Merwin E (2009), "Managing to improve quality: The relationship between accreditation standards, safety practices, and patient outcomes", Health Care Management Review, Vol. 34, No. 3, pp. 267-272.

18. Yao H, Greenberg MD, Haviland AM, Farley DO. (2009), "'Canary measures' among the AHRQ Patient Safety Indicators", American Journal of Medical Quality, Vol. 24, No. 6, pp. 465-473.

19. Zrelak PA, Sadeghi B, Utter GH, Baron R, Tancredi DJ, Geppert JJ, Romano PS. (2009), "Positive predictive value of the AHRQ Patient Safety Indicator for Central Line Associated Bloodstream Infection (Selected Infections Due to Medical Care)", under review.

2d. Exclusions Justified

2d.1 Summary of Evidence supporting exclusion(s):
Exclusions were evaluated by a clinical review panel using a structured review process. Panelists reviewed a proposed definition (based on prior work cited in 2c.3) that excluded trauma patients, but the panel agreed unanimously that these patients should be tracked and therefore included in the population at risk. Panelists stated that immunocompromised patients were at a higher risk of developing catheter-related infections (especially in the setting of cancer, given the need for long-term maintenance of central venous access), and that these infections may be less preventable in this population. Therefore, the panel agreed unanimously to exclude immunocompromised patients from the population at risk.

The exclusion of events reported as "present on admission" is based on evidence that a significant minority of cases otherwise flagged by PSI 7 are acquired prior to admission. The "present on admission" percentage was reported as 35% in California, 35% in New York, 40% in the Rochester, Minnesota area, and 56-64% at the University of Michigan (Houchens et al., 2008; Naessens et al., 2007; Bahl et al., 2008). However, hospital-specific rates including infections reported as present on admission were still highly correlated with hospital-specific rates excluding such infections (r=0.91 in California, r=0.88 in New York), especially among coronary

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artery bypass surgery patients (r=0.99 in California)(Glance et al., 2008).

2d.2 Citations for Evidence:
1. Bahl V, Thompson MA, Kau TY, Hu HM, Campbell DA (2008), "Do the AHRQ Patient Safety Indicators flag conditions that are present at the time of hospital admission? " Medical Care, Vol. 46, No. 5, pp. 516-522.
3. Glance LG, Li Y, Osler TM, Mukamel DB, Dick AW (2008), "Impact of date stamping on patient safety measurement in patients undergoing CABG: Experience with the AHRQ Patient Safety Indicators", BMC Health Services Research, Vol. 8, pp. 176.
3. Houchens RL, Elixhauser A, Romano PS (2008), "How often are potential patient safety events present on admission?" Joint Commission Journal on Quality and Patient Safety, Vol. 34, No. 3, pp. 154-163.
4. Naessens JM, Campbell CR, Berg B, Williams AR, Culbertson R (2007), "Impact of diagnosis-timing indicators on measures of safety, comorbidity, and case mix groupings from administrative data sources", Medical Care, Vol. 45, No. 8, pp. 781-788.

2d.3 Data/sample *(description of data/sample and size)*: Sampling not employed given use of a clinical review panel.

2d.4 Analytic Method *(type analysis & rationale)*:
We evaluated the potential exclusions using a structured review process based on the RAND Appropriateness Method (Nominal Group Technique). Unanimous agreement (consensus) was required for all proposed changes to indicator exclusion criteria.

2d.5 Testing Results *(e.g., frequency, variability, sensitivity analyses)*:
The extent of the analyses performed is stated in 2d1.

In regard to the non-present on admission exclusions, the exclusions were identified by a clinical review panel using a structured review process

In regard to the present on admission exclusions, the present on admission percentage was reported as 35% in California, 35% in New York, 40% in the Rochester, Minnesota area, and 56-64% at the University of Michigan (Houchens et al., 2008; Naessens et al., 2007; Bahl et al., 2008). However, hospital-specific rates including infections reported as present on admission were still highly correlated with hospital-specific rates excluding such infections (r=0.91 in California, r=0.88 in New York), especially among coronary artery bypass surgery patients (r=0.99 in California)(Glance et al., 2008).

