

Introduction to the Pediatric Toolkit for Using the AHRQ Quality Indicators: How To Improve Hospital Quality and Safety

The Agency for Healthcare Research and Quality (AHRQ) is an agency within the U.S. Department of Health and Human Services. AHRQ's mission is to:

- Invest in research and evidence to make health care safer and improve quality.
- Create materials to teach and train health care systems and professionals to help them improve care for their patients.
- Generate measures and data used to track and improve performance and evaluate progress of the U.S. health system.

The Pediatric Toolkit for Using the AHRQ Quality Indicators (Pediatric QI Toolkit) is a set of tools available free of charge. The Pediatric QI Toolkit is designed to support hospitals in assessing and improving the quality and safety of care they provide. AHRQ first released the original *Quality Indicators™ Toolkit for Hospitals* in 2012 with a focus on improving inpatient quality of care for adult patients. Recognizing a need for similar resources toward improving quality for pediatric patients, AHRQ expanded the effort to develop a pediatric version of the Toolkit.

Some aspects of the quality improvement process are similar for both populations. For example, both adult and pediatric settings must identify the problems specific to their own hospital processes, policies, and procedures in order to identify areas in need of improvement. However, there are also important differences in the culture of care for children and adults, as well as inherent differences between children and adults themselves, including:

- **Differential epidemiology:** With the exception of a subset of children with special health care needs, children are less likely than adults to have multiple comorbid conditions.
- **Dependence:** Parents and other caregivers play a critical role in children's health care.
- **Demographics:** Children are more likely than adults to live in poverty and to represent diverse racial and ethnic groups, and are less likely to have health insurance.
- **Development:** Physical, emotional and cognitive development change dramatically across childhood; the needs of children at different ages may be strikingly different.^{i,ii}

These factors have been considered throughout the Toolkit as they must be integrated across all stages of the process of quality improvement, from the initial identification of areas in need of improvement to the development and implementation of improvement strategies.

The Pediatric QI Toolkit can be used to support inpatient quality improvement with the AHRQ Pediatric Quality Indicators (PDIs). However, it is flexible enough to be used with any other

ⁱHalfon N, Inkelas M, Wood DL, et al. Health care reform for children and families: refinancing and restructuring the U.S. child health system. In: Anderson R, Rice TH, Kominski GF, eds. *Changing the US. health care system: key issues in health services, policy, and management*. San Francisco: Jossey-Bass; 1996. pp. 229-31.

ⁱⁱJameson EJ, Wehr E. Drafting national health care reform legislation to protect the health interests of children. *Stanford Law Policy Review* 1993;5:153-76.

pediatric quality measures and has been used successfully for non-PDI quality measures in a field test (for an example, see the case study in tool A.4).

Because hospitals vary in the extent to which they have existing quality improvement processes in place, the Pediatric QI Toolkit is designed as a flexible, modifiable set of tools that can be selected according to your hospital’s needs. All the tools can be modified easily to suit your needs. In addition, your hospital may choose to use only those tools that you find helpful. The Pediatric QI Toolkit serves as a “resource inventory” from which you can select the tools that are most appropriate to your hospital’s current quality improvement capabilities and efforts.

Below is the Roadmap to the Pediatric QI Toolkit, which you can use to quickly identify which tools to use at any point in time. Individual tools are grouped into six steps A through F below, followed by a general resources section.

Roadmap to the Pediatric QI Toolkit

Section A: Assessing Readiness To Change

Section A helps board members and staff better understand the AHRQ PDIs and assist senior and quality leaders in assessing the readiness of their organization to implement improvements.

Tool	Description
A.1. Introduction to Pediatric QI Toolkit	<i>Includes this introduction to toolkit (A.1) and a fact sheet on AHRQ PDIs (A.1a)</i>
A.2. Board PowerPoint Presentation on the AHRQ PDIs	<i>Includes PowerPoint presentation template to introduce project to the hospital board and/or senior leadership</i>
A.3. Getting Ready for Change Self-Assessment	<i>Includes survey to assess leaders’ perspectives on organizational readiness</i>
A.4. Case Study of Improvement Implementation	<i>Includes a case study of how a children’s hospital used the Pediatric QI Toolkit</i>

Section B: Applying QIs to Your Hospital’s Data

Section B helps quality leaders and analysts calculate their AHRQ PDI rates and identify documentation and coding issues that can affect those rates.

Note: The current version of the AHRQ QI software does not have risk adjustment capabilities. However, the tools below include information about risk adjustment that will be relevant when looking at past performance (using ICD-9ⁱⁱⁱ codes and software) and when later versions of the AHRQ QI software with risk adjustment capabilities are released.

Tool	Description
B.1. Applying the AHRQ Pediatric Quality Indicators to Hospital Data	<i>Includes instructions for performing calculations to identify current PDI rates in your hospital</i>
B.2. PDI Rates Generated by SAS QI (B.2a) and Windows QI (B.2b) Software	<i>Includes sample output from both software packages</i>
B.3. Excel Worksheets for Charts on Data, Trends, and Rates To Populate the PowerPoint Presentation Instructions; PowerPoint Presentation: The AHRQ Quality Indicators, Results, and Discussion of Data Analysis	<i>Includes instructions on how to use Excel worksheets to produce charts based on your hospital's data and a PowerPoint presentation template</i>
B.4. Documentation and Coding for PDIs	<i>Includes strategies for addressing documentation and coding issues with the PDIs</i>
B.5. Assessing Indicator Rates Using Trends and Comparators	<i>Includes guidance for conducting trend and comparator analysis</i>

Section C: Identifying Priorities for Quality Improvement

Section C includes a prioritization worksheet to help senior and quality leaders determine where to focus improvement efforts. It also includes a presentation designed to engage staff after a PDI has been chosen and the design of an implementation is beginning.

Tool	Description
C.1. Prioritization Worksheet and Instructions	<i>Includes Excel spreadsheet to assist in prioritizing selection of indicators</i>
C.2.. Prioritization Worksheet Example	<i>Includes an example of a completed prioritization worksheet</i>
C.3. Staff Engagement Presentation	<i>Includes a PowerPoint presentation template that can be used to engage frontline and other staff</i>

ⁱⁱⁱICD-9 = International Classification of Diseases, 9th Revision.

Section D: Implementing Evidence-Based Strategies To Improve Clinical Care

Section D supports the team in applying quality improvement methods to implement changes in practices. Tool D.3 no longer exists, but we have kept the existing numbering for the remaining tools.

Tool	Description
D.1. Improvement Methods Overview	<i>Includes an overview of the steps in a quality improvement process</i>
D.2. Project Charter	<i>Includes a charter to help you define the implementation team, goals, and measures of progress for your improvement project</i>
D.4. Selected Best Practices and Suggestions for Improvements	<i>Includes introduction to indicator-specific best practices and detailed information on best practices for selected indicators</i>
D.5. Gap Analysis	<i>Includes a tool to help you understand how your organization's practices align with best practices to identify potential areas for improvement</i>
D.6. Implementation Plan	<i>Includes a tool to help plan and monitor steps needed to begin implementation</i>
D.7. Implementation Measurement	<i>Includes an example of how to monitor progress once implementation has begun</i>
D.8. Project Evaluation and Debriefing	<i>Includes a tool to assist in evaluating the implementation process and identifying areas in need of further improvement</i>

Section E: Monitoring Progress and Sustainability of Improvements

Section E supports quality staff in tracking trends in performance on the measures.

Tool	Description
E.1. Monitoring Progress for Sustainable Improvement	<i>Includes a tool to assist with planning for ongoing examination of processes and outcomes for continuous improvement</i>

Section F: Analyzing Return on Investment

Section F helps senior leaders estimate the return on investment from improvement efforts around the AHRQ PDIs.

Tool	Description
F.1 Return on Investment Estimation	<i>Includes a step-by-step method for calculating return-on-investment (ROI) for an intervention aimed at improving performance on an AHRQ QI and an example ROI calculation</i>

Section G: Other Quality Improvement Resources

Section G helps quality staff identify other resources to support quality improvement.

Tool	Description
G.1. Available Comprehensive Quality Improvement Guides	<i>Includes an annotated list of related comprehensive quality improvement guides</i>
G.2. Specific Tools to Support Change	<i>Includes an annotated list of other related quality improvement tools and resources</i>

Fact Sheet on Pediatric Quality Indicators

What Are the Pediatric Quality Indicators (PDIs)?

The Pediatric Quality Indicators (PDIs) are a set of 16 measures (15 standalone measures and one composite measure) developed by the Agency for Healthcare Research and Quality (AHRQ) that can be used with hospital inpatient discharge data to provide a perspective on the quality of pediatric health care and the health of the pediatric population. The hospital PDIs screen for problems that occur while a patient is hospitalized and that patients experience as a result of exposure to the health care system. These events may be preventable by changes at the system or provider level. Some of these indicators also have area-level analogs designed to detect patient safety events on a county or regional level.

PDI 19 is a composite measure that is intended to reflect the safety climate of the hospital by providing a marker of patient safety (or “avoidance of harm”) during the delivery of pediatric health care. As a single and transparent metric, it can be easily used to monitor performance over time or across regions and populations with a methodology that can be applied at the national, regional, State, and provider level. Each PDI in the composite is amenable to prevention through system-level related structures and processes of care.

The composite indicator is intended to be used to monitor performance in national and regional reporting, as well as for comparative reporting and quality improvement at the provider level. It is not intended to reflect any broader construct of quality, beyond what is reflected in the component indicators themselves. Use of a composite can assist consumers in selecting hospitals, assist clinicians in allocating resources, and assist payers in assessing performance; especially in the presence of competing priorities or where more than one component measure may be important.

A Snapshot of the Indicators

The current 16 provider-level PDIs are listed in Table 1, along with information on their most recent annual rates and status regarding NQF endorsement.

A detailed list of indicator specifications, software for calculating the measures, and software documentation are available on the AHRQ Quality Indicators Web site: www.qualityindicators.ahrq.gov.

Table 1. The 2015 AHRQ Neonatal Quality Indicators (NQIs) and Pediatric Quality Indicators (PDIs), With 2012 Rates and National Quality Forum Endorsement Status

Neonatal or Pediatric Indicator	Rate per 1,000	NQF Endorsement	
		ID	Most Recent Year
NQI 01 Neonatal Iatrogenic Pneumothorax Rate	0.18		
NQI 02 Neonatal Mortality Rate	2.25		
NQI 03 Neonatal Blood Stream Infection Rate	25.18	0478	2013
PDI 01 Accidental Puncture or Laceration Rate	0.46	0344	2012
PDI 02 Pressure Ulcer Rate	0.27	0337	2015
PDI 03 Retained Surgical Item or Unretrieved Device Fragment Count	N/A*	0362	2012
PDI 05 Iatrogenic Pneumothorax Rate	0.11	0348	2012
PDI 06 RACHS-1 Pediatric Heart Surgery Mortality Rate	31.55	0339	2012
PDI 07 RACHS-1 Pediatric Heart Surgery Volume	N/A*	0340	2012
PDI 08 Perioperative Hemorrhage or Hematoma Rate	5.2		
PDI 09 Postoperative Respiratory Failure Rate	14.52		
PDI 10 Postoperative Sepsis Rate	14.33		
PDI 11 Postoperative Wound Dehiscence Rate	1.12		
PDI 12 Central Venous Catheter-Related Blood Stream Infection Rate	0.76		
PDI 13 Transfusion Reaction Count	N/A*	0350	2012
PDI 19 Pediatric Safety for Select Indicators	**		

* N/A: Not applicable; measure is based on a count of events.

** Composite score.

Based on AHRQ QI software version 5.0 for ICD-9 as of March, 2015; 2012 is the most recent version of HCUP available at time of toolkit publication.

Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases, 2012; AHRQ Quality Indicators Pediatric Quality Indicator Benchmark Data Tables. http://www.qualityindicators.ahrq.gov/Modules/pdi_resources.aspx.

AHRQ Quality Indicators Software

AHRQ provides free software—in both SAS[®] and Windows—for organizations to apply the PDIs to their own data to assist quality improvement efforts in acute care hospital settings. Both versions of the software include all the AHRQ QI modules, including the PDIs.

Some of the PDIs are calculated using present-on-admission (POA) codes in the hospital discharge data. In QI software version 5.0, the user had the option of indicating that POA should not be considered when running the software. In version 6.0, the option to ignore POA was removed. It is now assumed that all data include valid POA information.

In October 2015, the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) used to report medical diagnoses and inpatient procedures was officially replaced by the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM). This transition affected diagnosis and inpatient procedure coding across the United States. As of spring 2016, AHRQ has updated the QI software (v6.0) to account for the change to ICD-10. Because hospitals have just begun coding with ICD-10 codes, there are no available national data that allow hospitals to compare their measures to national benchmarks; however, future versions of the software will calculate risk-adjusted measures.

Board and Senior Leadership PowerPoint Presentations on the Pediatric Quality Indicators

What is the purpose of this tool?

The purpose of the PowerPoint presentation for the board is to help the board members understand the importance and financial and clinical implications of the AHRQ Pediatric Quality Indicators.

Who are the target audiences?

The key users of this tool are the quality officers and senior management staff who are educating the hospital board and/or senior leadership about the Pediatric Quality Indicators.

How can the tool help you?

This tool can be a standalone educational resource or serve as a resource to condense key points for presentation to your quality and patient safety committees, boards, organizational leaders, medical and surgical committees and performance improvement teams. You should delete, add, or modify slides to best suit your organization's needs.

How does this tool relate to others?

This tool is part of the Readiness To Change section in the Toolkit Roadmap. It can be related to the self-assessment tool by providing a rich knowledge base on the use of the AHRQ Pediatric Quality Indicators to identify quality topics for monitoring and performance improvement. An organization needs a thorough understanding of these indicators and their impact to evaluate the organization's infrastructure to support improvement efforts.

Instructions

Use and select the following slides to develop a presentation for your board/senior leadership. Delete or modify the text indicated in red.

The Agency for Healthcare Research and Quality (AHRQ) Pediatric Quality Indicators

***Background for Hospital Board &
Senior Leadership***

Date

Why are we here today?

- Understand the importance of the AHRQ Pediatric Quality Indicators (PDIs).
- Understand the financial and clinical implications of the PDIs for our organization.
- Endorse the PDIs as a tool for implementing and monitoring improvement.
- Make the PDIs a priority within our organization.

Leadership is key to improvement

- Hospital boards and senior leadership are increasingly turning to the AHRQ QIs as a tool for monitoring performance, particularly on patient safety.
- To be successful, improvement efforts within hospitals need to have attention and active support from boards and senior hospital leadership.
- Your active support will demonstrate that the hospital has made it a priority to improve quality and patient safety for pediatric patients.
- This support will help to motivate our staff to engage fully in improvement activities.

Pediatric health care quality is important

- The safety of our patients is a priority.
- Hospital quality indicators are increasingly available to consumers.
- Medicaid is no longer reimbursing hospitals for some hospital-acquired conditions and safety events for patients covered by Medicaid (including children).
- Pediatric indicators can be used to assess performance and compare against peer hospitals.

What is AHRQ?

- The **Agency for Healthcare Research and Quality**:
 - Is part of the U.S. Department of Health and Human Services.
 - Supports research designed to improve the outcomes and quality of health care, reduce health care costs, address patient safety and medical errors, and broaden access to effective services.
 - Sponsors, conducts, and disseminates research to help people make more informed decisions and improve the quality of health care services.
 - Acts as the regulator for Patient Safety Organizations that are certified under the Patient Safety and Quality Improvement Act.

What are the AHRQ Pediatric Quality Indicators?

- The PDIs are a set of 16 indicators that reflect quality of care inside hospitals and adverse events that children, adolescents, and, where specified, neonatal patients may experience as a result of exposure to the healthcare system.
- PDIs measure events likely to be preventable through changes at the system or provider level.
- PDIs are measured using hospital administrative data.
- One PDI (PDI 19) is a composite measure.
- Eight out of 16 provider-level PDIs are endorsed by NQF.

Where can I find more information on the AHRQ PDIs?

- More information on the PDIs, including specifications and benchmarks, is available at http://www.qualityindicators.ahrq.gov/modules/pdi_resources.aspx.

Why were the PDIs developed?

- Because quality and safety are so important, the AHRQ PDIs were developed to help hospitals:
 - **Screen for potential quality and safety problems** in children using easily accessible data.
 - **Compare themselves with other hospitals** using national standardized measures to assess quality of hospital care.

For more information, see *General Questions About the AHRQ QIs*. AHRQ Quality Indicators. Rockville, MD: Agency for Healthcare Research and Quality; July 2004.

www.qualityindicators.ahrq.gov/FAQs_Support/default.aspx.

How were the AHRQ PDIs developed?

- The AHRQ PDIs were developed through four processes:
 - Identification of candidate indicators
 - Literature review
 - Empirical analyses
 - Panel review
- Once developed, the PDIs were vetted by expert panels of clinicians.
- The initial set of PDI indicators was released in 2006.

For more information, see *Measures of Pediatric Health Care Quality Based on Hospital Administrative Data: The Pediatric Quality Indicators*. Rockville, MD: Agency for Healthcare Research and Quality; 2006.

http://www.qualityindicators.ahrq.gov/modules/pdi_resources.aspx; and

Pediatric Quality Indicators. Rockville, MD: Agency for Healthcare Research and Quality; July 2010.

http://www.qualityindicators.ahrq.gov/Downloads/Modules/PDI/V42/Pediatric_Ind_10_update.pdf.

Why use the AHRQ PDIs?

- The AHRQ PDIs identify quality topics for monitoring and performance improvement:
 - Use hospital administrative data
 - Highlight potential quality concerns
 - Identify areas that need further study and investigation
 - Allow monitoring of changes over time
- Because we cannot always measure “quality of care” per se, we use certain measures as an “indicator” of quality.

For more information, *General Questions About the AHRQ QIs*. AHRQ Quality Indicators. Rockville, MD: Agency for Healthcare Research and Quality; July 2004.

www.qualityindicators.ahrq.gov/FAQs_Support/default.aspx.

ICD-10-CM Conversion

- Change from ICD-9-CM to ICD-10-CM occurred in October 2015:
 - Addition of information relevant to ambulatory and managed care encounters
 - Expanded injury codes
 - Creation of combination diagnosis/symptom codes
 - Addition of 6th and 7th characters
 - Incorporation of common 4th and 5th digit subclassifications
 - Laterality
 - Greater specificity in code assignment
- The AHRQ PDIs have been updated to reflect this change.

ICD-10-CM = International Classification of Diseases, 10th Revision, Clinical Modification.

How are the AHRQ PDIs structured?

- Definitions based on:
 - ICD-10-CM diagnosis and procedure codes
 - Often along with other measures (e.g., MS-DRG, MDC, sex, age, procedure dates, admission type)
- Numerator = number of cases with the outcome of interest (e.g., pediatric cases with pressure ulcer)
- Denominator = population at risk (e.g., hospitalized patients)
- Observed rate = numerator/denominator
- Some AHRQ PDIs measured as volume counts

MS-DRG = Medicare Severity diagnosis-related group; MDC = major diagnostic classification.
Source: www.qualityindicators.ahrq.gov/resources/Presentations.aspx.

An Example: Pressure Ulcer (PDI 02)

- Numerator: Discharges with ICD-10-CM code of pressure ulcer in any secondary diagnosis field among cases meeting the inclusion and exclusion rules for the denominator.
- Denominator: All medical and surgical discharges age 17 years and younger defined by specific DRGs or Medicare Severity DRGs.
- Several exclusions (e.g., length of stay <5 days, principal diagnosis of pressure ulcer).

Source:

<http://www.qualityindicators.ahrq.gov/Downloads/Modules/PDI/V45/TechSpecs/PDI%2002%20Pressure%20Ulcer%20Rate.pdf>

How can the AHRQ PDIs be used in quality assessment?

- AHRQ PDIs can be used to flag potential problems in quality of care.
- AHRQ PDIs can be used to assess performance and compare against peer hospitals.
- Examples of hospital use of AHRQ QIs in the literature have examined the impact of:
 - Health information technology on quality of care.
 - Hospital board quality committees on quality of care.
 - The effectiveness of nurse staffing on care delivered.

Source: www.qualityindicators.ahrq.gov/Default.aspx and *AHRQ Quality Indicator Toolkit Literature Review*.

If you already have your current PDI data available: use slides 16-17 and delete slides 18-19.

If you do not have your PDI data available: use slides 18-19 and delete slides 16-17.

DELETE THIS SLIDE.

Current performance on the AHRQ PDIs

- *INSERT GRAPHS OR TEXT FROM YOUR HOSPITAL'S DATA HERE.*

Example

Next steps for QI team

1. Identify priorities for quality improvement.
2. Establish goals and performance targets.
3. Formulate an action plan to develop a multidisciplinary team for AHRQ PDI work.

Sample report on hospital performance on the AHRQ PDIs



Quality and Safety Management Report

Print Date:
Data Extract Date:

Tuesday, June 10, 2014
Wednesday, March 12, 2014

Great State Medical Center Oct - Dec 2013 (Q4) Agency View

AHRQ Pediatric Quality Indicators	Relative Performance	Denom	Observed	Target	UHC Median	Rank	Relative Performance	Denom	Observed	Target	UHC Median	Rank
			Score			x/n			Score			x/n
AHRQ Pediatric Quality Composite Indicators												
PDI99 AHRQ Pediatric Quality Indicator Composite	○		0.63	0.98	0.90	3/117	○		0.44	1.00	0.88	1/119
		N	Percent			x/n		N	Percent			x/n
Mortality (%)												
PDI06 RACHS-1 Pediatric heart surgery	⊖	20	5.0	3.7	0.0	33/ 41	⊖	99	4.0	3.7	1.9	38/ 55
PDI21 (NQ12) Neonatal mortality	○	520	1.3	1.4	0.4	57/104	○	2,064	0.9	1.0	0.4	60/106
		N	Rate/1000			x/n		N	Rate/1000			x/n
Surgical & Other (Rate per 1000)												
PDI01 Accidental puncture or laceration	○○	1,258	0.0	1.2	0.0	7/117	○○	4,990	0.0	1.2	0.3	2/120
PDI02 Pressure ulcer (Decubitus ulcer prior to 2007 Q4)	○○	188	0.0	0.2	0.0	23/103	○○	783	0.0	0.2	0.0	13/113
PDI05 Iatrogenic pneumothorax	○○	1,127	0.0	0.2	0.0	21/117	⊖	4,516	0.2	0.2	0.0	89/120
PDI08 Perioperative hemorrhage or hematoma	○○	147	0.0	5.2	0.0	4/ 98	○	572	3.5	5.4	0.0	76/117
PDI09 Post-operative respiratory failure	○○	106	9.4	21.0	0.0	59/ 92	○	443	11.3	18.3	7.0	63/116
PDI10 Post-operative sepsis	○○	110	9.1	21.4	0.0	54/ 93	○○	455	6.6	19.8	12.3	42/113
PDI11 Post-operative wound dehiscence	○○	45	0.0	0.4	0.0	19/ 76	○○	169	0.0	0.4	0.0	19/101
PDI12 Central venous catheter-related bloodstream infections	○○	1,091	0.9	3.0	0.0	68/116	○○	4,336	0.7	2.6	0.7	50/120
PDI19 Birth trauma - injury to neonate (PSI17)		437	6.9					1,758	5.7			
PDI20 (NQ11) Iatrogenic pneumothorax in neonates (PDI04 prior to 2007Q4)	○○	93	0.0	0.2	0.0	34/102	○○	355	0.0	0.2	0.0	32/105
PDI22 (NQ13) Bloodstream infection in neonates	○○	79	12.7	26.5	25.6	38/101	○	265	15.1	24.2	26.0	34/104
		N	x/n					N	x/n			
Surgical & Other (Count)												
PDI03 Retained surgical item or unretrieved device fragment			0	0	0				0	0	0	
PDI13 Transfusion reaction			0	0	0				0	0	0	
Volumes												
PDI07 RACHS-1 Pediatric heart surgery			20		12	27/ 63			104		16	24/ 81

Next steps for QI team

1. Run AHRQ PDI report with most recent quarter's data.
2. Review AHRQ PDI report at next board meeting.
3. Identify priorities for quality improvement.
4. Establish goals and performance targets.
5. Formulate an action plan to develop multidisciplinary team for AHRQ PDI work.

Getting Ready for Change Self-Assessment

What is the purpose of this tool? This tool can be used to assess your hospital's organizational infrastructure and its readiness to support effective implementation efforts. Using this checklist, you can highlight capabilities that should be in place within your hospital before implementing improvement efforts related to the AHRQ Pediatric Quality Indicators (PDIs). These capabilities are organized into two evidence-based domains:

1. **Infrastructure for Change Management**, to evaluate how ready your organizational infrastructure is to support quality improvement in general.
2. **Readiness To Work on the AHRQ Pediatric Quality Indicators**, to evaluate your organization's readiness to improve its performance specifically on the AHRQ PDIs.

Both domains are important to effectively implement change. Within each domain, we identify related dimensions that you should consider in assessing your hospital's status. Feel free to shorten or modify the checklist to best suit the needs of your hospital.

Who are the target audiences? Senior executives and trusted mid-level managers. It can be useful to have several senior executives review this tool independently. This includes, at a minimum, the chief medical officer, chief quality officer, nursing leadership, and members of your hospital's quality committee. It may also help to have feedback on these items from trusted mid-level managers, since they may bring alternative viewpoints and may have better knowledge of operational issues.

How can it help you? One of the first steps in successful change is to determine how ready the hospital is to undertake meaningful changes in the way it operates. Identifying and addressing barriers to change will improve your hospital's success in implementing successful performance improvements.

How does this tool relate to others? This tool helps you assess how prepared the hospital organization is to implement improvement initiatives for the AHRQ PDIs, which is a factor to consider in the *Gap Analysis* (Tool D.5). It also can guide your choice of other tools to address areas that you find need strengthening. Examples include *Applying the AHRQ Pediatric Quality Indicators to Hospital Data* (Tools B.1, B.2, B.3) and the *Prioritization Worksheet* that is used to identify priorities for improvement actions (Tool C.1). While not part of this toolkit, AHRQ's Hospital Survey on Patient Safety Culture may help you assess your hospital's readiness for change (see <http://www.ahrq.gov/professionals/quality-patient-safety/patientsafetyculture/hospital/>).

What should each person do?

- For each key concept, each individual should rate the extent to which the statement characterizes your hospital: Not at all, to some extent, or to a great extent.
- Complete both section 1 (Infrastructure for Change Management) and section 2 (Readiness To Work on the AHRQ Pediatric Quality Indicators).
- Note any particular concerns in each area to facilitate later discussion.

How do we review the results together? Once the individual reviews of the checklist are complete, schedule a meeting of the hospital's key leaders. The discussion at this meeting should focus on areas where your infrastructure needs strengthening or where there is a lack of consensus.

- For section 1, Infrastructure for Change Management, discuss the greatest vulnerabilities for your hospital, those that are most likely to cause quality improvement efforts to fail. Based on this discussion, identify an action plan with specific steps, individuals responsible for each step, and a timeline for revisiting progress.
- If your hospital does not use the AHRQ PDIs, consider your experience with other quality metrics when reviewing section 2.

References Used To Inform Survey Design

1. Keroack MA, Youngberg BJ, Cerese JL, et al. Organizational factors associated with high performance in quality and safety in academic medical centers. *Acad Med* 2007;82(12):1178-86.
2. Taylor SL, Ridgely MS, Greenberg MD, et al. Experiences of Agency for Healthcare Research and Quality-funded projects that implemented practices for safer patient care. *Health Serv Res* 2009;44:2 (Pt 2):665-83.
83. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2677034/>. Accessed May 12, 2016.

Section 1. Infrastructure for Change Management

This section will help you evaluate how ready your hospital is to support quality improvement actions.

To what extent does each statement characterize your hospital?	Not at all	To some extent	To a great extent
1a. Quality and safety as priorities			
• We have a shared sense of purpose that quality and safety are our highest priorities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Quality and patient safety are included in our hospital's main goals or pillars of performance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• The governing board is actively involved reviewing our hospital's performance on quality and patient safety measures.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We have open communication among providers, staff, patients, and caregivers about quality and patient safety.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall, our hospital's organizational structure places a high priority on quality and patient safety.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>My concerns in this area are:</i>			
1b. Management processes			
• Our management processes emphasize meeting quality performance standards and provide the resources we need for supporting quality improvement.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We have an anonymous, nonpunitive way of reporting events and errors.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Our leadership responds actively when patient safety issues are identified.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We document patient safety standards in protocols and guidelines that are clear and easy to understand.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We disseminate the protocols and guidelines widely within the hospital.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall, our hospital's management processes are designed to place a high priority on quality and patient safety.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>My concerns in this area are:</i>			
1c. Senior leadership			
• Everyday events are connected to our larger purpose through stories and rituals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Our governance structures and practices minimize conflict between our hospital's multiple missions and priorities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Our hospital is led as an alliance between the executive leadership team and the clinical department chairs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall, senior leaders within our hospital are passionate about service, quality, and safety and have an authentic, hands-on style.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>My concerns in this area are:</i>			
1d. Training			
We provide ongoing training for staff that helps them build skills to improve quality and patient safety.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>My concerns in this area are:</i>			

Pediatric Toolkit for Using the AHRQ Quality Indicators
How To Improve Hospital Quality and Safety

To what extent does each statement characterize your hospital?	Not at all	To some extent	To a great extent
1e. Accountability			
• Our hospital provides incentives or rewards (financial or nonfinancial) for high levels of patient safety.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Our medical leaders (such as department chairs or medical directors) accept responsibility for quality and safety within their departments.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We have accountability, innovation, and redundant processes to ensure quality at the unit level.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Our hospital has a policy of transparency, and information is shared at all levels (from top to bottom and vice versa).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall, our hospital holds senior leaders accountable for service, quality, and safety (e.g., CEO, COO, CMO, CNO, CFO, CQO, CIO).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>My concerns in this area are:</i>			
<hr/>			
1f. Data systems			
Overall, we have effective data systems: they are functional and allow us to obtain data when we need them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>My concerns in this area are:</i>			
<hr/>			
1g. Results focused			
• We continuously strive to improve and we benchmark our performance against external standards as a measure of success.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• In decisionmaking, we focus on the likely results to guide our choice of performance improvement approach, rather than always following a particular approach (such as Six Sigma).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We emphasize human behavior and work redesign as the keys to improvement.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We use technology as an accelerator and not as a substitute for work redesign.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall, we are driven to focus on results.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>My concerns in this area are:</i>			
<hr/>			
1h. Collaboration			
• The relationships between administration, providers, nurses, and other staff are typically collaborative in our hospital.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We provide frequent recognition of employee contributions at every level.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Employees value each other's critical knowledge when problem solving.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We have a sense that teamwork among staff is encouraged.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall, we have a sense of collaboration among all staff to improve patient safety.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>My concerns in this area are:</i>			

Section 2. Readiness To Work on the Quality Indicators

This section will help you evaluate your organization’s readiness to improve its performance specifically on the AHRQ Pediatric Quality Indicators. If your hospital does not currently use the AHRQ Pediatric Quality Indicators, it may help to consider your experience in working with and improving performance on other quality metrics.

To what extent does each statement characterize your hospital?	Not at all	To some extent	To a great extent
2a. AHRQ Pediatric Quality Indicators as a priority			
• We have a shared sense of purpose to decrease mortality and reduce complications in children.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We have open communication among providers, staff, patients, and caregivers about our work on the Pediatric Quality Indicators.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Our hospital leadership responds actively when we identify issues related to the Pediatric Quality Indicators.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Our hospital leaders emphasize the need for high performance on the Pediatric Quality Indicators.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We document safety standards related to the Pediatric Quality Indicators in our protocols and guidelines.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We continuously strive to improve our performance on the Pediatric Quality Indicators.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall, our hospital places a high priority on the AHRQ Pediatric Quality Indicators.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>My concerns in this area are:</i>			
<hr/>			
2b. Experience with the AHRQ Pediatric Quality Indicators			
• We include one or more of the Pediatric Quality Indicators in our existing set of quality and safety performance measures.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We review trend data on one or more of the Pediatric Quality Indicators on a regular basis in the hospital’s performance monitoring process.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We have undertaken quality improvement initiatives to address performance on one or more of the Pediatric Quality Indicators.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• We review and analyze everyday events related to the Pediatric Quality Indicators to identify areas where improvements are needed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall, we have experience working with the AHRQ Pediatric Quality Indicators.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>My concerns in this area are:</i>			
<hr/>			
2c. Accountability			
• Our hospital provides incentives or rewards (financial or nonfinancial) for performance on the Pediatric Quality Indicators.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Our medical leaders (such as department chairs or medical directors) accept responsibility for the Pediatric Quality Indicators within their departments.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall, we hold ourselves accountable for performance on the AHRQ Pediatric Quality Indicators.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>My concerns in this area are:</i>			

To what extent does each statement characterize your hospital?	Not at all	To some extent	To a great extent
2d. Data systems			
<ul style="list-style-type: none"> Our hospital maintains a database of discharge records using the Uniform Billing Code system, which can be used to track discharge records on each patient individually for the last 4 or 5 years. 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>Overall, our data systems have the needed capability to support quarterly monitoring of AHRQ Quality Indicator performance, or we have the ability to obtain this Quality Indicator information from another source.</p> <p><i>My concerns in this area are:</i></p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<hr/>			
2e. Training			
<p>We provide ongoing training for staff on the AHRQ Quality Indicators and what they mean.</p> <p><i>My concerns in this area are:</i></p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<hr/>			

Section 3. Role in Quality Improvement

Please indicate which of the following describe your role in quality improvement efforts at your institution (check all that apply)

- Senior leadership**
- Quality improvement team or committee**
- Frontline staff (e.g., RN, MD, NP, RT)**
- Other (specify):** _____

Case Study of Using the Pediatric QI Toolkit for Quality Improvement

What is the purpose of this tool? This tool provides a case study from a children's hospital that participated in the field test and evaluation of the Pediatric QI Toolkit. It offers a description of the tools the hospital chose to use, as well as several of the key actions it took to improve performance on central line-associated bloodstream infections (CLABSIs).

Who are the target audiences? The primary audiences for this tool are senior hospital leaders and quality leaders.

How can this tool help you? You can use this tool to better understand how other hospitals have used the toolkit.

How does this tool relate to others? This tool should be used together with the Introduction to the Pediatric QI Toolkit (Tool A.1), which provides an overview of all the individual tools and can help in selecting the tools that best meet your hospital's needs.

Children’s Hospital Uses AHRQ’s Pediatric QI Toolkit To Bring Physicians Together To Reduce CLABSIs

Abstract

The Ann & Robert H. Lurie Children’s Hospital used the Pediatric QI Toolkit to reduce central line-associated bloodstream infections (CLABSIs) in their hematology/oncology/stem cell transplant division. Within only 6 months of implementing changes to care processes, the hospital experienced a 50 percent decrease in their CLABSI count. Impressed with these early results, the hospital plans to extend the initiative to other units, and expand their efforts to improve timeliness of line removal.

Hospital Context for Quality Improvement Focus

The nursing staff at Lurie Children’s Hospital had made some progress in the past by implementing CLABSI reduction programs, such as the use of central venous catheter maintenance bundles. This strategy was associated with a drop in CLABSIs, but by the end of 2014, CLABSI rates were rising in the hematology/oncology/stem cell transplant division. Dr. Sangeeta Schroeder and Dr. Lee Budin (medical director for the hospital’s Center for Excellence, the hospital’s group that works on patient safety and quality) recognized that the hospital had to take a closer look at what was contributing to this rise in CLABSIs. The Pediatric QI Toolkit gave them the support to make that happen.

How the Pediatric QI Toolkit Was Used

Lurie Children’s Hospital used the improvement process laid out in the Pediatric QI Toolkit to gain a better understanding of the factors contributing to CLABSIs in their patients and identify workable solutions. Dr. Schroeder started the process with the “Getting Ready for Change Self-Assessment” (Tool A.3). This short survey is designed to gather input from a variety of staff members on how prepared the organization is to implement and sustain quality improvement initiatives. At Lurie Children’s Hospital, the survey was administered to about 20 staff members in the hospital’s Center for Excellence. The results helped to identify several opportunities to improve as an organization, such as enhancing communication about quality improvement work across divisions.

Hospital

Ann & Robert H. Lurie Children’s Hospital of Chicago, Illinois.

Lead staff for improvement project

Sangeeta Schroeder, M.D., hospitalist
Lee Budin, M.D., medical director of the Center for Excellence (the hospital’s group that works on patient safety and quality)

Quality measure

Central line-associated bloodstream infections (CLABSI)—Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network (NHSN)

Tools Used by Lurie Children’s Hospital

- Getting Ready for Change Self-Assessment (Tool A.3)
- Improvement Methods Overview (Tool D.1)
- Best Practices for Central Venous Catheter (CVC)-Related Bloodstream Infections (Tool D.4j)
- Gap Analysis (D.5)

In the spring of 2015, Drs. Schroeder and Budin pulled together a new multidisciplinary team to focus on reducing CLABSIs. This team was composed of Dr. Schroeder, two CLABSI physician task force leads (the stem cell transplant director and the medical director of the intensive care unit), and a patient safety analyst. In addition, the team's working members included representatives from hematology, oncology, stem cell transplant, pediatric intensive care, infection control, anesthesiology, surgery, interventional radiology, information management, and data analytics. A presentation by Dr. Schroeder that drew on materials from the Pediatric QI Toolkit, including the Improvement Methods Overview (Tool D.1), helped to get the team's buy-in early in the quality improvement process.

Two tools were critical to gaining physician support: Best Practices for Central Venous Catheter (CVC)-Related Bloodstream Infections (Tool D.4j) and the Gap Analysis (Tool D.5). The results of the gap analysis revealed the areas in which the hospital's practices diverged from recognized best practices. One specific problem was that physicians were ordering temporary lines such as peripherally inserted central catheter (PICC) lines, which had a higher rate of CLABSIs, when a more permanent line was needed. Highlighting this issue helped to get the necessary buy-in from the head of the hematology/oncology/stem cell transplant division and made it clear to everyone why physicians needed to take ownership of the problem and be part of the improvement process.

Implementing a Clinical Intervention

In addition to engaging physicians, the gap analysis helped the improvement team identify the clinical intervention they needed to make in the care process and the barriers they needed to overcome. Drilling down to the root causes of the problem revealed a variety of issues. For example, by thinking through the barriers to and advantages of different kinds of lines, the team learned that physicians were more likely to order PICC lines than permanent lines in part because of communication and scheduling issues with the operating room, where permanent lines are placed. In contrast, PICC lines were being placed by interventional radiology, and scheduling placement was easier and faster. Resolving those issues required working with surgeons and interventional radiologists who had never been brought to the same table together with the ordering physicians before. This approach greatly improved communication across divisions.

By clarifying how the existing phone-based ordering process contributed to the problem, the improvement process also revealed the need for an algorithm that physicians could use to help identify the most appropriate line to order based on a child's diagnosis. The algorithm that the team developed was incorporated into the hospital's electronic medical record through smart order sets that hardwire the best practice and facilitate adherence. This approach also provides an easier way to assess whether physicians are following the newly developed line algorithm.

Impact

Lurie Children's Hospital noticed positive changes in clinician behavior soon after kicking off its use of the Toolkit in June 2015. Use of permanent lines in the hematology/oncology/stem cell transplant division as a percentage of all lines increased. As a result, the CLABSI count decreased by 50 percent from the last quarter of 2014 to the last quarter of 2015. The physicians and other staff are also better able to successfully coordinate biopsies, imaging, and other procedures with the placement of permanent central lines.

Measure	Baseline	Status After 6 Months	Impact
Permanent line rate (number of line days/number of patient days)	0.49 as of project kickoff in June 2015	0.65 as of December 2015	33% increase in permanent line rate over period of 6 months
Temporary line rate (number of line days/number of patient days)	0.37 as of project kickoff in June 2015	0.16 as of December 2015	57% decrease in temporary line rate over period of 6 months

For Dr. Schroeder, another important result is that several hematologists on the faculty who were not part of the original initiative are now expressing interest in getting involved. She also regards improved communication with the pediatric surgery division as a positive outcome of this work.

Looking ahead, Dr. Schroeder and her colleagues are exploring how this approach could work in other clinical areas and as a way to improve practices related to timely line removal hospitalwide.

Advice for New Users of the Pediatric QI Toolkit

Based on the hospital's experience to date, Dr. Schroeder offered the following advice to her counterparts in other hospitals serving pediatric populations:

- **Feel free to use the Toolkit for improvement efforts related to any pediatric quality measure, not just the AHRQ PDIs.** While the Toolkit is part of a suite of resources designed to support use of the AHRQ QIs, most of the tools are equally useful for other measures. Lurie Children's Hospital was initially unsure as to whether the Toolkit could be easily used for a non-PDI quality measure. However, they successfully used many of the tools even though they used the Centers for Disease Control & Prevention National Healthcare Safety Network definition of CLABSI rather than the AHRQ specifications.
- **Adapt the tools to meet your needs.** Dr. Schroeder found that she was easily able to change the tools—such as the gap analysis and implementation plan—to meet the specific needs of her CLABSI reduction project. She was also able to modify the board presentation template so that it would support her need to educate clinicians and staff about the problem and the imperative to seek solutions.
- **Recognize that it will take time for everyone to embrace change.** Bringing team members on board and getting them to work together requires relationship building; even when everyone is invested in achieving the same end goal, they have not necessarily bought in to the process. Dr. Schroeder noted that a top-down approach would not have worked; the team needed time to band together, share their perspectives, and accept that the quality improvement process would work.

