

# 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 **yellow highlighted** 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 **pink** 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-005-10	NQF Project: Patient Safety Measures
<b>MEASURE DESCRIPTIVE INFORMATION</b>	
De.1 Measure Title: <a href="#">Central Venous Catheter-related Bloodstream Infections (pediatric)</a>	
De.2 Brief description of measure: <a href="#">Number of central venous catheter-related bloodstream infections per 1,000 discharges in cases under age 18 years</a>	
1.1-2 Type of Measure: <a href="#">outcome</a>	
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 "Pediatric Patient Safety for Selected Indicators Composite" ( <a href="http://qualityindicators.ahrq.gov/downloads/pdi/AHRQ_PDI_Workgroup_Final.pdf">http://qualityindicators.ahrq.gov/downloads/pdi/AHRQ_PDI_Workgroup_Final.pdf</a> ). This composite measure was endorsed by NQF (#0532) 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 pediatric 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 project." PDI 12 was determined to meet the latter standard, and was therefore included in the NQF-endorsed composite.	
De.4 National Priority Partners Priority Area: <a href="#">safety</a>	
De.5 IOM Quality Domain: <a href="#">safety</a>	
De.6 Consumer Care Need: <a href="#">Getting Better</a>	

CONDITIONS FOR CONSIDERATION BY NQF	
Four conditions must be met before proposed measures may be considered and evaluated for suitability as voluntary consensus standards:	<b>NQF Staff</b>
A. The measure is in the public domain or an intellectual property ( <a href="#">measure steward agreement</a> ) is signed. <i>Public domain only applies to governmental organizations. All non-government organizations must sign a</i>	A Y <input type="checkbox"/> N <input type="checkbox"/>

<p><i>measure steward agreement even if measures are made publicly and freely available.</i></p> <p><b>A.1</b> 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)? <b>Yes</b></p> <p><b>A.2</b> Indicate if Proprietary Measure (as defined in measure steward agreement):</p> <p><b>A.3</b> Measure Steward Agreement: <b>government entity- public domain- No Agreement</b></p> <p><b>A.4</b> Measure Steward Agreement attached:</p>	
<p><b>B.</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. <b>Yes, information provided in contact section</b></p>	<p><b>B</b></p> <p>Y <input type="checkbox"/></p> <p>N <input type="checkbox"/></p>
<p><b>C.</b> The intended use of the measure includes <u>both</u> public reporting <u>and</u> quality improvement.</p> <p>► <b>Purpose:</b> <b>public reporting, quality improvement 0,0,0,</b></p>	<p><b>C</b></p> <p>Y <input type="checkbox"/></p> <p>N <input type="checkbox"/></p>
<p><b>D.</b> 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.</p> <p><b>D.1</b> Testing: <b>Yes, fully developed and tested</b></p> <p><b>D.2</b> Have NQF-endorsed measures been reviewed to identify if there are similar or related measures? <b>Yes</b></p>	<p><b>D</b></p> <p>Y <input type="checkbox"/></p> <p>N <input type="checkbox"/></p>
<p><b>(for NQF staff use)</b> Have all conditions for consideration been met?</p> <p>Staff Notes to Steward (<i>if submission returned</i>):</p>	<p>Met</p> <p>Y <input type="checkbox"/></p> <p>N <input type="checkbox"/></p>
<p>Staff Notes to Reviewers (<i>issues or questions regarding any criteria</i>):</p>	
<p>Staff Reviewer Name(s):</p>	

<p>TAP/Workgroup Reviewer Name:</p>	
<p>Steering Committee Reviewer Name:</p>	
<p>1. IMPORTANCE TO MEASURE AND REPORT</p>	
<p>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.</p> <p><i>Measures must be judged to be important to measure and report in order to be evaluated against the remaining criteria. (evaluation criteria)</i></p> <p><b>1a. High Impact</b></p>	<p><a href="#">Eval</a></p> <p><a href="#">Rati</a></p> <p><a href="#">ng</a></p>
<p><b>(for NQF staff use)</b> <u>Specific NPP goal</u>:</p>	
<p><b>1a.1</b> Demonstrated High Impact Aspect of Healthcare: <b>affects large numbers, high resource use, patient/societal consequences of poor quality</b></p> <p><b>1a.2</b></p> <p><b>1a.3</b> Summary of Evidence of High Impact: <b>This outcome affects a large number of patients and is associated with high resource use and other consequences. 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 (CDC, 2000; Scott, 2009), and about 28% of nosocomial infections in pediatric intensive care units (Richards et al., 1999). About 14,797 healthcare-associated bloodstream infections occurred in high-risk nurseries alone in 2002 (Klevens et al., 2007). The overall rate of this indicator, as defined by AHRQ, was 1.77 per 1,000 eligible discharges in 2007 (HCUPnet, 2010), with approximately 6,960 numerator events reported in 2003, the most recent year for which this figure is available. In other words, approximately 9.3% of the infections flagged by either PSI 7 (the adult version of the measure) or PDI 12 (the pediatric version of the measure) are captured by PDI 12.</b></p>	<p><b>1a</b></p> <p>C <input type="checkbox"/></p> <p>P <input type="checkbox"/></p> <p>M <input type="checkbox"/></p> <p>N <input type="checkbox"/></p>

In a study involving 38 freestanding, academic, not-for-profit, tertiary care pediatric hospitals in the USA that participated in the Pediatric Health Information System database in 2006, each case flagged by PDI 12 was matched with up to three control subjects from the same hospital with the same APR-DRG severity level and age group, and similar propensity scores (based on primary payer, gender, disposition, and race). The average PDI 12 event was associated with 22.4 excess hospital days and excess total hospital charges of over \$174,000 (Kronman et al., 2008). These impact estimates are substantially greater than those based on clinical data from single centers (\$39,219 by Elward et al., 2005; \$46,133 by Slonim et al., 2001), and also greater than those reported for the adult version of this indicator, PSI 7 (i.e., 9.6 excess hospital days and \$38,700 in excess hospital charges from the Nationwide Inpatient Sample [Zhan and Miller, 2003], 4.5-9.5 excess hospital days and \$7,292-\$13,816 in excess hospital costs from the Department of Veterans Affairs [Rivard et al., 2008], 16.1 excess hospital days and \$33,118 in excess hospital costs after excluding infections that were present on admission [Foster et al., 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. Elward AM, Hollenbeak C, Warren DK, Fraser VJ (2005), "Attributable cost of nosocomial primary bloodstream infection in pediatric intensive care unit patients", Pediatrics, Vol. 115, No. 4, pp. 868-872.
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. Kronman MP, Hall M, Slonim AD, Shah SS (2008), "Charges and lengths of stay attributable to adverse patient-care events using pediatric-specific quality indicators: A multicenter study of freestanding children's hospitals", Pediatrics, Vol. 121, No. 6, pp. e1653-e1659.
7. Rivard PE, Luther SL, Christiansen CL, Shibe 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.
8. 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](http://www.cdc.gov/ncidod/dhqp/pdf/Scott_CostPaper.pdf).
9. Slonim AD, Kurtines HC, Sprague BM, Singh N (2001), "The costs associated with nosocomial bloodstream infections in the pediatric intensive care unit", Pediatric Critical Care Medicine, Vol. 2, pp. 170-174.
10. 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 in adult intensive care patients can be dramatically reduced by focused efforts to improve adherence with evidence-based guidelines (Berenholtz et al., 2004; Institute for Healthcare Improvement, 2009; Mermel, 2000; CDC, 2005; Yokoe et al., 2008). In the most noteworthy 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