2e. Risk Adjustment for Outcomes/ Resource Use Measures **2e.1 Data/sample** *(description of data/sample and size)*: The reference population for Version 4.1 risk-adjustment is the combined 2007 State Inpatient Data from all hospitals participating in the Healthcare Cost and Utilization Project; this data set includes 27,369,746 observations for adults. **2e.2 Analytic Method** *(type of risk adjustment, analysis, & rationale)*: Version 4.1 risk-adjustment uses generalized estimating equations to adjust for patient and hospitalization characteristics, while accounting for the hierarchical structure of the data (i.e., discharges clustered within hospitals). A binomial logit link function is employed because the outcome is dichotomous and low-frequency. **2e.3 Testing Results** *(risk model performance metrics)*: The model has an overall c statistic of 0.813, representing the area under a receiver operating characteristic (ROC) curve. **2e.4 If outcome or resource use measure is not risk adjusted, provide rationale**: Not applicable	**2e** C ☐ P ☐ M ☐ N ☐ NA ☐
2f. Identification of Meaningful Differences in Performance **2f.1 Data/sample from Testing or Current Use** *(description of data/sample and size)*: PSI 7 has been	**2f** C ☐ P ☐

operationalized with many administrative data sets, including the Nationwide Inpatient Sample (NIS) and State Inpatient Databases (SID) from AHRQ's HCUP program, the Patient Treatment File from the Department of Veterans' Affairs, Medicare Provider Analysis and Review (MEDPAR) data from the Center for Medicare & Medicaid Services, and hospital discharge data sets from 13 other countries collaborating in the Organization for Economic Cooperation and Development's Health Care Quality Indicators Project (i.e., New Zealand, Spain, Belgium, Germany, Singapore, United Kingdom, Canada, Ireland, Portugal, Switzerland, Denmark, Norway, and Sweden).

2f.2 Methods to identify statistically significant and practically/meaningfully differences in performance *(type of analysis & rationale)*:
Risk-adjusted hospital-specific rates are computed by multiplying the ratio of the number of observed events to the number of expected events by the overall rate in the reference population, which is currently the 2007 Nationwide Inpatient Sample. Recalibration to other populations with different overall rates can be performed, if the user wishes to compare performance within a set of hospitals, instead of comparing the performance of those hospitals to the average in the reference population. Confidence intervals are constructed around each hospital's risk-adjusted rate, which allows users to determine whether that hospital's risk-adjusted rate is significantly lower or higher (at the 95% confidence level) than the value that would be expected under the null hypothesis of equal quality across hospitals (i.e., the national average). Smoothed risk-adjusted rates are also estimated by the AHRQ software, and have been shown to provide better "predictions" of current hospital performance than unsmoothed rates. Smoothed rates are generally recommended for public reporting applications, because they explicitly account for variation in the reliability of estimated rates across hospitals with different volumes.

2f.3 Provide Measure Scores from Testing or Current Use *(description of scores, e.g., distribution by quartile, mean, median, SD, etc.; identification of statistically significant and meaningfully differences in performance)*:
 Meaningful differences in hospital performance can be identified using PSI 7. For example, in a HealthGrades analysis using 2005-2007 MEDPAR data, 242 hospitals recognized with the HealthGrades 2009 Patient Safety Excellence Award had an overall observed/expected ratio of 0.75 (95% confidence interval, 0.73-0.76), whereas the bottom 15% of hospitals had an overall observed/expected ratio of 1.41 (95% confidence interval, 1.39-1.43). This 47% difference in performance translated to an estimated total of 13,878 excess infections at non-award hospitals, leading to 598 estimated excess deaths and $268 million in estimated excess hospital costs. Similarly, Thomson Healthcare identified "100 Top Hospitals" as Performance Improvement Leaders for patient safety; all other hospitals combined had an estimated total excess of 4,207 infections, leading to 253 estimated excess deaths and $89 million in estimated excess hospital costs. Finally, state agencies or coalitions that publicly report performance on PSI 7, including the Florida Agency for Health Care Administration, have been able to identify multiple hospitals with better than expected or worse than expected performance.

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2g. Comparability of Multiple Data Sources/Methods

2g.1 Data/sample *(description of data/sample and size)*: PSI 7 has been operationalized with many administrative data sets, including the Nationwide Inpatient Sample (NIS) and State Inpatient Databases (SID) from AHRQ's HCUP program, the Patient Treatment File from the Department of Veterans' Affairs, Medicare Provider Analysis and Review (MEDPAR) data from the Center for Medicare & Medicaid Services, and hospital discharge data sets from 13 other countries collaborating in the Organization for Economic Cooperation and Development's Health Care Quality Indicators Project (i.e., New Zealand, Spain, Belgium, Germany, Singapore, United Kingdom, Canada, Ireland, Portugal, Switzerland, Denmark, Norway, and Sweden).

2g.2 Analytic Method *(type of analysis & rationale)*:
AHRQ PSI software has been applied to each of these data sets. In some cases, modest changes have been necessary to operationalize PSI 7, such as translating ICD-9-CM codes to ICD-10 (for non-USA data) or re-estimating length of stay based on the difference between the reported dates of admission and discharge.