Applying the AHRQ Pediatric Quality Indicators to Hospital Data

What is the purpose of this tool? This tool provides guidance on how to calculate your hospital's rates for the AHRQ Pediatric Quality Indicators (PDIs) and how to use those rates to assess the hospital's performance on the indicators. AHRQ has developed SAS programs and free QI software for Windows that you can use to calculate your PDI rates. This tool provides the following information:

- Overview of the AHRQ PDIs, data requirements, and issues involved in using them.
- Descriptions of the rates calculated for the PDIs and how to work with them.
- An example of how to interpret a hospital's PDI rates.
- Guidance for assessing performance on the PDIs (trends and comparators).

Who are the target audiences? The primary audiences for this tool are two groups of hospital staff.

- Quality and safety staff, as well as clinical and other staff (e.g., quality and/or patient safety officer at the hospital) involved in pediatric quality improvement work, should be involved in assessing the hospital's performance on the PDIs and making decisions on priorities for improvement.
- Statisticians, data analysts, and programmers can help calculate the PDIs using data available from the hospital and relevant information from other sources.

Whenever possible, this information is designed to be usable by the quality program staff. Some of the information is technical, however, and is intended for statistician or programmer audiences.

How can this tool help you? You can use this tool to help calculate and interpret the hospital rates for the PDIs as part of your hospital's quality improvement work. The examples and guidance provided should help you understand the different types of PDI rates generated by the AHRQ SAS program or QI Windows software and to assess your hospital's performance over time and in comparison to other hospitals.

How does this tool relate to others? This tool should be used together with the tool on *PDI Rates Generated by the AHRQ SAS Programs* (Tool B.2). That tool provides guidance on how to work with the SAS programs and QI Windows software used to calculate the PDIs for your hospital and describes how to read and use the output from the programs. By guiding your calculation of the PDI rates for your hospitals, this tool also is a resource for *PowerPoint and Excel Worksheets on Data, Trends, and Rates* (Tool B.3), which you can use to display your PDI rates for presentations.

Note: This tool was updated based on the test software available at the time of the Pediatric QI Toolkit revision (as of March 2016). Refer to AHRQ's QI software Web site (<http://www.qualityindicators.ahrq.gov/software>) for the most updated information on the software.

Working With the Quality Indicators

The AHRQ Quality Indicators (QIs) are designed to assess health care quality. The QIs consist of four modules measuring various aspects of quality, of which the Pediatric Quality Indicators (PDIs) were developed specifically for children. This toolkit addresses the PDIs relevant to the pediatric inpatient setting. Refer to the *PDI Fact Sheet* (Tool A.1a) in this toolkit for a summary description of these indicators.

The AHRQ PDIs are available for public use at no charge. Resource materials on the PDIs can be downloaded at http://www.qualityindicators.ahrq.gov/Modules/pdi_resources.aspx. Be sure to download three types of files for the PDI modules: (1) Technical_Specifications, which provides detailed information about definitions for the PDIs; (2) the QI Software, which includes SAS programs or a free Windows application for calculating the PDIs; and (3) the QI Software Instructions, which provide step-by-step instructions of how to run the software.

Types of Rates for Quality Indicators

The AHRQ QI software can generate four types of PDI rates, which serve different purposes. These are the observed rates, expected rates, risk-adjusted rates, and smoothed rates. Three types of counts are involved in the calculation of each of these rates, which define either the numerator or denominator for a rate.

The definitions of the four rates and the counts used to calculate them are shown in the box below. Precise definitions with mathematical detail are presented in the appendix.

The **rates for each indicator** are calculated as follows:

Observed rate = **Observed events/Eligible population**

Expected rate = **Expected events/Eligible population**

Risk-adjusted rate = (**Observed events/Expected events**) * reference population rate

Smoothed rate = Risk-adjusted rate * weight – reference population rate * (1 – weight)

The **counts** that are used to calculate the rates of each indicator are determined as follows:

Eligible population = for each PDI, the total number of a hospital's discharges that qualified for the eligible population for that specific indicator

Observed events = for each PDI, the total sum of events that occurred in the eligible population for that specific indicator

Expected events = for each PDI, the total sum of events expected to occur for that specific indicator if the hospital had average performance comparable to the reference population, considering its case mix

Data Used in Calculating the PDI Rates

Note: The information provided below related to expected, risk-adjusted, and smoothed rates is not applicable to v6.0 of the SAS and WinQI software, which only calculate observed rates when using ICD-10¹ data. The information about the expected, risk-adjusted, and smoothed rates are provided here because this information will still be relevant when looking at past performance (using ICD-9 codes and software). In addition, software to calculate expected, risk-adjusted, and smoothed rates is expected to become available in the future after national rates have been established using the ICD-10 codes.

Reference Population for the PDIs

The expected, risk-adjusted, and smoothed rates for the hospital-level PDIs are calculated using data for a reference population. AHRQ uses the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID) as the reference population. The SID is a large database of hospital discharge data maintained by AHRQ. It contains data for all hospital discharges from 47 States, representing more than 95 percent of all U.S. hospital discharges (for more information, see www.hcup-us.ahrq.gov/sidoverview.jsp).

Using this dataset, AHRQ performs statistical analyses to calculate reference-population PDI rates and identify risk factors. These measures are available as part of the AHRQ programs to calculate the PDI rates; hospitals do not have to do these calculations themselves.

Weights for the Smoothed Rates

The smoothed rates are calculated using weights that reflect the stability of your hospital's PDI rates, which are affected by the size of your hospital's patient population and the types of quality and safety events that occur in your hospital. When your hospital runs the QI software, weights are applied to the risk-adjusted rates for each PDI. These weights "shrink" the hospital's risk-adjusted rate toward the overall mean from the SID. The shrinkage estimate is called a "reliability adjustment."

For a hospital with less reliable PDI rate estimates, its smoothed rates will shrink more toward the SID mean, compared with smoothed rates for a hospital with more reliable rates. The resulting rates will have smaller year-to-year fluctuations in performance, so they will appear "smoother" than the raw rates.

Explanations of the Four Types of PDI Rates

Observed Rate

The observed rate (also called the raw rate) is the actual rate at which events measured by the indicator occurred in your hospital. If the hospital's primary interest is to identify cases for further followup and quality improvement, a review of the observed rates would be useful to identify PDIs that may be of concern. However, the observed rates are primarily intended to provide context for the user.

¹ICD-10 = International Classification of Diseases, 10th Revision. ICD-9 refers to the 9th Revision.

The observed rate is usually not appropriate for comparison across hospitals or over time because hospitals' patient case mixes can vary. If the number of eligible discharges for a PDI is small, the observed rate may appear to vary widely over time, even though the hospital's real performance on that indicator may not have changed. Therefore, to do other assessments, such as focusing on positive or negative performance, or comparisons with other hospitals, it is necessary to use the observed rate along with one of the other available rates.

Expected Rate

This rate currently is not available using the SAS or WinQI software v6.0. The expected rate is the rate a hospital would have if it had performed the same as the reference population given the provider's actual case mix (e.g., age, gender, diagnosis-related group [DRG], and comorbidity categories). The expected rate considers only the patient characteristics of a hospital's eligible discharges, not the actual observed events at the hospital.

Each eligible hospital stay is assigned an expected probability that a particular indicator event will occur based on the frequency with which the event occurred during similar stays in the reference population from the SID. The expected probabilities for the set of discharges are summed to obtain the number of expected events, which is then divided by your hospital's eligible population. The QI software contains the set of regression coefficients developed for each indicator from the SID, which the software uses to calculate and sum the probabilities to obtain the counts of expected events (see box above).

Another commonly used measure is:

$$\text{Observed to Expected (O/E) ratio} = \text{observed rate/expected rate}$$

If a hospital's observed rate for an indicator is higher than its expected rate (an O/E ratio greater than 1), the hospital performed worse than the reference population with an equivalent patient case mix. If the observed rate is lower than the expected rate (an O/E ratio less than 1), the hospital performed better than the reference population for that indicator with an equivalent case mix.

Risk-Adjusted Rate

This rate currently is not available using the SAS or WinQI software v6.0. The risk-adjusted rate is an estimate of how a hospital would perform on an indicator for an average case mix of patients, rather than for its own case mix. In other words, the risk-adjusted rate is the rate the hospital would have if its case mix were the same as the case mix in the reference population. This is the rate that should be used for making comparisons across hospitals, or for comparisons within your hospital over time, because it adjusts for differences in the patient mix and allows you to examine real changes in performance.

The risk adjustments account for differences in the age, sex, modified DRG, and comorbidity between a particular hospital and the entire SID. (Different DRGs and comorbidities are relevant for different PDIs.) To calculate a risk-adjusted rate, a hospital's observed rate is divided by its expected rate to obtain the O/E ratio. Then the O/E ratio is multiplied by the indicator rate for the reference population from the SID.

Smoothed Rate

This rate currently is not available using the SAS or WinQI software v6.0. The smoothed rate is a weighted average of the hospital's risk-adjusted rate and the reference population rate, where the weight reflects the reliability of the hospital's risk-adjusted rate. The smoothed rate can be used to assess whether any difference between a hospital's risk-adjusted rate and the reference population rate is likely to remain in the next measurement period.

When the hospital runs the QI software, a shrinkage factor is applied to the risk-adjusted rate for each PDI. The resulting rate will appear "smoother" than the observed rate, meaning that the smoothed rate will have smaller year-to-year fluctuations in performance. More information on interpreting smoothed rates can be found in the AHRQ publications *Guide to Inpatient Quality Indicators* and *Guide to Patient Safety Indicators*, both of which are available on the AHRQ Web site.

Your hospital can compare its smoothed rate for an indicator with its risk-adjusted rate by calculating the following ratio:

$$\text{Smoothed Rate Ratio} = \frac{\text{smoothed rate} - \text{reference population rate}}{\text{risk-adjusted rate} - \text{reference population rate}}$$

You can use this ratio to determine whether the difference between your hospital's risk-adjusted rate and the reference population rate is likely to remain in the next measurement period. The larger the ratio, the more similar the smoothed rate is to the risk-adjusted rate. AHRQ suggests that if the ratio is greater than 0.80, the difference is likely to persist (whether the difference is positive or negative). If the ratio is less than 0.80, a greater share of the difference may be due to random differences in patient characteristics (that are not controlled for in the risk-adjustment model) due to small numbers in the patient population.

If your hospital has a relatively small number of eligible discharges for a particular PDI, it may not be possible to precisely estimate changes in rates for that PDI over time. If the ratio indicates that the risk-adjusted rate is unlikely to persist over time, AHRQ suggests that you use the smoothed rate for comparison to others instead of the risk-adjusted rate and that you interpret these comparisons with caution. Alternatively, you might calculate the risk-adjusted rate using discharges from more than one year, which will make the rate more stable (reliable).

An Example That Illustrates Use of the PDI Rates

In this example, two hypothetical hospitals (A and B) are assessing their performance on PDI 02, Pressure Ulcers. The rates calculated for each hospital are summarized here; these rates for the two hospitals are discussed below, including examples of how you should interpret the rate comparisons as you assess the performance of your hospital on these indicators. ***Note that the currently available SAS and WinQI v6.0 software programs cannot provide the expected, risk-adjusted, and smoothed rates when using ICD-10 data.***

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Rates for PDI 02	Hospital A	Hospital B
Observed rate	0.02	0.06
Expected rate	0.04	0.10
Risk-adjusted rate	0.025	0.03
Smoothed rate	0.026	0.04

1. First, the two hospitals calculate their **observed rates** for PDI 02. Hospital A has an observed rate of 0.02 or 20/1,000, and Hospital B has an observed rate of 0.06 or 60/1,000. The national rate (from the SID) for PDI 02 is 0.05. It is not clear whether Hospital A or Hospital B has better or worse than average performance on PDI 02, compared with the SID rate, because they may have different case mixes than the SID population.
2. Hospital A has an **expected rate** of 0.04 for PDI 02. Since its expected rate is lower than the SID rate (0.05), its mix of patients is at *lower risk* for PDI 02 than the average case mix. Since its expected rate is higher than its observed rate, the hospital is performing better than expected on its case mix of patients. Hospital B has an expected rate of 0.10. Since its expected rate is higher than the SID rate (0.05), its mix of patients is at *higher risk* of PDI 02 than the average case mix. Since its expected rate is higher than its observed rate, the hospital also is performing better than expected on its case mix of patients.
3. Then the two hospitals calculate their **risk-adjusted rates** for PDI 02. Hospital A has a risk-adjusted rate of $0.025 = (0.02/0.04) * 0.05$ and Hospital B has a risk adjusted rate of $0.03 = (0.06/0.10) * 0.05$. The rates are calculated by multiplying each hospital's ratio of observed to expected rate by the SID rate of 0.05. These risk-adjusted rates suggest that Hospital A is performing slightly better on PDI 02 than Hospital B, and both hospitals are performing better than average, as represented by the SID rate. (Note that a lower rate for a PDI signifies better performance because fewer adverse events have occurred, in this case fewer patients with pressure ulcers.)
4. Hospital A is a relatively large hospital and has a **smoothed rate** of 0.026 on PDI 02, which is only slightly more similar to the reference population (SID) rate than its risk-adjusted rate. The smoothed-rate ratio discussed above takes a value of 0.96, suggesting that Hospital A's strong performance on PDI 02 is likely to persist. Hospital B is a small hospital that sees a small number of patients who are eligible for PDI 02. Hospital B has a smoothed rate of 0.04 and the smoothed-rate ratio takes a value of 0.50, which suggests that Hospital B's apparent good performance may not persist over time; that is, it may not reflect real performance. Hospital B may want to consider using the smoothed rate in comparing its performance on PDI 02 to others, or it could recalculate the risk-adjusted rate for PDI 02 using 2 years of discharge data to gain more stability in its rates.

Preparing To Calculate the PDI Rates

Hospital discharge data are required for the AHRQ PDIs. The needed data elements can be classified into the following categories:

- Hospital information, such as county.
- Patient demographics, such as age, gender, and race.
- Admission information, such as admission time (year, quarter), type (emergency vs. elective), admission source (from another hospital, emergency room in the same hospital).

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- International Classification of Diseases, 10th Revision (ICD-10-CM) diagnosis and procedure codes, and classifications based on those codes, such as Medicare Severity diagnosis-related groups (MS-DRGs) and major diagnostic categories (MDCs).
- Discharge information, such as length of stay, payer for hospital charges, and disposition of patient (died vs. transferred to another facility).

Detailed information about data elements, such as variable names, descriptions, and formats, is provided by AHRQ on its Web site (www.qualityindicators.ahrq.gov/modules/pdi_resources.aspx).

AHRQ recommends that individual hospitals ensure that their datasets use the variable names and formats required by the SAS programs before applying the programs to their datasets. The data elements in the PDIs are based on the coding specifications used in the HCUP SID. The SID coding specifications are similar to the Uniform Bill (UB-04) but not identical. For data elements used in the AHRQ PDIs, crosswalks between the SID and UB-04 coding specifications are included in the SID documentation available at <http://hcup-us.ahrq.gov/db/state/siddbdocumentation.jsp>. You can use the crosswalks to ensure that your hospital's discharge data are consistent with the SID coding system.

Some coding and measurement issues involved in calculating the QIs are summarized here:

- **Treatment of Missing Values.** The AHRQ QI software handles missing data by requiring confirmation for the assignment of a poor outcome or negative event. For example, to be assigned as a death, each case must actually be coded as a death; missing data are considered neutral. In addition, missing data for some elements results in the exclusion of that case from the denominator, whereas for a few other elements, the case is retained. For details about the impact of missing data for each data element, see the AHRQ Web site (www.qualityindicators.ahrq.gov/modules/pdi_resources.aspx).
- **Dealing With a Small Population at Risk.** The QI software calculates the observed rates regardless of the size of the population at risk. However, PDI rates based on only a few cases (i.e., a small population at risk) should be interpreted with caution. AHRQ recommends that, in some performance measurement work, rates be suppressed when fewer than 30 cases are in the denominator. This exclusion rule serves two purposes: (1) it eliminates unstable estimates based on too few cases; and (2) it helps protect the identities of patients.

Where To Turn for Help

Some hospitals may rely on an outside agency, such as the State hospital association or a parent organization, to analyze their data and produce their QIs. For assistance in obtaining these measures, you should contact these organizations.

Appendix. Formulas and Uses for the Four Types of PDI Rates

Type of Rate	Brief Description	Way To Use It
Observed Rate	<p>Raw rate generated by the QI software using a hospital's discharge data</p> $\text{Formula: } R^k = \frac{\sum_j Y_j^k}{\sum_j D_j^k}$ <p>where k indexes the QIs, j indexes the hospital's annual discharges, Y_j^k is a 0/1 variable taking the value 1 if discharge j meets the criteria for QI k, and D_j^k is a 0/1 variable taking the value 1 if discharge j is eligible for QI k.</p>	<p>Used to identify PDI areas of strength and those needing improvement; and for comparison with expected rates to identify PDI areas of strength and need for improvement.</p>
<p>Expected rate</p> <p>(Not currently available from the QI software for ICD-10)</p>	<p>Rate the hospital would have if it had performed the same as the reference population given the provider's actual case mix (e.g., age, gender, DRG, and comorbidity categories)</p> $\text{Formula: } E^k = \frac{\sum_j \hat{e}_j^k}{\sum_j D_j^k}$ <p>where in addition to the symbols defined above, $\hat{e}_j^k = \hat{\beta}^k X_j^k$ the predicted probability of QI k occurring on discharge j given the risks (X_j^k) present in discharge j where $\hat{\beta}^k$ is a vector of parameter estimates from a regression of the risks on occurrences of QI k in the SID.</p>	<p>Used for comparison with the observed rate within the same hospital to identify PDI areas of strength and need for improvement.</p>
<p>Risk-adjusted rate</p> <p>(Not currently available from the QI software for ICD-10)</p>	<p>Rate the hospital would have if it had the same case mix as the SID given the hospital's actual performance.</p> $\text{Formula: } A^k = \frac{\sum_j Y_j^k}{\sum_j \hat{e}_j^k} * (R_{SID}^k)$ <p>where in addition to the symbols defined above, R_{SID}^k is the raw rate for QI k in the entire SID.</p>	<p>Used for comparison (to other hospitals or sets of hospitals) to assess performance relative to others.</p>
<p>Smoothed rate</p> <p>(Not currently available from the QI software for ICD-10)</p>	<p>Weighted average of the hospital's risk-adjusted rate and the reference population rate, where the weight reflects the reliability of the hospital's risk-adjusted rate (a function of the number of eligible discharges).</p> <p>Formula:</p> <p>where in addition to the symbols defined above, w^k is a measure of the reliability of the hospital's risk-adjusted rate.</p>	<p>Used for comparison with the risk-adjusted rate within the same hospital to determine the reliability of the risk-adjusted rate over time. Also used instead of the risk-adjusted rate for comparing with others if the risk-adjusted rate is not reliable over time.</p>

PDI RATES GENERATED BY THE AHRQ SAS PROGRAMS

Guidance for Using the SAS Programs and an Example of Output for One Hospital

What is the purpose of this tool? To work with the Pediatric Quality Indicators (PDIs) for assessing its own performance, a hospital needs to calculate rates for these Indicators, using the SAS programs provided by the Agency for Healthcare Research and Quality (AHRQ). This tool provides three sets of information to help you work with the SAS programs to calculate rates for your hospital and use the output from those programs:

- An outline of the steps and programs used to calculate rates for the PDIs.
- Notes for analysts and programmers on issues to manage in working with the SAS programs.
- An example of the output from the SAS programs for one hospital.

Who are the target audiences? The primary audience for this tool is the programmers or analysts who will calculate PDI rates.

How can the tool help you? The examples and guidance provided by this tool should help you work more easily with the SAS programs used to calculate the PDIs for your hospital, and to read and use the output from the programs.

How does this tool relate to others? This tool should be used together with the B.1 tool on *Applying the Quality Indicators to Hospital Data*, which explains the different types of rates calculated for the PDIs.

Note: The current version of the AHRQ QI software does not have risk-adjustment capabilities when using ICD-10¹ data. However, this tool includes information about risk adjustment that will be relevant when looking at past performance (using ICD-9 codes and software) and when future versions of the AHRQ QI software with risk adjustment capabilities are released.

Also note that this tool was updated based on the test software available at the time of the Pediatric QI Toolkit revision (as of March 2016). Refer to AHRQ's QI software Web site (<http://www.qualityindicators.ahrq.gov/software>) for the most updated information on the software.

¹ICD-10 = International Classification of Diseases, 10th Revision. ICD-9 is the 9th Revision.

Indicator Data Generated by the SAS Programs

The following steps are taken to produce the rates for the PDIs:

1. Identify outcomes in inpatient records.
2. Identify pediatric populations at risk.
3. Calculate observed (raw) indicator rates.
4. Risk adjust the indicator rates (where applicable).
5. Create smoothed rates using multivariate signal extraction (where applicable).

The SAS programs provided by AHRQ for calculation of the PDIs, as well as documentation on how to use the programs, can be found in zip files on the AHRQ QI Web site:

<http://www.qualityindicators.ahrq.gov/software/>.

The documentation is provided in a guide for the PDIs. The guide includes instructions for calculating observed rates for the indicators.

Rates for the PDIs are calculated using the same programming steps, each of which uses a separate SAS program. The names and descriptions of the SAS programs involved are summarized in the following table.

Program	Program Description
PDI_CONTROL.SAS	Contains SAS statements that the user will modify to run the remaining module programs. Specify path names for input and output here.
PDI_FORMATS.SAS	Defines a format library that contains the diagnosis and procedure screens necessary for assigning outcomes for each indicator.
PDI_MEASURES.SAS	Processes hospital discharge abstract data and flags records if they contain the outcomes of interest for each indicator.
PDI_PROVIDER_1.SAS	Calculates the observed (raw) rates for the provider-level indicators. Allows stratification by any combination of provider, sex, age, race, and payer.
PDI_PROVIDER_2.SAS*	Calculates expected rates, risk-adjusted rates, and smoothed rates for each indicator.
PDI_COMPOSITE.SAS*	Calculates the composite rate for the PDIs.
PDI_STRATIFIED.SAS	The PDI_STRATIFIED program calculates the observed rates for the provider-level PDI, using the data derived in a previous step (PDI_MEASURES). These observed rates are stratified by risk group categories that are specific to each indicator.
PDI_AREA_1.SAS	Calculates the observed rates for the area-level PDI. These observed rates can be stratified by combinations of area, sex, age, and race categories.
PDI_AREA_2.SAS*	Calculates age and sex risk-adjusted rates for each area-level PDI (overall rates and rates by area) and then calculates smoothed rates.

*These programs are not available when using ICD-10 data in v6.0 of the ICD-10 QI software but will be available in a future version of the ICD-10 QI software.

**Program POPFILE (pop95t14.txt) is not included in the zip file due to size constraints.

Notes for Analysts and Programmers

The documentation provides guidance on how to set up the files and run the programs. However, as is usually the case when applying new programs to a data file, several issues have been identified that you will need to manage as you work with the AHRQ SAS programs. The identified issues are discussed here to help ease your first application of the programs to your data. Once you have run the programs successfully, any use of them on subsequent data should proceed smoothly.

One issue that affects the ability to begin to use the programs is the need to obtain a file that is not included in the zip files with the other AHRQ QI SAS programs. This is the population file, POPFILE (pop95t14.txt), which is located in a compressed folder (1995-2014 Population Files.zip) on the AHRQ QI Web site: <http://www.qualityindicators.ahrq.gov/software/>. The text file includes both the PDIs and PQIs and does not neatly fit within one module.

Getting Your Data Ready

When preparing data for the SAS PDI software programs, you should be aware that a few steps are essential for running the programs without errors.

1. Format and structure your dataset so that it matches the structure specified in the documentation. If you try to run the program without first structuring and formatting the data to the exact specifications listed, the program will not run properly. All numeric variables must be specified as numeric, and all character variables must be specified as character.
2. In some cases, you may not have a variable in your dataset that is required by the program. If it is not essential for calculating the rates, you may create an empty variable so that the program will run (e.g., AGEDAY, DQTR, and PAY2 may be created and set to missing).
3. The KEY variable is the unique case identifier. It is important that this variable be a unique numeric identifier for each record. You may create this variable in SAS using the built-in case counter (KEY = _n_;

Modifying the AHRQ SAS Programs

The control file used to specify the programs' parameters is PDI_CONTROL.SAS. Each command in this file is preceded by a comment and brief instructions. For some of the commands, the control file states that the user "MUST modify" the code. In other cases, the control file states that the user "MAY modify" the code. However, depending on the structure of your data, sometimes you *must* address these seemingly optional modifications. This is not clearly explained in the code.

For example, the number of diagnosis codes (Dx) or procedures *must* be changed if it does not match your data exactly. If you have 20 diagnosis code variables, the default number of diagnosis codes (30) must be changed or the program will not run properly.

Errors may not appear until you run the PDI_PROVIDER_1.SAS file. When troubleshooting, check the structure of the data and the control file first.

Example of SAS Program Output

An example of the output from the SAS programs for the PDI rates is provided on the following pages. This output was generated in March 2016 using an alpha version of the AHRQ SAS QI software v6.0 provided by AHRQ in December 2015, based on data provided by and adapted from a large hospital association. The program was run on a large set of discharge records that would have the best chance of finding events for the numerators in the observed rates. Even in this case, however, you will see that zero events were found for some of the Indicators.

This output consists of tables generated by the PDI_PROVIDER_1.SAS program. PDI_PROVIDER_1.SAS now generates three tables for the indicators. The first contains the number of events or numerator for each of the indicators, the second displays the population or denominator for the indicators, and the third displays the observed rate for each indicator. We do not currently provide output for the expected, risk-adjusted, and observed rates given that the software cannot generate these rates for ICD-10 at this time.

Refer to tool B.1 (Applying the AHRQ QIs to Hospital Data), for definitions of and more information about the four types of rates.

The values reported on each line are the minimum, maximum, mean, and sum for each measure (numerator, population, rate). Because this output is for one hospital, all the values on each line are the same. If the programs had been run for a group of hospitals, these values would differ because the results would be for a distribution of results across hospitals.

In the example below:

- TPPD = number of events for a given indicator (identified by the PDI number)
- TPNQ = number of events for a given indicator (identified by the NQI number)
- PPPD = the number of individuals in the population at risk for the event (PDI)
- PPNQ = the number of individuals in the population at risk for the event (NQI)
- OPPD = the observed rate of a given event (PDI)
- OPNQ = the observed rate of a given event (NQI)

Note that PSI 17 (Birth Injury to Neonate) is included in the output for the PDIs (as TPPS17, PPS17, and OPSS 17) even though it is not a PDI.

Getting Help From AHRQ

If you have problems getting the software installed or questions about the AHRQ Quality Indicators, you may contact AHRQ's technical support. The support e-mail address for the AHRQ Quality Indicators is QIsupport@ahrq.hhs.gov.

AHRQ also has a "frequently asked questions" page that may be useful:
http://qualityindicators.ahrq.gov/FAQs_Support/.

PDI_PROVIDER_1.SAS
PROGRAM: PROVIDER_1
AHRQ PEDIATRIC QUALITY INDICATORS: CALCULATE OBSERVED PROVIDER RATES
SUMMARY OF PEDIATRIC PROVIDER-LEVEL INDICATOR OVERALL NUMERATOR (SUM) WHEN _TYPE_=64 (_TYPE_=64)

The MEANS Procedure

Variable	N	N Miss	Minimum	Maximum	Sum
TPPD01	1	0	1.0000000	1.0000000	1.0000000
TPPD02	1	0	0	0	0
TPPD03	0	1	.	.	.
TPPD05	1	0	0	0	0
TPPD06	0	1	.	.	.
TPPD07	0	1	.	.	.
TPPD08	1	0	0	0	0
TPPD09	1	0	0	0	0
TPPD10	1	0	3.0000000	3.0000000	3.0000000
TPPD11	1	0	0	0	0
TPPD12	1	0	0	0	0
TPPD13	0	1	.	.	.
TPNQ01	1	0	0	0	0
TPNQ02	1	0	1.0000000	1.0000000	1.0000000
TPNQ03	1	0	0	0	0
TPPS17	1	0	14.0000000	14.0000000	14.0000000

PDI_PROVIDER_1.SAS
PROGRAM: PROVIDER_1
AHRQ PEDIATRIC QUALITY INDICATORS: CALCULATE OBSERVED PROVIDER RATES
SUMMARY OF PEDIATRIC PROVIDER-LEVEL INDICATOR OVERALL DENOMINATOR (SUM) WHEN _TYPE_=64

The MEANS Procedure

Variable	N	N Miss	Minimum	Maximum	Sum
PPPD01	1	0	1226.00	1226.00	1226.00
PPPD02	1	0	91.0000000	91.0000000	91.0000000
PPPD03	0	1	.	.	.
PPPD05	1	0	1125.00	1125.00	1125.00
PPPD06	0	1	.	.	.
PPPD08	1	0	40.0000000	40.0000000	40.0000000
PPPD09	1	0	33.0000000	33.0000000	33.0000000
PPPD10	1	0	73.0000000	73.0000000	73.0000000
PPPD11	1	0	17.0000000	17.0000000	17.0000000
PPPD12	1	0	989.0000000	989.0000000	989.0000000
PPPD13	0	1	.	.	.
PPNQ01	1	0	92.0000000	92.0000000	92.0000000
PPNQ02	1	0	1796.00	1796.00	1796.00
PPNQ03	1	0	35.0000000	35.0000000	35.0000000
PPPS17	1	0	1760.00	1760.00	1760.00

PDI_PROVIDER_1.SAS
PROGRAM: PROVIDER_1
AHRQ PEDIATRIC QUALITY INDICATORS: CALCULATE OBSERVED PROVIDER RATES
SUMMARY OF PEDIATRIC PROVIDER-LEVEL OBSERVED INDICATOR AVERAGE RATES(MEAN) WHEN _TYPE_=64

The MEANS Procedure

Variable	N	N Miss	Minimum	Maximum	Mean
OPPD01	1	0	0.000815661	0.000815661	0.000815661
OPPD02	1	0	0	0	0
OPPD03	0	1	.	.	.
OPPD05	1	0	0	0	0
OPPD06	0	1	.	.	.
OPPD08	1	0	0	0	0
OPPD09	1	0	0	0	0
OPPD10	1	0	0.0410959	0.0410959	0.0410959
OPPD11	1	0	0	0	0
OPPD12	1	0	0	0	0
OPPD13	0	1	.	.	.
OPNQ01	1	0	0	0	0
OPNQ02	1	0	0.000556793	0.000556793	0.000556793
OPNQ03	1	0	0	0	0
OPPS17	1	0	0.0079545	0.0079545	0.0079545

Please note that PDI_COMPOSITE.SAS is not currently available

PDI RATES GENERATED BY THE AHRQ *WINDOWS* QI SOFTWARE

Guidance for Using the *Windows* QI Software and an Example of Output for One Hospital

Note: This tool has *not* been updated for AHRQ's new ICD-10ⁱ WinQI Software (v6.0), as neither the final nor a test version of the software was available at the time of this tool's revision (March 2016). Feel free to use the information in this tool if you are continuing to use an earlier version of the WinQI software.

What is the purpose of this tool? To work with the Pediatric Quality Indicators (PDIs) for assessing its own performance, a hospital needs to calculate rates for these indicators, using the Windows software provided by the Agency for Healthcare Research and Quality (AHRQ). This tool provides three sets of information to help you work with the Windows software to calculate rates for your hospital and use the output from the software:

- An outline of the steps used to calculate PDI rates.
- Notes for analysts and programmers on issues to manage in working with the Windows software.
- An example of the output from the Windows software for one hospital.

Who are the target audiences? The primary audience for this tool is the programmers or analysts who will calculate PDI rates.

How can the tool help you? The examples and guidance provided by this tool should help you work more easily with the Windows software used to calculate the PDIs for your hospital, and to read and use the output from the software.

How does this tool relate to others? This tool should be used together with the B.1 tool on *Applying the Quality Indicators to Hospital Data*, which explains the different types of rates calculated for the PDIs.

ⁱICD-10 = International Classification of Diseases, 10th Revision.

Software Installation

Before installing and running the Windows QI software, you must first determine whether you have the requisite programs and permissions. Due to the security settings and firewalls on some networks, you may have trouble downloading and installing the software without support from your information technology (IT) department. In addition, you may not have the option to install and run the setup or software as an administrator; this restriction also necessitates assistance from the IT department and may delay or complicate installation and utilization of the software.

If you are unfamiliar with database structures, involve the IT department immediately. This will save you time and eliminate some frustrations.

Installation instructions are available on the AHRQ QI Web site:

http://www.qualityindicators.ahrq.gov/Downloads/Software/WinQI/V50/Software_Inst_WinQI_V50_May_2015.pdf.

Reading this file and following the steps listed will address many of the issues related to software installation.

Make sure your Windows OS has the latest Service Pack and updates applied. The Windows QI software has been tested on the following configurations: Microsoft SQL Server 2005 or 2008 (if the dataset contains more than about 4.5 million discharge records, then 2008 is required).

Hospitals that need to use a local networked instance of SQL Server may run into problems if the network version of SQL Server is not compatible with the QI software.

Your IT department's policies pertaining to SQL servers may affect your ability to install and use the Windows software. If so, you will need to contact your IT department's personnel for help accessing the server. Because each hospital's IT department's policies differ, we cannot effectively address all the issues that arise during this process.

Indicator Data Generated by the Windows Software

The Windows software provided by AHRQ for calculation of the PDIs, as well as documentation on how to use the software, can be found on the AHRQ QI Web site:

www.qualityindicators.ahrq.gov/Software/WinQI.aspx.

Once the software is installed, it will guide you through the following steps to produce the rates for the PDIs:

1. Identify outcomes in inpatient records.
2. Identify populations at risk.
3. Calculate observed (raw) indicator rates.
4. Risk adjust the indicator rates (where applicable).
5. Create smoothed rates using multivariate signal extraction (where applicable).

Notes for Analysts and Programmers

The documentation provides guidance on how to set up your file and run the software. However, as is usually the case when applying new software to a data file, several issues have been identified that you will need to manage as you work with the AHRQ Windows QI software. The identified issues are discussed here, to help ease your first application of the software to your data. Once you have run the software successfully, any use of it on subsequent data should proceed smoothly.

Getting Your Data Ready

When preparing data for the Windows QI software program, you should be aware that a few steps are essential for running the program correctly.

1. Format and structure your dataset so that it matches the structure specified in the documentation. If you try to run the program without first structuring and formatting the data to the exact specifications listed, the program will not run properly. All numeric variables must be specified as numeric, and all character variables must be specified as character (string). Diagnosis codes should not have a decimal point (and they will need to be removed prior to importing). Variable names do NOT need to match those in the table.
2. The KEY variable is the unique case identifier. This variable is not required by the software but is useful for merging discharge records in the patient-level report with the input data.
3. Not all variables are required to determine your rates, but some are necessary for stratification and other analyses. See Appendix A to determine whether you have the necessary variables for your intended analyses.
4. Some users found that their datasets were too large to use with the software and their available computing capacity. These individuals found it necessary to use only a subset of their data at a time in order to run the program.
5. An APR-DRG Grouper is built into the software if your data lack APR-DRG values. Use of this grouper is optional. You may use your institution's APR-DRG values if they are available and you choose to do so.

Running the Software

If you are running the software using the Windows 7 operating system, it is important to install and run the software as an administrator. Failing to do so will result in errors.

Once your data are ready, there is an Import Wizard that will allow you to map your variables with those required by the software. This map can be saved so that you do not need to repeat this step the next time you run the program.

There is an option to check the readability of your data to ensure that every row can be read and that every row has the same number of columns.

Rows with missing data for required variables will not be included in the analysis.

Once the variables have been identified and the data have been verified, indicator flags are created by the software. Data can then be saved as a CSV file if desired and will remain until new data are uploaded. Mapping files can also be saved at this time.

The user can then use the toolbar on the left side of the screen to generate reports and rates. Below are examples of two tables that can be created. Many other report options are available in the software that your hospital may find useful, but we only illustrate two basic examples here.

Example of Windows Software Output

An example of the output from the Windows software (using WinQI v4.5) is provided on the following pages. This output was generated in November 2013 using WinQI v4.5, based on data adapted from a hospital that participated in the first field test of the QI Toolkit. The program was run on a large set of discharge records that would have the best chance of finding events for the numerators in the observed rates. Even in this case, however, you will see that zero events were found for some of the indicators.

Note: Refer to Tool B.1, Applying the AHRQ Pediatric Quality Indicators to Hospital Data, for definitions of the four types of rates.

This output consists of two tables: Quick Report provider level and Provider Report. The Quick Report provides a summary of the numerators, denominators, and observed rates for the uploaded data. This report is generated by the software and can be saved in rich text format (RTF).

Users may choose to stratify based on a number of variables, including hospital, age category, sex, year, quarter, payer, race, or any other custom indicator they have in their dataset. This sample Provider Report gives the observed numerator, observed denominator, observed rate, expected rate, risk-adjusted rate, and smoothed rate for the PDIs without any stratification. Data and rates generated using the Provider Report option can be saved in comma separated value (CSV) format.

Quick Report

This is a summary of the numerators, denominators and observed rates for your currently loaded data.

Num. (numerator) refers to the number of events. Den. (denominator) refers to the number of individuals in the population at risk for the event. The rate refers to the observed rate. Pop. (population) rate refers to the population rate that is used for risk adjustment.

Filename: C:\Users\Desktop\AHRQinputFile.csv
Number of records: 11246
Has POA Flags: Y

Provider Level Indicators

Indicator	Name	Num.	Den.	Rate	Pop. Rate
NQI 1	NQI #1 Neonatal Iatrogenic Pneumothorax Rate	0	0	-	0.00200000
NQI 2	NQI #2 Neonatal Mortality Rate	-	0	-	-
NQI 3	NQI #3 Neonatal Blood Stream Infection	0	0	-	2.46621024
PDI 1	PDI #1 Accidental Puncture or Laceration Rate	1	2	0.5	0.05664000
PDI 2	PDI #2 Pressure Ulcer Rate	0	1	0	0.15210459
PDI 3	PDI #3 Retained Surgical Item or Unretrieved Device Fragment	0	0	-	-
PDI 5	PDI #5 Iatrogenic Pneumothorax Rate	3	54	0.05555556	0.15105490
PDI 6	PDI #6 RACHS-1 Pediatric Heart Surgery Mortality Rate	0	17	0	40.9102564
PDI 7	PDI #7 RACHS-1 Pediatric Heart Surgery Volume	0	52	-	-
PDI 8	PDI #8 Perioperative Hemorrhage or Hematoma Rate	6	454	0.01321586	2.48210598
PDI 9	PDI #9 Postoperative Respiratory Failure Rate	24	180	0.13333333	11.3162479
PDI 10	PDI #10 Postoperative Sepsis Rate	1	165	0.00606061	19.8884023
PDI 11	PDI #11 Postoperative Wound Dehiscence Rate	0	32	0	0.96714253
PDI 12	PDI #12 Central Venous Catheter-Related Blood Stream Infection	7	175	0.04	1.00410523
PDI 13	PDI #13 Transfusion Reaction County	0	0	-	-

Provider indicator population rates used in risk adjustment are based on the pooled discharges from the 2011 SID database. Population rates are only included for those indicators that use these rates in risk adjustment. One year empirical rates for indicators that are not risk adjusted may be found in the QI documentation.