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evidence-based procedures recommended by the CDC: hand washing, using full-barrier precautions during insertion of central venous catheters, cleaning the skin with chlorhexidine, 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, and 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). Further reductions may be difficult to achieve without technological innovation, such as chlorhexidine-impregnated sponges at the insertion site (Timsit, 2009).

Investigators affiliated with the National Association of Children's Hospitals and Related Institutions (NACHRI) just reported the results of a similar collaborative involving 29 pediatric intensive care units at 27 hospitals nationwide (Miller et al., 2010). The overall mean rate of central venous catheter related bloodstream infection decreased by 43%, from 5.4 per 1,000 catheter-days at baseline to 3.1 in the "steady-state stable-effect period," from 3 to 12 months after implementation. After adjusting for region and PICU demographics, the only significant predictor of the decrease in the infection rate was compliance with the "maintenance bundle," which includes assessing daily whether the catheter is needed, avoiding iodine ointment at the site, scrubbing with chlorhexidine followed by air drying for dressing changes, changing dressings every 2 days (gauze) or 7 days (clear) unless soiled, replacing tubing used to administer blood products or lipids within 24 hours, and replacing other administration sets and caps no more often than every 72 hours (risk ratio 0.41, 95% confidence interval 0.20-0.85).

Overall national performance on PDI 12 has shown significant improvement. The risk-adjusted national rate peaked at 2.83 per 1,000 eligible discharges in 2001, and then fell to 2.43 in 2006 and 1.77 in 2007 (HCUPnet, 2010). The drop in 2007 may be partially attributable to the introduction of a more specific code for infections due to central venous catheters (999.31) in October 2007. Hospitals in the Midwest report lower rates than hospitals in other regions (1.44 versus 1.72-2.27 per 1,000 eligible discharges, respectively). Larger hospitals and teaching hospitals consistently have higher rates of PDI 12 than smaller hospitals and non-teaching hospitals, respectively (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. Institute for Healthcare Improvement (2009), "Implement the Central Line Bundle", <http://www.ihc.org/IHI/Topics/CriticalCare/IntensiveCare/Changes/ImplementtheCentralLineBundle.htm>
5. Mermel LA (2000), "Prevention of intravascular catheter-related infections", *Annals of Internal Medicine*, Vol. 132, No. 5, pp. 391-402.
6. Miller MR, Griswold M, Harris JM II, Yenokyan G, Huskins WC, Moss M, et al. (2010), "Decreasing PICU catheter-associated bloodstream infections: NACHRI's quality transformation efforts", *Pediatrics*, Vol. 125, No. 2, pp. 206-213.
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 al. (2010), "Sustaining reductions in catheter related bloodstream infections in Michigan intensive care units: observational study", *BMJ*, Vol. 340, pp. C309.
9. Timsit JF, Schwebel C, Bouadma L, Geffroy A, Garrouste-Orgeas M, Pease S, et al. (2009), "Chlorhexidine-impregnated sponges and less frequent dressing changes for prevention of catheter-related infections in critically ill adults: A randomized controlled trial", *JAMA*, Vol. 301, No. 12, pp. 1231-1241.
10. 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 PDI 12, based on the 2007 Nationwide Inpatient Sample, were 1.96 per 1,000 eligible Medicaid discharges versus 1.61 per 1,000 eligible privately insured discharges (representing a risk ratio of 1.21 [p<0.001] for Medicaid relative to private insurance). Comparable national rates were 2.11 per 1,000 non-Hispanic blacks, 2.23 per 1,000 Hispanics, and 1.89 per 1,000 non-Hispanic whites, representing a risk ratio of 1.18 [p<0.05] for Hispanics relative to non-Hispanic whites.

**1b.5 Citations for data on Disparities:**

1. HCUPnet (2010), <http://hcupnet.ahrq.gov/HCUPnet.jsp> .
2. NHQRDRnet (2010), <http://nhqrnet.ahrq.gov/nhqrdr/jsp/nhqrdr.jsp> .

**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. Most of this literature is based on adults, but the work cited in section 1b.2 (Miller et al., 2010) suggests that safer catheter maintenance practices are likely to have a significant - but relatively smaller - beneficial impact on children.

**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

**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]

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**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, updating earlier guidelines that were published by the Hospital Infection Control Practices Advisory Committee of the Centers for Disease Control and Prevention (O'Grady et al., 2002), including a tailored pediatric/neonatal version (Garland et al., 2002).

**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)(Hamilton and Foxcroft, 2007)
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](http://www.cdc.gov/nhsn/PDFs/pscManual/5psc_CLIPcurrent.pdf)).

- 1c.10 Clinical Practice Guideline Citation:**
1. Ducei 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.ihl.org/IHI/Topics/CriticalCare/IntensiveCare/Changes/ImplementtheCentralLineBundle.htm> .
  3. Garland JS, Henrickson K, Maki DG. The 2002 Hospital Infection Control Practices Advisory Committee Centers for Disease Control and Prevention Guideline for Prevention of Intravascular Device-Related Infection", *Pediatrics*, Vol. 110, No. 5, pp. 1009-1013.
  4. Hamilton HC, Foxcroft D (2007), "Central venous access sites for the prevention of venous thrombosis, stenosis and infection in patients requiring long-term intravenous therapy", *Cochrane Database of Systematic Reviews*, 2007 Issue 3, Art. No. CD004084.
  5. 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
  6. National Quality Forum (2009), "Safe Practices for Better Healthcare-2009 Update: A Consensus Report", Washington, DC: NQF.
  7. 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: The Hospital Infection Control Practices Advisory Committee," *Pediatrics*, Vol. 110, No. 5, pp. e51.
  8. 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/> .
  9. The Joint Commission (2010), "2010 National Patient Safety Goals", available at: <http://www.jointcommission.org/patientsafety/nationalpatientsafetygoals> .