2g.3 Testing Results *(e.g., correlation statistics, comparison of rankings)*:
Rosen et al. (2005) reported that the crude rate of PSI 7 at VA hospitals in FY 2001 was 2.37 per 1,000 eligible discharges, but this rate decreased to 1.86 after risk-adjustment, compared with a very similar overall rate of 2.01 in the Nationwide Inpatient Sample (which excludes VA hospitals). In the same year, the risk-adjusted rate for Medicare beneficiaries was 2.80 per 1,000 eligible discharges, suggesting that the risk-adjustment

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model in 2000 may not have fully accounted for increased risk among Medicare beneficiaries. More recent data show convergence of risk-adjusted PSI 7 rates between Medicare and HCUP data; reported rates were 2.34 and 2.30 in 2005, 2.19 and 2.19 in 2006, and 2.12 and 2.03 in 2007, respectively (HCUPnet, 2010; HealthGrades, 2009). We are not aware of any studies comparing rates generated for the same hospitals AND the same patients using different data sets. References: 1. HCUPnet (2010), http://hcupnet.ahrq.gov/HCUPnet.jsp . 2. HealthGrades (2009), "HealthGrades Sixth Annual Patient Safety in American Hospitals Study", http://www.healthgrades.com/media/dms/pdf/PatientSafetyinAmericanHospitalsStudy2009.pdf . 3. Rosen AK, Rivard P, Zhao S, Loveland S, Tsilimingras D, Christiansen CL, et al. (2005), "Evaluating the Patient Safety Indicators: How well do they perform on Veterans Health Administration data?" Medical Care, Vol. 43, No. 9, pp. 873-884.	
2h. Disparities in Care **2h.1 If measure is stratified, provide stratified results** *(scores by stratified categories/cohorts)*: Stratification to identify disparities in care is encouraged, but is not intrinsic to the design of the indicator, so it is not mandatory. HCUPnet (2010) offers stratification by age group, gender, median income of patient's zip code, metropolitan location of residence, expected payment source, hospital region, hospital ownership/control, hospital teaching status, metropolitan location of hospital, and bed size of hospital. NHQRDRnet (2010) also offers racial/ethnic substratification, within strata defined by age group, gender, median income of patient's zip code, metropolitan location of residence, expected payment source, hospital region, hospital ownership/control, hospital teaching status, metropolitan location of hospital, and bed size of hospital. Differences across strata are generally statistically significant at the $p<0.01$ level, with a few exceptions. Users may specify additional stratification variables if desired. See 1b.4 for specific findings regarding disparities. References: 1. HCUPnet (2010), http://hcupnet.ahrq.gov/HCUPnet.jsp?Id=C1A585CEA047985F&Form=DispTab&JS=Y&Action=%3E%3ENext%3E%3E&__InDispTab=Yes&_Results=Print&SortOpt= 2. NHQRDRnet (2010), http://nhqrnet.ahrq.gov/nhqdr/jsp/nhqdr.jsp?catId=81021002&msrId=100206&tableTypeId=2&msridRO=100206&tableTypeRO=2&subGrpIdCB=7&PopCatIdCB=4#snhere **2h.2 If disparities have been reported/identified, but measure is not specified to detect disparities, provide follow-up plans:** Not applicable	**2h** C☐ P☐ M☐ N☐ NA ☐
TAP/Workgroup: What are the strengths and weaknesses in relation to the sub-criteria for *Scientific Acceptability of Measure Properties?*	**2**
Steering Committee: Overall, to what extent was the criterion, *Scientific Acceptability of Measure Properties*, met? Rationale:	*2* C☐ P☐ M ☐ N ☐
3. USABILITY	
Extent to which intended audiences (e.g., consumers, purchasers, providers, policy makers) can understand the results of the measure and are likely to find them useful for decision making. (evaluation criteria)	Eval Rati ng
3a. Meaningful, Understandable, and Useful Information **3a.1 Current Use:** in use	**3a** C☐ P☐ M☐

3a.2 Use in a public reporting initiative (disclosure of performance results to the public at large) (*If used in a public reporting initiative, provide name of initiative(s), locations, Web page URL(s). If not publicly reported, state the plans to achieve public reporting within 3 years*): N☐

Office for Oregon Health Policy and Research (see http://www.oregon.gov/OHPPR/HQ/)

Nevada Hospital Association Hospital Performance
http://www.nvhospitalquality.net/

Oklahoma Hospital Report
http://www.ok.gov/health/documents/08%20Hospital%20AR.pdf