Provider Level Report

Report from 07/17/2014 11:21:59 AM
 Provider report created 07/17/2014 11:22:21 AM
 Report from 07/17/2014 11:21:59 AM
 Rates Per case

Name	Observed Numerator	Observed Denominator	Observed Rate	Expected Rate	O-E Ratio	Reference Pop Rate	Risk-Adjusted Rate	Smoothed Rate
NQI #3 Neonatal Iatrogenic Pneumothorax Rate	0	0	0	0.001046	57.95983	0.000282	0.016343	0.007641
NQI #2 Neonatal Mortality Rate	-	0	0	0.000832	0	0.000405	0	0.000379
NQI # 3 Neonatal Blood Stream Infection		0				0.117371		
PDI #1 Accidental Puncture or Laceration	1	2	0.5			0.05664000		
PDI #2 Pressure Ulcer Rate	0	1	0	0.000251	0	0.15210459	0	0.000436
PDI #3 Retained Surgical Item or Unretrieved Device Fragment Count	0	0	0	0.000743	0	0.000409	0	0.000347
PDI #5 Iatrogenic Pneumothorax Rate	3	54	0.05555556			0.15105490		
PDI #6 RACHS-1 Pediatric Heart Surgery Volume	0	17	0			40.9102564		
PDI #7 RACHS-1 Pediatric Heart Surgery Volume						-		
PDI #8 Perioperative Hemorrhage or Hematoma Rate	6	454	0.01321586			2.48210598		
PDI #9 Postoperative Respiratory Failure Rate 24		180	0.13333333			11.3162479		
PDI #10 Postoperative Sepsis Rate	1	165	0.00606061			19.8884023		
PDI #11 Postoperative Wound Dehiscence Rate	0	32	0	0.001265	0	0.96714253	0	0.001665
PDI #12 Central Venous Catheter-Related Blood Stream Infection Rate	7	175	0	0.001144	0	0.002428	0	0.002309
PDI #13 Transfusion Reaction Count								

EXCEL WORKSHEETS FOR CHARTS ON DATA, TRENDS, AND RATES TO POPULATE THE POWERPOINT PRESENTATION

What is the purpose of this tool? This tool takes the rates you have calculated about your hospital's performance on the AHRQ Pediatric Quality Indicators (PDIs) and displays the information graphically.

Who are the target audiences? The key users of this tool are the quality officers, quantitative analysts, and programmers involved in calculating the rates.

How can it help you? This tool helps you easily create graphs that display your hospital's results on the AHRQ PDIs and how they compare with national averages. Although this tool uses national averages as the comparator, you may choose your State's rate, the national rate, or some other rate (e.g., benchmark).

How does this tool relate to others? Tool B.2a (sample SAS program output) provides information on how to calculate the rates requested in this tool. Copy and paste the graphs produced by this tool into B.3b (display PDI results), which provides a PowerPoint template for presenting the results of your analysis.

Note: The current version of the AHRQ QI software does not have risk-adjustment capabilities. However, the tools described below include information about risk adjustment that will be relevant when looking at past performance (using ICD-9ⁱ codes and software) and when later versions of the AHRQ QI software with risk adjustment capabilities are released. In addition, national average data using ICD-10 data are not currently available from AHRQ but are expected to be available in the future.

ⁱ ICD-9 = International Classification of Diseases, 9th Revision. ICD-10 is the 10th Revision.

Instructions

1. Determine which comparisons and/or trend analyses you would like to perform (see Tool B.1).
 - a. The worksheet “compare-PDI-rates-average” can be used to get an overall picture of the hospital’s overall pediatric patient safety performance relative to a national sample of hospitals.
 - b. The “trend-observed,” “trend-observed-expected,” and “trend-risk-adjusted-smoothed” worksheets can be used to compare performance for a single indicator over time. The “trend-observed” sheet also has a place to enter count data and a chart for monitoring changes in counts over time.
 - c. The “trend-risk-adjusted-smoothed” worksheet can be used to compare the risk-adjusted rate and smoothed rate for a single indicator over time.
 - d. The “trend-expected-average” worksheet can be used to track how expected performance on a single indicator (based on case mix) relative to national average performance fluctuates over time.
 - e. The “trend-risk-adjusted-average” worksheet can be used to track how a hospital’s performance on an indicator and the national average performance for that indicator fluctuate over time.
2. Obtain your rates using the QI software for SAS or Windows (see Tool B.2).
3. Erase the sample data and enter your data in the yellow cells.

See the other B tools for more information (B.1 explains what the rates mean; B.2a and B.2b show how to use the software with your data and obtain these rates).

The **observed rate** is the actual rate at which events measured by the indicator occurred in your hospital. This can be acquired from the SAS output or the Windows QI output from the Quick Report. If another organization provides these data for you, you may also obtain it from them.

Note: At this time, the following are only available for versions of the software that use ICD-9-CM diagnosis codes:

- The **expected rate** is the rate a hospital would have if it had performed the same as the reference population given the hospital’s actual case mix. This can be acquired from the SAS output or the Windows QI output from the Provider Report.
- The **risk-adjusted rate** is the estimate of how a hospital would perform on an indicator for an average case mix of patients, rather than its own case mix. This rate can be found in the provider-level reports from the Windows or SAS QI programs.
- The **confidence interval of the risk-adjusted rate** is identified in the SAS output as the lower CL (lower confidence limit) and upper CL (upper confidence limit). When creating provider-level reports using the Windows QI software, the user must specify that the confidence levels be included in the report.

- The **smoothed rate** is a weighted average of the hospital's risk-adjusted rate and the reference population rate, where the weight reflects the reliability of the hospital's risk-adjusted rate. This can be found in the SAS output or the Windows QI Provider Report.
4. Fill in the comparator rates from the group of hospitals that you would like to use for comparison. Compare_PDI_rates_average will automatically compute percent difference and display how your hospital is performing relative to the national average rate.

The **national average** is the rate used here as a comparison point. As noted above, you may choose your State's rate, the national rate, or any other rate that you may wish to use as a comparison. See Tool B.5 for more information about comparators.

Note: National average data for indicators calculated with ICD-10-CM rates are not yet available from AHRQ.

5. Modify the title of the graph or chart so that it reflects the years and indicators that you would like to observe over time.
6. Copy and paste the charts into the PowerPoint template or another document for display.

The risk-adjusted rate is the estimate of how a hospital would perform on an indicator for an average case mix of patients, rather than its own case mix. This rate can be found in the provider-level reports from the Windows or SAS QI programs. See the other B tools for more information (B1 explains what the rates mean; B2a and B2b show how to use the software with your data and obtain these rates).

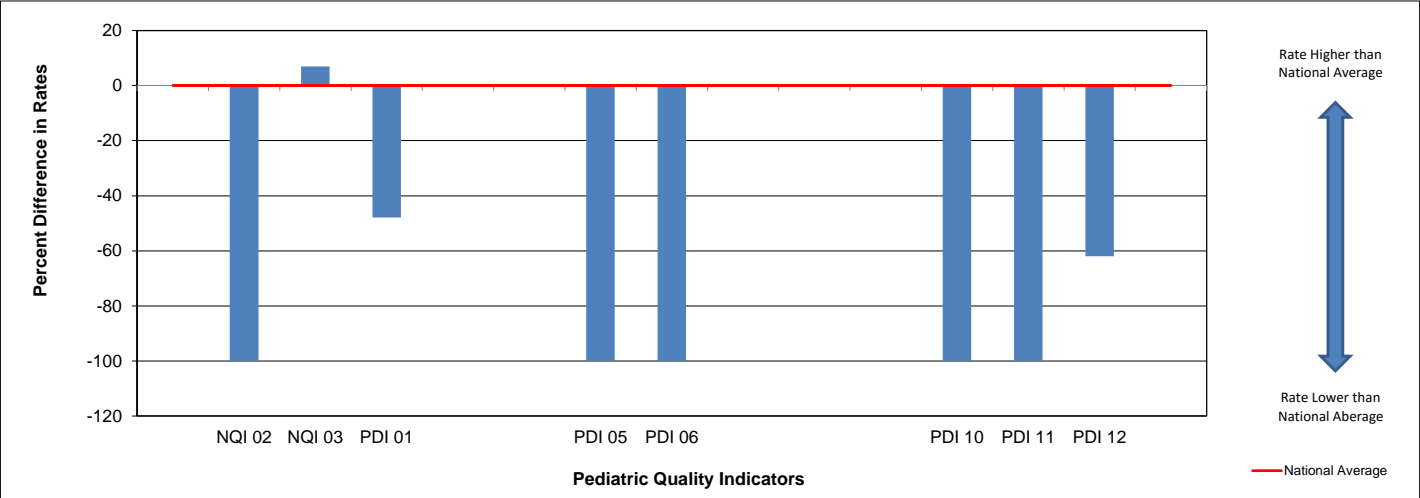
***Note: Risk-adjusted rates are not available in the most up-to-date version of the ICD-10 software. Future versions of the QI software will allow for risk adjustment and calculation of risk-adjusted and smoothed rates.**

The confidence interval of the risk-adjusted rate is identified in the SAS output as the lower CL (lower confidence limit) and upper CL (upper confidence limit). When creating provider-level reports using the Windows QI software, the user must specify that the confidence levels be included in the report.

The national average is the rate used here as a comparison point. You may choose your State's rate, the national rate, or any other rate that you may wish to use as a comparison. See Tool B5 for more information about comparators. Please note that AHRQ does not currently provide national averages using ICD-10 data.

		Enter your data here.				These calculate automatically.				
Indicator	Risk-Adjusted Rate	Risk-Adjusted (Lower Confidence Interval Bound)	Risk-Adjusted (Upper Confidence Interval Bound)	National Average	Percent Difference in Rates	Percent Difference in Rates (Lower Bound)	Percent Difference in Rates (Upper Bound)	Chart Label	How does your hospital compare to the national average?	
NQI 01 Neonatal Iatrogenic Pneumothorax Rate										
NQI 02 Neonatal Mortality Rate	0	0	0.00052261	0.00247	-100	-100	-78.8417	NQI 02	Statistically Lower	
NQI 03 Neonatal Blood Stream Infection Rate	0.0403736	0.0262083	0.054539	0.03773	7.00662603	-30.537238	44.5507554	NQI 03	No Statistically Significant Difference	
PDI 01 Accidental Puncture or Laceration Rate	0.0002971	0	0.0010748	0.00057	-47.877193	-100	88.5614035	PDI 01	No Statistically Significant Difference	
PDI 02 Pressure Ulcer Rate										
PDI 03 Retained Surgical Item or Unretrieved Device										
PDI 05 Iatrogenic Pneumothorax Rate	0	0	0.0004096	0.00015	-100	-100	173.066667	PDI 05	No Statistically Significant Difference	
PDI 06 RACHS-1 Pediatric Heart Surgery Mortality Rate	0	0	0.176267	0.04091	-100	-100	330.865314	PDI 06	No Statistically Significant Difference	
PDI 07 RACHS-1 Pediatric Heart Surgery Volume										
PDI 08 Perioperative Hemorrhage or Hematoma Rate				0.00248						
PDI 09 Postoperative Respiratory Failure Rate				0.01132						
PDI 10 Postoperative Sepsis Rate	0	0	0.0432385	0.01989	-100	-100	117.388135	PDI 10	No Statistically Significant Difference	
PDI 11 Postoperative Wound Dehiscence Rate	0	0	0.0075716	0.00097	-100	-100	680.57732	PDI 11	No Statistically Significant Difference	
PDI 12 Central Venous Catheter-Related Blood Stream Infection Rate	0.0003802	0	0.0010654	0.001	-61.98	-100	6.54	PDI 12	No Statistically Significant Difference	
PDI 13 Transfusion Reaction Count										

Your Hospital's Performance Relative to National average

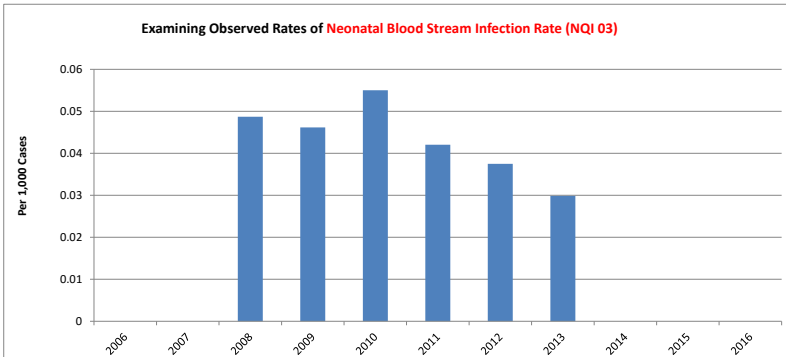


Enter Your Data Here		
Year	Observed Rate	Observed Count
2006		
2007		
2008	0.048711	17
2009	0.046154	15
2010	0.055	22
2011	0.042042	14
2012	0.0375	12
2013	0.029851	10
2014		
2015		
2016		

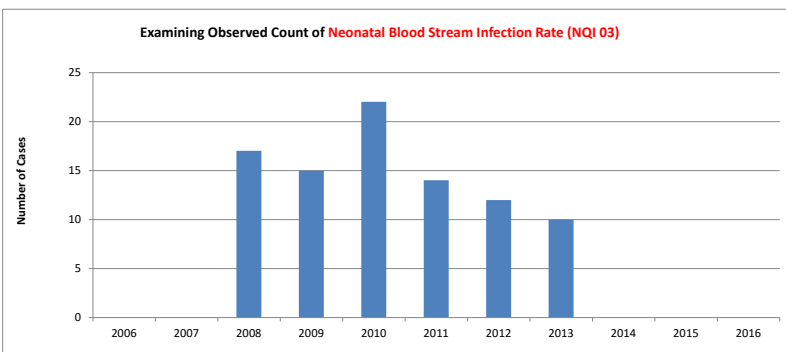
Note: Use caution comparing rates before and after 2014. Rates before the 4th quarter of 2014 are calculated using ICD-9; rates calculated during the 4th quarter of 2014 and later use ICD-10. The rates should be similar but may not yield a perfect comparison between years.

The **observed rate** is the actual rate at which events measured by the indicator occurred in your hospital. This can be acquired from the SAS output, or the Windows QI output from the Quick Report. If another organization provides these data for you, you may also obtain it from them.

See the other B tools for more information (B1 explains what the rates mean; B2a and B2b show how to use the software with your data and obtain these rates).



Directions: Add your data into the yellow cells beside the relevant year. Remove the "Neonatal Blood Stream Infection Rate" part of the title and revise it to reflect your PDI of interest.



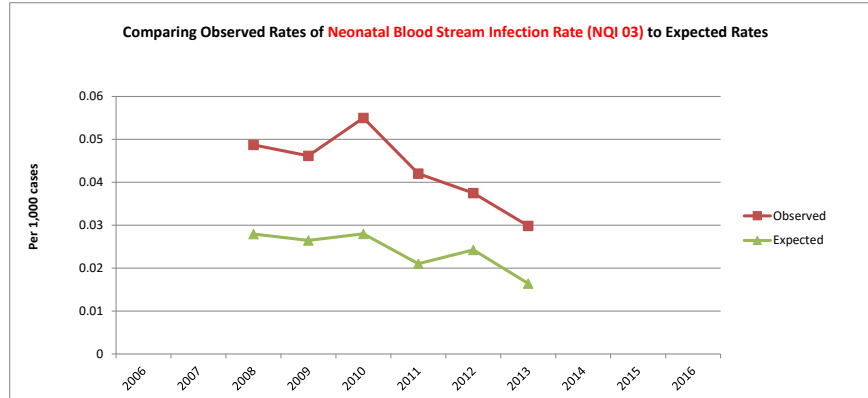
The **observed rate** is the actual rate at which events measured by the indicator occurred in your hospital. This can be acquired from the SAS output, or the Windows QI output from the Quick Report. If another organization provides these data for you, you may also obtain it from them.

The **expected rate** is the rate a hospital would have if it had average performance on a QI, as calculated in a reference population but accounting for the hospital's actual case mix. This can be acquired from the SAS output or the Windows QI output from the Provider Report.

See the other B tools for more information (B1 explains what the rates mean; B2a and B2b show how to use the software with your data and obtain these rates).

Enter Your Data Here		
Year	Observed	Expected
2006		
2007		
2008	0.048711	0.0279432
2009	0.046154	0.026476
2010	0.055	0.028
2011	0.042042	0.021021
2012	0.0375	0.02425
2013	0.029851	0.016418
2014		
2015		
2016		

Note: Expected rates are not available in the most up-to-date version of the ICD-10 software. Future versions of the QI software will allow for risk adjustment and calculation of expected rates.



Directions: Add your data into the yellow cells beside the relevant year. Remove the "Neonatal Blood Stream Infection Rate" part of the title and revise it to reflect your PDI of interest.

The **risk-adjusted** rate is the estimate of how a hospital would perform on an indicator for an average case mix of patients, rather than its own case mix. This rate can be found in the provider-level reports from the Windows or SAS QI programs.

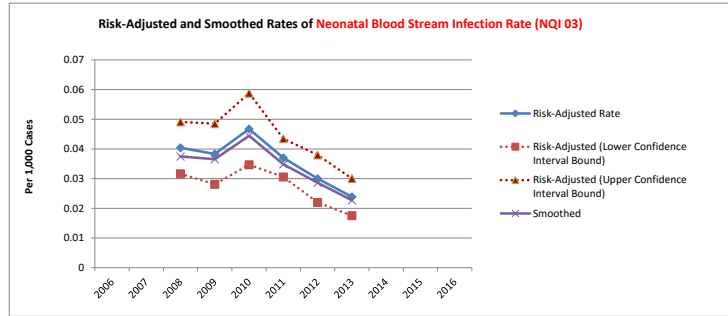
The **confidence interval of the risk-adjusted rate** is identified in the SAS output as the lower CL (lower confidence limit) and upper CL (upper confidence limit). When creating provider-level reports using the Windows QI software, the user must specify that the confidence levels be included in the report.

The **smoothed rate** is a weighted average of the hospital's risk-adjusted rate and the reference population rate, where the weight reflects the reliability of the hospital's risk-adjusted rate. This can be found in the SAS output or the Windows QI Provider Report.

[See the other B tools for more information \(B1 explains what the rates mean; B2a and B2b show how to use the software with your data and obtain these rates\).](#)

Enter Your Data Here				
Year	Risk-Adjusted Rate	Risk-Adjusted (Lower Confidence Interval Bound)	Risk-Adjusted (Upper Confidence Interval Bound)	Smoothed
2006				
2007				
2008	0.040374	0.031628	0.04912	0.037492
2009	0.038308	0.028083	0.048533	0.036529
2010	0.04675	0.034694	0.058806	0.044434
2011	0.036997	0.030539	0.043454	0.034819
2012	0.03	0.021993	0.038007	0.028607
2013	0.023881	0.017507	0.03004	0.022698
2014				
2015				
2016				

***Note: Risk-adjusted and smoothed rates are not available in the most up-to-date version of the ICD-10 software. Future versions of the QI software will allow for risk adjustment and calculation of risk-adjusted and smoothed rates.**



Directions: Add your data into the yellow cells beside the relevant year. Remove the "Neonatal Blood Stream Infection Rate" part of the title and revise it to reflect your PDI of interest.

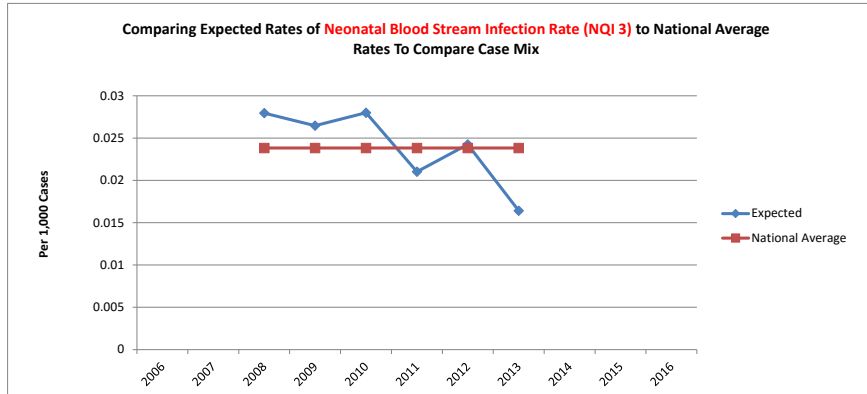
The **expected rate** is the rate a hospital would have if it had average performance on a QI, as calculated in a reference population but accounting for the hospital's actual case mix. This can be acquired from the SAS output or the Windows QI output from the Provider Report.

The **national average** is the rate used here as a comparison point. You may choose your State's rate, the national rate, or any other rate that you may wish to use as a comparison.

See the other B tools for more information (B1 explains what the rates mean; B2a and B2b show how to use the software with your data and obtain these rates; B5 explains how to use comparators).

Enter Your Data Here		
Year	Expected	National Average
2006		
2007		
2008	0.0279432	0.02383
2009	0.026476	0.02383
2010	0.028	0.02383
2011	0.021021	0.02383
2012	0.02425	0.02383
2013	0.016418	0.02383
2014		
2015		
2016		

***Note:** Expected rates are not available in the most up-to-date version of the ICD-10 software. Future versions of the QI software will allow for risk adjustment and calculation of expected rates.



Directions: Add your data into the yellow cells beside the relevant year. Remove the

"Neonatal Blood Stream Infection Rate" part of the title and revise it to reflect your PDI of interest.

The **risk-adjusted** rate is the estimate of how a hospital would perform on an indicator for an average case mix of patients, rather than its own case mix. This rate can be found in the provider-level reports from the Windows or SAS QI programs.

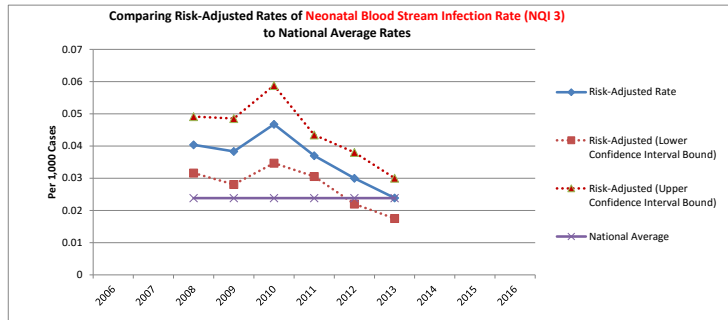
The **confidence interval of the risk-adjusted rate** is identified in the SAS output as the lower CL (lower confidence limit) and upper CL (upper confidence limit). When creating provider-level reports using the Windows QI software, the user must specify that the confidence levels be included in the report.

The **national average** is the rate used here as a comparison point. You may choose your State's rate, the national rate, or any other rate that you may wish to use as a comparison.

See the other B tools for more information (B1 explains what the rates mean; B2a and B2b show how to use the software with your data and obtain these rates; B5 explains how to use comparators).

Enter Your Data Here				
Year	Risk-Adjusted Rate	Risk-Adjusted (Lower Confidence Interval Bound)	Risk-Adjusted (Upper Confidence Interval Bound)	National Average
2006				
2007				
2008	0.040374	0.031628	0.04912	0.02383
2009	0.038308	0.028383	0.048533	0.02383
2010	0.04675	0.034694	0.058906	0.02383
2011	0.036997	0.030539	0.043454	0.02383
2012	0.03	0.021993	0.038007	0.02383
2013	0.023881	0.017507	0.03004	0.02383
2014				
2015				
2016				

***Note: Risk-adjusted rates are not available in the most up-to-date version of the ICD-10 software. Future versions of the QI software will allow for risk adjustment and calculation of risk-adjusted rates.**



Directions: Add your data into the yellow cells beside the relevant year. Remove the "Neonatal Blood Stream Infection Rate" part of the title and revise it to reflect your PDI of interest.

INSTRUCTIONS FOR USING THIS TOOL – DELETE THIS SLIDE BEFORE PRESENTATION

- *Use this PowerPoint presentation as a template for your presentation.*
- *Replace the charts with charts that you create with your data (use the Excel workbook from Tool B.3a for guidance) and replace the **red text** with your hospital's information.*

The Pediatric Toolkit for Using the AHRQ Pediatric Quality Indicators

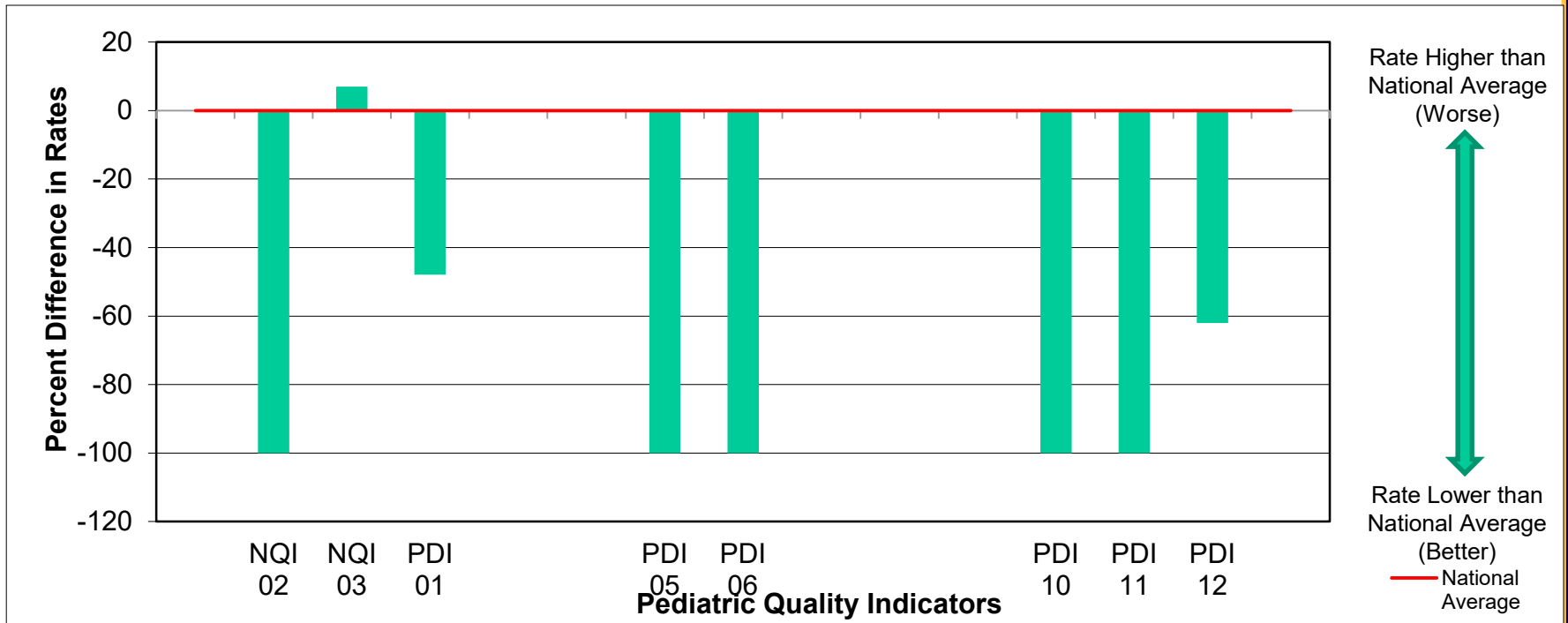
Results and Discussion of Data Analysis

How can the AHRQ PDIs be used in quality assessment?

- AHRQ PDIs can be used to flag potential problems in quality of care.
- AHRQ PDIs can be used to assess performance and compare against peer hospitals.
- Examples of hospital use of AHRQ QIs in the literature have examined the impact of:
 - Health information technology on quality of care.
 - Hospital board quality committees on quality of care.
 - The effectiveness of nurse staffing on care delivered.

Source: www.qualityindicators.ahrq.gov/Default.aspx and *AHRQ Quality Indicators Toolkit Literature Review*.

Your Hospital's Performance Relative to National Averages



Relative to a national sample of hospitals, **Your Hospital has similar or better performance on most of the PDIs.**

DELETE THIS SLIDE BEFORE PRESENTATION

- *In this example, we will examine the rates of Neonatal Blood Stream Infection (NQI 03) and how this particular hospital performed over time.*
- *Determine which indicator(s) you would like to focus on, and fill in these slides based on that indicator and your hospital's data.*
- *Based on the information that you would like to present, you may choose not to use all of the slides available here.*

Indicators that Require Attention

- Based on a review of **Your Hospital's** performance on the PDIs, we have decided to focus on the following indicators:
 - **Neonatal Blood Stream Infection Rate (NQI 03)**
 -
 -
 -
 -

DELETE THIS SLIDE BEFORE PRESENTATION

- *You may want to include information about the indicator as background information.*
- *Go to www.qualityindicators.ahrq.gov/ or see the Fact Sheet in this toolkit (Tool A.1a) to obtain this information.*

A PDI Example: Neonatal Blood Stream Infection (NQI 03)

- Numerator: Discharges with ICD-10-CM codes for healthcare-associated bloodstream infection, among cases meeting the inclusion and exclusion rules for the denominator
- Denominator: All newborns or outborns defined by Birth Weight Categories and/or specific ICD-10-CM codes
- ***DELETE THIS TEXT BEFORE PRESENTATION: Replace this information with information about your chosen indicators. Copy this slide and repeat as necessary.***

ICD-10 = International Classification of Diseases, 10th Revision

Source:

<http://www.qualityindicators.ahrq.gov/Downloads/Modules/PDI/V45/TechSpecs/NQI%2003%20Neonatal%20Blood%20Stream%20Infection%20Rate.pdf>

Comparing Performance Over Time

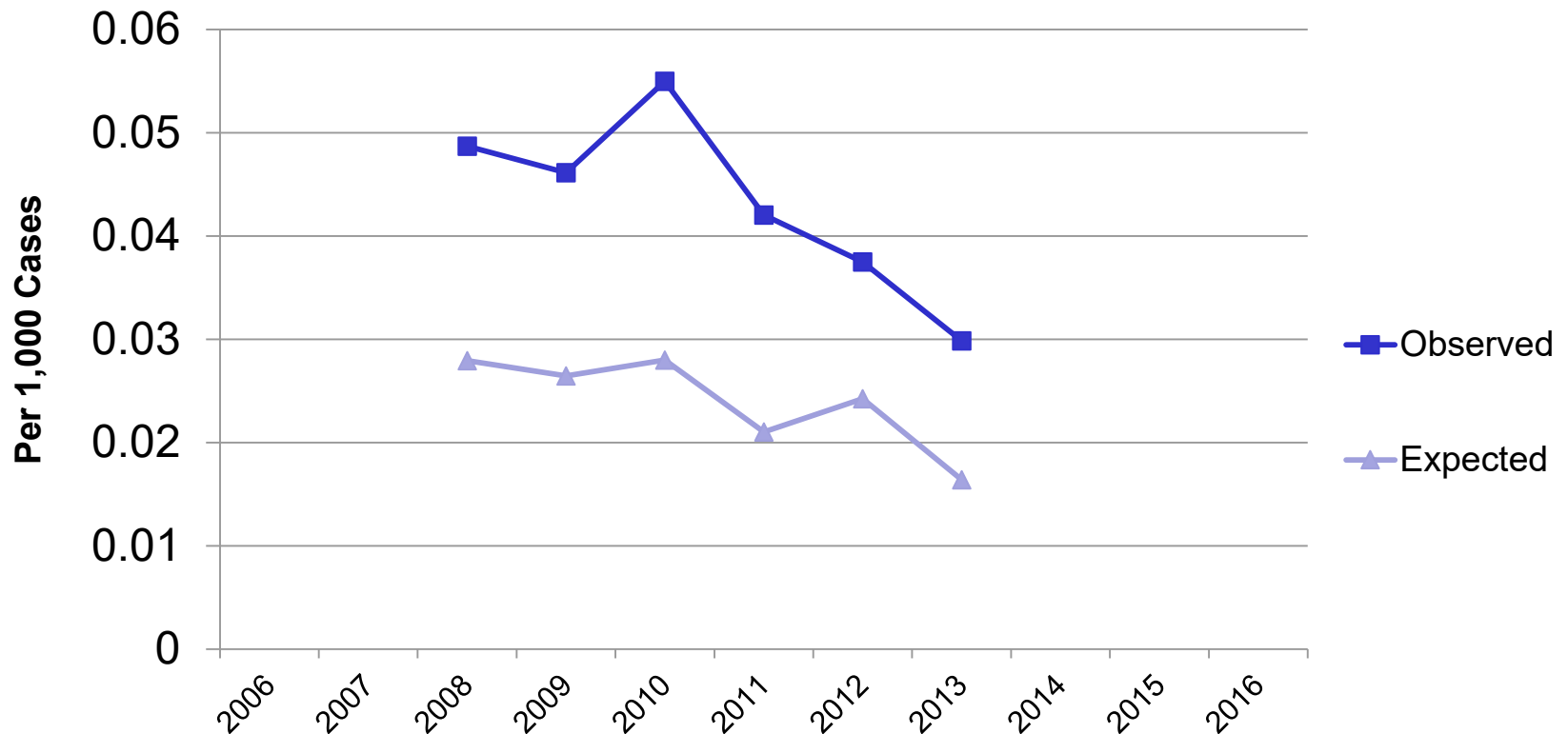
Examining Observed Rates of **Neonatal Blood Stream Infection Rate (NQI 03)**



Slides below are only applicable for ICD-9 versions of the software. Currently the ICD-10 software does not calculate expected, risk-adjusted, or smoothed rates, but will in the future.

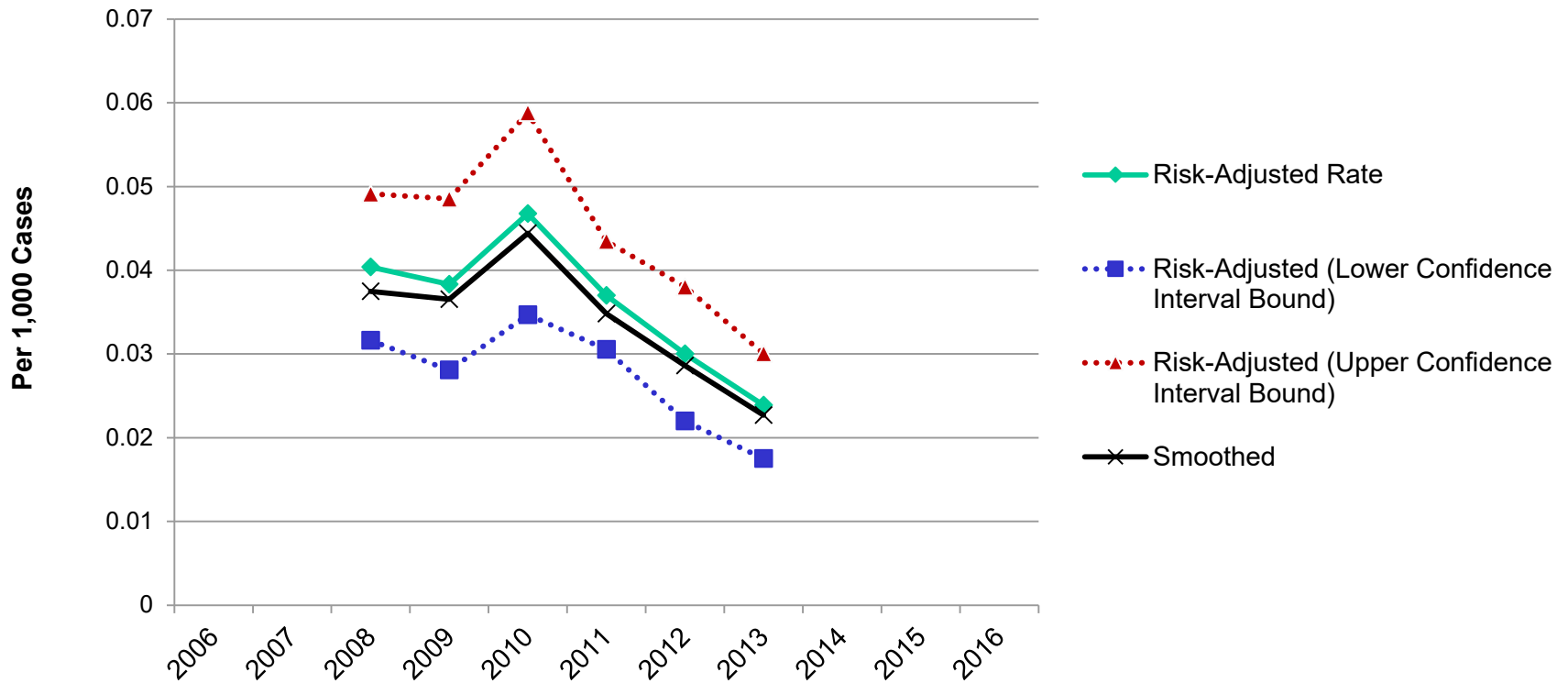
Comparing Observed Performance to Expected Performance Over Time

Comparing Observed Rates of Neonatal Blood Stream Infection Rate (NQI 03) to Expected Rates



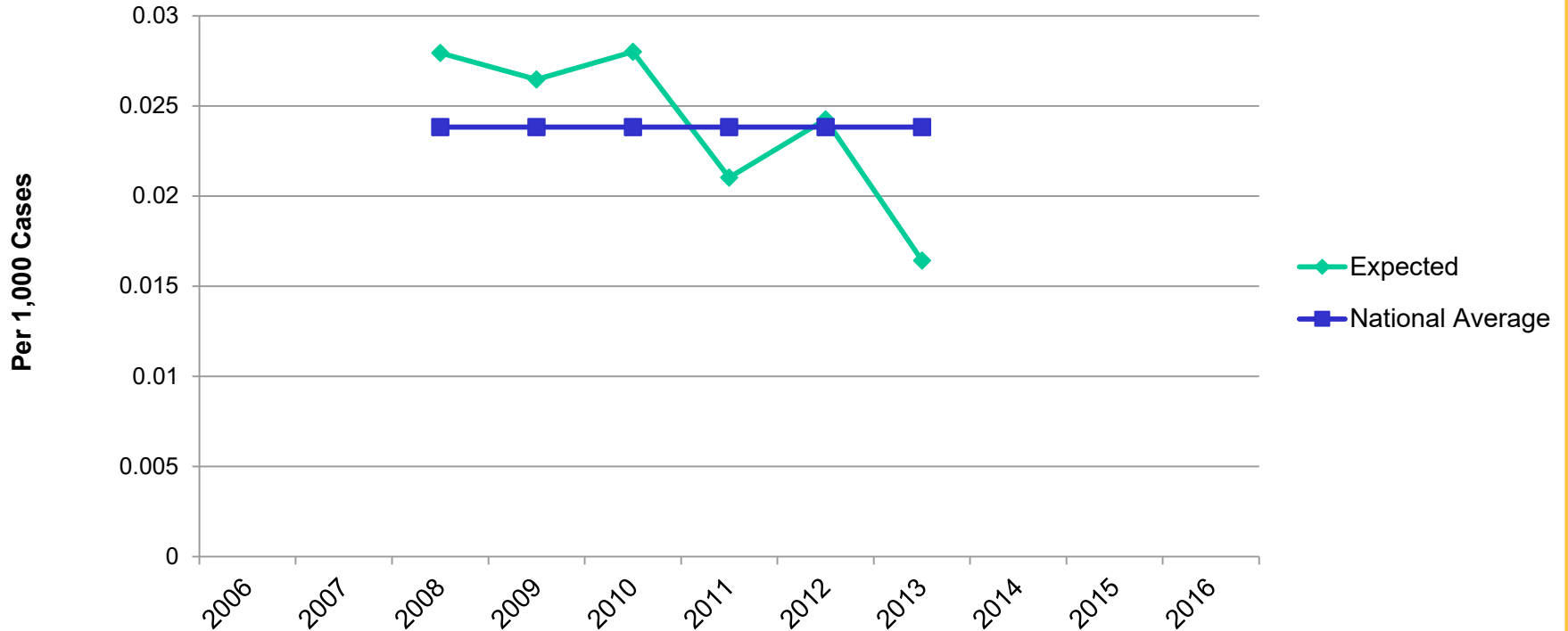
Comparing Risk-Adjusted and Smoothed Rates Over Time

Risk-Adjusted and Smoothed Rates of Neonatal Blood Stream Infection Rate (NQI 03)



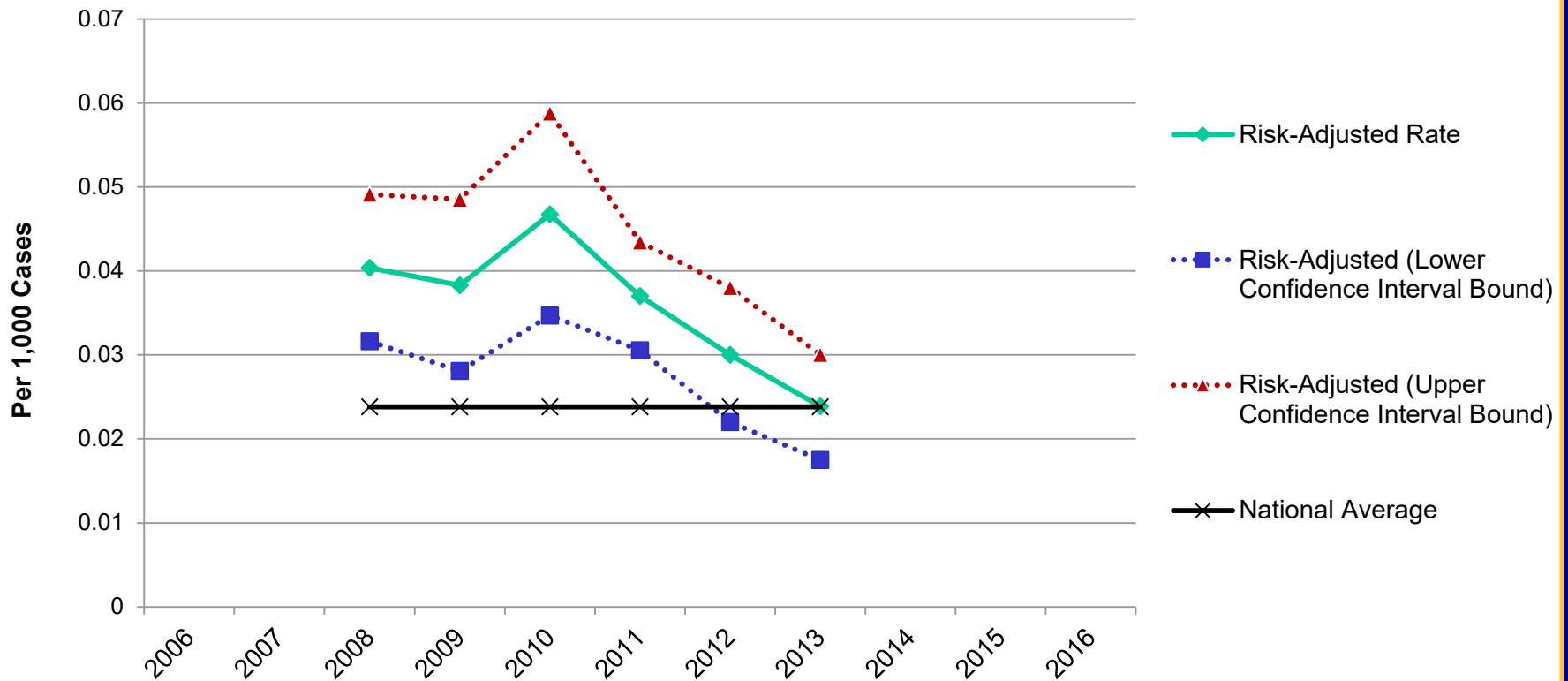
Evaluating Case Mix Relative to Other Hospitals

Comparing Expected Rates of **Neonatal Blood Stream Infection Rate (NQI 3)** to National Average Rates To Compare Case Mix



Comparing Hospital's Performance to National Performance Over Time

Comparing Risk-Adjusted Rates of **Neonatal Blood Stream Infection Rate (NQI 3)** to National Average Rates



INSTRUCTIONS FOR USING THIS TOOL – DELETE THIS SLIDE BEFORE PRESENTATION

- *Use this PowerPoint presentation as a template for your presentation.*
- *Replace the charts with charts that you create with your data (use the Excel workbook from Tool B.3a for guidance) and replace the **red text** with your hospital's information.*

The Pediatric Toolkit for Using the AHRQ Pediatric Quality Indicators

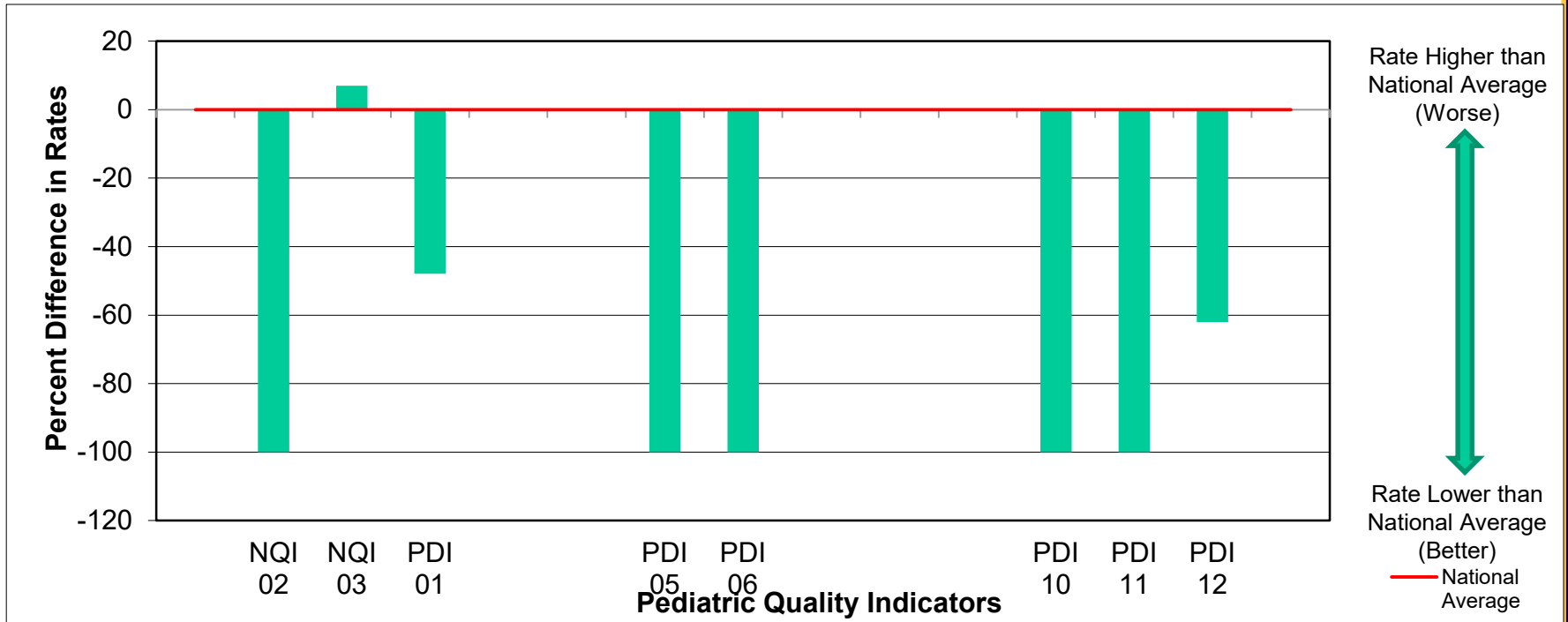
Results and Discussion of Data Analysis

How can the AHRQ PDIs be used in quality assessment?