<p><b>1c.11 National Guideline Clearinghouse or other URL:</b> See 1c.10 above.</p> <p><b>1c.12 Rating of strength of recommendation</b> (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.</p> <p><b>1c.13 Method for rating strength of recommendation</b> (If different from <a href="#">USPSTF system</a>, 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 &gt;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.</p> <p><b>1c.14 Rationale for using this guideline over others:</b>          All relevant guidelines are cited and are consistent with the use of PDI 12.</p>	
<p><b>TAP/Workgroup:</b> What are the strengths and weaknesses in relation to the sub-criteria for <i>Importance to Measure and Report</i>?</p>	<p>1</p>
<p><b>Steering Committee:</b> Was the threshold criterion, <i>Importance to Measure and Report</i>, met?          Rationale:</p>	<p>1          Y <input type="checkbox"/>          N <input type="checkbox"/></p>
<p><b>2. SCIENTIFIC ACCEPTABILITY OF MEASURE PROPERTIES</b></p>	
<p>Extent to which the measure, as <u>specified</u>, produces consistent (reliable) and credible (valid) results about the quality of care when implemented. (<a href="#">evaluation criteria</a>)</p>	<p><a href="#">Eval</a>  <a href="#">Rati</a>  <a href="#">ng</a></p>
<p><b>2a. MEASURE SPECIFICATIONS</b></p>	
<p><b>S.1</b> Do you have a web page where current detailed measure specifications can be obtained?  <b>S.2</b> If yes, provide web page URL:</p> <p><b>2a. Precisely Specified</b></p>	
<p><b>2a.1 Numerator Statement</b> (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</p> <p><b>2a.2 Numerator Time Window</b> (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.</p> <p><b>2a.3 Numerator Details</b> (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.</p>	<p>2a-spec          S          C <input type="checkbox"/>          P <input type="checkbox"/>          M <input type="checkbox"/>          N <input type="checkbox"/></p>

For discharges on or after October 1, 2007, the ICD-9-CM code for infection due to central venous catheters is 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 pediatrics

**2a.5 Target population gender:** Female, Male

**2a.6 Target population age range:** under age 18

**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, and age less than 18 years. 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. normal newborns
5. neonates with birth weight less than 500 grams
6. MDC 14 (pregnancy, childbirth, and puerperium)

**2a.10 Denominator Exclusion Details** (*All information required to collect exclusions to the denominator, including all codes, logic, and definitions*):

"Normal newborns" and "neonates" are defined in Appendix I, at

<http://qualityindicators.ahrq.gov/downloads/pdi/specs/PDI%20Appendices.pdf> .

Birth weight less than 500 grams is defined using any of the following ICD-9-CM diagnosis codes in any diagnosis field:

76401 - LIGHT-FOR-DATES <500G

76411 - LIGHT-FOR-DATES W/ MALNUTRITION <500G

76421 - FETAL MALNUTRITION <500G

76491 - FETAL GROWTH RETARDATION <500G

76501 - EXTREME IMMATURITY <500G

76511 - PRETERM NEC <500G

<p>V2131 - LOW BIRTHWEIGHT STATUS &lt;500G</p>	
<p><b>2a.11 Stratification Details/Variables</b> (<i>All information required to stratify the measure including the stratification variables, all codes, logic, and definitions</i>): Not applicable</p>	
<p><b>2a.12-13 Risk Adjustment Type:</b> Other (specify) Statistical risk model</p>	
<p><b>2a.14 Risk Adjustment Methodology/Variables</b> (<i>List risk adjustment variables and describe conceptual models, statistical models, or other aspects of model or method</i>): 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, age categories (13-17 years, 6-12 years, 3-5 years, 1-2 years, 91-364 days, 61-90 days, 29-60 days, less than 29 days), birth weight for neonates (500-999 grams, 1000-1249 grams, 1250-1499 grams, 1500-1999 grams, 2000-2499 grams, 2500 grams or above), hospitalization characteristics such as transfer-in status, AHRQ-defined Clinical Classifications Software (CCS) diagnosis categories (based on all diagnoses), major diagnostic categories or MDCs (based on the principal diagnosis), 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 CCS categories, which are less confounded by hospital-acquired complications, to capture the effects of comorbid illness. To account for low-frequency CCS categories and MDCs that could not be entered as dummy variables, aggregates of low-risk, intermediate-risk, and high-risk categories were also created and tested.</p> <p><b>2a.15-17 Detailed risk model available Web page URL or attachment:</b> Attachment submission_PDI12_attach_detail risk model-634025385122872051.xlsx</p>	
<p><b>2a.18-19 Type of Score:</b> rate/proportion  <b>2a.20 Interpretation of Score:</b> better quality = lower score  <b>2a.21 Calculation Algorithm</b> (<i>Describe the calculation of the measure as a flowchart or series of steps</i>):</p> <ol style="list-style-type: none"> <li>1. Enumerate the denominator at risk, as described above in 2a.8.</li> <li>2. Apply the denominator exclusions, as described above in 2a.9.</li> <li>3. Enumerate the numerator events, as described above in 2a.3.</li> <li>4. Estimate the numerator divided by the denominator, multiplied by 1,000.</li> </ol>	
<p><b>2a.22 Describe the method for discriminating performance</b> (<i>e.g., significance testing</i>): Significance testing</p>	
<p><b>2a.23 Sampling (Survey) Methodology</b> (<i>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)</i>): The application of this indicator uses inpatient administrative data. All patient discharges are used without sampling.</p>	
<p><b>2a.24 Data Source</b> (<i>Check the source(s) for which the measure is specified and tested</i>): Electronic administrative data/claims</p>	
<p><b>2a.25 Data source/data collection instrument</b> (<i>Identify the specific data source/data collection instrument, e.g. name of database, clinical registry, collection instrument, etc.</i>): 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).</p>	
<p><b>2a.26-28 Data source/data collection instrument reference web page URL or attachment:</b> URL <a href="http://www.qualityindicators.ahrq.gov/downloads/pdi/pdi_nqi_sas_documentation_v41.pdf">http://www.qualityindicators.ahrq.gov/downloads/pdi/pdi_nqi_sas_documentation_v41.pdf</a> Input specifications for all data elements are described in the PDI Software Documentation</p> <p><b>2a.29-31 Data dictionary/code table web page URL or attachment:</b> URL <a href="http://www.hcup-us.ahrq.gov/db/nation/nis/nisdbdocumentation.jsp">http://www.hcup-us.ahrq.gov/db/nation/nis/nisdbdocumentation.jsp</a> A description of data elements is at the specified URL;</p>	