Norton Healthcare - a multi-hospital system in Kentucky
http://www.nortonhealthcare.com/about/Our_Performance/index.aspx

Florida Agency for Health Care Administration (see ahca.myflorida.com)

My Health Finder (hospitals in the State of New York) (see http://www.myhealthfinder.com/)

Iowa Healthcare Collaborative (http://www.ihconline.org/iowareport/iowareport.cfm)

3a.3 If used in other programs/initiatives (*If used in quality improvement or other programs/initiatives, name of initiative(s), locations, Web page URL(s). If not used for QI, state the plans to achieve use for QI within 3 years*):

University Healthcare Consortium - An alliance of 103 academic medical centers and 219 of their affiliated hospitals. Reporting the AHRQ QIs to their member hospitals. (see www.uhc.edu. Note: measure results reported to hospitals; not reported on site).

Dallas Fort Worth Hospital Council – Reporting on measure results to over 70 hospitals in Texas (see www.dfwhc.ord. Note: measure results reported to hospitals; not reported on site).

Norton Healthcare - a multi-hospital system in Kentucky (see http://www.nortonhealthcare.com/about/Our_Performance/index.aspx)

Ministry Health Care - a multi-hospital system in Wisconsin (see http://ministryhealth.org/display/router.aspx. Note: measure results reported to hospitals; not reported on site).

Minnesota Hospital Association
http://www.mnhospitals.org/ Note: measure used in quality improvement. Not reported publicly by the association)

Testing of Interpretability   (*Testing that demonstrates the results are understood by the potential users for public reporting and quality improvement*)
3a.4 Data/sample (*description of data/sample and size*): A research team from the School of Public Affairs, Baruch College, under contracts with the Department of Public Health, Weill Medical College and Battelle, Inc., developed Hospital Quality Model Reports at the request of AHRQ. These reports are designed specifically to report comparative information on hospital performance based on the AHRQ Quality Indicators, including PSI 7. Their development was informed by:
1. Extensive search and analysis of the literature on hospital quality measurement and reporting, as well as public reporting on health care quality more broadly;
2. Interviews with quality measurement and reporting experts, purchasers, staff of purchasing coalitions, and executives of integrated health care delivery systems who are responsible for quality in their facilities;
3. Two focus groups with chief medical officers of hospitals and/or systems and two focus groups with quality managers from a broad mix of hospitals;
4. Four focus groups with members of the public who had recently experienced a hospital admission; and
5. Four rounds of cognitive interviews (N=62) to test draft versions of the Model Reports with members of the

Rating: C=Completely; P=Partially; M=Minimally; N=Not at all; NA=Not applicable

public with recent hospital experience and basic computer literacy, but widely varying levels of education.

3a.5 Methods *(e.g., focus group, survey, QI project)*:
Methods included literature summary, interviews with quality measurement and reporting experts, focus groups and cognitive interviews.

3a.6 Results *(qualitative and/or quantitative results and conclusions)*:
The Model Report, developed using the five-step process described in 3a.4, is available at
http://qualityindicators.ahrq.gov/downloads/technical/QILI_ModelReports_DRAFTHealthTopics.doc
And supporting documentation is available at
http://qualityindicators.ahrq.gov/downloads/technical/QILI_ModelReports_DRAFTGuidance.doc

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3b/3c. Relation to other NQF-endorsed measures

3b.1 NQF # and Title of similar or related measures:
NQF #: 0139, Title: Central line catheter-associated blood stream infection rate for ICU and high-risk nursery (HRN) patients, Status: Endorsed on: JAN 01, 2004, Steward(s): Centers for Disease Control and Prevention

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(for NQF staff use) Notes on similar/related endorsed or submitted measures:

3b. Harmonization
If this measure is related to measure(s) already endorsed by NQF (e.g., same topic, but different target population/setting/data source or different topic but same target population):
3b.2 Are the measure specifications harmonized? If not, why?
Harmonization is not possible because NQF #0139 is based on hospital participation in the National Healthcare Safety Network (NHSN), the National Database of Nursing Quality Indicators (NDNQI), the Collaborative Alliance for Nursing Quality (CALNOC), or a similar program of hospital-based active surveillance. The denominator for #0139 is based on prospective daily monitoring of "the number of patients with one or more central lines of any type," stratified by care setting (i.e., type of intensive care unit). The numerator definition for #0139 is based on specific clinical criteria for "laboratory-confirmed bloodstream infection" and "clinical sepsis," which cannot be replicated using ICD-9-CM codes.