- AHRQ PDIs can be used to flag potential problems in quality of care.
- AHRQ PDIs can be used to assess performance and compare against peer hospitals.
- Examples of hospital use of AHRQ QIs in the literature have examined the impact of:
 - Health information technology on quality of care.
 - Hospital board quality committees on quality of care.
 - The effectiveness of nurse staffing on care delivered.

Source: www.qualityindicators.ahrq.gov/Default.aspx and *AHRQ Quality Indicators Toolkit Literature Review*.

Your Hospital's Performance Relative to National Averages



Relative to a national sample of hospitals, **Your Hospital has similar or better performance on most of the PDIs.**

DELETE THIS SLIDE BEFORE PRESENTATION

- *In this example, we will examine the rates of Neonatal Blood Stream Infection (NQI 03) and how this particular hospital performed over time.*
- *Determine which indicator(s) you would like to focus on, and fill in these slides based on that indicator and your hospital's data.*
- *Based on the information that you would like to present, you may choose not to use all of the slides available here.*

Indicators that Require Attention

- Based on a review of **Your Hospital's** performance on the PDIs, we have decided to focus on the following indicators:
 - **Neonatal Blood Stream Infection Rate (NQI 03)**
 -
 -
 -
 -

DELETE THIS SLIDE BEFORE PRESENTATION

- *You may want to include information about the indicator as background information.*
- *Go to www.qualityindicators.ahrq.gov/ or see the Fact Sheet in this toolkit (Tool A.1a) to obtain this information.*

A PDI Example: Neonatal Blood Stream Infection (NQI 03)

- Numerator: Discharges with ICD-10-CM codes for healthcare-associated bloodstream infection, among cases meeting the inclusion and exclusion rules for the denominator
- Denominator: All newborns or outborns defined by Birth Weight Categories and/or specific ICD-10-CM codes
- ***DELETE THIS TEXT BEFORE PRESENTATION: Replace this information with information about your chosen indicators. Copy this slide and repeat as necessary.***

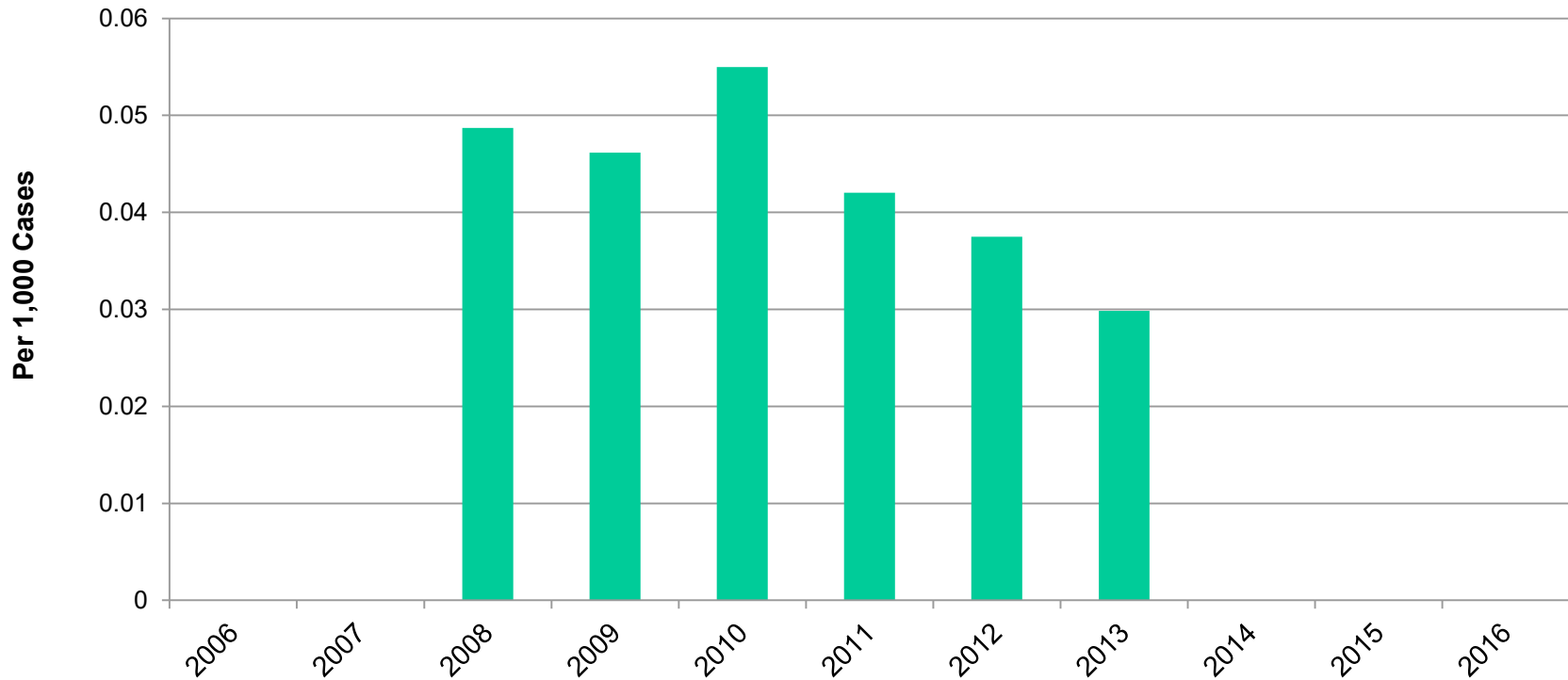
ICD-10 = International Classification of Diseases, 10th Revision

Source:

<http://www.qualityindicators.ahrq.gov/Downloads/Modules/PDI/V45/TechSpecs/NQI%2003%20Neonatal%20Blood%20Stream%20Infection%20Rate.pdf>

Comparing Performance Over Time

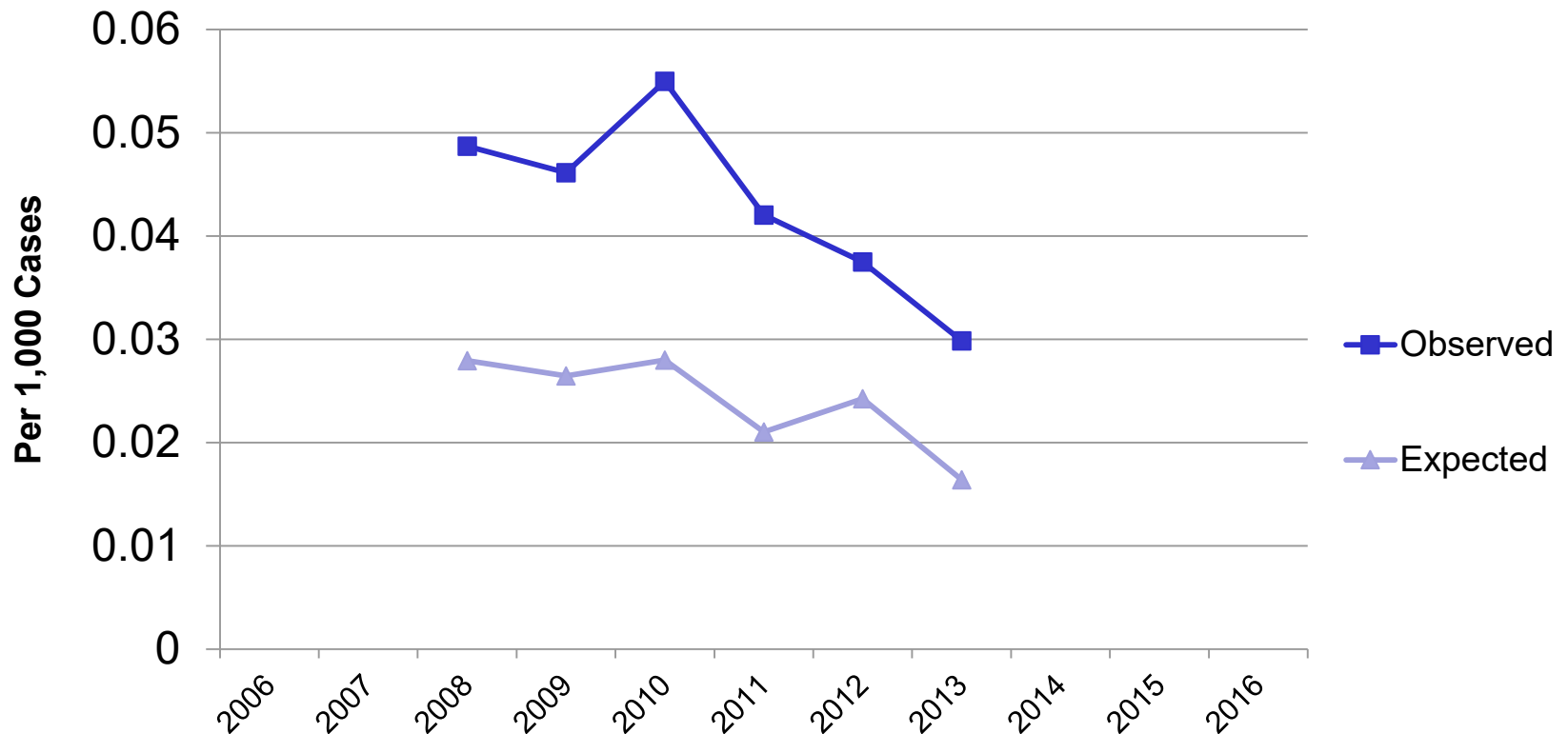
Examining Observed Rates of **Neonatal Blood Stream Infection Rate (NQI 03)**



Slides below are only applicable for ICD-9 versions of the software. Currently the ICD-10 software does not calculate expected, risk-adjusted, or smoothed rates, but will in the future.

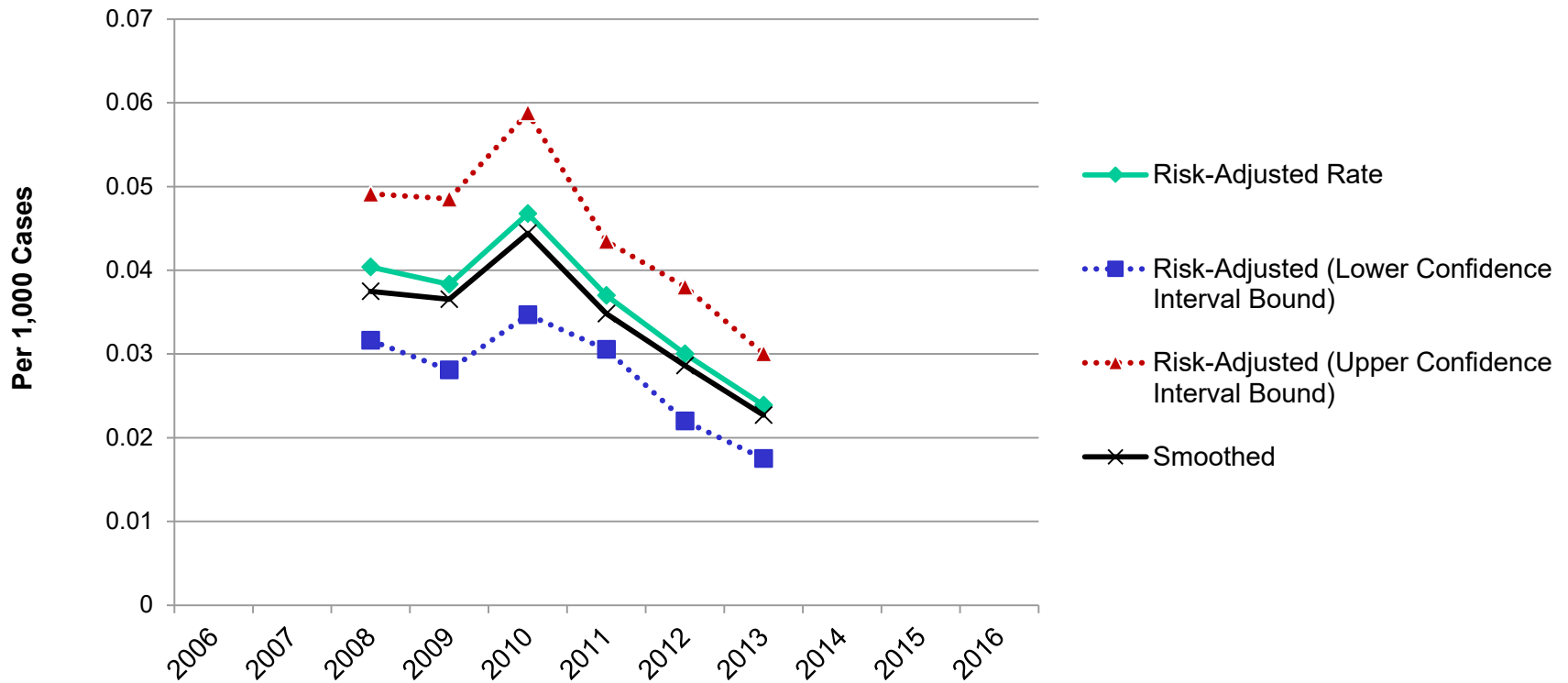
Comparing Observed Performance to Expected Performance Over Time

Comparing Observed Rates of Neonatal Blood Stream Infection Rate (NQI 03) to Expected Rates



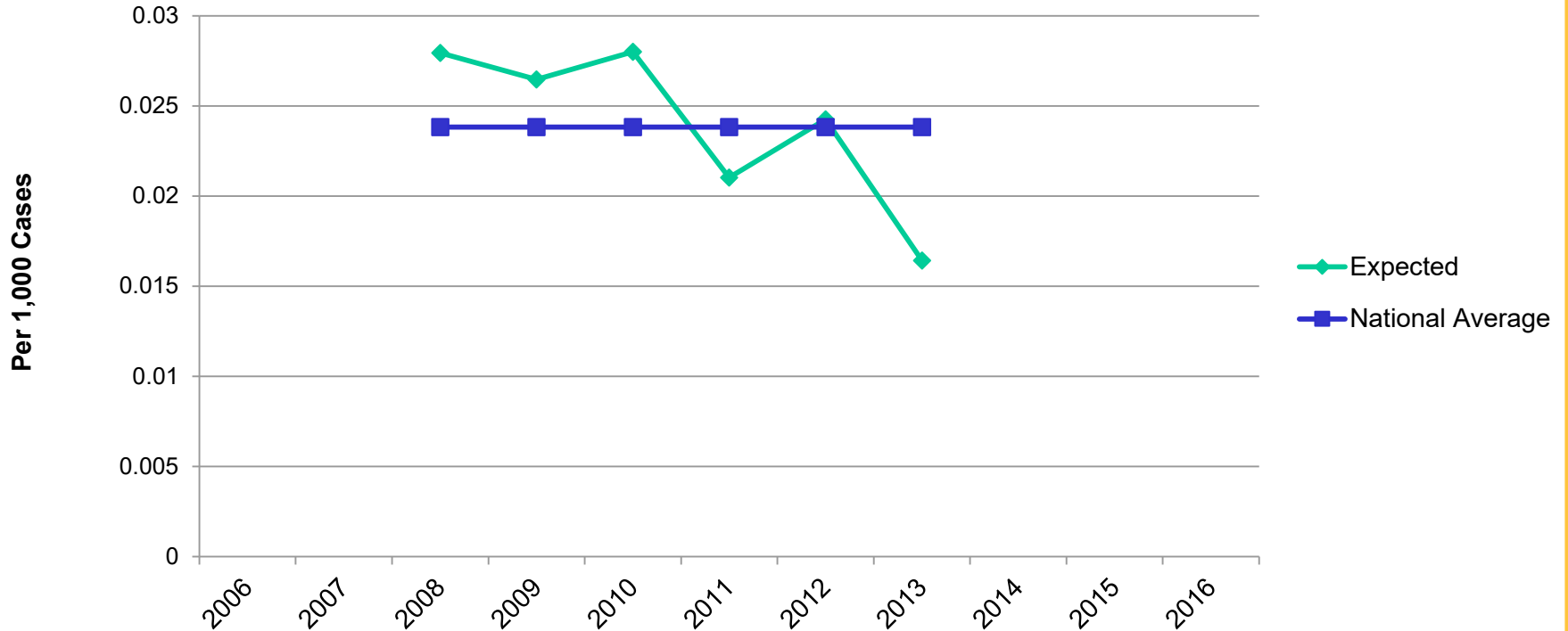
Comparing Risk-Adjusted and Smoothed Rates Over Time

Risk-Adjusted and Smoothed Rates of Neonatal Blood Stream Infection Rate (NQI 03)



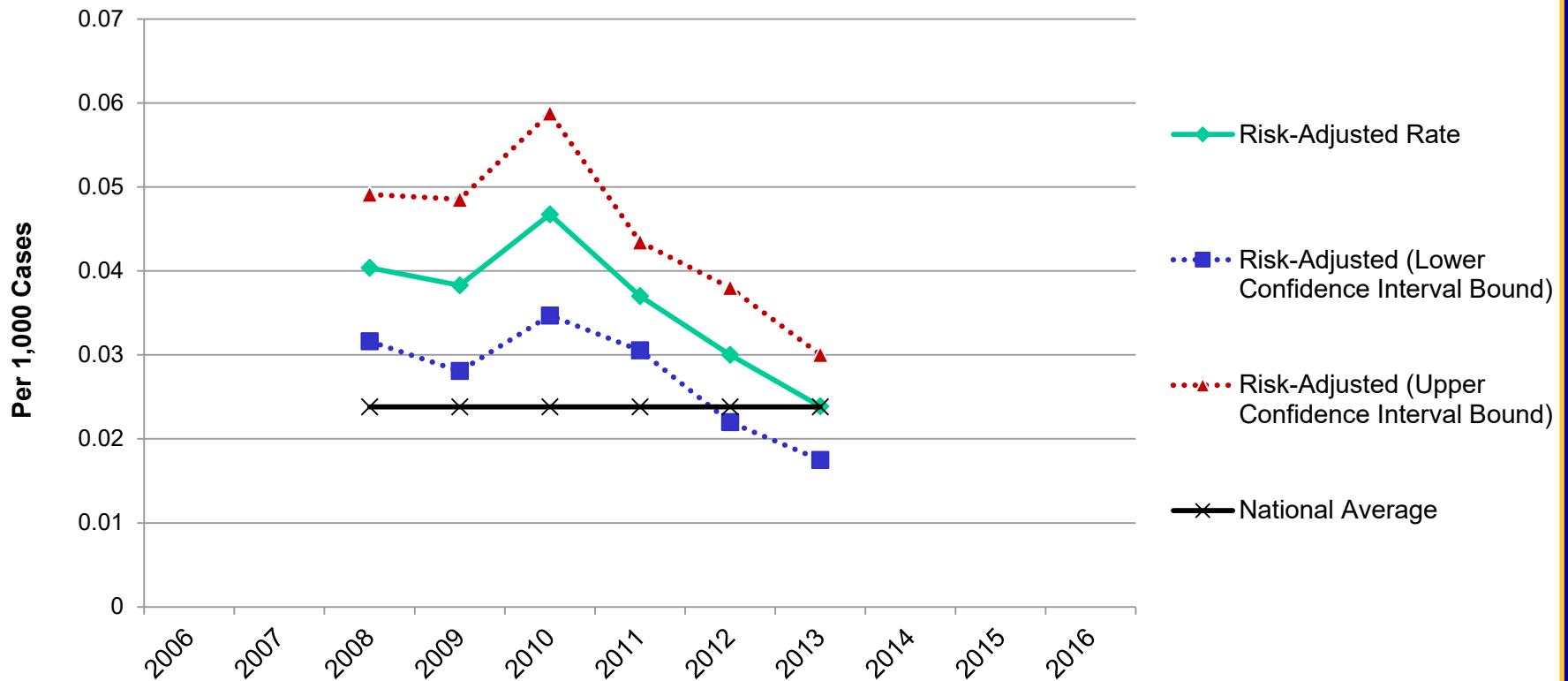
Evaluating Case Mix Relative to Other Hospitals

Comparing Expected Rates of **Neonatal Blood Stream Infection Rate (NQI 3)** to National Average Rates To Compare Case Mix



Comparing Hospital's Performance to National Performance Over Time

Comparing Risk-Adjusted Rates of **Neonatal Blood Stream Infection Rate (NQI 3)** to National Average Rates



Documentation and Coding for the AHRQ Pediatric Quality Indicators

Note: This tool was updated based on test software provided by AHRQ as of March 2016 (alpha version of SAS QI v6.0). This documentation and coding tool is updated less frequently than are the PDI specifications. Thus, it is possible that certain documentation and coding tips offered in this document may become outdated as the PDI specifications change. Please refer to AHRQ's QI software Web site (<http://www.qualityindicators.ahrq.gov/software>) for the most updated information on the software and indicator technical specifications. Along with any questions you may have, AHRQ welcomes any coding and documentation tips you may wish to offer at QIsupport@ahrq.hhs.gov.

What is the purpose of this tool? The purpose of this tool is to facilitate improvements to documentation and coding processes to ensure that the AHRQ Pediatric Quality Indicator (PDI) rates are accurate. The tool has two sections. The first describes procedures to address problems with documentation and coding practices among providers and hospital staff. The second illustrates some of the issues that can arise when documenting and coding each PDI.

Who are the target audiences? The primary audiences for this tool are pediatric providers, clinical documentation improvement specialists, coders, and quality officers. All of them have roles in the coding of diagnoses and procedures from medical records, which will be used to calculate PDI rates.

How can this tool help you? By using this tool, stakeholders should gain a better understanding of how documentation and coding can affect PDI rates. They will also learn about actions they can take to estimate their PDI rates more accurately. Efforts to improve documentation and coding accuracy can reduce variability in data, increase confidence in the PDI rates, and help identify areas where improvements can be made in both measurement and care processes.

How does this tool relate to the others? This tool should be used in conjunction with the other tools for applying QIs to hospital data (B tools). After you calculate your hospital's PDI rates, you can assess their validity by examining how accurately providers document diagnoses, procedures, events, and related issues. You also can look at how accurately these items were coded for use in quality measurement and billing processes.

Addressing the Documentation and Coding Process

The documentation and coding process is the transformation of clinical diagnostic statements and health care procedure notes into alphanumeric ICD-10-CM-PCSⁱ code numbers. The code numbers are detailed to accurately describe the diagnoses (the conditions the patient is seen for in the health care setting) and the procedures performed to diagnose or treat the patient.

Policymakers are placing greater emphasis on quality performance and expect hospitals to report on clinical care measures. Therefore, hospitals are now focusing both on coding for appropriate reimbursement and coding for accurate quality measurement and reporting.

The documentation and coding issues and suggested actions discussed in this section are relevant not only for coding of medical information for the PDIs but also for a hospital's entire documentation and coding process. In the following section, issues specific to the PDIs are discussed, including issues and actions specific to each PDI.

Coders must use the documentation provided by the treating providers, in compliance with coding guidelines (CDC, 2016; CMS, 2016), to establish the codes for each inpatient stay. To achieve accurate coding, providers need to understand the coding process and the rules that must be followed to ensure coding objectivity.ⁱⁱ Providers should use consistent language and specific diagnostic terms to document clinical care and to provide the complete information needed for accurate coding. Also needed is a well-established process through which clinical documentation improvement (CDI) specialists and coders can query providers to resolve questions or issues (Preskitt, 2005; Ballentine, 2009). The American Health Information Management Association (AHIMA) offers guidance on how best to establish CDI and compliant query practices (Bryant, et al., 2010; Bundenthal, et al., 2013).

In summary, effective documentation and coding processes involve the following key steps:

- *Documentation*: Establish documentation criteria for providers, including criteria for complete and timely notes.
- *Coding*: Establish coding policy, including conditions or events using the documentation from providers, and offer ongoing training and education.
- *Query process*: Establish an effective process that CDI specialists and coders can use to obtain clarification from providers on their documentation that may affect the coding process.

Documentation by Providers

Because coders can use only documentation from the treating providers that complies with coding regulations, physicians and other providers need to understand coding requirements and

ⁱ ICD-10-CM-PCS = International Classification of Diseases, 10th Revision, Procedure Coding System

ⁱⁱ Refer to the coding guidelines in the *AHA Coding Clinic* (2015), as designated by the four cooperating parties: American Hospital Association, American Health Information Management Association, Centers for Medicare & Medicaid Services, and National Center for Health Statistics.

the CDI process. The CDI specialist is the bridge between the coder and provider. CDI specialists use the entire record to look for clinical indications of diagnoses or procedures that are missing, lack specificity, or need clarification. The provider should answer the CDI query and document accordingly in the record for the coder to code. In addition, some general documentation practices should be consistently followed:

- Avoid abbreviations and symbols.
- Write complete SOAP (subjective, objective, assessment, and plan) notes.
- Avoid using copy and paste when using electronic documentation.
- Be thorough when making selections from “pick-lists” embedded in electronic records.
- Become familiar with rules and concepts of documentation and coding.
- Be accurate and comprehensive; your documentation should “tell” the patient’s clinical story of his or her conditions, treatments, and outcomes.
- Document a thorough history and physical.
- Document the outcomes of “rule out,” “consider,” and “possible” diagnoses.
- Identify the principal diagnosis or reason for admission.
- Include all secondary diagnoses and conditions that affect patient care or the clinical decisionmaking process.
- Document the reason for and objective of all operating room (OR) and non-OR procedures performed; this is particularly important with ICD-10-PCS code assignment.
- Answer all queries for clarification promptly and fully. Be sure to document the clarification or additional information in the medical record.

Expert Coding

Coders should be encouraged and empowered to focus on the quality of coding, not just productivity or reimbursement. It is important to take the time to ensure that the coded record is an accurate representation of the patient’s clinical condition and treatment. Clinical documentation specialists and coders should make careful queries to providers to clarify documentation when needed. Hospitals have found that the following issues have been sources of coding errors:

- Incomplete or inadequate provider documentation.
- Incorrect principal diagnosis selection, such as:
 - Coding a condition when a complication code should have been used.
 - Coding a symptom or sign rather than the diagnosis.
 - Coding only from the discharge summary and not the complete medical record.
 - Incorrectly applying the coding guidelines for principal diagnosis, especially when two or more diagnoses equally meet the definition of principal diagnosis.
- Incorrect or missing comorbidities or complications.
- Incorrect present on admission (POA) assignment of hospital-acquired conditions and vice versa; a list of diagnoses exempt from POA assignment can be found in Appendix 1 of the ICD-10-CM Official Guidelines for Coding and Reporting (CDC, 2016; CMS, 2016).

- Limitation of coding to the Medicare Severity diagnosis-related group (MS-DRG) (i.e., not coding the full record because reimbursement will not change with additional codes).
- Incorrect MS-DRG assignment.
- Encoder errors or incorrect encoder pathway.
- Reliance on computer-assisted coding software without thorough accompanying review of the complete medical record.
- Coders' lack of familiarity with ICD-10-PCS root operation definitions.

Query Process

Queries may be generated whenever the medical record lacks codable documentation or information is missing, conflicting, ambiguous, or illegible. It is important to have a well-defined query process to ensure that your clinical documentation specialists and coders can effectively obtain needed information without leading the provider or miscoding the information. A sample query form is provided below that might be used in that process. Hospitals may choose to form a CDI team consisting of trained nurses, coders, and other specialists that concurrently reviews charts and queries providers to clarify documentation prior to discharge.

Although coders cannot use documentation from nurses and allied health professionals, their notes often provide clues to issues that the provider may have failed to document. Hospitals may consider coordinating nurses' notes with provider documentation, especially for PDIs for which nurses' notes are known to be a good source of information (e.g., pressure ulcers).

SAMPLE QUERY FORM

Rationale: This is an example of a query necessary to determine the clinical significance of a condition resulting from a procedure.

Clinical scenario: During the removal of an abdominal mass, the surgeon documents, in the description of the operative procedure, a "serosal injury to the stomach was repaired with interrupted sutures."

Query: In the description of the operative procedure a serosal injury to the stomach was noted and repaired with interrupted sutures. Was this serosal injury and repair:

A complication of the procedure

Integral to the above procedure

Not clinically significant

Other

Clinically undetermined

Please document your response in the health record or below accompanied by clinical substantiation.

Name: _____ Date: _____

Clinical Documentation Improvement

Many hospitals have implemented a CDI program to successfully enhance the quality of clinical data. The essential steps for achieving an effective CDI program are described in the UHC clinical documentation challenges 2009 field book (UHC, 2009):

- Hire and train expert clinical documentation specialists to conduct concurrent chart review and clarify documentation before discharge.
- Educate providers about the need to partner with CDI staff to ensure the accuracy of performance data.
- Implement practices that support documentation improvement, such as a query process, education, tools and aids, and expert coding.
- Hold providers accountable for compliance with documentation requirements (e.g., financial incentives, recertification criteria, suspension, and peer review).
- Hold providers accountable for responding to queries for documentation clarification.
- Benchmark documentation and coding performance and communicate the results.
- Recognize and reward good performance.

Hospitals have successfully used a variety of structures for their CDI program, depending on their specific needs and cultures. Some approaches that have been successfully used by CDI programs to promote comprehensive documentation and accurate data include (UHC, 2010):

- Focus on units or services with poor performance data (e.g., elevated mortality index, high PDI rates).
- Track and communicate documentation query response rates by provider.
- Implement user-friendly query response methods (e.g., electronic queries linked to the medical record and documentation resources).
- Query for secondary diagnoses, comorbidities, complications, and risk-adjustment factors even when the additional codes will not change reimbursement.
- Review all deaths (e.g., patients who died with a low risk of mortality) to uncover improvement opportunities for documentation and coding and safe, high-quality clinical care.

Specific Strategies for Successful Documentation and Coding

The following strategies to improve coding processes have been delineated (Ballentine, 2009; UHC, 2009):

- Educational initiatives for clinical documentation specialists and coders:
 - Introductory didactic presentations on the PDIs and how their rates are calculated.
 - Online tutorial: documentation and coding.
 - Periodic memos with coding tips (“Tip of the Month”).
 - Comprehensive online references and coding tips.
 - Posters, announcements, and branding.
- Provider support:

- Introductory didactic presentations on the PDIs and how their rates are calculated.
 - Training on documentation and coding and how they can affect the hospital.
 - Intranet site with references and frequently asked questions.
 - Clinical documentation improvement liaisons.
 - Electronic health record offering on-demand documentation assistance.
 - Direct contact with clinical documentation specialists and coders.
 - Feedback associated with analysis of performance data and query response results.
 - Provider champions or dedicated documentation and coding specialists.
 - Presentation of a focus topic each month with suggestions to prevent patient safety events.
- CDI team and coding department changes:
 - Adequate staffing with expert CDI staff and coders.
 - Ongoing training and education for CDI specialists and coders.
 - Standing documentation and coding committee.
 - Internal and external audits of documentation and coding accuracy.

Training

Training for providers, clinical documentation specialists, and coders is essential to respond to changing expectations for accurate coding of clinical conditions and quality measures. Training also helps promote mutual understanding of clinical and coding terminology.

Provider buy-in is critical for effective documentation and coding, which can be encouraged through careful education, executive support, and provider champions. It also is important to hold providers accountable for compliance with documentation expectations and timely query responsiveness. To get buy-in, you can provide handouts (such as the fact sheets in this Pediatric QI Toolkit [Tool A.1a] and information about ICD-10 codes and how they are applied), pocket guides, and electronic health record alerts with coding terminology and frequently asked questions. Hospitals may want to make clinical documentation specialists available to provide real-time chart review, provider clarification, and one-on-one education.

One effective method for gaining buy-in from providers for documentation improvement is to present PDI rates based on their current style of documentation, side by side with revised rates after documentation clarification. This type of presentation highlights the consequences of inadequate documentation and the importance of standardization and clarification.

The hospital should periodically upgrade the skills of clinical documentation and coding staff. Coding errors may be due to a lack of knowledge of coding principles and terminology, or due to unfamiliarity with changing coding and/or external regulatory requirements. The quality of staff's initial training, as well as their ability to stay abreast of current guidelines, is fundamental to their expertise. This is especially important during the current ICD-10 transition years.

Ways To Establish an Effective Coding Communication and Review Process

The hospital can build a foundation for an accurate and comprehensive coding process by establishing written coding compliance policies that provide instructions on the entire process,

from point of service to billing or claim forms. The American Health Information Management Association has published a coding compliance document that lays out a set of suggested protocols to include in an organization's policies (AHIMA 2010). This document is a useful guide for developing hospital documentation and coding policy, which would include a standard process for the management of documentation, queries, coding, and ongoing quality assurance. AHIMA offers other resources, including guidance on developing a CDI program (Bryant, et al., 2010), a toolkit with sample forms and other resources to get started (AHIMA 2014), and a collaborative position statement for writing compliant, nonleading queries (Bundenthal, et al., 2013).

Actions To Code Patient Safety Events Accurately

A number of issues during both the documentation and coding processes can affect the validity of the PDIs. The **positive predictive value (PPV)** is an assessment of how accurately the measurement (i.e., the reported PDI rate) reflects the occurrence of actual events. The formula for PPV is:

$$\text{Positive Predictive Value (PPV)} = \text{True Positives} / \text{Flagged Cases}$$

The ideal value for PPV is equal to 1, where the number of true positives is equal to the number of flagged cases. If the number of true positives is lower than the number of flagged cases ($PPV < 1$) (e.g., individuals were coded as having a patient safety event when no event actually occurred), there is a problem with *false positives*.

On the other hand, the problem may be one of missed cases that should have been detected, which would result in the number of true positives being higher than the number of flagged cases. Missed cases, known as false negatives, are more difficult to address than false positives, because they are present in cases that were not identified for calculating PDI rates. Finding missed cases requires a new review of the relevant cases (in the rate denominator) for evidence of events that previously had not been documented, coded, and flagged. .

Reasons for False Positives

Several key reasons for false positives in the PDI rates have been identified by hospitals and reported in the health care literature. These include coding of POA, miscoding, lack of coding specificity, inclusion of nonelective surgical admissions, and inaccurate coding of history of events.

Present on admission. One of the most frequently cited causes of false positive cases is improper use of the POA flag (Glance, et al., 2008). Most PDIs have a coding exception that removes cases that arrived at the hospital with a condition that would be coded as a patient safety event had it occurred during the patient's stay (see Table 2). If POA is not indicated in the documentation or is not properly coded, the PDI rate will be inflated (Houchens, et al., 2008).

Improper use of the POA flag is a particular problem for hospitals that receive many transfers from other institutions. When the clinical conditions are unclear, it is appropriate for the provider to document "rule out," "possible," or "consider" diagnoses as long as he or she thoroughly documents the resolution of these tentative conditions in the medical record.

Miscoding. Diagnosis or procedure codes can be miscoded by assigning an incorrect code, omitting a code, or coding additional codes when not needed, which may also lead to inflated PDI rates. It is recommended that there be an ongoing process in place to audit coding, track and report errors, and provide feedback and education. The ICD-10 coding classification presents a new set of challenges for coders and CDI specialists and will require closer scrutiny in the early phases of transition.