<p>however, only a limited number of these data elements are required for estimation of PDI 12.</p> <p><b>2a.32-35 Level of Measurement/Analysis</b> (<i>Check the level(s) for which the measure is specified and tested</i>) Facility/Agency</p> <p><b>2a.36-37 Care Settings</b> (<i>Check the setting(s) for which the measure is specified and tested</i>) Hospital</p> <p><b>2a.38-41 Clinical Services</b> (<i>Healthcare services being measured, check all that apply</i>) Clinicians: Nurses, Clinicians: Physicians (MD/DO)</p>	
<b>TESTING/ANALYSIS</b>	
<p><b>2b. Reliability testing</b></p> <p><b>2b.1 Data/sample</b> (<i>description of data/sample and size</i>): Reliability testing was conducted on the 2003 Kids' Inpatient Database (KID), which is a stratified probability sample of discharges from the hospitals in the Nationwide Inpatient Sample. Sampling probabilities of 10% for uncomplicated in-hospital births and 80% for other pediatric cases ensure that cases at risk for PDI 12 are well-represented in the data set.</p> <p><b>2b.2 Analytic Method</b> (<i>type of reliability &amp; rationale, method for testing</i>): 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).</p> <p><b>2b.3 Testing Results</b> (<i>reliability statistics, assessment of adequacy in the context of norms for the test conducted</i>): The MSX signal ratio was very high at 0.97 (relative to a range among all AHRQ PDIs of 0.01 to 0.97). The factor loading of PDI 12 on the "Pediatric Patient Safety for Selected Indicators" factor-weighted composite was the highest (0.2046) of all PDIs, suggesting that PDI 12 may be a "canary measure" of pediatric patient safety, just as PSI 7 has been identified as a "canary measure" of adult patient safety (Yao et al., 2009).</p> <p>References: 1. Agency for Healthcare Research and Quality (2008), "Pediatric Composite Measure Workgroup Final Report, March 2008", available at: <a href="http://qualityindicators.ahrq.gov/downloads/pdi/AHRO_PDI_Workgroup_Final.pdf">http://qualityindicators.ahrq.gov/downloads/pdi/AHRO_PDI_Workgroup_Final.pdf</a> . 2. 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.</p>	<p>2b</p> <p>C <input type="checkbox"/></p> <p>P <input type="checkbox"/></p> <p>M <input type="checkbox"/></p> <p>N <input type="checkbox"/></p>
<p><b>2c. Validity testing</b></p> <p><b>2c.1 Data/sample</b> (<i>description of data/sample and size</i>): Multiple data sets have been used, as described fully in 2c.3 below.</p> <p><b>2c.2 Analytic Method</b> (<i>type of validity &amp; rationale, method for testing</i>): 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.</p> <p><b>2c.3 Testing Results</b> (<i>statistical results, assessment of adequacy in the context of norms for the test conducted</i>): The face validity of PDI 12 was established through a nationally representative, multispecialty expert panel, which included one pediatric emergency physician, one pediatric cardiac surgeon, two pediatric general/trauma surgeons, one neonatologist, one pediatric critical care physician, one pediatric radiologist, one</p>	<p>2c</p> <p>C <input type="checkbox"/></p> <p>P <input type="checkbox"/></p> <p>M <input type="checkbox"/></p> <p>N <input type="checkbox"/></p>

pediatric oncologist, one ambulatory pediatrician, one pediatric infectious disease specialist, and one pediatric hospitalist (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 PDI 12 on a 1-9 scale, based on its usefulness for internal quality improvement, its usefulness for comparative reporting, 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 7 on “usefulness” for quality improvement, 6.5 on “usefulness” for comparative reporting, and 7 on “preventability,” with indeterminate agreement on both dimensions, leading to a classification of “acceptable”. The median ratings were 6 on “likelihood that complication is charted” and 5 (intermediate) on susceptibility to bias, supporting use of the indicator with appropriate attention to risk-adjustment and stratification.

Through similar processes, the adult version of this indicator (PSI 7) was endorsed by a separate expert panel in 2001. PSI 7 was also 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 implementation guide developed by The Joint Commission (2005).

Most of the pertinent evidence regarding construct validity is based on the adult version of this indicator, and is summarized in our submission for PSI 7. Analyses performed during the construction of the “Pediatric Patient Safety for Selected Indicators” composite revealed that PDI 12 is moderately correlated at the hospital level with PDI 5 (Iatrogenic Pneumothorax,  $r=0.23$ ), PDI 9 (Postoperative Respiratory Failure,  $r=0.13$ ), and PDI 9 (Postoperative Sepsis,  $r=0.11$ ).

The best recent evidence about the criterion validity of PDI 12 comes from a study by Scanlon et al. (2008) on behalf of 28 children’s hospitals in NACHRI. Physicians and other clinicians at the participating hospitals reviewed 285 consecutive cases flagged by PDI 12 in 2003-2005; 11% ( $n=30$ ) were incorrectly coded and 39% ( $n=110$ ) were present on admission; about 41% ( $n=117$ ) of all flagged events were judged to be potentially preventable (Scanlon et al., 2008). In a previous study from the same organization, physicians reviewed 145 flagged events from 14 hospitals in 2003, using an online tool to assess implicit process of care, and judged 39% to be preventable and 31% to be clearly non-preventable (Sedman et al., 2005; Scanlon et al., 2006). These findings are consistent with the findings reported for PSI 7 from the AHRQ PSI Validation Pilot Project ( $N=191$  cases from 47 hospitals). In this latter 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 PDI 12, as described above, which would increase the positive predictive value (PPV) from 51% ( $145/285$ ) to 83% ( $145/175$ ). 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 should improve PPV beyond 83%, although validation data based on the new ICD-9-CM code are not yet available. There is more limited evidence on the sensitivity of PDI 12 and 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 PSI 7 from 2.02 to 2.52 per 1 000 eligible discharges; 56% of the post-discharge events were complications of hemodialysis (Gallagher et al., 2005a). One study from 24 US hospitals participating in a patient safety collaborative reported the sensitivity of PSI 7 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. 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](http://192.5.14.110/pubs/working_papers/2008/RAND_WR601.pdf) .
2. 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.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. Scanlon MC, Miller M, Harris JM, Schulz K, Sedman A (2006), "Targeted chart review of pediatric patient safety events identified by the Agency for Healthcare Research and Quality's Patient Safety Indicators methodology", Journal of Patient Safety, Vol. 2, No. 4, pp. 191-197.
9. Scanlon MC, Harris JM, Levy F, Sedman A (2008), "Evaluation of the Agency for Healthcare Research and Quality Pediatric Quality Indicators", Pediatrics, Vol. 121, No. 6, pp. e1723-1731.
10. Sedman A, Harris JM 2nd, Schulz K, Schwalenstocker E, Remus D, Scanlon M, Bahl V (2005), "Relevance of the Agency for Healthcare Research and Quality Patient Safety Indicators for children's hospitals", Pediatrics, Vol. 115, No. 1, pp. 135-145.
11. The Joint Commission (2005), "National Quality Forum (NQF) Endorsed Nursing-Sensitive Care Performance Measures", [http://www.jointcommission.org/PerformanceMeasurement/MeasureReserveLibrary/nqf\\_nursing.htm](http://www.jointcommission.org/PerformanceMeasurement/MeasureReserveLibrary/nqf_nursing.htm)
12. 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 agreed 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), but they felt that it was important to track these infections in all patients, even those at high risk. They made specific recommendations about stratifying high-risk and intermediate-risk patients, instead of excluding them, as described in section 2h.1.