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3c. Distinctive or Additive Value
3c.1 Describe the distinctive, improved, or additive value this measure provides to existing NQF-endorsed measures:
The NHSN, NDNQI, CALNOC, and similar programs are voluntary programs that are designed for regional or national surveillance and local quality improvement; hospital-specific results are not released to the public or to other stakeholders. Some states now require hospital reporting of central venous catheter associated bloodstream infections to state public health authorities, using the NQF #0139 definition, and plan to make these data publicly available. However, these programs are still in very early stages of development, and the majority of consumers and other stakeholders in the USA do not have access to usable data about hospital-specific rates of this complication.

5.1 Competing Measures If this measure is similar to measure(s) already endorsed by NQF (i.e., on the same topic and the same target population), describe why it is a more valid or efficient way to measure quality:
This measure complements NQF #0139 in two ways:
1.   It covers all inpatient units in acute care hospitals, not just intensive care units. The cost of extending NQF #0139 to all inpatient units would be prohibitive for many hospitals, given the need for trained infection control professionals to collect the data, yet about 57% of nosocomial bloodstream infections are believed to occur outside of intensive care units and nurseries (Klevens et al., 2007). It is unknown how many infections due to central venous catheters occur outside of intensive care units and nurseries, but it is likely to be at least 25% of the total.
2.   The denominator is based on all adult medical, surgical, and obstetric patients, not just patient days with central venous catheters in place. As a result, rates of PSI 7 can be reduced either by reducing the number of days with central venous catheters (i.e., patient days at risk among eligible patients) or by inserting and maintaining such catheters more carefully. This feature is consistent with the Institute for Healthcare Improvement's "central line bundle" and other efforts to emphasize removing central lines as soon as they are no longer necessary for patient care. Although CDC epidemiologists have argued that the

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number of central line-days is a potential confounder of inter-facility differences in the number of central line associated infections (Tokars et al., 2007), it may also be argued that central line-days are in the causal pathway between patient characteristics and central line associated infections, and therefore do not meet the formal definition of a confounder (Porta, 2008). Focusing exclusively on reducing the number of infections per central-line day overlooks the potential for reducing the HAI burden by using lines more judiciously or removing them more quickly. References: 1. Klevens RM, Edwards JR, Richards CL Jr, Horan TC, Gaynes RP, Pollock DA, et al. (2007). "Estimating health care-associated infections and deaths in US hospitals, 2002." Public Health Reports, Vol. 122, No. 2, pp. 160-166. 2. Porta M (2008), "A Dictionary of Epidemiology, Fifth Edition." New York: Oxford University Press. 3. Tokars JI, Klevens RM, Edwards JR, Horan TC (2007), "Measurement of the impact of risk adjustment for central line-days on interpretation of central line-associated bloodstream infection rates", Infection Control and Hospital Epidemiology, Vol. 28, No. 9, pp. 1025-1029.	
TAP/Workgroup: What are the strengths and weaknesses in relation to the sub-criteria for *Usability?*	3
Steering Committee: Overall, to what extent was the criterion, *Usability***, met?** **Rationale:**	3 C☐ P☐ M☐ N☐
4. FEASIBILITY	
Extent to which the required data are readily available, retrievable without undue burden, and can be implemented for performance measurement. (evaluation criteria)	*Eval Rating*
4a. Data Generated as a Byproduct of Care Processes **4a.1-2 How are the data elements that are needed to compute measure scores generated?** coding/abstraction performed by someone other than person obtaining original information,	4a C☐ P☐ M☐ N☐
4b. Electronic Sources **4b.1 Are all the data elements available electronically?** (*elements that are needed to compute measure scores are in defined, computer-readable fields, e.g., electronic health record, electronic claims*) Yes **4b.2 If not, specify the near-term path to achieve electronic capture by most providers.**	4b C☐ P☐ M☐ N☐
4c. Exclusions **4c.1 Do the specified exclusions require additional data sources beyond what is required for the numerator and denominator specifications?** No **4c.2 If yes, provide justification.**	4c C☐ P☐ M☐ N☐ NA ☐
4d. Susceptibility to Inaccuracies, Errors, or Unintended Consequences **4d.1 Identify susceptibility to inaccuracies, errors, or unintended consequences of the measure and describe how these potential problems could be audited. If audited, provide results.** Some concerns were raised by the expert panelists who originally rated this indicator for AHRQ (see http://qualityindicators.ahrq.gov/downloads/technical/psi_technical_review.zip). Panelists noted that while many or most of these infections are preventable, even with the best of care, there is a normal underlying rate of these infections. Panelists also expressed concern over the documentation of this	4d C☐ P☐ M☐ N☐