Lack of coding specificity. If documentation or codes are not specific enough, rates can be inflated. This issue is especially important for the following PDIs:

- PDIs 10 and 12 (Postoperative Sepsis and Central Venous Catheter-Related Bloodstream Infection [CLABSI]). A provider may write, “consider sepsis,” despite the lack of evidence of a confirmed infection. Again, it is appropriate for a provider to document tentative conditions and complications as long as he or she follows through to document the confirmation, exclusion, or suspected and treated but uncertain conditions.

History of event. Providers may document “history of” a disease or illness when it is a long-term, chronic, or ongoing condition. It is important to clearly differentiate current conditions from those historic conditions that have been treated and have completely resolved.

Reasons for Missed Cases

Finding missed cases in PDI measurements may be much more difficult than finding false positives. Several of the reasons listed above (especially miscoding and lack of specificity) may bias results in a downward direction. For example, missed cases could occur if an accidental laceration is not clearly documented in the medical record or if cases with sepsis are not identified due to incomplete review of the record.

Hospital quality or CDI staff who are interested in finding missed cases may need to come up with creative solutions for finding them. One example would be to inspect laboratory documentation of infections to search for missed line infections. Another would be to audit charts to find missed cases, especially those of high-risk patients (e.g., long length of stay, ICU populations who may be at risk for pressure ulcers or CLABSI, deaths, oncology patients).

Documentation and Coding Issues for Individual PDIs

Some specific documentation issues for the PDIs are listed in Table 1. Some specific coding issues for the PDIs are listed in Table 2. These issues were identified through a search of published papers on QI measurement issues, and from feedback from hospitals during field testing of the Pediatric QI Toolkit.

References

- American Health Information Management Association (AHIMA). Defining the Core Clinical Documentation Set for Coding Compliance 2010. Available at: http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1_049822.pdf. Accessed March 15, 2016.
- American Health Information Management Association (AHIMA) Clinical Documentation Improvement Toolkit: 2014. Available to AHIMA members at: http://library.ahima.org/xpedio/groups/secure/documents/ahima/bok1_050585.pdf. Accessed March 15, 2016.
- American Hospital Association. Coding clinic for ICD-10-CM annual subscription. Chicago:AHA; 2015.
- Ballentine NH. Coding and documentation: Medicare Severity diagnosis-related groups and present-on-admission documentation. *J Hosp Med* 2009;4:124-30.
- Bryant G, DeVault K, Ericson C, Garrett G, Haik W, Holmes R, Mandler EE. Guidance for clinical documentation improvement programs. *Journal of AHIMA/American Health Information Management Association*. 2010 May;81(5):45.
- Bundenthal S, Belley S, Comfort A, DeVault K, Endicott M, Ericson C, Haik W, Holmes N, Iruveda W, Jurcak F, Meysenburg M. Guidelines for achieving a compliant query practice. *Journal of AHIMA/American Health Information Management Association*. 2013 Feb;84(2):50.
- Centers for Disease Control and Prevention Official ICD-10-CM Guidelines for Coding and Reporting, FY 2016. Available at: http://www.cdc.gov/nchs/data/icd/10cmguidelines_2016_Final.pdf. Accessed March 15, 2016.
- Centers for Medicare & Medicaid Services and National Center for Health Statistics ICD-10-PCS Official Guidelines for Coding and Reporting; 2016. Available at: <https://www.cms.gov/Medicare/Coding/ICD10/Downloads/2016-Official-ICD-10-PCS-Coding-Guidelines-.pdf>. Accessed March 15, 2016.
- Glance LG, Li Y, Osler TM, et al. Impact of date stamping on patient safety measurements in patients undergoing CABG: experience with AHRQ Patient Safety Indicators. *BMC Health Serv Res* 2008 Aug 13;8:176.
- Houchens RL, Elixhauser A, Romano PS. How often are potential patient safety events present on admission? *Jt Comm J Qual Patient Saf* 2008;34(3):154-63.
- Preskitt JT. CPT and ICD-9-CM coding for surgical residents and new surgeons in practice. Chicago: American College of Surgeons; 2005.
- University HealthSystem Consortium. Clinical documentation challenges: benchmarking project field book. Chicago: UHC; 2009.
- UHC. Clinical documentation improvement collaborative field brief. Chicago: UHC; 2010.

Additional Resources

- Bahl V, Thompson MA, Kau TY, et al. Do the AHRQ Patient Safety Indicators flag conditions that are present at the time of hospital admission? *Med Care* 2008;46(5):516-22.
- Behal R. Post-operative hemorrhage or hematoma (AHRQ Patient Safety Indicator). Dissecting the Red Dot. UHC Presentation/Guideline.
- Cevasco M, Borzecki AM, O'Brien WJ, et al. Validity of the AHRQ Patient Safety Indicator "central venous catheter-related bloodstream infections." *J Am Coll Surg* 2011;212(6):984-90.
- Gallagher B, Cen L, Hannan EL. Validation of AHRQ's Patient Safety Indicator for accidental puncture and laceration. In: Henriksen K, Battles JB, Marks ES, et al., eds. *Advances in Patient Safety: From Research to Implementation (Volume 2: Concepts and Methodology)*. Rockville, MD: Agency for Healthcare Research and Quality; 2005.
- Grobman WA, Feinglass J, Murthy S. Are the Agency for Healthcare Research and Quality obstetric trauma indicators valid measures of hospital safety? *Am J Obstet Gynecol* 2006;195(3):868-74.
- Haut ER, Noll K, Efron DT, et al. Can increased incidence of deep vein thrombosis (DVT) be used as a marker of quality of care in the absence of standardized screening? The potential effect of surveillance bias on reported DVT rates after trauma. *J Trauma* 2007;63(5):1132-37.
- Iezzoni LI, Foley SM, Daley J, et al. 1992. Comorbidities, complications, and coding bias. Does the number of dx codes matter in predicting in-house mortality? *JAMA* 1992;267(16):2197-2203.
- Neal B, Romano P. Coding postoperative respiratory failure: perspectives and possible changes. UHC Presentation, undated.
- Sadeghi B, Baron R, Zrelak P, et al. Cases of iatrogenic pneumothorax can be identified from ICD-9-CM coded data. *Am J Med Qual* 2010;25(3):218-24.
- Shin MH, Borzecki AM, Rosen AM. Assessing the criterion validity of selected Patient Safety Indicators (PSIs): are they ready for prime time? Academy Health Presentation, June 13, 2011. Available at: www.academyhealth.org/files/2011/monday/shin.pdf. Accessed March 15, 2016.
- Shufelt JL, Hannan EL, Gallagher BK. The postoperative hemorrhage and hematoma patient safety indicator and its risk factors. *Am J Med Qual* 2005;20(4):210-18.
- Utter GH, Cuny J, Sama P, et al. Detection of postoperative respiratory failure: how predictive is the Agency for Healthcare Research and Quality's Patient Safety Indicator? *J Am Coll Surg* 2010 Sep;211(3):347-54.
- Utter GH, Zrelak PA, Baron R, et al. Positive predictive value of the AHRQ accidental puncture or laceration patient safety indicator. *Ann Surg* 2009;250(6):1041-5.
- Vartak S, Ward MM, Vaughn TE. Do postoperative complications vary by hospital teaching status? *Med Care* 2008;46(1):25-32.

Pediatric Toolkit for Using the AHRQ Quality Indicators
How To Improve Hospital Quality and Safety

White RH, Sadeghi B, Tancredi DJ, et al. How valid is the ICD-9-CM based AHRQ patient safety indicator for postoperative venous thromboembolism? *Med Care* 2009;47(12):1237-43.

Zrelak PA, Sadeghi B, Utter GH, et al. Positive predictive value of the Agency for Healthcare Research and Quality Patient Safety Indicator for central line-related bloodstream infection (“selected infections due to medical care”). *J Healthc Qual* 2011 Mar-Apr;33(2):29-36.

Table 1. Documentation Issues Pertaining to Each Pediatric Quality Indicator

PDI		Documentation Problems Identified
NQI 01	Neonatal Iatrogenic Pneumothorax Rate	Document the etiology of pneumothorax - spontaneous or congenital versus caused by medical intervention (iatrogenic). Document whether the condition was present on admission or immediately after birth. Pneumothoraces occurring during or immediately after a procedure are generally considered iatrogenic unless documented to be the result or component of an underlying clinical condition.
NQI 02	Neonatal Mortality Rate	Document and code for anencephaly; polycystic kidney, and/or trisomy in newborns, regardless of gestational age and early or expected mortality.
PDI 01	Accidental Puncture or Laceration Rate	In documenting cuts, punctures, or lacerations, it is important to distinguish between those that are inherent to the procedure itself and those that are unintended and are therefore considered a complication or unexpected event. Query the physician: <ul style="list-style-type: none"> • If the physician’s postoperative/procedure note and operative/procedure report do NOT clearly describe the circumstances of the puncture or laceration. • If the postoperative/procedure note documentation conflicts with the operative/procedure report.
PDI 02	Pressure Ulcer Rate (stage III, IV, Unstageable)	Diagnosis and site of pressure ulcer must be documented by treating physician. The stage of ulcer can be documented by nursing or other non-physicians/clinicians. “Unspecified stage” and “unstageable” are not interchangeable terms. Unspecified stage should be used when the stage of the ulcer is not known; unstageable should be used when the stage cannot be clinically determined due to previous graft, recent surgery, eschar, or scar tissue, for example. If the ulcer progresses from one stage to another higher stage during the encounter, code should be assigned based on the highest stage documented and assigned a POA indicator of “N” for Not present on admission (CDC Official Coding Guideline).
PDI 03	Retained Surgical Item or Unretrieved Device Fragment	Foreign body intentionally left in during a procedure is NOT considered a retained FB for purposes of coding.
PDI 05	Iatrogenic Pneumothorax	Document the etiology of pneumothorax: spontaneous or congenital versus caused by medical intervention (iatrogenic). Pneumothoraces occurring during or immediately after a procedure are generally considered iatrogenic unless documented to be the result or component of an underlying clinical condition. Document and code any associated pleural effusion or chest trauma.

PDI		Documentation Problems Identified
PDI 08	Perioperative Hemorrhage or Hematoma Rate	<p>Need to distinguish between ecchymosis (flat bruising of the skin) and hematoma (bruising with mass). Hemorrhage is excessive blood loss; some procedures inherently have large volumes of expected blood loss, so distinguish between expected blood loss and hemorrhage. Document and code any coexisting coagulation disorders.</p>
PDI 09	Postoperative Respiratory Failure	<p>Either the diagnosis code for “acute post-procedural respiratory failure” OR procedure codes for intubation and mechanical ventilation zero or more days after an OR procedure. Document the reason for longer than usual post-procedure ventilation; some procedures, by their nature, require ventilation for an extended time.</p> <p>Document any neuromuscular or neurodegenerative disorders and craniofacial anomalies.</p>
PDI 12	Central Venous Catheter-Related Blood Stream Infection	<p>Differentiate between a central line and a peripheral line infection; the distinction is made by the location of the end of catheter tip (peripheral vs. central vein), not the insertion site.</p> <p>Document whether the infection is localized to the skin and subcutaneous tunnel or systemic involving the bloodstream.</p> <p>CV-CRBSI is “infection due to central venous catheter,” which means that the catheter is the source of the infection, not when the catheter becomes infected from another source (e.g., bacteremia, sepsis from the urinary tract).</p> <ul style="list-style-type: none"> • Query if the source of the bloodstream infection is not evident. • Query if it is not clear whether the “central line infection” is localized or a bloodstream infection. • Work with physicians to make them aware of the documentation requirements. • Work with coders to explain how to use codes appropriately.

*NQI 03, PDI 06, PDI 07, PDI 10, PDI 11, and PDI 13 are not included in this table as there were no specific documentation issues to highlight.

Table 2. Coding Issues Pertaining to Each Pediatric Quality Indicator

PDI		POA Required	Miscoding	Lack of Coding Specificity	Measure Includes Only Elective Admissions
PDI 01	Accidental Puncture or Laceration	X	Chart reviews have found cases incorrectly coded as PDI that were actually due to normal operative conduct, a disease-related lesion, or complication other than accidental puncture and laceration (bleeding, infection, dislodgement of a gastrostomy tube, or fracture).	Occasionally, intraoperative bleeding or other routine events are coded as accidental puncture or laceration. Clarify whether lacerations are unintended or an integral part of a procedure, such as to facilitate access to the surgical site in cases of unusual anatomy, or extensive disease.	
PDI 02	Pressure Ulcer	X	<p>If the ulcer progresses from one stage to another higher stage during the encounter, code should be assigned based on the highest stage documented and assigned a POA indicator of "N" for Not present on admission (CDC Official Coding Guideline).</p> <p>"Unspecified stage" and "unstageable" are not interchangeable terms; the code for unspecified stage should be used when the stage of the ulcer is not documented or is unknown; unstageable should be used when the stage cannot be clinically determined.</p>	Provider must document the site of pressure ulcer; the stage of the ulcer can be documented and coded from nurse or other clinician notes.	
PDI 03	Retained Surgical Item or Unretrieved Device Fragment	X	<p>Foreign body intentionally left by surgeon should not be coded as "retained" foreign body.</p> <p>Retained foreign body discovered and retrieved prior to the end of the surgical episode should not be coded.</p>		

PDI		POA Required	Miscoding	Lack of Coding Specificity	Measure Includes Only Elective Admissions
PDI 05	Iatrogenic Pneumothorax	X	<p>Pneumothoraces occurring during or immediately after a procedure are generally considered iatrogenic unless documented to be the result or component of an underlying clinical condition. Query the provider for clarification if needed.</p> <p>Code any documented chest trauma, pleural effusion, and/or thoracic/chest procedures, including diagnostic procedures.</p> <p>Do not code incidental findings of pneumothorax found on chest x-ray unless the provider has documented the clinical significance.</p>	<p>Query for the etiology of pneumothorax if not documented: spontaneous, due to an underlying condition, disease, or injury or caused by medical intervention (iatrogenic).</p>	
PDI 08	Perioperative Hemorrhage or Hematoma	X	<p>Need to distinguish between ecchymosis (flat bruising of the skin) and hematoma (bruising with mass).</p> <p>Indicator requires diagnosis code and procedure code.</p> <p>ICD-10-PCS root operation “control” is used for any circumstance of stopping or attempting to stop post-procedural bleeding. If the “control” procedure fails and a more definitive procedure is required to stop the bleeding, code only the definitive procedure. (ICD-10-PCS Official Coding Guideline).</p>	<p>Differentiate between hemorrhage and expected intra-op and post procedural bleeding that is within normal for that specific procedure.</p>	X

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PDI		POA Required	Miscoding	Lack of Coding Specificity	Measure Includes Only Elective Admissions
			Hemorrhage cannot be coded from documented volume blood loss of any amount.		
PDI 09	Postoperative Respiratory Failure Rate	X	<p>Postoperative respiratory failure is acute in nature and thus is classified as acute J95.821 or acute and chronic combined J95.822</p> <p>Coding should distinguish between respiratory insufficiency and respiratory failure (UHC Documentation Guide Post- Operative Respiratory Failure).</p> <p>Intubation and mechanical ventilation utilized during surgery should not be coded. Code ventilation that is continued in the postoperative period only when the provider indicates that there is reason to keep the patient intubated and ventilated longer than usual in the postoperative period. Code all re-intubation that occurs after surgery and extubation.</p>	The coder should never assume a diagnosis of respiratory failure without a documented diagnosis by the physician. If there are clinical indicators of failure, query the provider for clarification.	X
PDI 10	Postoperative Sepsis	X	Negative or inconclusive blood cultures do not preclude a diagnosis of sepsis in patients with clinical evidence of the condition; however, the provider should be queried (CDC Official Coding Guideline).	When coding severe sepsis remember any organ dysfunction or failure should be associated with or due to the sepsis; if the relationship is not clear, query the provider.	X

PDI		POA Required	Miscoding	Lack of Coding Specificity	Measure Includes Only Elective Admissions
PDI 11	Postoperative Wound Dehiscence Rate	X	Depth of the wound dehiscence: external/superficial vs. internal/deep should be documented and coded accordingly. Internal involves the abdominal fascial or muscle layer and deeper.	Code the specific anatomical layers repaired (e.g., skin, subcutaneous tissue, fascia, muscle, or deeper tissues or structures). <i>The procedure codes in the general anatomical regions body systems should only be used when the procedure is performed on an anatomical region rather than a specific body part or on the rare occasion when no information is available to support assignment of a code to a specific body part (ICD-10-PCS Official Coding Guidelines).</i>	.
PDI 12	Central Venous Catheter-Related Bloodstream Infections (CV-CRBI)	X	Bloodstream infections from peripheral lines may be miscoded as central lines; the distinction is made by the location of the end of catheter tip (peripheral vs. central vein), not the insertion site. Assign the correct seventh digit character "A" if the infection is being actively treated regardless of number of encounters or providers that have treated the infection. Assign the correct seventh digit character "D" for infections previously treated and undergoing only routine care or monitoring and followup.	Central line infections can be localized to skin and subcutaneous tissues (T80212A), bloodstream infection (T80211A), or other and unspecified (T80218A, T80219A). If the type and/or location is not evident, query provider for clarification.	
PDI 13	Transfusion Reaction	X	Transfusion reactions cannot be coded from nurse or other nonprovider notes. The reaction must be documented by a treating provider.		

*NQI 01, NQI 02, NQI 03, PDI 6, and PDI 7 are not included in this table as there were no specific coding issues to highlight.

Assessing Indicator Rates Using Trends and Comparators

What is the purpose of this tool? This tool provides guidance on how to assess your hospital's performance on the AHRQ Pediatric Quality Indicators (PDIs), by examining trends in the hospital's PDI rates and comparing them to the rates of other similar hospitals.

Who are the target audiences? The primary audiences for this tool are three groups of hospital staff:

- Quality and safety staff, as well as clinical and other staff (e.g., quality or patient safety officer at the hospital) involved in quality improvement work, should be involved in assessing the hospital's performance on the PDIs and making decisions on priorities for improvement.
- Hospital board and management leaders need to review this information on a regular basis to monitor the hospital's performance on the PDIs.
- Statisticians, data analysts, and programmers can help to develop and interpret the trend and comparator data for the hospital.

How can this tool help you? You can use this tool to support the development of trend and comparator information for comparing your hospital's current performance on the PDI rates to its performance in previous years (trends) and to other hospitals (comparators). These comparisons will help identify which PDIs the hospital may need to address for quality improvement, because its performance on them either is declining (or not improving) or is lower than that of its peers.

How does this tool relate to others? This tool uses rates for the AHRQ PDIs, which are the output from the software that AHRQ provides for calculating these rates. Guidance for use of these software programs is provided in the tools on *PDI Rates Generated by the AHRQ SAS Programs* (Tool B.2a) and *PDI Rates Generated by the AHRQ Windows QI Software* (Tool B.2b).

You also can use the PowerPoint and Excel worksheets on data, trends, and rates (Tool B.3) to display trends and comparisons for your PDI rates for presentations.

The information generated from trend and comparator analysis is used in the *Prioritization Matrix* (Tool C.1) to help guide the hospital through decisions regarding which PDIs are most important to address in quality improvement efforts. It also can be used in the *Project Evaluation and Debriefing* (Tool D.8) and *Monitoring Progress for Sustainable Improvement* (Tool E.1)

Reviewing Your Hospital's PDI Rates Over Time and Comparing Your Hospital's Rates With Other Hospitals

After calculating your hospital's PDI rates, it is helpful to put your performance into context to assess how well your hospital is performing. The two most common comparisons are with your *hospital's own historic performance* (trends in rates) and with *other hospitals* (comparators). You can use this information in two important ways to improve and sustain performance on the PDIs:

- To inform decisionmaking early in your quality improvement process, regarding which indicators are priorities for quality improvement actions.
- To ensure that improvements achieved by an implementation process are sustained beyond the end of that process, by tracking both trend and comparator information as part of an ongoing monitoring process

Performing Trend Analysis for the PDI Rates

To conduct a trend analysis (or develop control charts) of a hospital's PDI rates, calculate the rates for multiple time periods, and then plot those rates on graphs to identify any changes in rates that may be occurring over time. To have confidence that any changes in rates observed over time are real, you will need to calculate the rates for all years in the trendline using the same methods and measures. For valid trend information, it is important to be consistent over time in:

- The coding of your discharge data.
- The definitions of the PDIs used.
- The calculations performed by the AHRQ QI software (using the same version for each year).
- The method used for risk adjustment (which is not currently available for v6.0 of the QI software).

The best way to achieve this consistency is to choose one method for each item and apply the method to all the years included in the trendline. Because the measurement methods for the PDIs change from year to year, you will have to use the methods for one year instead of using the relevant methods for each year. At times, you will be constrained by the availability of the variables needed to calculate the rates, many of which are not available for all years (e.g., the present-on-admission variable). When this happens, it will be necessary to choose methods that are based on the data with the more limited set of variables (see below for further discussion).

Although this approach may make the rate estimates used for trending less accurate for some years, it allows you to make valid cross-year comparisons. Then you can use the correct rates for the current year for any other analyses that are relevant only to that year.

Consistency of the AHRQ definition of the PDIs and AHRQ software programs. AHRQ has revised its definitions of the PDIs frequently, for two reasons. The first is to incorporate into its PDI definitions the annual updates made to the International Classification of Diseases, 10th Revision (ICD-10-CM) and Diagnosis-Related Group (DRG) codes. The other is to respond to new research findings regarding the validity and reliability of the PDIs.

AHRQ typically revises its PDI definitions and programs each year. Therefore, the rate you calculate for one year (with the old codes) may differ from those in the following year (with the new codes). As of spring 2016, AHRQ released QI Version 6.0, which includes substantial changes. The most notable change is the lack of ability to risk adjust, as ICD-10 data availability is limited given its recent introduction.

AHRQ does not provide guidance on how to account for the changes in coding when analyzing trends. Any bias that might be created when the old codes are used to estimate the updated PDIs will depend on the specific changes made. The simplest approach you can take is to choose one version of the codes and use it to calculate PDI rates for all the time periods included in your trend analysis.

Analysts and staff should be particularly careful when comparing rates that were calculated using the ICD-9-CM version of the indicators with rates that were calculated using the ICD-10-CM version of the indicators, as there may be differences in the definitions that may not yield a perfect comparison. In addition, AHRQ's QI software v.6.0 does not provide the ability to risk-adjust rates.

Risk adjustment. *Risk adjustment is not currently available for AHRQ's QI software as of the v6.0 release but may be available in the future.* Once risk-adjusted data are available, when analyzing trends, it is advisable to calculate risk-adjusted PDI rates to control for any changes that may occur in your patient population over time. If your patient characteristics remain stable over time, however, there is less need for risk adjustment. Different methods of risk adjustment can be used for your trend analysis. Once you select a method, it should be applied consistently to rates across your trend timeline.

Ideally, you should calculate the PDI rates for at least 4 to 5 years (more if possible) up to and including the most recent year for which you have data. Once you calculate the rates, you can display them in tables or graphs. (Refer to Tool B.3, Excel worksheets for charts and PowerPoint presentation for support in displaying this information.) Observation of the trendlines will provide information on whether your rates are improving, staying about the same, or declining. You can use regression methods to estimate a line through the years of data, using an observation for each year's rate. A statistically significant coefficient on the year variable will indicate a trend.

Trendlines also can be used to identify any changes in trends for PDI rates related to quality improvement efforts. In these trendlines, your original 4 to 5 years of data (or more) serve as the baseline, and then you continue to chart trends for subsequent years during and after your improvement implementation period. If the postimplementation trend shows an improvement over the baseline trend, you have identified a possible effect of your improvement efforts. You should use caution in attributing such a change in trend to your improvement efforts, however, because other factors may affect changes in rates and could confound your findings.

Comparing Your Hospital With Other Hospitals

Comparison data provide comparisons with other organizations similar to your hospital for performance measures of interest to you. The terms "comparator" and "benchmark" are often

used interchangeably, but they are different.ⁱ “Comparator” is an umbrella term. A frequently used comparator is the national, regional, or practice average.

Another type of comparator is a benchmark, which connotes a level of performance that is desirable. A national, regional, or practice average also could be a benchmark, if the average is viewed as the desirable target. Usually, however, a benchmark is pegged to performance that is above average, although it depends on the metric and how well average hospitals are performing.

You can use comparison data to learn how well your hospital is doing on an array of measures relative to other hospitals, and you can identify the measures for which your hospital is doing quite well and others for which its performance is lower than your peers.

There is no single answer regarding which groups of hospitals to use for comparison. To determine your hospital’s performance relative to other similar hospitals, the ideal comparator would be groups of hospitals that you consider to be peers to your hospital, such as academic medical centers, rural hospitals, or community hospitals. You may decide that you want to make comparisons with several hospital groups that are important to your hospital based on mission or market strategy. However, you may wish to compare with hospitals with above average performance, and you may decide to use top-performing hospitals as your benchmark. Once you choose the comparison groups, you need to search for sources of the comparison or benchmark information.

Comparison data for the ICD-9 version of the AHRQ PDIs may be found at national, State, and regional levels. National averages for 2012 are currently provided by AHRQ. This information can be found at the following Web site:

http://www.qualityindicators.ahrq.gov/Downloads/Modules/PDI/V50/Version_50_Benchmark_Tables_PDI.pdf.

The most recent available PDI rates from AHRQ are from 2012. National averages based on ICD-10 data are not yet available.

Availability of data at the State and regional levels will vary, depending on the activities of organizations in each area. Some hospitals may rely on an outside agency, such as the State hospital association or a parent organization, to analyze their data and produce their PDI rates. These organizations typically provide comparison data for those using their services. Availability of comparison data using ICD-10 data (particularly those that are risk adjusted) may be limited until ICD-10 codes have been in use for some time.

Check with your State or regional hospital association, or other systems in which you participate, to find out what comparative data they produce that you might use.

NOTE: When using average PDI rates as comparators, pay attention to which version of the AHRQ QI software was used to calculate the rates. Because different versions of the QI software

ⁱ McNamara P, Shaller D, De La Mare J, et al. Confidential physician feedback reports: designing for optimal impact on performance. Rockville, MD: Agency for Healthcare Research and Quality; 2016. Available at: <http://www.ahrq.gov/professionals/clinicians-providers/resources/confidreportguide/index.html>. Accessed March 20, 2016.

generate different rates, even when applied to the same dataset, you will need to ensure that the PDI rates you are using were generated from the same version of the QI software that you used to calculate your hospital's rates.

Similar to the trend data, comparator information can be used early in your improvement process to help identify priority PDIs for improvement, as well as later in the process to assess how much improvement is being achieved by your implementation process. For setting priorities, you can apply the comparator information to your work with the *Prioritization Worksheet* (Tool C.1). For later monitoring, it can be used with Tool D.8 (*Project Evaluation and Debriefing*) and Tool E.1 (*Monitoring Progress for Sustainable Improvement*).

Prioritization Worksheet

What is the purpose of this tool? In today's health care world, hospitals are required to take on more responsibility than ever. With many different competing priorities, senior leaders need to work to prioritize their efforts. With fewer resources than ever before, hospitals need to prioritize where to spend those resources to obtain maximum benefit. Tool C.1, the Prioritization Worksheet, will help your organization determine which Pediatric Quality Indicators (PDIs) to focus your resources on.

The Prioritization Worksheet (C.1) has four sections. The first section (blue) will identify which PDIs are worse than the comparator set by your institution. The second section (green) will identify the cost implication of each PDI for your organization. The third section (purple) will assist your organization in aligning each PDI with your organizational strategic initiatives, external mandates your organization must comply with, and public perceptions of your care for each indicator. The fourth section (orange) will give your organization an idea of how likely each improvement initiative is to succeed, based on current barriers.

Organizations do not need to use every section in this tool. For example, if financial information will not be used in the decision process, that section can be left blank. Conversely, if there is additional organization-specific information needed for prioritization, columns can be added (e.g., length of stay, mortality rates, patients harmed).

This tool should be used to guide your decisionmaking process regarding priorities at your organization. The tool does not need to be used to make final decisions but should be used in your prioritization discussion. Ultimately, senior leadership must make the final decision on what should take priority at your organization.

Who are the target audiences? The target audiences for this tool are organization strategic planners, senior clinical leaders, and quality improvement leaders.

How can this tool help you? This tool is designed to help guide your organization's discussion in determining the direction of organizational focus and decisions about which AHRQ PDIs should be addressed during quality improvement initiatives.

How does this tool relate to the others? This tool should be used prior to starting work using the improvement methods tools (Section D). In particular, it can provide information on factors that may be barriers to implementation for use in the *Gap Analysis* (Tool D.5), and outcomes (e.g., cost-effectiveness and volume) could be linked to the *Implementation Measurement* (Tool D.7) and *Project Evaluation and Debriefing* (Tool D.8).

Directions for Using the Prioritization Worksheet

Section 1 - Blue: Own Rate and National Comparator

1. Using section 1 of the worksheet, calculate your organization's performance on each specific PDI (using section B of the toolkit); if the data are provided to you by an outside vendor, obtain those data. It is suggested that you use at least a year's worth of data in the tool. Prefill your performance rates for the specified time period into column C, "Own Rate."
2. Determine what your organizational comparator will be. It is up to your organization to determine what you will use as a comparator. Consider using outside comparators, such as those received from vendors, comparators received from national studies, or the targets obtained from running the AHRQ QI software. Refer to Tool B.5 for more information on selecting a comparator. Once you decide on those comparators, fill them into column D, "National Comparators."
3. Once your hospital's specific rates and comparators are set, determine which PDIs are worse than the comparator your organization has set. Either check or highlight each box next to the PDIs that have a rate worse than the comparator. This will help your organization narrow down which PDIs are a potential issue within your organization.

Section 2 - Green: Estimate Annual Cost and Cost To Implement

For more information about consideration of costs, see the Return-on-Investment (ROI) Tool F.1.

4. In column E, "Volume of Cases at Risk," indicate the annual volume of each PDI event occurring within your organization. This number is the total raw number of events occurring within your organization for your chosen time period. Consider highlighting the high-volume indicators on the worksheet to bring those indicators to your attention. Each hospital will need to determine what is considered high volume for them.
5. Column F, "Cost of Single Event," indicates the average cost to your organization of one event. This number is meant to help estimate cost and is not absolute. Each organization will need to determine if this information will be used to prioritize. If so, it is imperative that you bring in members of your finance department to calculate these numbers. We have not included cost estimates for a single event directly in the worksheet, as you may want to consider your own specific costs given variability of costs. If you decide to calculate your own costs using internal data, you may wish to consider the following challenges:
 - Costs versus charges: Wherever possible, strive to use actual costs as opposed to charges (which will typically overestimate cost).
 - Appropriate comparator: When trying to identify the cost attributable to an adverse event captured by your indicator, be thoughtful about which patients will serve as your comparator, meaning, the patients *without* the adverse event. Patients who experience adverse events often tend to have more comorbidities and other risk factors and thus have accrued more costs even prior to the adverse event. Therefore, choose a group that did not experience the adverse event that is as comparable as possible to the group that did experience the adverse event and/or adjust for possible factors that could increase both costs and risk of the adverse event (e.g., concurrent cancer diagnosis). Ideally, if your data permit, consider only costs that occur *after* the adverse event occurred.

6. Column G, “Total Cost,” will estimate the total cost of this event to your organization for the chosen time period. To determine this number, for each PDI, multiply column E, “Volume of Cases at Risk” by column F, “Cost of Single Event.” The total number should give you an idea of total cost to your organization for each indicator. Consider highlighting those indicators that have a high total cost for your organization. Again, each organization will have to determine on its own what will be considered high cost.
7. Column H, “Cost To Implement,” will determine the anticipated cost in resources, such as supplies, staff time, and facility changes, to implement the improvement initiative compared with the total cost of the event to your organization. With the help of colleagues from the finance department, determine what the cost would be to your organization to implement an improvement project for the high-priority PDIs. Compare the total costs of having an adverse event (Column G, Total Cost) with the anticipated cost to implement improvement initiatives (Column H, Cost To Implement). In other words, you are measuring the cost of implementation vs. the cost of not stopping these events. For each indicator, either answer “Yes,” meaning the cost to improve is less than the cost of the event to the organization, or “No,” meaning the cost to improve is more than the cost of the event to the organization.
8. Column I, “Penalties and Incentives,” will estimate institutional penalties and incentives that may accrue depending on performance, such as the Hospital-Acquired Condition Reduction and Value-Based Purchasing Programs. With the help of colleagues from the finance department, estimate the potential financial effects of bringing your institution’s PDIs in line with national comparators.
9. For column J, “Proxies for Cost,” additional information may be used in addition to or instead of cost estimates in Columns F-I. Examples could include length of stay, additional procedures, readmissions, or patients harmed.

Section 3 - Purple: Rate Strategic Alignment and Regulatory Mandates

10. For column K, “Strategic Alignment,” read the statement and then rate, on a scale of 10-0, how much you agree or disagree that each indicator aligns with your strategic goals, cultural mission, organizational values, and priorities. A 10 indicates that you completely agree that the PDI aligns with organizational goals and priorities, while a score of 0 indicates you completely disagree that the PDI aligns with the organizational goals, mission, values, and priorities. Your team can go through and rate how well all the PDIs align with your organization’s strategic goals, mission, values, and priorities and then highlight those indicators that are above a certain number.
11. In column L, “External Mandates,” the same rules apply. On a scale of 10-0, how much do you agree or disagree that each indicator has a high level of external regulatory mandates on your organization. This number should reflect your current situation. Have you been cited in the past by The Joint Commission regarding a certain condition? Are you currently under a Request for Information involving an indicator? Again, consider highlighting those indicators that are above a certain number.
12. In column M, “Public Perception,” rate how much public perception will influence your work on the indicators. Again, each organization will rate this item differently depending on its situation. Has your organization recently experienced negative press regarding an event? What would this look like in the community if you had an event in your organization? Are you competing for market share that would influence you to focus on a certain indicator? Again, consider highlighting those indicators that are above a certain number.

Section 4 - Orange: Barrier Assessment

13. In each column (N-R), indicate whether your organization agrees with the barrier assessment (see below for further explanation of each category). In those areas marked with a no, your organization will need to address these barriers before an improvement project is started.

Barrier Assessment Categories

Executive-Level Support

Top-level commitment is vital to engendering commitment from those at the front line. If employees do not see that the company's leadership is backing a project, they are unlikely to change.

Staff Capability

Since project teams handle a wide range of activities, resources, pressures, external stimuli, and unforeseen obstacles, they must be cohesive and well led. The team leader must be capable. The team members must have sufficient skills, motivations, and time to spend on the project.

Staff Willingness

It is important to recognize the role that managers and staff will play. By communicating with them early and consistently, senior executives can get employees on board.

Time and Effort

When companies launch transformation efforts, they frequently do not realize or do not know how to deal with the fact that employees are already busy with their day-to-day responsibilities.

Ability To Monitor Progress

The probability that projects will run into trouble rises exponentially when the time between reviews exceeds 8 weeks. Scheduling milestones and assessing their impact are the best way by which executives can review the execution of projects, identify gaps, and spot new risks.

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AHRQ Quality Indicators Prioritization Matrix																	
	Section 1-Blue		Section 2-Green						Section 3-Purple			Section 4-Orange					
	Own Rate and National Benchmark		Estimate Annual Cost and Cost To Implement						Rate Strategic Alignment and Regulatory Mandates Rate on scale of 10 (agree/high) to 0 (disagree/low)			Barrier Assessment (indicate Yes or No)					
			Volume of Cases at Risk	Cost of Single Event	Total Cost	Cost To Implement	Penalties and Incentives	Proxies for Cost	Strategic Alignment	External Mandates	Public Perception	Executive-Level Support	Staff Capability	Staff Willingness	Time and Effort	Ability To Monitor Progress	
	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	
List of PDIs	Own Rate	National Comparator	Annual volume of this event	Anticipated average cost for one case with this event	The total annual cost of this event to our organization	Anticipated cost to investigate/ implement new process is less than annual cost of event	Anticipated costs and benefits from HAC Reduction, VBP, etc.	Additional information that could be used instead of or in addition to cost estimates in columns F-H	Aligned with established organizational goals and priorities	• Regulatory • Value-based purchasing • Sentinel event	• Publicly reported • Public perception • Marketing • Competitive pressure	Do we have the committed support of our senior leadership?	Do we have staff with the needed skills for this PI team?	Are affected staff willing to change?	Will the added demand on staff time and effort be reasonable?	Do we have a method to review PI progress on a regular basis?	
Neonatal	NQI 01 Neonatal Iatrogenic Pneumothorax	0.0	0.2	0	\$61,991	\$ -	N		7	8	7	Y	Y	Y	Y	Y	
	NQI 02 Neonatal Mortality Rate	0.0	2.5	0		\$ -	N		8	10	9	Y	Y	Y	Y	Y	
	NQI 03 Neonatal Blood Stream Infection Rate	40.4	23.8	17	\$121,010	\$ 2,057,170	Y		10	9	9	Y	Y	Y	Y	N	
Pediatric	PDI 01 Accidental Puncture	0.3	0.6	1	\$41,204	\$ 41,204	N		9	9	9	Y	Y	Y	Y	Y	
	PDI 02 Pressure Ulcer	0.0	0.2	0	\$85,344	\$ -	N		6	6	6	Y	Y	Y	Y	Y	
	PDI 05 Iatrogenic Pneumothorax Rate	0.0	0.1	0	\$61,991	\$ -	N		6	6	6	Y	Y	Y	Y	Y	
	PDI 06 RACHS-1 Pediatric Heart Surgery Mortality Rate		36.9	0		\$ -	N		1	5	5	Y	N	Y	Y	N	
	PDI 07 RACHS-1 Pediatric Heart Surgery Volume			54		\$ -	N		1	5	5	Y	N	Y	Y	N	
	PDI 08 Perioperative Hemorrhage or Hematoma Rate	0.0	4.9	0	\$75,932	\$ -	N		6	6	6	Y	Y	Y	Y	Y	
	PDI 09 Postoperative Respiratory Failure Rate	0.0	11.0	0	\$140,507	\$ -	N		7	7	7	Y	Y	Y	Y	Y	
	PDI 10 Postoperative Sepsis Rate	0.0	16.2	0	\$117,815	\$ -	N		9	10	10	Y	Y	Y	Y	Y	
	PDI 11 Postoperative Wound Dehiscence Rate	0.0	1.1	0	\$76,737	\$ -	N		5	5	5	Y	Y	Y	Y	Y	
	PDI 12 Central Venous Catheter-Related Blood Stream Infection	0.4	0.8	2	\$121,010	\$ 242,020	N		10	9	9	Y	Y	Y	Y	N	
	Sentinel Event	PDI 03 Unretrieved Device Fragment Count	0.0		0	\$31,366	\$ -	N		10	10	10	Y	Y	Y	Y	Y
		PDI 13 Transfusion Reaction	0.0		0	\$86,698	\$ -	N		4	10	8	Y	Y	Y	Y	Y
Pediatric Safety Composite Indicator	PDI 19 Pediatric Safety for Selected Indicators																

Tool C.2

INSTRUCTIONS FOR USING THIS TOOL

DELETE THIS SLIDE BEFORE PRESENTATION

- *Use this PowerPoint presentation as a template for your presentation to hospital staff.*
- *Replace the charts with charts that you create with your data (using the Excel workbook in Tool B.3a) and replace the **red text** with information relevant to your hospital.*
- *Modify as needed to suit your hospital – you may wish to delete some slides or sections of slides, and/or add material relevant to your hospital.*
- *Modify as needed to suit the audience – you may need to tailor for presentations to physicians, nurses, coding staff, or other groups.*
- *As you modify the presentation, consider explicitly addressing any sensitive issues that you know are likely to be on the minds of your front-line staff (e.g., time demands of a new intervention).*

Introduction to
[Our Hospital's]
Quality Improvement
Initiative on
[Topic(s) selected]

What are the AHRQ Pediatric Quality Indicators?

- The PDIs are a set of 16 indicators that reflect quality of care inside hospitals and adverse events that children, adolescents, and, where specified, neonatal patients may experience as a result of exposure to the healthcare system.
- PDIs measure events likely to be preventable through changes at the system or provider level.
- PDIs are measured using hospital administrative data.
- One PDI (PDI 19) is a composite measure.
- Eight of 16 provider-level PDIs are endorsed by NQF.

http://www.qualityindicators.ahrq.gov/modules/pdi_resources.aspx

Why were the PDIs developed?

- Because quality and safety are so important, the AHRQ PDIs were developed to help hospitals:
 - **Screen for potential quality and safety problems** in children using easily accessible data.
 - **Compare themselves with other hospitals** using national standardized measures to assess quality of hospital care.

General Questions About the AHRQ QIs. AHRQ Quality Indicators. July 2004. Agency for Healthcare Research and Quality, Rockville, MD. www.qualityindicators.ahrq.gov/FAQs_Support/default.aspx.

Why try to improve our performance?

- Because we are committed to **reducing harm** to our patients:
 - Discomfort
 - Complications
 - Mortality
- Because it **aligns with our mission** to [insert relevant portion of hospital mission statement here].