The exclusion of normal newborns was intended to remove noise from the denominator, due to the extremely low risk of catheter related bloodstream infection in this population. Neonates with birth weight less than 500 grams are excluded because of the poor prognosis and exceptionally long hospital course of such extremely immature infants. Adolescents under 18 years of age with pregnancy-related diagnoses are excluded because these patients are captured in the denominator definition of PSI 7.

The exclusion of events reported as "present on admission" is based on evidence that a significant minority of cases otherwise flagged by PSI 7 and PDI 12 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).

2d  
 C   
 P   
 M   
 N   
 NA

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). In the one study focused on children, from 28 children's hospitals throughout the USA, the "present on admission" percentage was 39% (110/285)(Scanlon 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.
2. 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.
3. 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.
4. Scanlon MC, Harris JM II, Levy F, Sedman A (2008), "Evaluation of the Agency for Healthcare Research and Quality Pediatric Quality Indicators", *Pediatrics*, Vol. 121, No. 6, pp. e1723-1731.

**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 exclusion of normal newborns was intended to remove noise from the denominator, due to the extremely low risk of catheter related bloodstream infection in this population. Neonates with birth weight less than 500 grams are excluded because of the poor prognosis and exceptionally long hospital course of such extremely immature infants. Adolescents under 18 years of age with pregnancy-related diagnoses are excluded because these patients are captured in the denominator definition of PSI 7.

The following empirical analyses were completed using the 2003 KIDs' Inpatient Database (KID):

Panelists suggested we stratify this indicator by risk, instead of excluding high-risk patients. We examined the risk of this complication for several groups theorized to have higher risk. We found the following conditions to be associated with highly elevated risk: short bowel syndrome (RR=97.69), immunocompromised state (RR = 29.61), lymphosarcoma and reticulosarcoma (RR = 34.17), myeloid leukemia (RR = 38.69), monocytic leukemia (RR = 77.43), leukemia of unspecified cell type (RR=51.43). The following patients were at intermediate risk: cystic fibrosis (RR=8.81), hemophilia (RR=14.26), Hodgkin's disease (RR=10.49), other malignant neoplasms of lymphoid and histiocytic tissue (RR=17.00), lymphoid leukemia (RR=18.95), and all other cancers (RR=15.60). To further investigate the definition of immunocompromised state, we examined each of the following conditions, which are associated with impaired immunity, separately: HIV, primary immunodeficiencies, transplant, high risk cancer (leukemia, lymphoma), other cancers, lupus, other rare autoimmune diseases, juvenile rheumatoid arthritis, other rheumatoid arthritis, short bowel syndrome, renal conditions treated with immune suppressants, renal failure, hepatic failure, severe malnutrition, cachexia and spleen disorders. We found that patients with rheumatoid arthritis were not at elevated risk for this complication (relative risk less than 1.4). Patients with spleen disorders had a slightly elevated risk (relative risk between 1.4 and 3). Patients with lupus, other rare autoimmune diseases, renal diseases, hepatic failure and cachexia had a moderately elevated risk (relative risk between 3 and 9). Patients with primary immunodeficiencies, all types of cancer, short bowel syndrome, renal failure, or severe malnutrition or having undergone a transplant procedure had a greatly elevated risk (relative risk above 9). These analyses informed the recommended stratification, described in 2h.1.

In a separate analysis, we examined the length of stay for patients with numerator events, given peer review comments on patients with short (0-1 day) stays, who were suspected of having infections that were present at admission. We found that almost 22% of the denominator-eligible patients had a length of stay of less than

<p>2 days, but only 1.8% of numerator patients had a length of stay of less than 2 days. On this basis, with the support of our expert clinical panel, we felt comfortable excluding short-stay (0-1 day) patients.</p>	
<p><b>2e. Risk Adjustment for Outcomes/ Resource Use Measures</b></p> <p><b>2e.1 Data/sample</b> (<i>description of data/sample and size</i>): 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 5,546,905 observations for children.</p> <p><b>2e.2 Analytic Method</b> (<i>type of risk adjustment, analysis, &amp; rationale</i>): 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.</p> <p><b>2e.3 Testing Results</b> (<i>risk model performance metrics</i>): The model has an overall c statistic of 0.872, representing the area under a receiver operating characteristic (ROC) curve.</p> <p><b>2e.4 If outcome or resource use measure is not risk adjusted, provide rationale:</b> Not applicable</p>	<p>2e C <input type="checkbox"/> P <input type="checkbox"/> M <input type="checkbox"/> N <input type="checkbox"/> NA <input type="checkbox"/></p>
<p><b>2f. Identification of Meaningful Differences in Performance</b></p> <p><b>2f.1 Data/sample from Testing or Current Use</b> (<i>description of data/sample and size</i>): PDI 12 has been operationalized with many administrative data sets, including the Nationwide Inpatient Sample (NIS) and Kids' Inpatient Database (KID) from AHRQ's HCUP program, the University HealthSystem Consortium's Clinical Data Base, the Pediatric Health Information System from 34 children's hospitals affiliated with the Child Health Corporation of America, and the Aggregate Case Mix Comparative Database from 76 hospitals in the National Association of Children's Hospitals and Related Institutions.</p> <p><b>2f.2 Methods to identify statistically significant and practically/meaningfully differences in performance</b> (<i>type of analysis &amp; rationale</i>): 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.</p> <p><b>2f.3 Provide Measure Scores from Testing or Current Use</b> (<i>description of scores, e.g., distribution by quartile, mean, median, SD, etc.; identification of statistically significant and meaningfully differences in performance</i>): Meaningful differences in hospital performance can be identified using PDI 12, at least for children's hospitals and other hospitals with high pediatric volume. Sedman et al. (2005) estimated PDI rates for 43 children's hospitals that submitted data to the NACHRI Aggregate Case Mix Comparative Database in 1999-2002. Aggregating data across four years, they identified 11 hospitals with PDI 12 rates that were significantly above the mean and 19 hospitals with PDI 12 rates that were significantly below the mean. In support of this finding, Slonim et al. (2007) were able to estimate hospital-specific fixed and random effects using 2003 data from 34 children's hospitals. The standard error of hospital-specific observed/expected ratios for PDI 12, based on 2001-2003 SID data from AHRQ, is lower (0.115) than that for any other PDI (0.169 to 1.116)(AHRQ,</p>	<p>2f C <input type="checkbox"/> P <input type="checkbox"/> M <input type="checkbox"/> N <input type="checkbox"/></p>