complication by physicians. Panelists noted that documentation of these infections is likely to be varied, and to reflect differences in how clinically minor infections are documented. Despite the potential of bias due to charting or under-reporting, panelists generally felt that these complications were important to track. Finally, as with other indicators tracking infections, concern regarding the potential overuse of prophylactic antibiotics remains.	
4e. Data Collection Strategy/Implementation **4e.1** Describe what you have learned/modified as a result of testing and/or operational use of the measure regarding data collection, availability of data/missing data, timing/frequency of data collection, patient confidentiality, time/cost of data collection, other feasibility/ implementation issues: This measure has been in use since 2003, and AHRQ operates a user support system for users to submit concerns and suggestions related to all of its measures. The issues involved in data collection for this measure are standard for all measures based on administrative data. No particular feasibility or implementation issues have arisen for this measure. **4e.2** Costs to implement the measure (*costs of data collection, fees associated with proprietary measures*): The cost of implementation is minimal, and software to compute the measure is provided at no charge by AHRQ (see http://www.qualityindicators.ahrq.gov/software.htm). Other resources available at no cost to users include a User Guide with detailed Technical Specifications, Software Documentation, a Technical Review to provide supporting background information, an up-to-date change log, an annual user conference (now combined with the AHRQ Annual Conference), periodic newsletters and e-mail blasts, periodic webinars, and an e-mail support line. **4e.3** Evidence for costs: Not applicable. **4e.4** Business case documentation: The business case for use of this indicator has been established through several carefully designed studies demonstrating up to $38,700 in excess hospital charges, and up to $33,118 in excess hospital costs, attributable to the average case of PSI 7 (see 1a.3 above). These amounts represent estimates of the "business case" for preventing one event, for the average hospital payer.	4e C☐ P☐ M☐ N☐
TAP/Workgroup: What are the strengths and weaknesses in relation to the sub-criteria for *Feasibility?*	4
Steering Committee: Overall, to what extent was the criterion, *Feasibility*, met? Rationale:	4 C☐ P☐ M☐ N☐
RECOMMENDATION	
(for NQF staff use) Check if measure is untested and only eligible for time-limited endorsement.	Time-limited ☐
Steering Committee: Do you recommend for endorsement? Comments:	Y☐ N☐ A☐
CONTACT INFORMATION	
Co.1 Measure Steward (Intellectual Property Owner) **Co.1** <u>Organization</u> Agency for Healthcare Research and Quality	540 Gaither Road	Rockville	Maryland	20850 **Co.2** <u>Point of Contact</u> John	Bott, MSSW, MBA	john.bott@ahrq.hhs.gov	301-427-1317	

Measure Developer If different from Measure Steward
Co.3 Organization
Agency for Healthcare Research and Quality | 540 Gaither Road | Rockville | Maryland | 20850

Co.4 Point of Contact
John | Bott, MSSW, MBA | john.bott@ahrq.hhs.gov | 301-427-1317

Co.5 Submitter If different from Measure Steward POC
John | Bott, MSSW, MBA | john.bott@ahrq.hhs.gov | 301-427-1317- |Agency for Healthcare Research and Quality

Co.6 Additional organizations that sponsored/participated in measure development
Battelle Memorial Institute
UC Davis
Stanford University

ADDITIONAL INFORMATION

Workgroup/Expert Panel involved in measure development
Ad.1 Provide a list of sponsoring organizations and workgroup/panel members' names and organizations.
Describe the members' role in measure development.

Desmond Birkett, MD, Surgeon
Burlington, MA
Department of General Surgery, Lahey Clinic
Nominated by the American College of Surgeons

Eric A. Coleman, MD, MPH, Geriatrician
Denver, CO
University of Colorado Health Science Center
Nominated by the American Geriatric Society

John Crabtree, MD, Surgeon
Bellflower, CA
Kaiser Permanente Bellflower Medical Center
Nominated by the American College of Surgeons

Kathleen Ellstrom, MS, PhD, Critical care nurse
Grand Terrace, CA
Kaiser Foundation Hospital – Riverside
Nominated by the American Association of Critical-Care Nurses

Sunil Kripalani, MD, MSc, Hospitalist
Atlanta, GA
Emory University School of Medicine
Nominated by the National Association of Inpatient Physicians

Peter Lindenauer MD, MSc, Hospitalist
Springfield, MA
Baystate Medical Center, Division of Healthcare Quality
Tufts University School of Medicine
Nominated by the National Association of Inpatient Physicians

Jim Webster, MD, MS, Internist
Chicago, IL
Northwestern University Medical School
Nominated by the American College of Physicians

We conducted a structured panel review using a Modified Delphi Method (Nominal Group). Users rated the indicators on issues of face validity, reliability, coding accuracy, bias, and overall usefulness.