Why your voice is important

- You know our hospital and our patients best!
- Your involvement is critical to help us ensure that:
 - We design an intervention that we can effectively implement **together**.
 - We provide appropriate training and support for you to implement the intervention.
 - We take into account the demands on your time and minimize disruption to your workflow.

Our focus

- We have chosen to focus a quality improvement initiative on:

[Insert name of pediatric indicator(s)
selected]

Why this matters

- [Insert name of pediatric indicator(s) selected] is important to our patients and to all of us because improvement on this indicator may reduce:
 - [modify/add/delete as needed for your indicator]
 - Patient suffering
 - Days spent in the hospital
 - Unnecessary medications
 - Unnecessary surgery
 - Risk of death
 - [Add specific outcomes for your selected indicator]

[Example of a patient from your hospital]

- *Personalized patient stories often bring home the importance of improving performance on a measure.*
- *Consider inserting here the deidentified story of a patient who suffered the adverse event captured by your indicator.*
- *Include the impact on the patient, family, and staff and how it could have been prevented.*

How we selected this topic

- We chose to address [this topic] based on:
 - Comparison between our hospital and peer hospitals
 - Our performance over time
 - Volume and cost of events
 - Ability to change
- The next several slides give more detail on these reasons.

Our hospital's performance on [Chosen PDI]

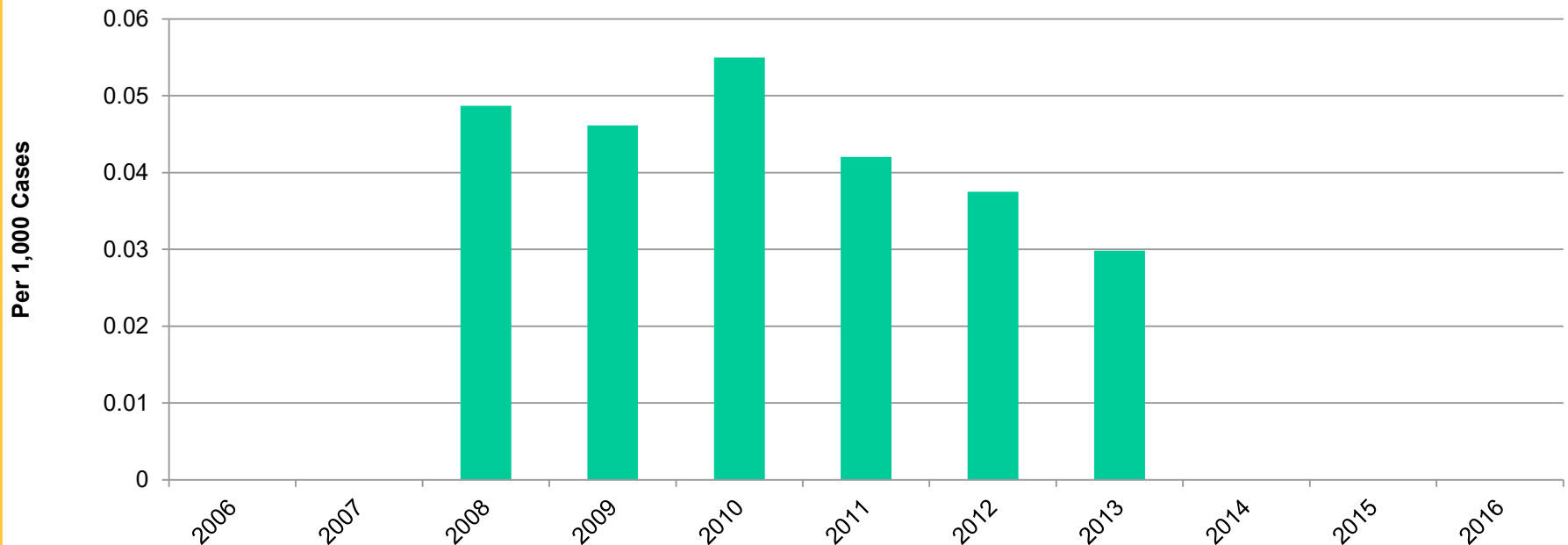
- Our hospital's data show a [Chosen PDI] rate of [#] during [time period].
 - This means that about [#] patients in our hospital had [Chosen PDI] in the last year.
- Our hospital performed [better/same/worse] than the national average in [insert year(s)].
- The approximate cost to our hospital for each [chosen PDI] is [cost].

DELETE THIS SLIDE BEFORE PRESENTATION

- *In this example, we will examine the rates of Neonatal Blood Stream Infection (NQI 03) for this particular hospital performed over time.*
- *Replace the chart and fill in the slide based on the indicator you've selected and your hospital's data.*
- *Based on the information that you would like to present, you may choose not to use this slide.*

Our Hospital's Performance Has Been [Stable/Worsening/Improving] Over Time

Examining Observed Rates of **Neonatal Blood Stream Infection Rate (NQI 03)**



Ability to change

- We believe we can work together to change our current rates of [Chosen PDI] because:
 - [modify/add/delete as needed]
 - We are all committed to the safety of our patients.
 - We have support from our senior leadership.
 - We have staff with the skills to make the change.
 - We are willing to work toward change.
 - The demand on staff time will be reasonable.

Next steps

- Now that we have identified [**Chosen PDI**] as an area for improvement, we will:
 - Examine **best practices** related to [**Chosen PDI**].
 - Talk with staff to determine whether **documentation and coding** related to [**Chosen PDI**] need to be improved.
 - Make a **plan for improvement together** with a variety of staff who work in different roles (e.g., physicians, nurses).
 - Identify **potential barriers** and how to overcome them.

Stay Tuned...

- We plan to review best practices for [selected indicator] by [date].
- We will review documentation and coding by [date].
- We plan to consult with [nurses, physicians, hospital administrators] about potential strategies for improvement and barriers around [date].
- We anticipate that we'll begin implementing a plan around [date].

Any Questions or Ideas?

We want to hear from you! If you have suggestions or thoughts as we develop our plan to improve [Chosen PDI], please contact [staff member] at [contact info].

INSTRUCTIONS FOR USING THIS TOOL

DELETE THIS SLIDE BEFORE PRESENTATION

- *Use these PowerPoint slides for any presentations for which they may be useful.*
- *These slides may be useful earlier on in the process than during implementation; feel free to use them at any point in your QI process.*
- *Modify as needed to suit your hospital – you may wish to delete sections of slides, and/or add material relevant to your hospital.*

Improvement Methods Overview

Prior to Action Planning

- Use Assessment of Organizational Readiness for Change related to the Pediatric Quality Indicators (Section A tools or AHRQ Survey on Patient Safety Culture)
- Review current performance on each of the metrics (Section B tools)
- Determine priorities for performance improvement (Section C tool)

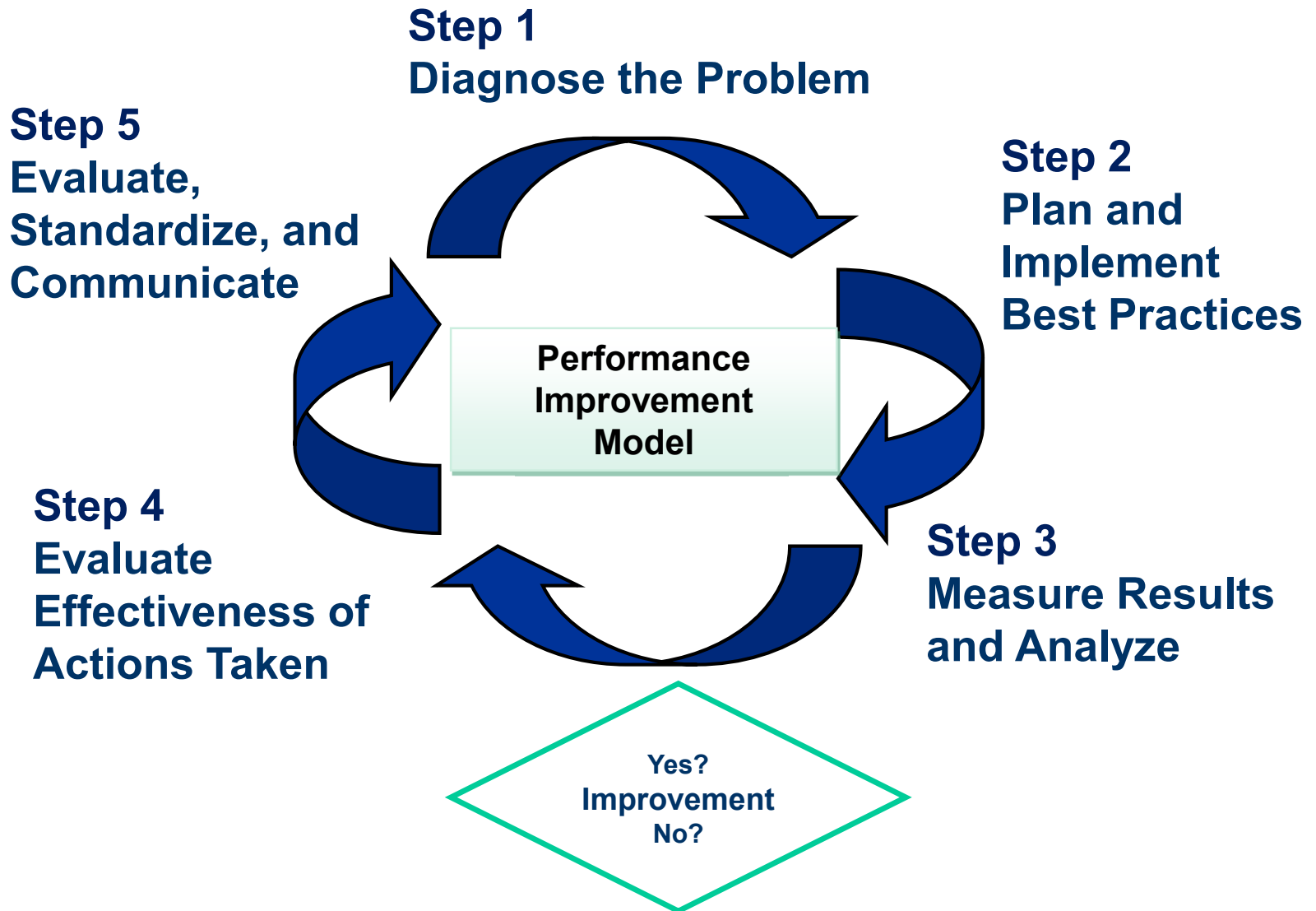
Preparation/Action Planning

- Designate staff who will work as a project team throughout the performance improvement initiative
- Have the team review the output from the tools in sections A, B, and C
- Have the team review list of other resources in case they may be helpful (Section G tools)

Performance Improvement Model

1. Diagnose the problem
2. Plan and implement best practices
3. Measure results and analyze
4. Evaluate effectiveness of actions taken
5. Evaluate, standardize, and communicate

Source: Langley GJ, Nolan KM, Nolan TW, et al. The improvement guide: a practice approach to enhancing organizational performance. San Francisco: Jossey-Bass; 1996.



Source: Langley GJ, Nolan KM, Nolan TW, et al. The improvement guide: a practice approach to enhancing organizational performance. San Francisco: Jossey-Bass; 1996.

Step 1
Diagnose the Problem

- Describe Improvement Initiative – Project Charter (Tool D.2)
- Review and Select Best Practices (Tools D.3, D.4)
- Conduct a Gap Analysis (Tool D.5)
- Select Best Practices on Gap Analysis

Step 5
Evaluate, Standardize, and Communicate

- Project Evaluation (Tool D.8)
 - Focus on lessons learned
 - Future planning
 - Standardization of best practices

Step 2
Plan and Implement Best Practices

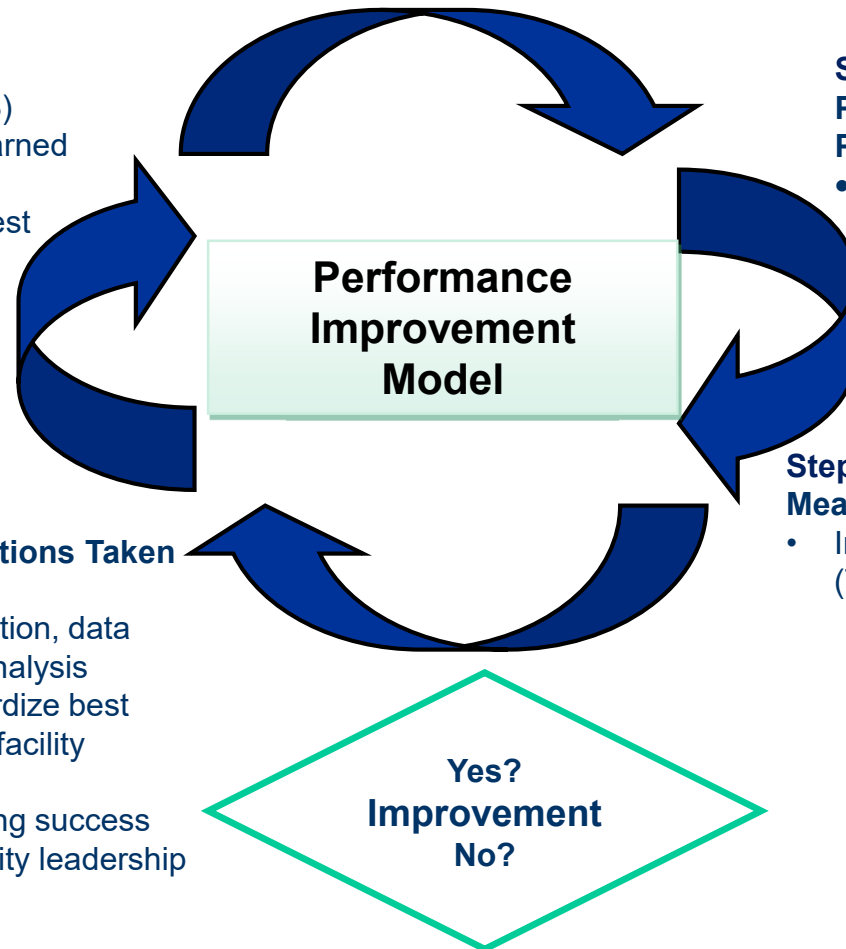
- Develop Implementation Plan (Tool D.6)

Step 3
Measure Results and Analyze

- Implementation Measurement (Tool D.7)
 - Collect data on key process measures related to each best practice
 - Review data to determine effectiveness

Step 4
Evaluate Effectiveness of Actions Taken

- Results satisfactory:
 - Continue implementation, data measurement, and analysis
 - Integrate and standardize best practices throughout facility
- Results not satisfactory:
 - Identify issues blocking success
 - Report results to facility leadership



Source: Langley GJ, Nolan KM, Nolan TW, et al. The improvement guide: a practice approach to enhancing organizational performance. San Francisco: Jossey-Bass; 1996.

Project Charter

What is the purpose of this tool? The purpose of the project charter is to describe the performance improvement rationale, goals, barriers, and anticipated resources to which the team will commit.

Who are the target audiences? Staff members directly involved in the improvement project. Consider adding representatives from the physician and nursing staff, along with quality improvement representatives.

How can the tool help you? Upon completion of the project charter, the project team will have the following:

- Working knowledge of the project.
- Specific performance measures and targeted improvement goals.
- Identified organizational forces that may promote or impede project success.

How does this tool relate to others? The tool should be used after completion of the prioritization worksheet and in conjunction with the best practice detail forms.

Instruction Steps

1. Describe the project scope and provide a goal statement. Some questions that can be addressed in the scope include whether this is a pilot project or will be implemented throughout the hospital. Which units will this project affect? Are certain service lines included? What patient population will be included?
2. Document the case for change; list the key business reasons for initiating the project, specifically stating the business problem. These should come from Tool C.1, the prioritization worksheet.
3. List the performance measures and baseline performance data. Set a performance goal for each measure.
4. List the project milestones that will guide your team in keeping on track. Milestones are major points in a project lifecycle. Some milestones for improvement projects could be the development of a tool or policy or completion of staff training on a new procedure.
5. Consider factors that are potential barriers to success, such as resistance to change, resource limitations, or time constraints.
6. List the individuals or groups who will be affected by these strategies; include stakeholders.
7. Choose team members based on stakeholder analysis. Enter the project team members' names. Review the estimated percentage of time the executive liaison, physician liaison, and project liaison will dedicate to the project.
8. Document any additional resources that may be needed, such as team members and administrative support.
9. Review the charter with the executive, physician, and project liaisons and obtain signatures.

Resources

Project Charter Template. Version 1.5. Austin: Texas Project Delivery Framework, Texas Department of Information Resources; December 23, 2009.

Project Charter

Due: _____

To: _____

Project: _____ Schedule: _____ to _____

Institution: _____ Individual Completing This Form: _____

PROJECT PLAN

1. PROJECT DESCRIPTION/SCOPE. *Pilot unit or housewide project? Specific patient population? Are certain service lines being included?*

2. CASE FOR CHANGE (Potential ROI). *Describe the business reason(s) for initiating the project, specifically stating the business problem.*

3. PERFORMANCE MEASURES

	<i>Baseline</i>	<i>Goal</i>

4. Milestones

Evaluation Date

a.	a.
b.	b.
c.	c.

5. POTENTIAL BARRIERS TO SUCCESS (from Tool C.1. Prioritization Worksheet)

ASSEMBLE TEAM AND RESOURCES

6. STAKEHOLDERS. List the individuals or groups who will be affected by these strategies.

a.	d.
b.	e.
c.	f.

7. TEAM MEMBERS. Consider including representatives from stakeholder groups noted above.

Executive Liaison: _____	Team Member: _____
Physician Liaison: _____	Team Member: _____
Project Liaison: _____	Team Member: _____
Team Member: _____	Team Member: _____

% Time Required of Each: Executive Liaison _____ Physician Liaison _____ Project Liaison _____

8. ADDITIONAL RESOURCES NEEDED

- a. _____
- b. _____
- c. _____

9. SIGNATURES

Executive Liaison/Date: _____

Physician Liaison/Date: _____

Project Liaison/Date: _____

Resources:

1. © 2007 by Karl E. Wieggers. Permission is granted to use and modify this template.
2. Project Charter Template. Version 1.5. Austin: Texas Project Delivery Framework; December 23, 2009.
3. DHFS – Project Chart.

Introduction to the Pediatric Best Practices Tool

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

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

This tool provides information on evidence-based best practices when available, as well as information gathered from real-world experience in working with hospitals. The references cited were not derived from a full systematic evidence-based review, and the best practices forms are not meant to replace validated guidelines. Guidelines developed specifically for pediatric populations were frequently not available. We used general guidelines whenever the best practices could be reasonably applied to pediatric populations and included specific pediatric best practices whenever available.

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

Of note, these best practices were created in 2014 based on v4.5 of the AHRQ PDIs and updated based on feedback from our evaluation. Thus, you may identify updated guidelines and/or changes to indicator specifications that may differ from the best practices in this Toolkit. Best practices will be updated periodically as the Pediatric QI Toolkit is updated.

Which PDIs have best practices forms? Best practices forms have been developed for all PDIs for which there was sufficient evidence to recommend best practices. Best practices forms exist for the following 12 PDIs:

- NQI 01 Neonatal Iatrogenic Pneumothorax Rate (bundled with the best practices for PDI 05)
- NQI 03 Neonatal Blood Stream Infection Rate
- PDI 01 Accidental Puncture or Laceration Rate
- PDI 02 Pressure Ulcer Rate
- PDI 03 Retained Surgical Item or Unretrieved Device Fragment Count
- PDI 05 Iatrogenic Pneumothorax Rate
- PDI 06 RACHS-1 Pediatric Heart Surgery Mortality Rate
- PDI 08 Perioperative Hemorrhage or Hematoma Rate
- PDI 09 Postoperative Respiratory Failure Rate
- PDI 10 Postoperative Sepsis Rate
- PDI 11 Postoperative Wound Dehiscence Rate
- PDI 12 Central Venous Catheter-Related Blood Stream Infection Rate

Why are there only best practices for selected PDIs? There are some indicators for which it would be impractical or infeasible to develop best practices forms based on the available evidence. In addition, some PDIs related to preventable hospitalizations reflect the quality of ambulatory care, not the quality of in-hospital care (PDIs 14, 15, 16, 17, 18, and 19). The other indicators for which we do not have best practices forms are listed below, along with a rationale for why best practices were not developed:

- *NQI 02 Neonatal Mortality Rate:* This PDI relates to the death rate for a number of ICD-9¹ codes. Given the heterogeneity of these diagnoses, it would not be feasible to develop a best practices form that addresses all of these conditions.
- *PDI 07 RACHS-1 Pediatric Heart Surgery Volume:* Increasing heart surgery volume is not a practice that is amenable to a best practices form.
- *PDI 13 Transfusion Reaction Count:* There are extensive existing guidelines on blood product transfusions. Some guidelines are product specific, so the best practices form can become very complex. However, the creation of a best practices form about general practices related to preventing transfusion reactions would not help readers, as most, if not all, hospitals have transfusion guidelines in place.

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

What does the tool include? The Best Practices and Suggestions for Improvement Tool details each of the following components of a best practice and its implementation:

- Background information on the problem
- Brief summary table of best practices
- Best processes/systems of care
- Additional resources

How does this tool relate to others? The Best Practices and Suggestions for Improvement Tool is used to prepare the Gap Analysis (Tool D.5) and the Implementation Plan (Tool D.6).

What are the steps for using the tool?

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

¹ ICD-9 = International Classification of Diseases, 9th Revision.

Selected Best Practices and Suggestions for Improvement

PDI 01: Accidental Puncture or Laceration

Why focus on accidental puncture and laceration in children?

- Pediatric surgery, due to the patients’ smaller anatomy, is often technically more complex than adult surgery and may carry a higher risk of accidental puncture or laceration to patients.¹
- Rates in children are high, ranging anywhere from 0.64 to 2.2 incidents per 1,000 pediatric discharges, depending on the study.²⁻⁴
- One study found that accidental puncture and laceration is associated with higher mean length of stay for children (by 7.7 days) and mean charges per stay (by \$41,204) compared with those without this complication. Children with this complication also had higher odds of in-hospital mortality (2.7 times the odds of children without the complication), even after adjusting for numerous other risk factors.⁴

Recommended Practice	Details of Recommended Practice
Use appropriate safety techniques during the perioperative period.	Use appropriate safety measures to protect pediatric patients and staff from accidental punctures and lacerations during the perioperative period.
At close of surgery, appropriately dispose of all sharps.	Dispose of all needles and other sharps in appropriate containers after the completion of surgery.

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key nurses, physicians and other providers, and surgical technicians from the operating room; and representatives from quality improvement, radiology, and information services to develop time-sequenced guidelines, care paths, or protocols for the full continuum of care.⁵

Recommended Practice: Appropriate safety techniques during the perioperative period

- Use appropriate equipment selection methods.⁵⁻⁷
 - Use scalpel blades with safety blades.
 - Use mechanical/instrument tissue retraction.
 - Use blunt surgical instruments.
 - Use alternative cutting methods (e.g., cautery, harmonic scalpel).
- Keep used needles on the sterile field in a disposable puncture-resistant needle container.
- Adopt a hands-free technique of passing suture needles and sharps between perioperative team members.^{5,8}
- Use a one-handed or instrument-assisted suturing technique to avoid finger contact with needles.
- Use control-release or pop-off needles.
- Double glove.⁷
- Do not bend, break, or recap contaminated needles.⁸

Recommended Practice: Appropriate sharps disposal

- Use closable orange or red, leak-proof puncture-resistant disposable containers.⁶
- Place disposal containers close to the point of use.⁶
- Empty routinely and do not allow to overfill.⁶
- Use mounted, upright containers, either floor or wall.⁶

Educational Recommendation

- Plan and provide education on protocols and standing orders to physicians and other providers, nurses, and all other staff involved in accidental puncture and laceration prevention and care. Education should occur upon hire, annually, and when this protocol is added to job responsibilities.⁹

Effectiveness of Action Items

- Track compliance with elements of established protocol steps.
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement.
- Mandate that all personnel follow the protocol and develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physicians and other providers, nursing, and ancillary staff; senior medical staff; and executive leadership) on level of compliance with process.
- Monitor and evaluate performance regularly to sustain improvements achieved.

Additional Resources

Systems/Processes

- Centers for Disease Control and Prevention. Workbook for Designing, Implementing, and Evaluating a Sharps Injury Prevention Program
<http://www.cdc.gov/sharpssafety/resources.html>
- ECRI Institute. Patient Safety E-Alerts: At the Sticking Point. When Sharps Safety Features Fail to Protect
https://www.ecri.org/components/PSOCore/Pages/E-lert_020314.aspx?tab=2
- OSHA Needlestick/Sharps Injuries
<https://www.osha.gov/SLTC/etools/hospital/hazards/sharps/sharps.html>
- American Nurses Association Needlestick Prevention Guide
<http://www.nursingworld.org/safeneedles>

Tools

- WHO Needlestick Injury Prevention Assessment Tool
http://www.who.int/occupational_health/activities/2needlest.pdf

Staff Required

- Surgeons
- Pediatricians and other providers who care for children
- Perioperative nurses

- Pediatric nurses
- Surgical technologists

Equipment

- Personal protective equipment
- Sharps containers

Communication

- Systemwide education on protocol
- Communication between surgeon and surgical nurse/surgical technician on agreed upon neutral zone

Authority/Accountability

- Senior leadership mandating protocol for all providers

References

1. McDonald K, Romano P, Davies S, et al. Measures of pediatric health care quality based on hospital administrative data: the Pediatric Quality Indicators. Rockville, MD: Agency for Healthcare Research and Quality; 2006.
http://qualityindicators.ahrq.gov/downloads/modules/pdi/v30/pdi_measures_v30.pdf. Accessed May 13, 2016.
2. National Healthcare Quality and Disparities Report. Rockville, MD: Agency for Healthcare Research and Quality. Table 3_3_1_5_1.1. Admissions with accidental puncture or laceration during procedure per 1,000 medical and surgical admissions, age less than 18 years, United States, 2007-2012. <http://nhqrnet.ahrq.gov/inhqrdr/data/query>. Accessed May 13, 2016.
3. Sedman A, Harris JM, Schulz K, et al. Relevance of the Agency for Healthcare Research and Quality Patient Safety Indicators for children's hospitals. *Pediatrics* 2004;115(1):135-45.
4. Miller MR, Zhan C. Pediatric patient safety in hospitals: a national picture in 2000. *Pediatrics* 2004;113(6):1741-6.
5. Occupational Health Surveillance Program, Massachusetts Department of Public Health. Sharps Injuries in the Operating Room, Massachusetts Sharps Injury Surveillance System Data, 2004. <http://www.mass.gov/eohhs/docs/dph/occupational-health/sharps-injuries-operate-room-04.pdf>. Accessed May 13, 2016.
6. Association of periOperative Registered Nurses (AORN). Sharps Safety Tool Kit. <https://www.aorn.org/guidelines/clinical-resources/tool-kits/sharps-safety-tool-kit>. Accessed May 31, 2016.
7. Berguer R, Heller P. Strategies for preventing sharps injuries in the operating room. *Surg Clin North Am* 2005 Dec;85(6):1299.
8. Guideline Statement for the Implementation of the Neutral Zone in the Perioperative Environment. Littleton, CO: Association of Surgical Technologists; January 2013.
http://www.ast.org/uploadedFiles/Main_Site/Content/About_Us/Guideline_Neutral_Zone.pdf. Accessed May 13, 2016.
9. Vaccine Administration. Atlanta, GA: Centers for Disease Control and Prevention; 2010.
<http://www.cdc.gov/vaccines/pubs/pinkbook/vac-admin.html>. Accessed May 13, 2016.

Selected Best Practices and Suggestions for Improvement

PDI 02: Pressure Ulcer

Why focus on pressure ulcers in children?

- Although children are typically more active and less chronically ill than adults, pressure ulcers can be a significant iatrogenic problem for chronically ill infants and children in pediatric health care settings.
- More than 50 percent of pressure ulcers in neonates and children are attributed to equipment and devices.¹
- Pressure ulcer rates are high in children, particularly those with high-risk conditions (e.g., spina bifida, cerebral palsy); studies have found rates ranging from 2.4 to 7.7 per 1,000 pediatric discharges (across all children).²⁻⁴ In subgroups at particular risk of pressure ulcers, such as children with spina bifida, rates can be as high as 43 percent.¹
- Pressure ulcers lead to significantly increased length of stay and cost, with one study finding an increased mean length of stay of 18 days and increased charges of \$85,344 in pediatric patients affected by pressure ulcers. Children with this complication also had higher odds of in-hospital mortality (3.5 times the odds of children without the complication), even after adjusting for numerous other risk factors.³
- Part of this excess cost is likely to be shouldered by hospitals, as the Centers for Medicare & Medicaid Services will not reimburse for stage III and IV pressure ulcers for Medicaid patients unless they are present on admission.⁵

Recommended Practice	Details of Recommended Practice
Skin Assessment at Admission and Daily, With Documentation of Lesions	Complete total skin assessment every 24 hours, with special attention to bony prominences, especially the coccygeal/sacral skin, heels, and skin adjacent to external devices. ⁶ Include in the medical record complete documentation of any pressure ulcer found. ^{1,7-12}
Pressure Ulcer Risk Assessment at Admission and Daily	Evaluate all patients for pressure ulcers and pressure ulcer risk (using Braden Q Scale, Glamorgan Scale, or other tool) upon admission and every 24 hours thereafter, using valid risk assessment, with results documented in the patient's chart. ^{1,7,9-12}
Repositioning of Patients Every 1 to 2 Hours and Promotion of Highest Level of Mobility	Use a turn schedule and appropriate repositioning techniques to turn patients every 1 to 2 hours to decrease the mechanical load for patients. ^{8,10,11}
Daily Rounds Assessment	Include in the daily rounds the following: (1) nutritional assessment to ensure adequate nutrition and hydration and (2) reassessment of the need for special pressure-distributing surfaces. ⁷⁻¹⁰

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key nurses; physicians and other providers (including hospitalists); pharmacists; wound, ostomy, and continence nurses; inpatient units; and representatives from quality improvement and information services to develop evidence-based guidelines, care paths, or protocols for the full continuum of care for the prevention of pressure ulcers in children.¹⁰
- The above team:
 - Identifies the purpose, goals, and scope and defines the target population of this guideline.
 - Analyzes problems with guideline compliance, identifies opportunities for improvement, and communicates best practices to frontline nurses.
 - Establishes measures that will tell if changes are leading to improvement.
 - Agrees on the use of a standard risk assessment tool (for example, Braden Q Scale); facilities may adapt the tool to allow for easy completion, using check boxes and short phrases to ensure completion.¹²

Recommended Practice: Skin Assessment at Admission and Daily, With Documentation of Lesions

- Determine organizational policy for the frequency of skin checks (at least once daily).
- Assign responsibility to staff for skin checks and repositioning of patients.
- Give all patients a head-to-toe skin inspection at admission and at least once a day, paying particular attention to bony prominences and skin adjacent to external devices.^{1,6-12}
 - Pay particular attention to the occiput, which is the most common site for pressure ulcer development in small, young children. In older, larger children, the sacral area is most at risk.^{1,12}
 - Include a visual cue on each admission documentation record for the completion of a total skin assessment and risk assessment.^{11,12}
 - Educate professionals on how to undertake a comprehensive skin assessment that includes techniques for identifying blanching response, localized heat, edema, and induration (hardness).^{9,11}
 - Ensure that skin inspection includes assessment for localized heat, edema, or induration (hardness), especially in individuals with darkly pigmented skin.⁸
 - Ask patients and/or caregivers, as appropriate, to identify any areas of discomfort or pain that could be attributed to pressure damage.⁹⁻¹¹
 - Observe the skin for pressure damage caused by medical devices. Pediatric patients on continuous positive airway pressure (CPAP) need particular attention to their nares and nasal septum.^{1,9,10}
- Document results of the skin inspection in the medical record, including skin temperature, skin color, skin texture/turgor, skin integrity, and moisture status.⁷⁻¹¹

- Identify and stage all pressure ulcers according to the National Pressure Ulcer Advisory Panel criteria. Also include the following^{1,7,10}:
 - Location
 - Tissue type
 - Shape
 - Size
 - Presence of sinus tracts/tunneling
 - Undermining
 - Exudate amount and type
 - Presence/absence of infection
 - Wound edges

Recommended Practice: Pressure Ulcer Risk Assessment at Admission and Daily

- Determine which pressure ulcer risk assessment will be used as the standard in your organization. Use a risk assessment tool with established validity and reliability, such as the Braden Q Scale or Glamorgan Scale.^{1,7,8,12}
- Include in the pressure ulcer prevention protocol that a risk assessment should be completed at admission, daily, and when the patient's status changes (e.g., moving to a different level of care).^{1,8-11}
- Assign responsibility for conducting a pressure ulcer risk assessment at admission and when the patient's status changes.
- Know the risk factors in the pediatric population for developing pressure ulcers, which include¹²:
 - Significant prematurity.
 - Critical illness.
 - Neurologic impairments (myelomeningocele and spinal cord injury).
 - Nutritional deficits, poor tissue perfusion or oxygenation.
 - Exposure to prolonged pressure from hospital apparatus or tubes.
- Document risk assessment results in the medical record.⁹⁻¹¹

Recommended Practice: Repositioning of Patients Every 1 to 2 Hours and Promotion of Highest Level of Mobility

- Have senior leaders ensure that staff can access the appropriate resources to help increase mobility.
- Educate caregivers to promote the highest possible level of patient mobility.⁷
- Maintain head of bed at the lowest point consistent with patient's medical condition.^{7,10,11}
- Schedule regular turning and repositioning for bedbound and chairbound patients every 1 to 2 hours.^{7,8,10}
 - Frequency of repositioning will be influenced by variables such as the individual's tissue tolerance, his/her level of activity and mobility, his/her general medical condition, overall treatment objectives, and assessments of the individual's skin condition.^{7,9}

- Record repositioning regimens, specifying frequency and position adopted, and include an evaluation of the outcome of the repositioning regimen.⁹

Recommended Practice: Daily Rounds Assessment

- For patients at risk, perform a nutritional assessment at entry to a new health care setting and whenever the patient's status changes.^{1,7,9,10,12}
- For patients at risk, develop a reliable process for consulting a dietitian when nutritional elements could contribute to risk of nutritional deficiencies.^{1,9-11}
 - Ensure fluid balance by providing fluids and supplements as appropriate.^{9,10}
- Give nutritional supplements only to at-risk patients with identified nutritional deficiencies.^{10,13}
- Attempt to redistribute pressure on the skin of a pediatric patient.
 - Consider placing at-risk pediatric patients on a pressure-reducing surface rather than a standard hospital mattress.^{7,8-11}
 - Consider the use of foam overlay to reduce occipital pressures in children. For children over the age of 2, consider also using a gel pillow.¹
- Avoid surfaces designed for adults:
 - Many times, children are placed on support surfaces designed and indicated for adults. Due to few pediatric studies, it is undetermined if this is a current safe practice.^{1,12}
 - Low-air-loss beds designed for adults cannot accommodate infants and small children due to their height and weight.¹
- Triage use of pressure-redistributing beds and mattresses.⁹
- Frequent skin assessments under pediatric-specific devices are important preventive measures. Consider specifically including the following in organizational protocols:
 - Pediatric blood pressure cuffs
 - Transcutaneous oxygen pressure probes
 - Tracheostomy plates
 - Nasal prong and CPAP masks
 - IV dressing/IV caps
 - Arm boards, plaster casts, and traction boots
 - Orthotics
 - Wheelchairs and wheelchair cushions (must be frequently readjusted in growing children)
- Ensure that beds, cribs, and isolettes are inspected so that tubing, leads, toys, and syringe caps are not under or on top of patient's skin. The skin around nasogastric and orogastric tubes, head dressings, and hats should be assessed for pressure damage.⁷
- Ensure a reliable process for redistributing pressure (e.g., use a turn clock as a reminder to staff, implement turn rounds).

Educational Recommendation

- Educational programs for the prevention of pressure ulcers should be structured, organized, and comprehensive and should occur upon hire, annually, and when this protocol is added to job responsibilities.
- Programs should be directed to all health care providers in preventing ulcers. Education should also be directed toward patients, families, and patients' caregivers.^{10,11}

Effectiveness of Action Items

- Track compliance with elements of established protocol steps.^{10,11}
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement.¹¹
- Develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physician and other providers, nursing, and ancillary staff; senior medical staff; and executive leadership) on level of compliance with process.
- Conduct surveillance and determine prevalence of healthcare-associated pressure ulcers to evaluate outcomes of new process.¹¹
- Monitor and evaluate performance regularly to sustain improvements achieved.¹⁰

Additional Resources

Systems/Processes

- Agency for Healthcare Research and Quality. Preventing pressure ulcers in hospitals, a toolkit for improving quality of care
<http://www.ahrq.gov/professionals/systems/long-term-care/resources/pressure-ulcers/pressureulcertoolkit/index.html>
- How-to Guide: Prevent Pressure Ulcers. Cambridge, MA: Institute for Healthcare Improvement; 2014
www.ihc.org
- How-to Guide: Prevent Pressure Ulcers, Pediatric Supplement. Cambridge, MA: Institute for Healthcare Improvement; 2014
www.ihc.org
- AHRQ Health Care Innovations Exchange: Pediatric Skin Care Program Focuses on Proactively Identifying and Providing Preventive Therapy to At-Risk Intensive Care Unit Patients, Leading to Significant Reductions in Pressure Ulcers
<https://innovations.ahrq.gov/profiles/pediatric-skin-care-program-focuses-proactively-identifying-and-providing-preventive>

Policies/Protocols

- Perry D, Borchert K, Burke S, et al. Institute for Clinical Systems Improvement. Pressure Ulcer Prevention and Treatment Protocol. Updated January 2012
<https://www.icsi.org/asset/6t7kxy/>

Tools

- Braden Scale for Predicting Pressure Sore Risk
<http://www.bradenscale.com/images/bradenscale.pdf>

- Pressure Ulcer Scale for Healing (PUSH Tool)
<http://www.npuap.org/resources/educational-and-clinical-resources/push-tool/>
- Pressure Ulcer Training, National Database of Nursing Quality Indicators
<https://members.nursingquality.org/NDNQIPressureUlcerTraining/>
- Pressure Ulcer Prevention Quick Reference Guide, NPUAP and European Pressure Ulcer Advisory Panel
http://www.npuap.org/Final_Quick_Prevention_for_web_2010.pdf
- Pressure Ulcer Stages Revised by NPUAP
<http://www.npuap.org/national-pressure-ulcer-advisory-panel-npuap-announces-a-change-in-terminology-from-pressure-ulcer-to-pressure-injury-and-updates-the-stages-of-pressure-injury/>

Staff Required

- Physicians and other providers (dermatology, family practice, pediatrics, internal medicine)
- Nurses
- Nursing assistants
- Relevant consultants (occupational therapy, physical therapy, enterostomal therapy, wound specialists, etc.)
- Dietitians

Equipment

- Access to equipment (therapeutic surfaces)

Communication

- Systemwide education on protocol
- Education on how to use the risk assessment accurately and reliably; requires staff development and competency testing in most organizations

Authority/Accountability

- Senior leadership mandating protocol for all providers

References

1. Baharestani M, Ratliff C. Pressure ulcers in neonates and children: an NPUAP white paper. *Adv Skin Wound Care* 2007;20(4):208, 210, 212, 214, 216, 218-20.
2. National Healthcare Quality Report. Rockville, MD: Agency for Healthcare Research and Quality; 2003. <http://archive.ahrq.gov/qual/nhqr03/nhqr03.htm>. Accessed May 13, 2016.
3. Miller MR, Zhan C. Pediatric patient safety in hospitals: a national picture in 2000. *Pediatrics* 2004;113(6):1741-6.
4. VanGilder C, Amlung S, Harrison P, et al. Results of the 2008-2009 International Pressure Ulcer Prevalence™ Survey and a 3-year, acute care, unit-specific analysis. *Ostomy Wound Manage* 2009;55(11):39-45.
5. Centers for Medicare & Medicaid Services. Hospital-Acquired Conditions (Present on Admission Indicator). <http://www.cms.gov/Medicare/Medicare-Fee-for-Service->

[Payment/HospitalAcqCond/index.html?redirect=/hospitalacqcond/06_hospital-acquired_conditions.asp](#). Accessed May 13, 2016.