<p>2008).</p> <p>References</p> <ol style="list-style-type: none"> <li>Agency for Healthcare Research and Quality (2008), "Pediatric Composite Measure Workgroup Final Report, March 2008", available at: <a href="http://qualityindicators.ahrq.gov/downloads/pdi/AHRO_PDI_Workgroup_Final.pdf">http://qualityindicators.ahrq.gov/downloads/pdi/AHRO_PDI_Workgroup_Final.pdf</a> .</li> <li>Sedman A, Harris JM 2nd, Schulz K, Schwalenstocker E, Remus D, Scanlon M, Bahl V (2005), "Relevance of the Agency for Healthcare Research and Quality Patient Safety Indicators for children's hospitals", <i>Pediatrics</i>, Vol. 115, No. 1, pp. 135-145.</li> <li>Slonim AD, Marcin JP, Turenne W, Hall M, Joseph JG (2007), "Pediatric patient safety events during hospitalization: Approaches to accounting for institution-level effects", <i>Health Services Research</i>, Vol. 42, No. 6 Part 1, pp. 2275-2293.</li> </ol>	
<p><b>2g. Comparability of Multiple Data Sources/Methods</b></p> <p><b>2g.1 Data/sample</b> (<i>description of data/sample and size</i>): PDI 12 has been operationalized with many administrative data sets, including the Nationwide Inpatient Sample (NIS) and Kids' Inpatient Database (KID) from AHRO's HCUP program, the University HealthSystem Consortium's Clinical Data Base, the Pediatric Health Information System from 34 children's hospitals affiliated with the Child Health Corporation of America, and the Aggregate Case Mix Comparative Database from 76 hospitals in the National Association of Children's Hospitals and Related Institutions.</p> <p><b>2g.2 Analytic Method</b> (<i>type of analysis &amp; rationale</i>):          AHRO PDI software has been applied to each of these data sets, with minimal adaptation.</p> <p><b>2g.3 Testing Results</b> (<i>e.g., correlation statistics, comparison of rankings</i>):          We are not aware of any studies comparing rates generated for the same hospitals AND the same patients using different data sets.</p>	<p>2g</p> <p>C <input type="checkbox"/></p> <p>P <input type="checkbox"/></p> <p>M <input type="checkbox"/></p> <p>N <input type="checkbox"/></p> <p>NA <input type="checkbox"/></p>
<p><b>2h. Disparities in Care</b></p> <p><b>2h.1 If measure is stratified, provide stratified results</b> (<i>scores by stratified categories/cohorts</i>):          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) does not include PDI 12. Differences across strata are generally statistically significant at the p&lt;0.01 level, with a few exceptions. See 1b.4 for specific findings regarding disparities.</p> <p>The AHRQ expert panel that endorsed this indicator recommended stratification based on key clinical characteristics, to facilitate comparison of similar patients across hospitals. This stratification option is built into the AHRQ PDI software (McDonald et al., 2008):          High-risk: Immunodeficient patients with HIV, transplantation, short bowel syndrome, cancer, end stage renal disease, severe malnutrition, and other immune system disorders (overall rate in 2003 KID: 24.82 per 1,000 eligible hospitalizations)          Intermediate-risk: Other conditions associated with long-term use of central venous catheters or parenteral nutrition, including cystic fibrosis, hemophilia, lupus, hepatic failure, cachexia, splenic disorders, chronic kidney disease, other autoimmune disorders (overall rate in 2003 KID: 7.61 per 1,000 eligible hospitalizations)          Low-risk: All other hospitalizations (overall rate in 2003 KID: 1.64 per 1,000 eligible hospitalizations)</p> <p>References:</p> <ol style="list-style-type: none"> <li>HCUPnet (2010), <a href="http://hcupnet.ahrq.gov/HCUPnet.jsp?Id=C1A585CEA047985F&amp;Form=DispTab&amp;JS=Y&amp;Action=%3E%3ENext%3E%3E&amp;__InDispTab=Yes&amp;_Results=Print&amp;SortOpt=">http://hcupnet.ahrq.gov/HCUPnet.jsp?Id=C1A585CEA047985F&amp;Form=DispTab&amp;JS=Y&amp;Action=%3E%3ENext%3E%3E&amp;__InDispTab=Yes&amp;_Results=Print&amp;SortOpt=</a></li> <li>McDonald KM, Davies SM, Haberland CA, Geppert JJ, Ku A, Romano PS (2008), "Preliminary assessment of pediatric health care quality and safety in the United States using readily available administrative data", <i>Pediatrics</i>, Vol. 122, No. 2, pp. e416-e425.</li> </ol>	<p>2h</p> <p>C <input type="checkbox"/></p> <p>P <input type="checkbox"/></p> <p>M <input type="checkbox"/></p> <p>N <input type="checkbox"/></p> <p>NA <input type="checkbox"/></p>