Ad.2 If adapted, provide name of original measure: NA

Ad.3-5 If adapted, provide original specifications URL or attachment
Measure Developer/Steward Updates and Ongoing Maintenance **Ad.6** Year the measure was first released: 2003 **Ad.7** Month and Year of most recent revision: 2010-01 **Ad.8** What is your frequency for review/update of this measure? annual **Ad.9** When is the next scheduled review/update for this measure? 2011-01
Ad.10 Copyright statement/disclaimers: The AHRQ QI software is publicly available. We have no copyright disclaimers.
Ad.11 -13 Additional Information web page URL or attachment:
Date of Submission (*MM/DD/YY*): 04/07/2010

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Category	Range Start	End
Intercept	1	-10.4463	0.1654	3989.7064	<.0001			
XCV1	1	5.1532	0.2581	398.7902	<.0001	MDRG	101	
XCV2	1	4.6728	0.2615	319.4171	<.0001	MDRG	102	
XCV3	1	3.3145	0.2633	158.4833	<.0001	MDRG	103	
XCV4	1	3.2657	0.2021	261.0351	<.0001	MDRG	114	
XCV5	1	3.8285	0.2801	186.8707	<.0001	MDRG	118	
XCV6	1	3.1494	0.2683	137.8021	<.0001	MDRG	128	
XCV7	1	3.6467	0.274	177.1331	<.0001	MDRG	401	
XCV8	1	3.9214	0.2283	295.1126	<.0001	MDRG	402	
XCV9	1	3.5074	0.1933	329.384	<.0001	MDRG	404	
XCV10	1	3.3731	0.2279	219.0443	<.0001	MDRG	408	
XCV11	1	1.8462	0.321	33.0818	<.0001	MDRG	409	
XCV12	1	1.9204	0.2643	52.8068	<.0001	MDRG	410	
XCV13	1	4.2798	0.1576	737.6734	<.0001	MDRG	416	
XCV14	1	2.5564	0.2801	83.267	<.0001	MDRG	502	
XCV15	1	4.3071	0.1838	549.1194	<.0001	MDRG	503	
XCV16	1	3.3381	0.2553	170.9047	<.0001	MDRG	504	
XCV17	1	3.3357	0.1985	282.3069	<.0001	MDRG	507	
XCV18	1	4.148	0.1959	448.5088	<.0001	MDRG	508	
XCV19	1	3.7197	0.2945	159.5703	<.0001	MDRG	509	
XCV20	1	2.0837	0.2742	57.735	<.0001	MDRG	511	
XCV21	1	3.0476	0.2472	151.9819	<.0001	MDRG	514	
XCV22	1	2.9646	0.2255	172.8573	<.0001	MDRG	520	
XCV23	1	2.0252	0.2634	59.0974	<.0001	MDRG	522	
XCV24	1	2.9198	0.189	238.6412	<.0001	MDRG	524	
XCV25	1	2.883	0.2471	136.129	<.0001	MDRG	531	
XCV26	1	4.9055	0.1844	707.4048	<.0001	MDRG	601	
XCV27	1	4.692	0.1552	914.4856	<.0001	MDRG	602	
XCV28	1	4.2451	0.2104	406.9654	<.0001	MDRG	604	
XCV29	1	3.8936	0.3018	166.4616	<.0001	MDRG	611	
XCV30	1	3.607	0.2442	218.1001	<.0001	MDRG	613	
XCV31	1	2.4577	0.2057	142.7984	<.0001	MDRG	615	
XCV32	1	3.6754	0.2298	255.8326	<.0001	MDRG	619	
XCV33	1	2.6784	0.2036	173.1243	<.0001	MDRG	620	
XCV34	1	3.396	0.2122	256.2106	<.0001	MDRG	621	
XCV35	1	5.0106	0.2428	425.8933	<.0001	MDRG	701	
XCV36	1	1.8419	0.2929	39.5476	<.0001	MDRG	705	
XCV37	1	3.0222	0.2736	121.9942	<.0001	MDRG	708	
XCV38	1	4.2535	0.1841	534.0397	<.0001	MDRG	710	
XCV39	1	3.3038	0.2862	133.2293	<.0001	MDRG	711	
XCV40	1	4.0442	0.255	251.5953	<.0001	MDRG	805	
XCV41	1	1.136	0.2632	18.6294	<.0001	MDRG	807	
XCV42	1	4.5564	0.2554	318.247	<.0001	MDRG	832	
XCV43	1	2.8557	0.3327	73.6791	<.0001	MDRG	901	