6. Black JM, Cuddigan JE, Walko MA, et al. Medical device related pressure ulcers in hospitalised patients. *Int Wound J* 2010;7:358-65.
7. Guideline for the prevention and management of pressure ulcers. Mt. Laurel, NJ: Wound Ostomy and Continence Nurses Society; June 2010.
8. Patient safety and quality: an evidence-based handbook for nurses. Rockville, MD: Agency for Healthcare Research and Quality; 2008. AHRQ Publication No. 08-0043. <http://archive.ahrq.gov/professionals/clinicians-providers/resources/nursing/resources/nurseshdbk/nurseshdbk.pdf>. Accessed May 13, 2016.
9. European Pressure Ulcer Advisory Panel and National Pressure Ulcer Advisory Panel. Prevention and treatment of pressure ulcers: quick reference guide. Washington, DC: National Pressure Ulcer Advisory Panel; 2009.
10. Registered Nurses' Association of Ontario (RNAO). Risk assessment & prevention of pressure ulcers 2011 supplement. Toronto, ON: RNAO; 2011.
11. Perry D, Borchert K, Burke S, et al. Pressure ulcer prevention and treatment protocol. Bloomington, MN: Institute for Clinical Systems Improvement; January 2012. https://www.icsi.org/_asset/6t7kxy/. Accessed May 13, 2016.
12. How-to guide: preventing pressure ulcers, pediatric supplement. Cambridge, MA: Institute for Healthcare Improvement; 2014. www.ihl.org.
13. Reddy M, Gill SS, Rochon PA. Preventing pressure ulcers: a systematic review. *JAMA* 2006;296(8):974-84.
14. Safe practices for better healthcare—2010 update. Washington, DC: National Quality Forum; 2010.
15. Hospital-acquired conditions (HAC) in acute inpatient prospective payment system (IPPS) hospitals [Factsheet]. Baltimore, MD: Centers for Medicare & Medicaid Services; 2011.

Selected Best Practices and Suggestions for Improvement

PDI 03: Retained Surgical Item or Unretrieved Device Fragment Count

Why focus on retained foreign objects in children?

- Complications of retained foreign objects can include perforation of the bowel, sepsis, and even death.¹ These complications can occur early in the postoperative period, or even months or years later.
- Like adults, children are at risk for having foreign bodies left in the surgical field following a procedure. The 2006 National Healthcare Quality Report found an incidence of 0.05 events per 1,000 discharges in pediatric populations (0-17 years old) (compared with 0.09 at 18-44 years, 0.12 at 45-64 years, and 0.08 at 65 or more years).²
- In addition to the considerable morbidity and mortality risks for pediatric patients, retained foreign objects are costly. One study found that retained surgical items or unretrieved device fragments in children resulted in an increased mean length of stay (5.7 days) and an average increased charge of \$31,366 even after adjusting for age, gender, expected payer, comorbidities, and hospital characteristics.³
- Part of this cost is likely to be shouldered by hospitals, as the Centers for Medicare & Medicaid Services will not reimburse for foreign objects retained after surgery for Medicaid patients.⁴

Recommended Practice	Details of Recommended Practice
Counts at Appropriate Points During Surgery	Perform a sponge, sharp, and instrument count when instruments/sponges are opened, as surgery begins, as closure begins, and during subcuticular or skin closure in the same sequence. ^{1,5-11}
Appropriate Staff Education	Create an education model that promotes development of knowledge and research for perioperative staff consistent with national criteria. ^{5,12}
Team Collaboration	Promote and maintain a collaborative and ethical work environment that facilitates trust and confidence to allow all members of the interdisciplinary team to speak up if patient safety is compromised. ¹²⁻¹⁴
Use of Equipment and Instruments	Integrate new instruments or equipment into practice that prevents retention of foreign bodies, including incorporating technology, such as radio frequency identification devices and barcoding, as a safety practice. ^{11,12,15-17}
Standardized Practices	Integrate use of innovative surgical techniques, radiographic technology, and standardized practices and protocols for all procedures. ^{1,7,8}

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key perioperative/procedure personnel, including nurses, physicians and other providers, technicians, anesthesiologists, and representatives from the quality improvement department, to develop evidence-based protocols for care of the pediatric patient preoperatively, intraoperatively, and postoperatively to prevent retention of foreign objects.⁵
- The above team:
 - Identifies the purpose, goals, and scope and defines the target population for this guideline.
 - Analyzes problems with guidelines compliance, identifies opportunities for improvement, and communicates best practices to frontline teams.
 - Establishes measures that would indicate if changes are leading to improvement, identifies process and outcome metrics, and tracks performance using these established metrics.
 - Determines appropriate facility resources for effective and permanent adoption of practices.

Recommended Practice: Counts at Appropriate Points During Surgery

- Count all sponges and instruments for a procedure where sponges or instruments could be retained.^{5,7,8}
- Count sharps and miscellaneous items (e.g., cautery tips and scratch pads) on all procedures.⁷
- Perform at least four counts:
 - When instruments/sponges are opened,
 - Before surgery begins,
 - As closure begins, and
 - During subcuticular or skin closure in the same sequence (i.e., start at surgical field, progress to table and then off the field).^{1,5,10,17}
- Complete the count audibly and have the count concurrently viewed by the circulator and one other person.^{5,7,11}
- Separate items being counted; place used sponges in a clear bag for visualization when performing final counts.^{6,7,10,11}
- Have circulators or another designee monitor sponges or other items that are not x-ray detectable and ensure that they are disposed of separately.
 - Note: Needles less than 17 mm may not be detectable with plain x-ray.⁶
- Do not remove any sponges, sharps, or instruments from the operating room or procedural area until the case has been completed.⁷
- Ensure that the surgeon performs a methodical wound check prior to count.^{2,3}
- Use a “timeout” when final count occurs.^{5,10,11,18}
- Document the results of the final count in the surgical record or operative note.⁵

- Develop a protocol for staff to handle discrepancies, including use of x-ray detectable sponges and towels only.^{5,6,7,9}
 - If there is a discrepancy, the surgeon and surgical team should be notified immediately.
 - A manual inspection of the incision site should occur, along with inspection of the surrounding surgical area, including tables, linens, and the floor.
 - If the object still is not found, an x-ray should be obtained and read immediately.
 - When obtaining a postsurgical x-ray after a count discrepancy, be sure to indicate this reason when ordering the film so radiology staff are aware.¹⁸
 - Document all appropriate steps taken to retrieve the object in the patient's medical record.

Recommended Practice: Appropriate Staff Education

- Create an education model that promotes development of knowledge and research for perioperative staff consistent with national criteria.^{5,12,18} The model should include:
 - Orientation for new hires.
 - Continuing education.
 - Multidisciplinary team communication.

Recommended Practice: Team Collaboration

- Promote and maintain a collaborative and ethical work environment that facilitates trust and confidence to allow all members of the interdisciplinary team to speak up if patient safety is being compromised.^{5,12-14,18}
 - Create a safe environment for team members to report unsafe practices and unprofessional team behaviors; develop a mechanism for acquiring this information and a clear set of expectations for how this information is addressed.
 - Create a process to address staff who are noncompliant.

Recommended Practice: Use of Equipment and Instruments

- Integrate new instruments or equipment into practice that prevents retention of foreign bodies.
- Consider use of computer-assisted methods for counting, including use of a barcoding system on surgical sponges and instruments.^{7,8,17}
- Consider use of radio frequency identification devices on surgical sponges and instruments.^{5,12,15}
- Consider use of numbered surgical sponges and instruments for a more comprehensive, thorough count to reduce the risk of miscounting.¹¹

Recommended Practice: Standardized Practices

- Integrate use of innovative surgical techniques, including the use of minimally invasive procedures when applicable.
- Consider routine use of a closing x-ray and radio-opaque surgical materials for all pediatric patients, especially high-risk patients (e.g., bariatric patients) or high-risk situations (e.g., emergency procedures).^{1,7,8}

- If they are not implemented routinely, consider implementing additional screening methods for high-risk cases even when counts are documented as correct (e.g., obese pediatric patients, multiple handoffs, long procedures, procedures that convert from laparoscopic to open, emergency procedures).¹

Educational Recommendation

- Plan and provide education on any protocols related to foreign body retention to physicians and other providers, nursing, and all other staff involved in operative or procedural cases. Education should occur upon hire, annually, and when this protocol is added to job responsibilities.⁵

Effectiveness of Action Items

- Track compliance with elements of established protocol by using checklists, appropriate documentation, etc.^{5,18}
- Follow a standard for performance improvement such as PDSA (Plan-Do-Study-Act) or Lean Six Sigma. Also consider performing a failure mode and effects analysis to better understand the process and where breakdowns can occur.
- Mandate that all personnel follow the safety protocols developed by the team to prevent foreign body retention and develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physicians and other providers, nursing, and ancillary staff; and executive leadership) on level of compliance with process.¹⁸
- Conduct a root cause analysis for any occurrences of foreign body retention.⁵
- Monitor and evaluate performance regularly to sustain improvements achieved.

Additional Resources

Systems/Processes

- Statement on the Prevention of Retained Foreign Bodies After Surgery, American College of Surgeons
<https://www.facs.org/about-acf/statements/51-foreign-bodies>
- Prevention of Retained Foreign Objects, American College of Surgeons
<https://www.facs.org/~media/files/publications/bulletin/2009/2009%20november%20bulletin.ashx>

Policies/Protocols

- Institute for Clinical Systems Improvement. Perioperative Protocol. Health Care Protocol: Prevention of Unintentionally Retained Foreign Objects During Vaginal Deliveries. Updated November 2012
https://www.icsi.org/_asset/3xvmi8/RFO.pdf
- NoThing Left Behind®: Prevention of Retained Surgical Items Multi-Stakeholder Policy
http://www.nothingleftbehind.org/uploads/NoThing_Left_Behind_Policy_v5.pdf
- Department of Veterans Affairs, VHA Directive, Prevention of Retained Surgical Items
http://www.va.gov/vhapublications/ViewPublication.asp?pub_ID=3183

Tools

- Children’s Hospital of Boston Pediatric Surgical Safety Checklist
http://www.aaos.org/news/aaosnow/aug11/clinical12_f1.pdf
- Pennsylvania Patient Safety Authority. Retained Foreign Object Audit Form
<http://patientsafetyauthority.org/EducationalTools/PatientSafetyTools/rfo/Documents/audit.pdf> (hit Cancel when prompted for login, and wait for file to open)
- World Health Organization Surgical Safety Checklist
http://who.int/patientsafety/safesurgery/tools_resources/SSSL_Checklist_finalJun08.pdf

Staff Required

- Surgeons
- Radiologists
- Resident physicians
- Other providers involved in perioperative care
- Anesthesia professionals
- Perioperative registered nurses
- Surgical technologists

Equipment

- x-ray and other imaging technologies to ensure that no surgical equipment is left within the body cavity
- Radio-opaque surgical materials

Communication

- Systemwide education on policy/protocol
- Timeout performed before start and at closing of surgical procedure

Authority/Accountability

- Operating room staff responsible for conducting counts at appropriate times
- All staff within the operating room to actively participate in the timeout and be empowered to stop the procedure if there are concerns

References

1. Gawande AA, Studdert DM, Orav EJ, et al. Risk factors for retained instruments and sponges after surgery. *N Engl J Med* 2003;348:229-35.
2. National Healthcare Quality Report. Rockville, MD: Agency for Healthcare Research and Quality; 2006. Table 2.15a. <http://archive.ahrq.gov/qual/nhqr06/safety/T2-15A.htm>. Accessed May 13, 2016.
3. Miller MR, Zhan C. Pediatric patient safety in hospitals: a national picture in 2000. *Pediatrics* 2004;113(6):1741-6.
4. Hospital-acquired conditions (HAC) in acute inpatient prospective payment system (IPPS) hospitals [Factsheet]. Baltimore, MD: Centers for Medicare & Medicaid Services; 2011.

5. The Joint Commission. Sentinel Event Alert Issue 51, October 17, 2013.
http://www.jointcommission.org/assets/1/6/SEA_51_URFOs_10_17_13_FINAL.pdf.
Accessed May 13, 2016.
6. Retained surgical items. No Thing Left Behind. A National Surgical Patient Safety Project to Prevent Retained Surgical Items. <http://www.nothingleftbehind.org>. Accessed May 13, 2016.
7. AORN recommended practices on retained surgical items. AORN Perioperative Standards and Recommended Practices. Denver: Association of Perioperative Registered Nurses; 2010.
<http://www.aorn.org>. Accessed May 13, 2016.
8. King CA. To count or not to count. In: Watson DS, ed. Perioperative safety. St. Louis: Mosby Elsevier; 2011. p. 128-33.
9. Rogers A, Jones F, Oleynikov D. Radiofrequency identification (RFID) applied to surgical sponges. *J Surg Endosc* 2007;21(7):1235-7.
10. Raso R, Gulinello C. Creating cultures of safety: risk management. *Nurse Manage* 2010;41(12):27-33.
11. Pelter M, Stephens K, Loranger D. An evaluation of a numbered surgical sponge product. *AORN J* 2007;85(5):931-40.
12. Kasatpibal N. Safe surgery implementation in Thailand. *AORN J* 2009;90(5):743-9.
13. Bogner M. Human error in medicine. New Jersey Hove, UK: Lawrence Erlbaum Associates; 1994.
14. Riley R, Manias E, Polgase A. Governing the surgical count through communication interactions: implications for patient safety. *Qual Saf Health Care* 2006;15:369-74.
15. Greenberg C, Diaz-Flores R, Lipsitz S. Barcoding surgical sponges to improve safety: a randomized controlled trial. *Ann Surg* 2008;247(4):612-6.
16. LaFever G. Chasing zero events of harm: an urgent call to expand safety culture work and customer engagement. *Nurs Patient Care* 2010;28-42.
17. Reason J. Human error: models and management. *BMJ* 2000;320(7237):768-70.
18. Norton E, Martin C, Micheli A. Patients count on it: an initiative to reduce incorrect counts and prevent retained surgical items. *AORN J* 2012;95(1):109-21.

Selected Best Practices and Suggestions for Improvement

NQI 01/PDI 05: Iatrogenic Pneumothorax

Why focus on iatrogenic pneumothorax in neonates and children?

- Complex procedures performed near the lungs can be more difficult in children than in older patients because of their smaller lung size.
- Iatrogenic pneumothorax in children occurs at rates that are at least comparable to those in adults at 0.48 per 1,000 discharges in pediatric patients.¹
- Neonates have an even higher risk of iatrogenic pneumothorax due to barotrauma.²
- Iatrogenic pneumothorax leads to significantly increased length of stay and cost, with one study finding an increased mean length of stay of 11.6 days and increased charges of \$61,991 in affected pediatric patients. Children with iatrogenic pneumothorax also had 7.5 times the odds of in-hospital mortality, even after adjusting for numerous risk factors.³ These results were supported by another study that found an average of \$53,604 in excess total charges associated with iatrogenic pneumothorax in children.⁴

Recommended Practice	Details of Recommended Practice
Identification of Patients at Risk	Develop a process to address common iatrogenic pneumothorax risk factors identified in the literature for the neonate and pediatric population. ⁵
Safe Insertion Techniques During Pleural Procedures	Standardize procedures and position techniques during pleural procedures, such as thoracentesis and chest tube insertion. ⁶⁻⁹
Provider Training	Develop specified training components and criteria and establish a plan for continued competency. ^{6,7}
Standardized Practices	Develop and standardize practices for site identification, marking, and procedural practice. ^{6,7,10-12}

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key procedural personnel who care for pediatric patients, including nurses, physicians and other providers, technicians, and representatives from the quality improvement department, to develop evidence-based protocols for care of the neonatal and pediatric patient preprocedure, intraprocedure, and postprocedure to prevent iatrogenic pneumothorax.
- The above team:
 - Identifies the purpose, goals, and scope and defines the target population for this guideline.
 - Analyzes problems with guideline compliance, identifies opportunities for improvement, and communicates best practices to frontline teams.
 - Establishes measures to indicate if changes are leading to improvement, identifies process and outcome metrics, and tracks performance using these metrics based on a standard performance improvement methodology (e.g., FOCUS-PDSA).

- Determines appropriate facility resources for effective and permanent adoption of practices.

Recommended Practice: Identification of Neonatal and Pediatric Patients at Risk

- Determine risk for iatrogenic pneumothorax during the history and physical.
- Consider the many factors identified in the literature that are associated with a higher risk of pneumothorax. Some common risk factors among neonates and children are¹³⁻¹⁵:
 - Respiratory distress syndrome.
 - Meconium aspiration syndrome.
 - Pulmonary hypoplasia.
 - Infants who need resuscitation at birth.
 - Below-average body mass index.
 - Previous pneumothorax.
 - Ventilated patients (CPAP, PPV).
 - Suctioning during ventilation.
 - Reintubation.
 - Chest compressions.
 - Active expiration.
 - Smoking (if applicable).
 - Cystic fibrosis.

Recommended Practice: Safe Insertion Techniques During Pleural Procedures

- Standardize procedures and equipment.⁷
 - Use of real-time ultrasound to identify and mark site and/or guidance for thoracentesis.^{8,9,10,12,13,16-18}
 - Requirement of preprocedural verification of the correct patient using two identifiers.
 - Requirement of preprocedural verification of the intended procedure and the correct site selection.
- Use a lateral approach; avoid posterior approach if possible. A lateral approach minimizes risks of vessel laceration.^{6,8}
- Use blunt dissection vs. trocar use for chest tube insertion.^{6,9}

Recommended Practice: Provider Training

- Provide specified training, including three components:
 - Theoretical didactic training,
 - Simulated practice, and
 - Formal, supervised practice with minimum observation criteria.^{6,7}
- Consider identifying a subset of practitioners (e.g., focus group) who receive specific training to perform the procedure (thoracentesis, chest tube insertion) regularly. Establish criteria for continued competency with minimum procedural number.^{6,7}

Recommended Practice: Standardized Practices

- Appropriate site selection, including use of the "safe triangle" (defined by the anterior border of the latissimus dorsi, the lateral border of the pectoralis major, and a horizontal line through the anatomical position of the ipsilateral nipple) as a default to reduce chances of visceral perforation. Consider using pleural ultrasound to provide real-time localization of pleural fluid.^{6,10}
- Site marking performed immediately prior to the procedure to reduce the likelihood of fluid redistribution or tissue/organ movement secondary to patient repositioning.^{6,11}
- Implementation of procedural guidelines (e.g., American College of Chest Physicians).

Educational Recommendation

- Plan and provide education on protocols to physicians and other providers, nursing, and all other staff involved in procedural cases in children and neonates. Education should occur upon hire, annually, and when this protocol is added to job responsibilities.

Effectiveness of Action Items

- Track compliance with elements of established protocol by using checklists, appropriate documentation, etc.
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement practices.
- Mandate that all personnel follow the safety protocols developed by the team to prevent iatrogenic pneumothorax and develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physicians and other providers, nursing, and ancillary staff; senior medical staff; and executive leadership) on the level of compliance with process.
- Conduct surveillance and determine prevalence to evaluate outcomes of new process.
- Monitor and evaluate performance regularly to sustain improvements achieved.

Additional Resources

Systems/Processes

- WHO Surgical Care at the District Hospital 2003, World Health Organization
<http://www.who.int/surgery/publications/Postoperativecare.pdf>
- Baumann M, Strange C, Sahn S, et al. Management of spontaneous pneumothorax: an American College of Chest Physicians Delphi Consensus Statement. *Chest* 2001;119(2):590-602.
- Henry M, Arnold T, Harvey J. BTS guidelines for the management of spontaneous pneumothorax. *Thorax* 2003;58 Suppl 2:ii39-ii52

Policies/Protocols

- University of Iowa Children's Hospital - Technique for Insertion of a Chest Tube
<http://www.uichildrens.org/childrens-content.aspx?id=234467>

Tools

- AHRQ Innovations Quality Tool: Problems and Prevention: Chest Tube Insertion
<https://innovations.ahrq.gov/qualitytools/problems-and-prevention-chest-tube-insertion>

- NHS Chest Drain Protocol
<http://www.bsuh.nhs.uk/EasySiteWeb/GatewayLink.aspx?allId=383931>

Staff Required

- Physicians and other providers (pediatric surgeons, neonatologists, pediatricians)
- Registered nurses
- Respiratory therapists

Equipment

- Computerized tomography (CT)
- Ultrasound

Communication

- Education on policy/protocol of monitoring and treatment of pneumothorax
- Communication system to escalate up the chain of command when provider not responding to diagnosis of pneumothorax or signs and symptoms of pneumothorax

Authority/Accountability

- Senior leaders such as chief/chairs of surgery, medicine and pediatrics, nursing leadership, and unit managers

References

1. National Healthcare Quality Report. Rockville, MD: Agency for Healthcare Research and Quality; 2003. <http://archive.ahrq.gov/qual/nhqr03/nhqr03.htm>. Accessed May 16, 2016.
2. AHRQ PDI Technical Specifications Documentation. http://www.qualityindicators.ahrq.gov/Modules/pdi_resources.aspx. Accessed May 16, 2016.
3. Miller MR, Zhan C. Pediatric patient safety in hospitals: a national picture in 2000. *Pediatrics* 2004;113(6):1741-6.
4. Kronman MP, Hall M, Slonim AD, et al. 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* 2008;121(6):e1653-e1659.
5. De Lassence A, Timsit JF, Tafflet M, et al. Pneumothorax in the intensive care unit. *Anesthesiology* 2006;104(1):5-13.
6. Wrightson J, Fysh E, Maskell N, et al. Risk reduction in pleural procedures: sonography, simulation and supervision. *Curr Opin Pulm Med* 2010;16:340-50.
7. Duncan DR, Morgenthaler TI, Ryu JH, et al. Reducing iatrogenic risk in thoracentesis: establishing best practice via experiential training in a zero-risk environment. *Chest* 2009;135:1315-20.
8. Mayo P, Beaulieu Y, Doelken P., et al. American College of Chest Physicians: competence in critical care ultrasonography. *Chest* 2009;135:1050-60.
9. Barnes TW, Morgenthaler TI, Olson EJ, et al. Sonographically guided thoracentesis and rate of pneumothorax. *J Clin Ultrasound* 2005;33:442-6.
10. Wraight W, Tweedie D, Parkin I. Neurovascular anatomy and variation in the fourth, fifth, and sixth intercostal spaces in the midaxillary line: a cadaveric study in respect to chest drain insertion. *Clin Anat* 2005;18:346-49.

11. Deneuille M. Morbidity of percutaneous tube thoracostomy in trauma patients. *Eur J Cardiothorac Surg* 2002;22:673-8.
12. Grogan D, Irwin R, Channick R. Complications associated with thoracentesis. A prospective, randomized study comparing three different methods. *Arch Intern Med* 1990;150:873-7.
13. Segulier-Lipszyc E, Elizur A, Klin B, et al. Management of primary spontaneous pneumothorax in children. *Clin Pediatr* 2011;50(9):797-802.
14. Litmanovitz I, Carlo W. Expectant management of pneumothorax in ventilated neonates. *Pediatrics* 2008;122(5):e975-9.
15. Bhat Yellanthoor RB, Ramdas V. Frequency and intensive care related risk factors of pneumothorax in ventilated neonates. *Pulmon Med* 2014;727323. doi: 10.1155/2014/727323. Epub 2014 Apr 28..
16. Sadeghi B, Baron R, Zrelak P, et al. Cases of iatrogenic pneumothorax can be identified from ICD-9-CM coded data. *Am J Med Qual* 2010;25(3):218-24.
17. Celik B, Sahin E, Nadir A, et al. Iatrogenic pneumothorax: etiology, incidence, and risk factors. *Thorac Cardiovasc Surg* 2009;57:286-90.
18. Jones P, Moyers J, Rogers J. Ultrasound-guided thoracentesis: is it a safer method? *Chest* 2003;123:418-23.

Selected Best Practices and Suggestions for Improvement

PDI 06: RACHS-1 Pediatric Heart Surgery Mortality

Why focus on pediatric heart surgery mortality?

- Heart defects are among the most common birth defects in the United States. About 35,000 infants (1 of every 125) are born with a heart defect each year.¹
- Other children will develop heart disease later that may require surgery, including conditions such as arrhythmias, cardiomyopathies, Kawasaki disease, and rheumatic fever.
- National annual charges for inpatient congenital cardiac surgery currently exceed \$2.2 billion.¹
- One study found that in-hospital mortality after pediatric heart surgery was associated with \$337,226 in excess total charges on average per death.²
- Some hospitals³ already publicly report pediatric heart surgery mortality rates.

Recommended Practice	Details of Recommended Practice
Conduct Multidisciplinary Rounds	Conduct multidisciplinary rounds on patients involving members of the entire health care team on a daily basis. ⁴
Conduct a Preoperative Planning Conference	Conduct a multidisciplinary preoperative planning conference to plan all pediatric cardiac surgery cases. ⁴
Ensure That Transesophageal Echocardiography (TEE) and Epicardial Echocardiography Are Available Intraoperatively	Intraoperative TEE and epicardial echocardiography should be available if needed during the surgical case. ⁴
Use Appropriate Antibiotic Selection and Timing	Administer timely and appropriate antibiotics preoperatively and postoperatively.
Use Appropriate “Timeout” Preprocedure and Postprocedure	Perform and document that all pediatric heart surgery cases have an appropriate preprocedural and postprocedural timeout. ⁴

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key procedural personnel, including nurses, physicians and other providers, technicians, and representatives from the quality improvement department, to develop evidence-based protocols for care of the neonatal patient population.
- The above team:
 - Identifies the purpose, goals, and scope and defines the target population for this guideline.
 - Analyzes problems with guidelines compliance, identifies opportunities for improvement, and communicates best practices to frontline teams.

- Establishes measures to indicate if changes are leading to improvement, identifies process and outcome metrics, and tracks performance using these metrics based on a standard performance improvement methodology (e.g., FOCUS-PDSA).
- Determines appropriate facility resources for effective and permanent adoption of practices.

Recommended Practice: Conduct multidisciplinary rounds involving multiple members of the health care team

- Conduct multidisciplinary rounds on all pediatric cardiac surgery patients on a daily basis.⁴
- Members of the team that should participate at a minimum include⁴:
 - Cardiac surgery.
 - Cardiology.
 - Critical care.
 - Caregivers/family.
 - Nurses.
 - Pharmacist.
 - Respiratory therapists.

Recommended Practice: Conduct a multidisciplinary preoperative planning conference

- Conduct a preoperative multidisciplinary planning conference before the pediatric cardiac surgery case.⁴
- Members of the team that should participate at a minimum include⁴:
 - Cardiac surgery.
 - Cardiology.
 - Critical care.
 - Anesthesia.

Recommended Practice: Ensure that transesophageal echocardiography (TEE) and epicardial echocardiography are available intraoperatively

- Intraoperative TEE and epicardial echocardiography should be available if needed during the surgical case.⁴
- In cases where TEE would be contraindicated or not provide enough information, epicardial echocardiography and appropriate staff support should be available if needed during a case.⁴

Recommended Practice: Use appropriate antibiotic selection and timing

- Administer prophylactic antibiotics within 1 hour prior to surgical incision.^{4,5}
- Administer appropriate antibiotic selection based on evidence-based guidelines.^{4,5}

Recommended Practice: Use appropriate “timeout” both preprocedure and postprocedure

- All “timeouts” should include the following:⁴
 - A “timeout,” including at a minimum the following elements: patient ID, site, procedure, and patient allergies.

- A preprocedural briefing by the attending surgeon in which the following is shared with the entire surgical team: operative plan, diagnosis, planned procedure, anesthesia and bypass strategies, antibiotic prophylaxis, availability of blood products, any anticipated/planned implants, and any anticipated challenges.
- A postprocedural debriefing by the attending surgeon in which opportunities for improvement are discussed, along with successful elements of the surgery.
 - Specifics should include the name of the procedure performed, instrument, correct sponge and needle counts, appropriate specimen labeling (if applicable), equipment problems, blood product use, and any breaks in technique.
 - This should take place prior to the patient leaving the OR (a more in-depth discussion can take place after the case).

Educational Recommendation

- Plan and provide education on protocols to physicians and other providers, nursing, and all other staff involved in procedural cases. Education should occur upon hire, annually, and when this protocol is added to job responsibilities.

Effectiveness of Action Items

- Track compliance with elements of established protocol by using checklists, appropriate documentation, etc.
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement practices.
- Mandate that all personnel follow the safety protocols developed by the team and develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physicians and other providers, nursing, and ancillary staff; senior medical staff; and executive leadership) on the level of compliance with process.
- Conduct surveillance and determine prevalence to evaluate outcomes of new process.
- Monitor and evaluate performance regularly to sustain improvements achieved.

Additional Resources

Systems/Processes

- Guidelines for pediatric cardiovascular centers. *Pediatrics* 2002;109(3):544-9.

Tools

- The Society of Thoracic Surgeons Patient Safety Checklist
<http://www.sts.org/quality-research-patient-safety/patient-safety-0>
- American Heart Association Congenital Heart Defects Tools and Resources
http://www.heart.org/HEARTORG/Conditions/CongenitalHeartDefects/Congenital-Heart-Defects_UCM_001090_SubHomePage.jsp
- IHI How-to Guide: Prevent Surgical Site Infection — Pediatric Supplement
<http://www.ihl.org/resources/Pages/Tools/HowtoGuidePreventSurgicalSiteInfectionPediatricSupplement.aspx>

Staff Required

- Physicians and other providers (pediatric cardiologists, pediatric cardiovascular surgeons, pediatric cardiovascular anesthesiologists, pediatric intensive care physicians, and other providers in these areas)

Equipment

- TEE
- Epicardial echocardiography

Communication

- Education on policy/protocol of monitoring and treatment of bloodstream infections

Authority/Accountability

- Senior leaders such as chief/chairs of surgery and medicine, nursing leadership, and unit managers

References

1. National Voluntary Consensus Standards for Pediatric Cardiac Surgery: A Consensus Report. Washington, DC: National Quality Forum; December 2011.
http://www.qualityforum.org/Publications/2011/12/National_Voluntary_Consensus_Standards_for_Pediatric_Cardiac_Surgery_A_Consensus_Report.aspx. Accessed May 16, 2016.
2. Kronman MP, Hall M, Slonim AD, et al. 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* 2008;121(6):e1653-e1659.
3. The Children's Hospital of Philadelphia. Heart Surgery Survival Rates by Type of Procedure. <http://www.chop.edu/service/cardiac-center/cardiac-outcomes/volumes-mortality-rates-procedure.html>. Accessed May 16, 2016.
4. Jacobs J, Jacobs M, Mayer Jr J, et al. Quality measures for congenital and pediatric cardiac surgery. *World J Pediatr Congenit Heart Surg* 2012;3(1):32-47.
5. The Joint Commission. Specifications Manual for National Hospital Inpatient Quality Measures, Version 4.3. 2014.
http://www.jointcommission.org/specifications_manual_for_national_hospital_inpatient_quality_measures.aspx. Accessed May 16, 2016.

Selected Best Practices and Suggestions for Improvement

PDI 08: Perioperative Hemorrhage or Hematoma

Why focus on perioperative hemorrhage and hematoma in children?

- Postoperative hemorrhage or hematoma can complicate surgery in children, just as in adults. It is a concerning complication of tonsillectomy with or without adenoidectomy, which is one of the most common surgical procedures performed in children.¹
- Rates of postoperative hemorrhage or hematoma have been reported to range from 1.3 to 2.7 per 1,000 pediatric discharges.^{2,3}
- Postoperative hemorrhage and hematoma lead to a significantly higher length of stay (6-7 days, depending on the study) and excess charges (anywhere from about \$75,000 to \$111,000) in children with this complication, even after controlling for a number of other risk factors.^{2,4}

Recommended Practice	Details of Recommended Practice
Risk Factor Determination	Determine which factors place pediatric patient at an increased risk of bleeding during the postoperative period.
Management of Blood Loss	Proper management of blood loss, including frequent dressing checks, is key to management of postoperative hemorrhage and hematoma in the pediatric population. ⁵
Medication Management	Determine if and when discontinuation of antiplatelet/anticoagulant medication prior to the procedure or surgery is appropriate. ⁵ Avoid medications that could increase the risk of postoperative bleeding.

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key preoperative/perioperative/procedure personnel, including nurses, physicians and other providers, and surgical technicians, and representatives from the quality improvement department to develop evidence-based protocols for care of the pediatric patient preoperatively, intraoperatively, and postoperatively to prevent postoperative hemorrhage or hematoma.
- The above team:
 - Identifies the purpose, goals, and scope and defines the target population for this guideline.
 - Analyzes problems with guideline compliance, identifies opportunities for improvement, and communicates best practices to frontline teams.
 - Monitors measures that would indicate if changes are leading to improvement, identifies process and outcome metrics, and tracks performance using these metrics.
 - Determines appropriate facility resources for effective and permanent adoption of practices.

Recommended Practice: Risk Factor Determination

- The following factors may place pediatric patients at an increased risk for postoperative bleeding following some selected pediatric surgeries^{6,7}:
 - In cardiac surgery:
 - Preoperative body weight
 - Presence of cyanotic heart disease
 - Time required for wound closure
 - In tonsillectomy patients:
 - Patients age 11 and older
 - History of chronic tonsillitis
 - Excessive intraoperative blood loss
 - Elevated postoperative mean arterial pressure

Recommended Practice: Management of Blood Loss

- Interventions include applying pressure to the site and being prepared to return the pediatric patient to the operating room:
 - Consider developing a standard set of criteria or early warning signs (see below) that are appropriate for pediatric patients and can be used to trigger notification of the responsible surgeon of possible postoperative bleeding.
 - Incorporate all components of the criteria/early warning signs into a tool designed to provide standardized documentation of all pertinent details of the event. This tool will provide the data to track patient characteristics, processes, and outcomes for continuous quality improvement.
 - Establish a policy to empower nurses to rapidly escalate up the chain of authority to reach the responsible surgeon (limit time to 5-minute wait after initial page before moving to notify next higher level of authority).
 - Provide educational sessions to all clinical staff who care for children on the pilot units (nurses, residents, attending physicians, respiratory therapists, patient care technicians, certified nursing assistants, etc.) in the use of the early warning sign criteria, required documentation, and policy for rapid escalation up the chain of authority to notify responsible surgeon.
- Common early warning signs of hemorrhage can include but are not limited to⁵:
 - Restlessness and anxiety.
 - Frank bleeding and bruising.
 - Tachycardia.
 - Diminished cardiac output and dropping central venous pressure.
 - Reductions in urine output.
 - Swelling and discoloration of the extremities.

Recommended Practice: Medication Management

- Develop a process and protocol for determining if discontinuation of antiplatelet/anticoagulant medications prior to procedure or surgery is appropriate.⁵
 - Practice recommendation should be selected based on individual patient risk factors and current evidence-based guidelines for a particular surgery.
 - Work with caregivers to obtain a thorough history of medication use prior to surgery. The history must specifically address the use of over-the-counter and prescribed medications.
 - Document this information in the patient's medical record so that it is available to all care providers.
- Ketorolac use should be avoided during the postoperative period of a tonsillectomy due to higher rates of hemorrhage. Consider using other nonsteroidal anti-inflammatory drugs for the postoperative treatment of pain instead.⁸

Educational Recommendation

- Plan and provide education on protocols to physicians and other providers, nursing, and all other staff involved in operative cases, procedural cases, and care of pediatric patients postoperatively. Education should occur upon hire, annually, and when this protocol is added to job responsibilities.

Effectiveness of Action Items

- Track compliance with elements of the established protocol by using checklists, appropriate documentation, etc.
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement practices.
- Mandate that all personnel follow the protocols and practices developed by the team to prevent postoperative hemorrhage and hematoma and develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physicians and other providers, nursing, and ancillary staff; senior medical staff; and executive medical and administrative leadership) on level of compliance with process.
- Conduct surveillance and determine prevalence of postoperative hemorrhage to evaluate outcomes of new process.
- Monitor and evaluate performance regularly to sustain improvements achieved (e.g., Clinicians who perform tonsillectomy should determine their rate of primary and secondary post-tonsillectomy hemorrhage at least annually).⁸

Additional Resources

Systems/Processes

- The Merck Manual for Health Care Professionals: Postoperative Care
<http://www.merckmanuals.com/professional/special-subjects/care-of-the-surgical-patient/postoperative-care>

- WHO Surgical Care at the District Hospital 2003: Postoperative Care, World Health Organization
<http://www.who.int/surgery/publications/Postoperativecare.pdf>
- Anticoagulant Toolkit: Reducing Adverse Drug Events, Institute for Healthcare Improvement
<http://www.ihp.org/knowledge/Pages/Tools/AnticoagulantToolkitReducingADEs.aspx>

Policies/Protocols

- Recommended Curriculum Guidelines for Family Medicine Residents: Care of the Surgical Patient, American Academy of Family Physicians
http://www.aafp.org/dam/AAFP/documents/medical_education_residency/program_directors/Reprint259_Surgical.pdf
- Periprocedural and Regional Anesthesia Management With Antithrombotic Therapy: Adult—Inpatient and Ambulatory, Clinical Practice Guideline, UW Health
http://www.uwhealth.org/files/uwhealth/docs/anticoagulation/Periprocedural_Anticoagulation_Guideline.pdf

Tools

- Postoperative Handover (ITCAS Checklist 3)
<http://www.imperial.ac.uk/media/imperial-college/medicine/surgery-cancer/pstrc/postoperativehandoveritcaschecklist3.pdf>

Staff Required

- Physicians and other providers (pediatricians, neonatologists, pediatric surgeons)
- Nursing and nursing assistants
- Respiratory therapists
- Transfusion medicine service

Communication

- Systemwide education on policy/protocol of monitoring postoperative pediatric patients

Authority/Accountability

- Senior leadership mandating protocol for all providers
- Providers involved in postoperative care held accountable for following protocol

References

1. Derkay CS. A cost-effective approach for preoperative hemostatic assessment in children undergoing adenotonsillectomy. *Arch Otolaryngology Head Neck Surg* 2000;126(5):688.
2. Miller MR, Zhan C. Pediatric patient safety in hospitals: a national picture in 2000. *Pediatrics* 2004;113(6):1741-6.
3. Sedman A, Harris JM 2nd, Schulz K, et al. Relevance of the Agency for Healthcare Research and Quality Patient Safety Indicators for children's hospitals. *Pediatrics* 2005;115(1):135-45.
4. Kronman MP, Hall M, Slonim AD, et al. 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* 2008;121(6):e1653-e1659.

5. Dagi TF. The management of postoperative bleeding. *Surg Clin N Am* 2005;85(6):1191-1213.
6. Savan V, Willems A, Faraoni D, et al. Multivariate model for predicting postoperative blood loss in children undergoing cardiac surgery: a preliminary study. *Br J Anaesth* 2014;112(4):708-14. <http://bjaoxfordjournals.org/content/112/4/708.long>. Accessed May 16, 2016.
7. Myssiorek D, Alvi A. Post-tonsillectomy hemorrhage: an assessment of risk factors. *Int J Pediatr Otorhinolaryngol* 1996 Sep;37(1):35-43.
8. Baugh RF, Archer SM, Mitchell RB, et al; and American Academy of Otolaryngology-Head and Neck Surgery Foundation. Clinical practice guideline: tonsillectomy in children. *Otolaryngol Head Neck Surg* 2011 Jan;144(1 Suppl):S1-30.

Selected Best Practices and Suggestions for Improvement

PDI 09: Postoperative Respiratory Failure

Why focus on postoperative respiratory failure in children?

- Even though there is debate regarding the definition of true postoperative respiratory failure, it still remains an important patient adverse event. Generally, postoperative respiratory failure is the failure to wean from mechanical ventilation within 48 hours of surgery or unplanned intubation/reintubation postoperatively.¹
- Postoperative respiratory failure occurs in about 2 to 3 per 1,000 pediatric discharges.^{2, 3}
- Using Healthcare Cost and Utilization Project data, Miller and Zhan found 33 of 10,000 discharges had postoperative respiratory failure in pediatric patients ages 0-18. This complication resulted in an average of 24.4 additional days in the hospital and \$140,507 in increased charges.³
- Kronman and colleagues found that postoperative respiratory failure resulted in an average excess length of stay of 4.8 days and an average of \$77,739 in additional charges.⁴

Recommended Practice	Details of Recommended Practice
Assess risk factors.	Develop a set of risk factors for postoperative respiratory failure and screen all patients undergoing elective surgery. ⁵
Initiate various treatments during the perioperative and postoperative period to reduce a patient’s risk of developing respiratory failure.	To prevent or lessen the risk of developing postoperative respiratory failure, perform lung expansion exercises and selective use of nasogastric tubes, and use short-acting neuromuscular blockade. ^{6,7}

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key nurses, physicians and other providers, hospitalists, respiratory therapists, dietitians, and pharmacists from infection control, intensive care, and inpatient units including operating room; and representatives from quality improvement, radiology, and information services to develop time-sequenced guidelines, care paths, or protocols for the full continuum of care.

Recommended Practice: Assess risk factors

- Determine which pediatric patients are at increased risk for postoperative respiratory failure to better prepare clinicians to anticipate adverse events postoperatively, as well as improve allocation of resources after surgery.⁵
- Some risk factors for pediatric respiratory failure are^{5,6,8,9}:
 - Age (infants and young children).
 - Acute lung disease (status asthmaticus, bronchiolitis, pneumonia, pulmonary edema, depressed neural ventilatory drive, acute respiratory syndrome, pulmonary contusion, cystic fibrosis, acute or chronic upper airway obstruction).