<p><b>2h.2</b> If disparities have been reported/identified, but measure is not specified to detect disparities, provide follow-up plans:  <a href="#">Not applicable</a></p>	
<p><b>TAP/Workgroup:</b> What are the strengths and weaknesses in relation to the sub-criteria for <i>Scientific Acceptability of Measure Properties</i>?</p>	2
<p><b>Steering Committee:</b> Overall, to what extent was the criterion, <i>Scientific Acceptability of Measure Properties</i>, met?  <b>Rationale:</b></p>	<p>2  C <input type="checkbox"/>  P <input type="checkbox"/>  M <input type="checkbox"/>  N <input type="checkbox"/></p>
<b>3. USABILITY</b>	
<p>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. (<a href="#">evaluation criteria</a>)</p>	<a href="#">Eval</a> <a href="#">Rati</a> <a href="#">ng</a>
<b>3a. Meaningful, Understandable, and Useful Information</b>	
<b>3a.1 Current Use:</b> <a href="#">in use</a>	
<p><b>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):</b>  <a href="#">Norton Healthcare - a multi-hospital system in Kentucky</a>  <a href="http://www.nortonhealthcare.com/about/Our_Performance/index.aspx">http://www.nortonhealthcare.com/about/Our_Performance/index.aspx</a></p> <p><a href="#">My Health Finder (hospitals in the State of New York)</a>  <a href="http://www.myhealthfinder.com/">http://www.myhealthfinder.com/</a></p> <p><a href="#">Iowa Healthcare Collaborative</a>  <a href="http://www.ihconline.org/iowareport/iowareport.cfm">http://www.ihconline.org/iowareport/iowareport.cfm</a></p>	
<p><b>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):</b>  <a href="#">Dallas Fort Worth Hospital Council - Reporting on measure results to over 70 hospitals in Texas</a>  site: <a href="http://www.dfwhc.org">www.dfwhc.org</a>.  (Note: Measure results reported to hospitals for quality improvement. Results not reported on website.)</p> <p><a href="#">Child Health Corporation of America (CHCA) - A 42 member hospitals, which are large freestanding pediatric hospitals</a>  site: <a href="http://www.chca.com/index_no_flash.html">http://www.chca.com/index_no_flash.html</a>  (Note: Measure results reported to hospitals for quality improvement. Results not reported on website.)</p> <p><a href="#">National Association of Children's Hospitals and Related Institutions (NACHRI) -approximately 85 member of hospitals</a>  site: <a href="http://www.nachri.org">www.nachri.org</a>  (Note: Measure results reported to hospitals for quality improvement. Results not reported on website.)</p> <p><a href="#">Norton Healthcare - a multi-hospital system in Kentucky</a>  site: <a href="http://www.nortonhealthcare.com/about/Our_Performance/index.aspx">http://www.nortonhealthcare.com/about/Our_Performance/index.aspx</a></p> <p><a href="#">University Healthcare Consortium - An alliance of 103 academic medical centers and 219 of their affiliated hospitals.</a>  site: <a href="http://www.uhc.edu">www.uhc.edu</a>  (Note: Measure results reported to hospitals for quality improvement. Results not reported on website.)</p>	
<p><b>3a</b>  C <input type="checkbox"/>  P <input type="checkbox"/>  M <input type="checkbox"/>  N <input type="checkbox"/></p>	

**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 the PDIs. 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 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](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](http://qualityindicators.ahrq.gov/downloads/technical/QILI_ModelReports_DRAFTGuidance.doc)

**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

**(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-

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<p>specific rates of this complication.</p> <p><b>5.1 Competing Measures</b> 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:</p> <p>This measure complements NQF #0139 in two ways:</p> <ol style="list-style-type: none"> <li>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.</li> <li>2. The denominator is based on all pediatric patients, not just patient days with central venous catheters in place. As a result, rates of PDI 12 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 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.</li> </ol> <p>References:</p> <ol style="list-style-type: none"> <li>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.</li> <li>2. Porta M (2008), "A Dictionary of Epidemiology, Fifth Edition." New York: Oxford University Press.</li> <li>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.</li> </ol>	
<p><b>TAP/Workgroup: What are the strengths and weaknesses in relation to the sub-criteria for <i>Usability</i>?</b></p>	<p>3</p>
<p>Steering Committee: Overall, to what extent was the criterion, <i>Usability</i>, met? Rationale:</p>	<p>3 C <input type="checkbox"/> P <input type="checkbox"/> M <input type="checkbox"/> N <input type="checkbox"/></p>
<p><b>4. FEASIBILITY</b></p>	
<p>Extent to which the required data are readily available, retrievable without undue burden, and can be implemented for performance measurement. (<a href="#">evaluation criteria</a>)</p>	<p><a href="#">Eval</a> <a href="#">Rati</a> <a href="#">ng</a></p>
<p><b>4a. Data Generated as a Byproduct of Care Processes</b></p> <p><b>4a.1-2</b> How are the data elements that are needed to compute measure scores generated? coding/abstraction performed by someone other than person obtaining original information,</p>	<p>4a C <input type="checkbox"/> P <input type="checkbox"/> M <input type="checkbox"/> N <input type="checkbox"/></p>
<p><b>4b. Electronic Sources</b></p> <p><b>4b.1</b> Are all the data elements available electronically? (<i>elements that are needed to compute measure scores are in defined, computer-readable fields, e.g., electronic health record, electronic claims</i>) Yes</p>	<p>4b C <input type="checkbox"/> P <input type="checkbox"/> M <input type="checkbox"/> N <input type="checkbox"/></p>

<p><b>4b.2</b> If not, specify the near-term path to achieve electronic capture by most providers.</p>	
<p><b>4c. Exclusions</b></p> <p><b>4c.1</b> Do the specified exclusions require additional data sources beyond what is required for the numerator and denominator specifications? No</p> <p><b>4c.2</b> If yes, provide justification.</p>	<p><b>4c</b> C <input type="checkbox"/> P <input type="checkbox"/> M <input type="checkbox"/> N <input type="checkbox"/> NA <input type="checkbox"/></p>
<p><b>4d. Susceptibility to Inaccuracies, Errors, or Unintended Consequences</b></p> <p><b>4d.1</b> 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 <a href="http://qualityindicators.ahrq.gov/downloads/pdi/pdi_measures_v31.pdf">http://qualityindicators.ahrq.gov/downloads/pdi/pdi_measures_v31.pdf</a> ). 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 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.</p>	<p><b>4d</b> C <input type="checkbox"/> P <input type="checkbox"/> M <input type="checkbox"/> N <input type="checkbox"/></p>
<p><b>4e. Data Collection Strategy/Implementation</b></p> <p><b>4e.1</b> 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 2006, 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.</p> <p><b>4e.2</b> Costs to implement the measure (<i>costs of data collection, fees associated with proprietary measures</i>): The cost of implementation is minimal, and software to compute the measure is provided at no charge by AHRQ (see <a href="http://www.qualityindicators.ahrq.gov/software.htm">http://www.qualityindicators.ahrq.gov/software.htm</a> ). 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.</p> <p><b>4e.3</b> Evidence for costs: Not applicable.</p> <p><b>4e.4</b> Business case documentation: The business case for use of this indicator has been established through several carefully designed studies demonstrating up to \$172,484 in excess hospital charges attributable to the average case of PDI 12 (see 1a.3 above). These amounts represent estimates of the “business case” for preventing one event, for the average hospital payer.</p>	<p><b>4e</b> C <input type="checkbox"/> P <input type="checkbox"/> M <input type="checkbox"/> N <input type="checkbox"/></p>
<p><b>TAP/Workgroup:</b> What are the strengths and weaknesses in relation to the sub-criteria for <i>Feasibility</i>?</p>	<p>4</p>
<p><b>Steering Committee:</b> Overall, to what extent was the criterion, <i>Feasibility</i>, met? Rationale:</p>	<p>4 C <input type="checkbox"/> P <input type="checkbox"/> M <input type="checkbox"/> N <input type="checkbox"/></p>
<p><b>RECOMMENDATION</b></p>	
<p>(for NQF staff use) Check if measure is untested and only eligible for time-limited endorsement.</p>	<p>Time-</p>

	limited <input type="checkbox"/>
Steering Committee: Do you recommend for endorsement? Comments:	Y <input type="checkbox"/> N <input type="checkbox"/> A <input type="checkbox"/>