XCV44	1	2.4112	0.2403	100.6869	<.0001	MDRG	910
XCV45	1	2.8668	0.274	109.4293	<.0001	MDRG	1007
XCV46	1	3.0013	0.2513	142.6061	<.0001	MDRG	1008
XCV47	1	4.3478	0.2885	227.0921	<.0001	MDRG	1109
XCV48	1	3.5064	0.1863	354.0585	<.0001	MDRG	1110
XCV49	1	2.7751	0.2326	142.3481	<.0001	MDRG	1113
XCV50	1	4.2038	0.1744	580.7689	<.0001	MDRG	1604
XCV51	1	4.6935	0.1723	741.931	<.0001	MDRG	1801
XCV52	1	3.7109	0.2739	183.5789	<.0001	MDRG	1802
XCV53	1	4.5186	0.1873	582.0616	<.0001	MDRG	1807
XCV54	1	3.7623	0.1623	537.3715	<.0001	MDRG	1808
XCV55	1	2.3717	0.2932	65.4512	<.0001	MDRG	2019
XCV56	1	3.8229	0.2682	203.1643	<.0001	MDRG	2104
XCV57	1	2.7286	0.3028	81.2101	<.0001	MDRG	2107
XCV58	1	1.8405	0.2244	67.2562	<.0001	MDRG	2302
XCV59	1	4.6819	0.2227	441.944	<.0001	MDRG	2408
XCV60	1	4.0497	0.1518	711.5581	<.0001	MDC	1
XCV61	1	4.2996	0.1555	764.3386	<.0001	MDC	4
XCV62	1	3.4719	0.1541	507.317	<.0001	MDC	5
XCV63	1	3.2956	0.1695	378.2045	<.0001	MDC	6
XCV64	1	3.7659	0.1943	375.8012	<.0001	MDC	7
XCV65	1	2.4587	0.1607	234.2335	<.0001	MDC	8
XCV66	1	3.2864	0.2091	246.9937	<.0001	MDC	9
XCV67	1	3.0244	0.2187	191.302	<.0001	MDC	10
XCV68	1	2.7886	0.2268	151.1395	<.0001	MDC	11
XCV69	1	0.7036	0.3449	4.1629	0.0413	MDC	13
XCV70	1	3.9804	0.2436	266.9287	<.0001	MDC	16
XCV71	1	4.7615	0.1675	807.916	<.0001	MDC	18
XCV72	1	3.897	0.2089	348.1609	<.0001	MDC	21
XCV73	1	5.0269	0.2331	465.0427	<.0001	MDC	22
XCV74	1	2.9876	0.2875	107.9883	<.0001	MDC	23
XCV75	1	4.0233	0.2586	241.9673	<.0001	MDC	24
XCV76	1	0.9619	0.0544	313.1084	<.0001	TRNSFER	
XCV77	1	0.9147	0.0949	92.8943	<.0001	NOPOUB04	
XCV78	1	-2.1745	0.0727	893.8078	<.0001	NOPRDAY	
XCV79	1	0.3377	0.0509	43.9705	<.0001	COMORB	CHF
XCV80	1	0.2605	0.0669	15.1509	<.0001	COMORB	VALVE
XCV81	1	-0.3505	0.0349	100.7696	<.0001	COMORB	HTN_C
XCV82	1	0.6532	0.0655	99.3123	<.0001	COMORB	PARA
XCV83	1	0.3139	0.0539	33.9697	<.0001	COMORB	NEURO
XCV84	1	0.1411	0.0404	12.2049	0.0005	COMORB	CHRNLUNG
XCV85	1	0.3123	0.0538	33.6904	<.0001	COMORB	RENLFAIL
XCV86	1	0.1626	0.0846	3.6971	0.0545	COMORB	LIVER
XCV87	1	0.1816	0.0963	3.5572	0.0593	COMORB	ARTH
XCV88	1	0.2789	0.0544	26.2642	<.0001	COMORB	OBESE
XCV89	1	0.822	0.059	193.9338	<.0001	COMORB	WGHTLOSS
XCV90	1	0.4903	0.1021	23.0349	<.0001	COMORB	BLDLOSS

| XCV91 | 1 | 0.3453 | 0.041 | 71.053 | <.0001 | | COMORB | ANEMDEF |
| XCV92 | 1 | 0.4499 | 0.0757 | 35.2967 | <.0001 | | COMORB | DRUG |

| | c | 0.813 |