**CONTACT INFORMATION**

**Co.1 Measure Steward (Intellectual Property Owner)**  
**Co.1 Organization**  
 Agency for Healthcare Research and Quality | 540 Gaither Road | Rockville | Maryland | 20850

**Co.2 Point of Contact**  
 John | Bott, MSSW, MBA | john.bott@ahrq.hhs.gov | 301-427-1317

**Measure Developer If different from Measure Steward**  
**Co.3 Organization**  
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**Co.4 Point of Contact**  
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**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.**

Thomas James Abramo, MD, FAAP, FACEP, Pediatric Emergency Medicine  
 Dallas, Texas  
 Children's Medical Center of Dallas, Parkland Memorial Hospital  
 Nominated by the Society for Academic Emergency Medicine

Gregory B. DiRusso, MD, FACS, Thoracic Surgery, Congenital Heart Surgery  
 Washington, DC  
 Children's National Medical Center  
 Nominated by the Child Health Corporation of America

J. Craig Jackson, MD, Neonatology  
 Seattle, Washington  
 Children's Hospital and Regional Medical Center/University of Washington Medical Center, Providence Everett Medical Center, Overlake Hospital Medical Center, Evergreen Hospital Medical Center  
 Nominated by the National Association of Children's Hospitals and Related Institutions

Vicki L. Montgomery, MD, FAAP, FCCM, Pediatric Critical Care Medicine  
 Louisville, Kentucky  
 Kosair Children's Hospital  
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Larry Moss, MD, Pediatric Surgery, Surgical Critical Care  
 New Haven, Connecticut  
 Yale New Haven Children's Hospital  
 Nominated by the American Academy of Pediatrics

Dennis L. Murray, MD, FAAP, Pediatric Infectious Disease  
 Augusta, Georgia  
 Medical College of Georgia Health System, Children's Medical Center  
 Nominated by the Pediatric Infectious Diseases Society

John B. Pietsch, MD, Pediatric General Surgery  
 Nashville, Tennessee  
 Vanderbilt Children's Hospital  
 Nominated by the National Association of Children's Hospitals and Related Institutions

Daniel Rauch, MD, Pediatrics  
 Valhalla, New York  
 Maria Fareri Children's Hospital  
 Nominated by the Ambulatory Pediatric Association

Manrita Sidhu, MD, Pediatric Radiology, Diagnostic Radiology  
 Pediatric Quality Indicators Technical Report Appendix B - Page 2  
 AHRQ Quality Indicators Web site: <http://www.qualityindicators.ahrq.gov/>  
 Seattle, Washington  
 Children's Hospital and Regional Medical Center/University of Washington Medical Center  
 Nominated by the National Association of Children's Hospitals and Related Institutions

Michael Weiner, MD, Pediatric Oncology  
 New York, New York  
 Children's Hospital of New York, New York Presbyterian Hospital  
 Nominated by the American Society of Pediatric Hematology/Oncology

Lisa Zaoutis, MD, Hospitalist  
 Philadelphia, Pennsylvania  
 The Children's Hospital of Philadelphia  
 Nominated by the Ambulatory Pediatric Association

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: [2006](#)  
**Ad.7** Month and Year of most recent revision: [2010-01](#)  
**Ad.8** What is your frequency for review/update of this measure?  
**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
Intercept	1	-7.4059	0.1636	2049.25	<.0001		
XCV1	1	-0.4838	0.1067	20.55	<.0001	Age in Years	13
XCV2	1	-0.7377	0.1159	40.47	<.0001	Age in Years	6
XCV3	1	-0.4960	0.1246	15.86	<.0001	Age in Years	3
XCV4	1	-0.2189	0.1081	4.11	0.0427	Age in Years	1
XCV5	1	2.1335	0.1438	220.12	<.0001	Birthweight	1250g
XCV6	1	2.3471	0.1335	309.20	<.0001	Birthweight	1000g
XCV7	1	2.4191	0.1444	280.76	<.0001	Birthweight	500g
XCV8	1	0.7947	0.1725	21.24	<.0001	MDRG	416
XCV9	1	1.7472	0.1598	119.60	<.0001	MDRG	602
XCV10	1	1.2337	0.1677	54.14	<.0001	MDRG	1711
XCV11	1	2.1339	0.1735	151.22	<.0001	MDRG	7705
XCV12	1	0.5612	0.1199	21.92	<.0001	MDC	5
XCV13	1	0.5808	0.1850	9.86	0.0017	MDC	7
XCV14	1	0.6733	0.1569	18.42	<.0001	MDC	10
XCV15	1	-0.5745	0.1014	32.13	<.0001	MDC	15
XCV16	1	0.3627	0.1512	5.75	0.0165	MDC	16
XCV17	1	0.4032	0.1413	8.14	0.0043	CCS	39
XCV18	1	0.5581	0.1097	25.87	<.0001	CCS	52
XCV19	1	0.3630	0.0845	18.44	<.0001	CCS	58
XCV20	1	-0.5321	0.1725	9.51	0.002	CCS	63
XCV21	1	0.5735	0.1595	12.93	0.0003	CCS	81
XCV22	1	0.4577	0.1686	7.36	0.0067	CCS	82
XCV23	1	0.4958	0.1284	14.91	0.0001	CCS	83
XCV24	1	0.5180	0.1973	6.89	0.0087	CCS	103
XCV25	1	0.2714	0.1007	7.26	0.0071	CCS	138
XCV26	1	0.6683	0.1119	35.64	<.0001	CCS	151
XCV27	1	0.8449	0.0812	108.18	<.0001	CCS	213
XCV28	1	0.9890	0.1221	65.58	<.0001	CCS	214
XCV29	1	0.3127	0.0859	13.25	0.0003	CCS	217
XCV30	1	0.8191	0.0723	128.34	<.0001	TRANSFER	
XCV31	1	0.8719	0.1458	35.78	<.0001	NOPOUB04	
XCV32	1	-2.7673	0.1814	232.68	<.0001	NOPRDAY	
XCV33	1	1.2164	0.1643	54.85	<.0001	Intermediate Risk	
XCV34	1	2.0654	0.0778	704.76	<.0001	High Risk	
c		0.8720				Age in Days	29
						Birthweight	1500g



**End**

17

12

5

2

1499g

1249g

999g

364

Above