- Rib cage abnormalities.
- Decreased central nervous system input (head injury, ingestion of central nervous system depressant, adverse effect of procedural sedation, intracranial bleeding, apnea of prematurity).
- Peripheral nerve/neuromuscular junction (spinal cord injury, organophosphate/carbamate poisoning, Guillain-Barré syndrome, myasthenia gravis, infant botulism).
- Additional adult risk factors that are applicable to children are:
 - Smoking.
 - Obesity.
 - Functional dependence and/or neuromuscular weakness.
 - Higher American Society of Anesthesiologists (ASA) score/class.
 - Emergency surgery.
 - High-risk surgery (e.g., emergent and prolonged procedures, open vs. laparoscopic).
 - Serum albumin <3.0 g/dL.
 - BUN >30 mg/dL.

Recommended Practice: Initiate various treatments during the perioperative and postoperative period to reduce a patient's risk of developing respiratory failure

- Implement strategies to minimize the following conditions that can contribute to respiratory failure⁹:
 - Appropriate antibiotic use for respiratory infections (if indicated)
 - Deep breathing exercises and smoking cessation (if applicable) to prevent atelectasis
 - Lifestyle changes to reduce obesity
- Ensure that caregivers recognize the importance of using lung expansion exercises with children, such as incentive spirometry, deep breathing, intermittent positive-pressure breathing, and continuous positive airway pressure. These exercises have been shown to reduce the likelihood of postoperative respiratory failure.
- Use nasogastric tubes selectively since they can increase the risk of aspiration.
- Use short-acting neuromuscular blockade. Long-acting neuromuscular blockade has a higher incidence of residual block, and patients with higher residual block were more than 3 times as likely to develop postoperative pulmonary complications than those without residual block.¹⁰

Educational Recommendation

- Plan and provide education on protocols and standing orders to physicians and other providers, nurses, and all other staff involved in postoperative respiratory failure prevention and care (emergency department, intensive care unit, etc). Education should occur upon hire, annually, and when this protocol is added to job responsibilities.

Effectiveness of Action Items

- Track compliance with elements of established protocol steps.
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement.
- Mandate that all personnel follow the postoperative respiratory failure protocol and develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physicians and other providers, nursing, and ancillary staff; senior medical staff; and executive leadership) on level of compliance with process.
- Monitor and evaluate performance regularly to sustain improvements achieved.

Additional Resources

Systems/Processes

- WHO Postoperative Care
<http://www.who.int/surgery/publications/Postoperativecare.pdf>

Policies/Protocols

- AARC Clinical Practice Guideline: Incentive Spirometry: 2011
<http://www.rcjournal.com/cpgs/pdf/10.11.1600.pdf>

Staff Required

- Surgeons
- Intensivists
- Nursing
- Respiratory therapy

Equipment

- Incentive spirometer

Communication

- Systemwide education on policy/protocol of monitoring postoperative patients

Authority/Accountability

- Senior leadership mandating protocol for all providers

References

1. Gupta H, Gupta P, Morrow L, et al. Development and validation of a risk calculator predicting postoperative respiratory failure. *Chest* 2011 Nov;140(5):1207-15.
2. AHRQ PDI technical specifications documentation.
http://www.qualityindicators.ahrq.gov/Modules/pdi_resources.aspx. Accessed May 17, 2016.
3. Miller MR, Zhan C. Pediatric patient safety in hospitals: a national picture in 2000. *Pediatrics* 2004;113(6):1741-6.
4. Kronman MP, Hall M, Slonim AD, et al. 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* 2008;121(6):e1653-9. doi: 10.1542/peds.2007-2831.
5. Utter G. Why focus on postoperative respiratory failure? [PowerPoint]. University of California, Davis: Premier Healthcare Alliance; 2010.
<http://www.qualityindicators.ahrq.gov/Downloads/Resources/Presentations/2010/Utter%20Premier%20PRF%20overview.11042010.pdf>
 6. Brueckmann B, Villa-Urbe J, Eikermann M, et al. Development and validation of a score for prediction of postoperative respiratory complications. *Anesthesiology* 2013 Jun;118(6):1276-85.
 7. Smetana G. Postoperative pulmonary complications: an update on risk assessment and reduction. *Cleve Clin J Med* 2009 Nov;76 Suppl 4:S60-S65.
 8. Najaf-Zadeh A, Leclerc F. Noninvasive positive pressure ventilation for acute respiratory failure in children: a concise review. *Ann Intensive Care* 2011 May;1(1):15.
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3224494/>. Accessed May 17, 2016.
 9. Pope J, McBride J. Consultation with the specialist: respiratory failure in children. *Pediatr Rev* 2004 May;25(5):160-7.
 10. Lawrence V, Cornell J, Smetana G. Clinical guidelines. Strategies to reduce postoperative pulmonary complications after noncardiothoracic surgery: systematic review for the American College of Physicians. *Ann Intern Med* 2006;144(8):596.

Selected Best Practices and Suggestions for Improvement

PDI 10: Postoperative Sepsis

Why focus on postoperative sepsis in children?

- Postoperative sepsis remains a major surgical complication in children, occurring in around 10 per 1,000 surgical pediatric discharges.¹
- In the United States, the overall incidence of sepsis has increased significantly in recent decades.²
- One study found this complication resulted in an average excess length of stay of 26 days and \$117,815 in additional charges¹; another study found an excess length of stay of 23.52 days and even higher excess charges of \$261,173.³

Recommended Practice	Details of Recommended Practice
Implement strategies to prevent sepsis.	Infection prevention strategies include general infection control practices, hand washing, and strategies to prevent nosocomial infections. ⁴
Screen patients for sepsis.	Develop a 1-page sepsis screening tool; integrate tool into electronic medical record. ^{5,6}
Use a sepsis resuscitation bundle.	Develop a specific resuscitation bundle with end goals specific to the pediatric population. ⁵
Develop policies and procedures.	Use Surviving Sepsis Campaign’s evidence-based guidelines; include the 3-hour and 6-hour bundles. ⁵
Adopt sepsis measures.	Evaluate compliance by using process measures such as door-to-antibiotic time; share reports regularly to communicate progress. ⁵

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key nurses, physicians and other providers, respiratory therapists, dietitians, and pharmacists from infection control, intensive care, and inpatient pediatric units, including operating room; and representatives from quality improvement, radiology, and information services to develop time-sequenced guidelines, care paths, or protocols for the full continuum of care.⁵

Recommended Practice: Implement strategies to prevent sepsis

- General infection control practices include⁴:
 - Use standard precautions for all patients.
 - Apply contact precautions for appropriate patients with pathogens that can be transmitted by direct or indirect contact.
 - Apply droplet precautions to patients with pathogens that can be transmitted by infectious droplets.

- Apply airborne precautions to patients with epidemiologically important pathogens that can be transmitted by the airborne route.
- Require hand washing before and after any patient contact and handling of any contaminated items, and between tasks and procedures.
- Reduce nosocomial infections by implementing the following:
 - Oral care and proper positioning to prevent nosocomial pneumonia
 - Appropriate insertion, maintenance, and removal protocols for all invasive catheters
 - Appropriate skin and wound care

Recommended Practice: Screen patients for sepsis

- Develop a 1-page sepsis screening tool using a standardized set of physiologic triggers or early warning signs that alert providers to respond quickly with appropriate interventions; integrate tool into electronic medical record, if applicable.
- Ensure that nurses assess patients with a history suggestive of a new infection for sepsis at least daily.
- Ensure that screening begins upon patient arrival at the emergency department or soon after hospital admission, if not admitted through the ED.
- Use a rapid response team to respond to a positive screen.
- Pilot the screening tool with 1 or 2 nursing units. Allow the staff piloting the tool to provide feedback. Incorporate staff feedback when the tool is revised.

Recommended Practice: Use a sepsis resuscitation bundle

- Develop a pediatric sepsis resuscitation bundle with the following elements⁵:
 - Start with addressing hypoxemia or respiratory distress, if present.
 - Consider using any of the following to improve oxygenation: face mask, high-flow nasal cannula, or nasopharyngeal continuous positive airway pressure (CPAP). If mechanical ventilation is used, use lung-protective strategies whenever possible.
 - Aim for end goals of pediatric sepsis resuscitation at central venous oxygen saturation (ScvO₂) greater than or equal to 70% and a cardiac index between 3.3 and 6.0 L/min/m². Specific targets include:
 - A capillary refill of ≤2 s.
 - Normal blood pressure for age.
 - Normal pulses with no differential between peripheral and central pulses.
 - Warm extremities.
 - Urine output greater than 1 mL/kg/hr.
 - Normal mental status.
 - An initial hemoglobin of 10g/dL, then maintain greater than 7.0 g/dL.
 - Blood glucose target of ≤180 mg/dL.
 - Use the American College of Critical Care Medicine-Pediatric Advanced Life Support (PALS) guidelines for the management of septic shock (refer to the Surviving Sepsis

Campaign Guidelines, Figure 2, for the PALS management algorithm; see Additional Resources, “Systems/Processes”).

- Evaluate and treat for pneumothorax, pericardial tamponade, or endocrine emergencies (e.g., hypoadrenalism and hypothyroidism) in patients with refractory shock.
- Administer antibiotics within 1 hour of sepsis recognition. Blood cultures should ideally be obtained before the administration of antibiotics but should not delay the start of antibiotics.
- Provide early and aggressive infection source control (e.g., debridement or drainage, peritoneal washout).
- Perform fluid resuscitation with crystalloids or albumin.
 - Bolus 20 mg/kg over 5-10 minutes until hemodynamically stable.
 - Consider inotropic support if fluid resuscitation not successful. If low cardiac output and elevated systemic vascular resistance with normal blood pressure present, add vasodilator therapies.
- Add extracorporeal membrane oxygenation (ECMO) in children with refractory septic shock or with refractory respiratory failure (if available).
- Initiate timely hydrocortisone therapy in children with fluid-refractory, catecholamine-resistant shock and suspected or proven absolute (classic) adrenal insufficiency.
- Use enteral nutrition in children who can tolerate it; parenteral nutrition in those who cannot.

Recommended Practice: Develop policies and procedures

- An organizationwide pediatric sepsis management protocol, policy, and/or procedures are necessary to integrate evidence-based guidelines into clinical practice.
- Convene a multidisciplinary team that includes different professions and service lines.⁵
- Incorporate the “Surviving Sepsis Campaign” evidence-based pediatric guidelines into the sepsis management protocol and/or procedures.⁵
- Develop a systemwide protocol. Institute the goal that all pediatric services use the same protocol, including the emergency and pediatric and neonatal intensive care departments.
- Develop order sets, preferably electronic, for nonsevere sepsis and for severe sepsis/septic shock.
- Develop a systemwide antibiotic policy and/or procedure that includes type, dosing, initiation, timing, and compatibility.
- Use a process for screening pediatric patients for sepsis, such as a paper or electronic screening tool that is 1 page and will take 2-3 minutes to complete. Also consider use of the rapid-response team for screening.
- Incorporate a mechanism for handoff communication between the emergency department and pediatric/neonatal intensive care unit.
- Implement a systemwide sepsis education program. Include didactic presentations and electronic offerings.

Recommended Practice: Adopt sepsis measures

- Organizational performance goals need to be determined. Use a retrospective chart review tool to identify baseline sepsis management compliance.

- Evaluate compliance by using process measures such as door-to-antibiotic time; share reports regularly with stakeholders to communicate progress.
- Use a systemwide mechanism to share data with administrators, providers, and staff, such as a sepsis management dashboard and/or reports.

Educational Recommendation

- Plan and provide education on protocols and standing orders to physicians and other providers, nurses, and all other staff involved in sepsis prevention and care (emergency department, intensive care unit, etc.). Education should occur upon hire, annually, and when this protocol is added to job responsibilities.⁵

Effectiveness of Action Items

- Track compliance with elements of established protocol steps.
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement.
- Mandate that all personnel follow the sepsis protocol and develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physicians and other providers, nursing, and ancillary staff; senior medical staff; and executive leadership) on level of compliance with process.⁵
- Monitor and evaluate performance regularly to sustain improvements achieved.⁵

Additional Resources

Systems/Processes

- The Pediatric Guidelines from the Surviving Sepsis Campaign: Considerations for Care <http://sccmmedia.sccm.org/video/OnDemand/SurvivingSepsis/SSC-Pediatric-Guidelines.mp4>
- AHRQ Innovations Exchange: Emergency Department Protocol Leads to Faster Identification and Treatment of Pediatric Patients With Sepsis <https://innovations.ahrq.gov/profiles/emergency-department-protocol-leads-faster-identification-and-treatment-pediatric-patients>

Policies/Protocols

- Stony Brook Medicine Severe Sepsis/Septic Shock Recognition and Treatment Protocols <http://www.survivingsepsis.org/SiteCollectionDocuments/Protocols-Sepsis-Treatment-Stony-Brook.pdf>

Tools

- Sepsis Pediatric Order Set - Stony Brook <http://www.survivingsepsis.org/SiteCollectionDocuments/Protocols-Sepsis-Orders-Stony-Brook.pdf>
- Pediatric ICU Severe Sepsis Screening Tool - Stony Brook <http://www.survivingsepsis.org/SiteCollectionDocuments/Protocols-Pediatric-ICU-Screening-Tool.pdf>

Staff Required

- Emergency Department staff
- Pediatric/Neonatal Intensive Care Unit staff
- Postoperative pediatric unit staff
- Ancillary staff (lab, respiratory, dietary, etc.)

Equipment

- Equipment for blood draws
- Appropriate medications, including antibiotics and vasopressors

Communication

- Communication of critical lactate and blood culture results to team in a timely manner

Authority/Accountability

- Senior leadership mandating protocol for all providers

References

1. Miller MR, Zhan C. Pediatric patient safety in hospitals: a national picture in 2000. *Pediatrics* 2004;113(6):1741-6.
2. Vogel TR, Dombrowskiy VY, Lowry SF. Trends in postoperative sepsis: are we improving outcomes? *Surg Infect (Larchmt)* 2009 Feb;10(1):71-8.
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2846560/>. Accessed May 17, 2016.
3. Kronman MP, Hall M, Slonim AD, et al. 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* 2008;121(6):e1653-59.
4. Kleinpell RM, Munro CL, Giuliano KK. Targeting health care-associated infections: evidence-based strategies. In: Hughes RG, ed. *Patient safety and quality: an evidence-based handbook for nurses*. Rockville, MD: Agency for Healthcare Research and Quality; 2008. Chapter 42. <http://www.ncbi.nlm.nih.gov/books/NBK2632/>. Accessed May 17, 2016.
5. Dellinger RP, Levy MM, Rhodes A, et al. Surviving Sepsis Campaign: international guidelines for management of severe sepsis shock: 2012. *Crit Care Med* 2013;41(2):580-637.
6. Cardoso T, Carneiro AH, Ribeiro O, et al. Reducing mortality in severe sepsis with the implementation of a core 6-hour bundle: results from the Portuguese community-acquired sepsis study (SACiUCI study). *Crit Care* 2010;4(3):R83.

Selected Best Practices and Suggestions for Improvement

PDI 11: Postoperative Wound Dehiscence

Why focus on postoperative wound dehiscence in children?

- Like adults, children can experience wound dehiscence as a postoperative complication; children under 1 year of age may be at particularly high risk due to impaired wound healing.
- Postoperative wound dehiscence occurs in about 8 per 10,000 pediatric surgical discharges.¹
- The reported mortality rate for children with postoperative wound dehiscence is between 8 percent and 45 percent.²
- In addition to causing significant morbidity and mortality, wound dehiscence also results in an excess hospital length of stay of 21.1 days, along with \$76,737 in excess charges.¹
- Proper identification of patients at risk, prevention of surgical site infections, and appropriate postsurgical wound assessment help decrease the incidence of postoperative wound dehiscence. Although many risk factors are nonmodifiable (e.g., emergency surgery), some factors can be addressed by hospitals, such as improving nutritional status and decreasing surgical error.

Recommended Practice	Details of Recommended Practice
Assess for risk of wound dehiscence.	Determine risk factors for postoperative wound dehiscence and identify pediatric patients at risk. ²⁻⁵
Reduce the incidence of surgical site infections.	Administer timely and appropriate antibiotics preoperatively and postoperatively. ^{3,4} Use appropriate wound dressings as determined by the type of closure. ⁵
Conduct postoperative wound assessment.	Assess the surgical wound postoperatively and document any findings of wound dehiscence. ³⁻⁵

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key nurses, physicians and other providers, hospitalists, respiratory therapists, dietitians, and pharmacists from infection control, intensive care, and inpatient units, including operating room; and representatives from quality improvement, radiology, and information services to develop time-sequenced guidelines, care paths, or protocols for the full continuum of care.

Recommended Practice: Assess for risk of wound dehiscence

- Complete a preoperative assessment to identify factors that could increase the risk of postoperative wound dehiscence in the pediatric population.^{2,6}
 - Wound infections
 - Age <1 year
 - Emergency surgery
 - Mechanical ventilation
 - Median or vertical incisions

- Malnutrition
- When possible, eliminate or mitigate risk factors.
- Educate patients and caregivers about the importance of compliance with postoperative instructions.
- Optimize nutrition before surgery, especially increased protein.^{3,4}
- Eliminate smoking products before surgery. Be mindful that smoking poses an increased risk of postoperative wound dehiscence. Therefore, particularly among adolescent patients, encourage elimination of tobacco products prior to surgery, where relevant.^{3,4}

Recommended Practice: Reduce the incidence of surgical site infections

- Consider chlorihexidine bathing preoperatively for infants 2 months of age and older.⁴
- If removing hair prior to surgery, use the following appropriate techniques^{7,8}:
 - Hair removal with clippers, depilatory, or no hair removal at all
- Ensure that prophylactic antibiotics are administered within 1 hour prior to surgical incision.^{3,4,8}
- Administer appropriate antibiotic selection based on evidence-based guidelines.^{3,4,8}
- Use appropriate wound dressings determined by the type of closure⁵:
 - Primary: Dry, sterile cover dressing for 24-48 hours
 - Secondary and Chronic: Dressings that provide a moist wound healing environment while preventing it from becoming too wet
- Perform routine pain assessments to ensure early identification of delayed wound healing.^{3,4}

Recommended Practice: Conduct postoperative wound assessment

- Documentation of the surgical wound should occur 48 hours after surgery to establish a baseline.^{3,5}
- Repeat assessment should occur every shift thereafter.^{3,5}
- Symptoms of wound dehiscence should be elicited, including^{3,4}:
 - Bleeding.
 - Reported pain (if old enough to verbalize) or increased heart rate not accounted for by other factors.
 - Crying and agitation.
 - Swelling.
 - Redness.
 - Fever.
 - Broken sutures.
 - Open wound.
 - Pulling or ripping sensation reported by patient (if old enough to verbalize).

Educational Recommendation

- Plan and provide education on protocols and standing orders to physicians and other providers, nurses, and all other staff involved in postoperative care. Education should occur upon hire, annually, and when this protocol is added to job responsibilities.⁴

Effectiveness of Action Items

- Track compliance with elements of established protocol steps.
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement.
- Mandate that all personnel follow the wound dehiscence protocol and develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physicians and other providers, nursing, and ancillary staff; senior medical staff; and executive leadership) on level of compliance with process.
- Monitor and evaluate performance regularly to sustain improvements achieved.

Additional Resources

Systems/Processes

- Agency for Healthcare Research and Quality. Universal ICU decolonization: an enhanced protocol
http://www.ahrq.gov/professionals/systems/hospital/universal_icu_decolonization/index.html
- Centers for Disease Control and Prevention (CDC). Surgical Site Infection (SSI)
<http://www.cdc.gov/hai/ssi/ssi.html>

Policies/Protocols

- WHO Surgical Care at the District Hospital, 2003
<http://www.who.int/surgery/publications/en/SCDH.pdf>

Tools

- CDC Surgical Site Infection Toolkit
http://www.cdc.gov/HAI/pdfs/toolkits/SSI_toolkit021710SIBT_revised.pdf
- WHO Surgical Safety Checklist
http://www.who.int/patientsafety/safesurgery/tools_resources/SSSL_Checklist_finalJun08.pdf

Staff Required

- Pediatric surgeons
- Perioperative and postoperative nursing

Equipment

- Dressing supplies
- Appropriate antibiotics

Communication

- Systemwide education on policy/protocol of monitoring postoperative pediatric patients

Authority/Accountability

- Senior leadership mandating protocol for all providers

References

1. Miller MR, Zhan C. Pediatric patient safety in hospitals: a national picture in 2000. *Pediatrics* 2004;113(6):1741-6.
2. Van Ramshorst G, Salu N, Lange J, et al. Risk factors for abdominal wound dehiscence in children: a case-control study. *World J Surg* 2009 Jul;33(7):1509-13.
3. Hahler B. Surgical wound dehiscence. *MEDSURG Nurs* 2006;15(5):296-301.
4. Orstod H, Koast DK, Kuhnko J, et al. Best practice recommendation: prevention and management of open surgical wounds. *Wound Care Canada* 2010;8(1):6-32.
5. Beattie S. Bedside emergency: wound dehiscence. *Modern Medicine*: 2007 June 1. <http://www.modernmedicine.com/content/bedside-emergency-wound-dehiscence> . June 1, 2007. Accessed May 17, 2016.
6. Khan M, Khan K, Imran M, et al. Dehiscence of laparotomy wounds in children. *J Postgrad Med Instit (Peshawar - Pakistan)* 2011;23(4):318-21. <http://www.jpmi.org.pk/index.php/jpmi/article/viewFile/273/185>. Accessed May 17, 2016.
7. Van Ramshorst G, Nieuwenhuizen J, Lange J, et al. Abdominal wound dehiscence in adults: development and validation of a risk model. *World J Surg* 2010 Jan;34(1):20-27.
8. Specifications manual for national hospital inpatient quality measures, version 4.3. Oakbrook Terrace, IL: The Joint Commission; 2014. http://www.jointcommission.org/specifications_manual_for_national_hospital_inpatient_quality_measures.aspx (January 16, 2014). Accessed May 17, 2016.

Selected Best Practices and Suggestions for Improvement

PDI 12: Central Venous Catheter (CVC)-Related Bloodstream Infection Rate (BSIs)

Why focus on central line-associated bloodstream infections (CLABSIs) in children?

- With a reported mortality rate of up to 35 percent and 14,000 to 28,000 associated deaths per year, CLABSIs are a target of hospital prevention and reduction efforts.¹
- National Healthcare Safety Network (NHSN) data show from 2006 to 2008 the pooled mean rate of CLABSIs for pediatric cardiothoracic ICUs was 3.3 per 1,000 central line days; for pediatric medical/surgical intensive care units (ICUs), the pooled mean rate was 3.0 CLABSIs per 1,000 central line days.²
- Overall, central venous catheters are increasingly used in hospitals outside of ICUs.¹
- In addition to the considerable morbidity and mortality risks for patients, pediatric CLABSIs are costly. A recent study comparing pediatric CLABSI cases to matched controls showed an attributable cost of about \$55,000 and an attributable length of stay of 19 days.³
- Part of this cost is likely to be shouldered by hospitals, as the Centers for Medicare & Medicaid Services will not reimburse for CLABSI for Medicaid patients unless it is present on admission.⁴
- In addition, CLABSI (in neonatal ICUs and pediatric ICUs) is one of the core set of children’s health care quality measures for voluntary public reporting by Medicaid and the Children’s Health Insurance Program.⁵
- AHRQ-funded researchers found that an intervention to implement evidence-based practices and reduce CLABSI rates (part of the Michigan Health and Hospital Association Keystone Center for Patient Safety and Quality Keystone ICU project) was successful at nearly eliminating CLABSIs in ICUs (the study included one pediatric ICU).⁶
- Efforts to decrease CLABSIs have been shown to be successful in pediatric populations as well. In one study that implemented a best-practice central line maintenance care bundle, CLABSI rates in hospitalized pediatric oncology patients decreased from 2.25 per 1,000 central line days at baseline to 0.81 per 1,000 central line days by the second 12 months of the intervention.⁷

Recommended Practice	Details of Recommended Practice
Central Line Insertion Checklist	A central line insertion checklist should be used to document that the insertion protocol was followed during insertion of a central line. The following elements, at a minimum, should be found on the checklist: Date, start time, end time, hands washed prior to insertion, sterile gloves, sterile gown, cap, mask for providers inserting and assisting with insertion, full-body sterile drape for patient, chlorhexidine skin prep, if not contraindicated (e.g., <2 months of age), insertion site, type of catheter used, circumstances for insertion, dressing type, followup chest x-ray complete, and provider inserting procedure note. ⁸⁻¹⁰
Site Selection	The upper or lower extremities (or the scalp in neonates or young infants) can be used as the catheter insertion site. ¹¹

Maximal Barrier Precautions and Skin Preparation	To prevent CLABSIs, providers must ⁸⁻¹¹ : <ul style="list-style-type: none"> • Wash hands before and after central line insertion. • Apply maximal barrier precautions. • Use chlorhexidine skin prep unless contraindicated.
Daily Monitoring, Assessment, and Line Access	All central lines should be assessed daily for need and removed promptly if the line is no longer needed for care of the patient. Central lines should also be assessed daily for the presence of infection and to ensure that the dressing is intact. ^{8,10,11} Disinfect hubs, needless connectors, and injection ports prior to use. ¹²

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key nurses, physicians and other providers, hospitalists, and pharmacists from infection control, intensive care, and inpatient units, including operating room; and representatives from quality improvement, radiology, and information services to develop time-sequenced guidelines, care paths, or protocols for the full continuum of care for placement and maintenance of central line catheters in children.

Recommended Practice: Central Line Insertion Checklist

- Develop insertion checklist:
 - The above team must develop the central line insertion checklist. The checklist should have all of the following⁸⁻¹⁰:
 - Date, start time, end time, hands washed prior to insertion, sterile gloves, sterile gown, cap, mask, full-body sterile drape, chlorhexidine skin prep unless contraindicated, insertion site, type of catheter, circumstances for insertion, dressing type, followup chest x-ray complete, person inserting, cart used, and procedure note.
 - A central line insertion cart should include all the components and equipment needed to insert a central line. The cart should be available on all units/areas where central lines are inserted and should be brought into the room. The central line cart, at a minimum, should include all of the following^{9,10}:
 - Supplies for maximal barrier precautions: sterile gloves, masks, sterile gowns, and caps for any provider inserting or assisting in the insertion of a central line. For the patient, a full-length sterile drape (if Pyxis is used, replenish cart and charge patient).
 - Chlorhexidine for skin prep, if not contraindicated.
 - Central venous catheter insertion kit.
 - Central venous catheters (triple lumens, Swan-Ganz catheters, peripherally inserted central catheters, umbilical catheters, etc.).

- Supplies to dress the catheter site (sterile, transparent, semipermeable dressings are preferred but if the site is bleeding or oozing or the patient is diaphoretic, a gauze dressing is preferred).
- Central line insertion checklist.
- Follow protocol for insertion.
 - The time-sequenced protocol includes the following for all insertions of central venous catheters:
 - Identify indications for catheter insertion and use. Patients must meet criteria for insertion, set by institution.⁹
 - Define competency criteria to identify staff eligible to insert central lines and remove central lines within the institution. These procedures should be done by a nurse, physician, or other health care professional who has received appropriate education to ensure that the proper procedures are followed.⁹
 - Start by first bringing the central line cart into the patient's room or within proximity of patient's room.
 - The clinician assisting the procedure starts with the checklist. The health care professional assisting with the insertion completes the checklist and is empowered to stop the procedure if the central line protocol is not followed.⁸
 - Obtain informed consent from patient and/or patient's caregiver(s) to insert the central line and put the consent in the medical record.
 - Educate the patient, if appropriate, and caregivers about CLABSIs.¹⁰
 - Ensure that the person inserting and anyone assisting wash their hands with antiseptic soap and water or use an alcohol-based hand rub prior to starting to prep the patient (the use of gloves does not obviate hand hygiene).¹⁰

Recommended Practice: Site Selection

- Select appropriate site for insertion of central line⁹⁻¹¹:
 - The upper or lower extremities or the scalp (in neonates or young infants) can be used as an insertion site.¹¹
 - The risks and benefits of a particular site must always be considered on an individual basis and clinician discretion should be used.
 - Providers (including any assistants) should wash their hands before and after palpating catheter insertion sites (palpation of the insertion site should not be performed after the application of antiseptic, unless performed with sterile gloves).

Recommended Practice: Maximal Barrier Precautions and Skin Preparation

- Prepare skin:
 - Prepare skin with chlorhexidine skin antiseptic, if not contraindicated, by first breaking the central core. Let the solution saturate the pad.
 - Apply with a back and forth motion for at least 30 seconds. Do not wipe or blot.⁸
 - Allow antiseptic solution to dry completely before puncturing the site.^{8,11}

- If patient is allergic to chlorhexidine or it is contraindicated, apply substitute antiseptic (tincture of iodine, an iodophor, or 70% alcohol can be used as a substitute).
 - For an umbilical insertion site, avoid tincture of iodine because of the potential effect on the neonatal thyroid. Other iodine-containing products (e.g., povidone iodine) can be used.¹¹
- Apply maximal barrier precautions.⁸⁻¹¹
 - The clinician and anyone assisting with insertion should wear a cap, mask, sterile gown, and sterile gloves.
 - The patient should be covered from head to toe with a sterile drape, leaving a small opening for the insertion site.
- Perform timeout to verify the patient ID x2, announce procedure to be performed, and verify that all medication and syringes are labeled.
- Clinician assisting is empowered to stop procedure if central line protocol is not followed.⁸
- Select appropriate catheter for insertion. Use the minimum number of ports or lumens essential for management of patient.
- Insert central line:
 - Consider placing central line via guided ultrasound if available.¹¹
 - Place caps on lumens.
 - Suture in place or use sutureless securement device.
- Dress central line insertion site with a sterile, transparent, semipermeable dressing to cover the catheter site. If the site is bleeding or oozing or the patient is diaphoretic, a gauze dressing is preferred. Consider use of a chlorhexidine-impregnated sponge dressing for patients >2 months old.^{9,11}
 - Date and time the dressing.
 - Do not routinely apply prophylactic topical antimicrobial or antiseptic ointment or cream to the insertion site of peripheral venous catheters.
- After inserting and dressing the catheter site, remove gown and gloves and then wash hands.
 - Confirm catheter placement via x-ray after placement.
 - Clinician inserting central line should complete progress note on checklist, sign, and put in chart.

Recommended Practice: Daily Monitoring, Assessment, and Line Access

- Review necessity of central line daily⁹⁻¹¹:
 - During multidisciplinary rounds, review necessity of line and record date and time of line placement. If the patient has a long-term CVC (tunneled or totally implantable), determine a timeframe to review necessity, such as weekly.

- Remove promptly if line is unnecessary.
- Remove umbilical catheters as soon as possible. Umbilical artery catheters should not stay in place for more than 5 days and umbilical venous catheters should not stay in place for more than 14 days.¹¹
- Inspect central line site daily for signs of infection.
- Do not replace catheters:
 - At scheduled time intervals.
 - Over a guide wire if the patient is suspected of having catheter-related infection.
- Remove and do not replace umbilical artery catheters if any signs of CLABSI, vascular insufficiency in the lower extremities, or thrombosis are present.¹¹
- Remove and do not replace umbilical venous catheters if any signs of CLABSI or thrombosis are present.
- Follow appropriate dressing assessment and replacement according to best practices specific to the age of the child, type of central line, and other patient-related factors, such as skin condition.
 - In younger pediatric patients, the risk of dislodging the catheter may outweigh the benefit of changing the dressing.¹¹
- Clean all injection ports with 70% alcohol or an iodophor before accessing the system. Also cap all stopcocks when not in use.¹²
- Ensure patency of central line by flushing after every central line use.
- When removing central lines, follow these steps:
 - Assess developmental status of the child to determine need for restraint or sedation.
 - Explain procedure to patient/caregiver (as appropriate).
 - Position patient.
 - Perform hand hygiene and put on clean gloves.
 - Remove the dressing and discard along with gloves.
 - Repeat hand hygiene and don sterile gloves.
 - Remove sutures.
 - Ask the patient to take a deep breath, hold it, and bear down (if applicable).
 - Pull the catheter slowly and gently while covering the site with sterile gauze to prevent air embolism. Stop if there is any resistance.
 - Once catheter is removed, hold pressure until bleeding stops and apply a sterile occlusive dressing.
 - Inspect the integrity of the central line to make sure it did not break off inside the vein.
- Establish standing order sets for inserting central lines, to include chest x-ray to confirm placement, type of dressing to be used, dressing changes, and daily monitoring. Mandate the use of these standing orders anytime a central line is placed.
- Assign responsibility for appropriate placement of standing orders on units (decisions based on accessibility via electronic medical record versus paper).

Educational Recommendation

- Plan and provide education on protocols and standing orders to physicians and other providers, nurses, and all other staff involved in inserting, maintaining, and accessing central lines (emergency department, intensive care unit, other medical units, ancillary departments, etc). Education should occur upon hire, annually, when this protocol is added to job responsibilities, and when new equipment is introduced in the organization.¹⁰
- Provide appropriate education to the caregivers of the pediatric patient on proper infection prevention techniques, such as appropriate hand washing. Caregivers should also be educated on how to care for the line (per hospital policy) if the child is to be discharged with a central line (e.g., Broviac, port-a-cath) in place.

Effectiveness of Action Items

- Track compliance with elements of established protocol steps by using insertion checklist, appropriate documentation, and other required procedures.¹⁰
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement.¹⁰
- Mandate that all personnel follow the central line protocol and develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physicians and other providers, nursing, and ancillary staff; senior medical staff; and executive leadership) on level of compliance with process.⁹
- Conduct surveillance and prevalence of bloodstream infections (using Centers for Disease Control and Prevention’s NHSN definitions) to evaluate outcomes of new process.^{9,13}
- Monitor and evaluate performance regularly to sustain improvements achieved.⁹

Additional Resources

Systems/Processes

- How-to Guide: Prevent Central Line-Associated Bloodstream Infections. Institute for Healthcare Improvement
<http://www.ihl.org/resources/pages/tools/howtoguidepreventcentrallineassociatedbloodstreaminfection.aspx>
- How-to Guide: Improving Hand Hygiene. Institute for Healthcare Improvement.
<http://www.ihl.org/knowledge/Pages/Tools/HowtoGuideImprovingHandHygiene.aspx>
- Guideline for Hand Hygiene in Health-Care Settings. Centers for Disease Control and Prevention
<http://www.cdc.gov/mmwr/PDF/rr/rr5116.pdf>
- Preventing Central Line–Associated Bloodstream Infections: A Global Challenge, a Global Perspective. Joint Commission Resources
http://www.jointcommission.org/assets/1/18/CLABSI_Monograph.pdf
- Central Line-Associated Bloodstream Infections (CLABSI). Johns Hopkins Medicine Department of Hospital Epidemiology and Infection Control
http://www.hopkinsmedicine.org/heic/infection_surveillance/clabsi.html
- CLABSI: Central Line-Associated Bloodstream Infection Prevention Toolkits & Resources. Armstrong Institute for Patient Safety and Quality
<https://armstrongresearch.hopkinsmedicine.org/csts/clabsi/resources.aspx>

Policies/Protocols

- Montana State Hospital Policy and Procedure – Handwashing
http://dphhs.mt.gov/Portals/85/amdd/documents/MSH/volumeii/infectioncontrol/handwashing_1.pdf
- Policy for the Care of Patient With Short Term Central Venous Catheter. Johns Hopkins Hospital
https://cdn.community360.net/app/jh/csts/clabsi/JHH_VAD_Appendix_F_Care_Shortterm_Cath.pdf
- Policies & Procedures. Central Venous Catheters Insertion – Assisting. Saskatoon Health Region
<https://www.saskatoonhealthregion.ca/about/NursingManual/1073.pdf>

Tools

- Central Line Insertion Care Team Checklist. Johns Hopkins Health System
https://cdn.community360.net/app/jh/csts/clabsi/JHH_VAD_Appendix_C_Central_Line_Checklist.pdf
- Reducing Central Venous Catheter-associated Bloodstream Infections, CHANGE PACKAGE. CHCA Clinical Improvement Collaborative
<http://iphi.nonprofitoffice.com/vertical/Sites/%7B00CFF503-04BE-4895-B1A4-FF765B2CE512%7D/uploads/%7BA8536386-10B4-4983-A868-57FD85E3D911%7D.PDF>

Staff Required

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

Equipment

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

Communication

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

Authority/Accountability

- Senior leadership mandating protocol for all providers⁸
- Providers inserting and assisting insertion of central lines held accountable for following protocol
- RN empowered to stop procedure⁷

References

1. Safe Practices for Better Healthcare—2010 Update. Washington, DC: National Quality Forum; 2010.
2. Miller M, Niedner M, Brill R, et al. Reducing PICU central line-associated bloodstream infections: 3-year results. *Pediatrics* 2011 Nov;128(5):e1077-83.
3. Goudie A, Dylan L, Brady PW, et al. Attributable cost and length of stay for central line-associated bloodstream infections. *Pediatrics* 2014 Jun;133(6):e1525-32.
4. Centers for Medicare & Medicaid Services. Hospital-Acquired Conditions (Present on Admission Indicator). http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/index.html?redirect=/hospitalacqcond/06_hospital-acquired_conditions.asp. Accessed May 17, 2016.
5. State Reporting of the Central Line-Associated Blood Stream Infection (CLABSI) Measure: Summary of Workgroup Findings and Recommendations. Children's Health Care Quality Measures Technical Assistance and Analytic Support Program, sponsored by the Centers for Medicare & Medicaid Services. May 2012. <http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Quality-of-Care/Downloads/CLABSI-Workgroup-Report.pdf>. Accessed May 17, 2016.
6. Pronovost P, Needham D, Berenholtz S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU. *New Engl J Med* 2006;355(26):2725-32.
7. Rinke M, Chen A, Miller M, et al. Implementation of a central line maintenance care bundle in hospitalized pediatric oncology patients. *Pediatrics* 2012 Oct;130(4):e996-e1004.
8. How-to Guide: Prevent Central Line-Associated Bloodstream Infection. Cambridge, MA: Institute for Healthcare Improvement; 2012. <http://www.ihc.org/resources/pages/tools/howtoguidepreventcentrallineassociatedbloodstreaminfection.aspx>. Accessed May 17, 2016.
9. Marschall J, Mermel L, Yokoe D, et al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals. *Infect Contr Hosp Epidemiol* 2008 Oct;29 Suppl 1:S22-S30.
10. The Joint Commission. 2016 National Patient Safety Goals. http://www.jointcommission.org/standards_information/npsgs.aspx. Accessed May 17, 2016.
11. O'Grady NP, Alexander M, Burns LA, et al. Guidelines for the prevention of intravascular catheter-related infections, 2011. Atlanta: Centers for Disease Control and Prevention; 2011. www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf. Accessed May 17, 2016.
12. Chopra V, Krein SL, Olmsted RN, et al. Prevention of central line-associated bloodstream infections: brief update review. In: Shekelle PG, Wachter RM, Pronovost PJ, et al. Making Health Care Safer II: An Updated Critical Analysis of the Evidence for Patient Safety Practices. Comparative Effectiveness Review No. 211. (Prepared by the Southern California RAND Evidence-based Practice Center under Contract No. 290-2007-10062-I.) Rockville, MD: Agency for Healthcare Research and Quality; March 2013. AHRQ Publication No. 13-E001-EF. p. 88-109. www.ahrq.gov/research/findings/evidence-based-reports/ptsafetyuptp.html. Accessed May 17, 2016.
13. Centers for Disease Control and Prevention's National Healthcare Safety Network. CDC/NHSN Surveillance Definitions for Specific Types of Infections. http://www.cdc.gov/nhsn/PDFs/pscManual/17pscNosInfDef_current.pdf. Accessed May 17, 2016.

Selected Best Practices and Suggestions for Improvement

NQI 03: Neonatal Blood Stream Infection

Why focus on neonatal blood stream infection (BSI)?

- Central line-associated bloodstream infection (CLABSI) rates are higher in children than in adults, particularly in neonates.¹ Newborn infants, and especially premature newborns, are more susceptible to bloodstream infections (BSIs) because of poor skin integrity, immature immune systems, repeated invasive procedures, exposure to many caregivers, and an environment conducive to abnormal microbial colonization.
- Between 2 percent and 10 percent of all babies admitted to the neonatal intensive care unit (NICU) experience at least one episode of BSI.²
- Low-birth-weight infants with BSIs are at increased risk for chronic lung disease, periventricular leukomalacia, necrotizing enterocolitis, severe retinopathy of prematurity, poor neurodevelopmental outcomes, prolonged hospitalization, and death.³
- The mortality of BSIs in neonates has been estimated to be as high as 21 percent.⁴
- BSIs in neonates lead to significantly increased length of stay and cost, with an increased average length of stay of 23 days⁵ and excess costs of \$25,090 or more.³
- Part of this cost is likely to be shouldered by hospitals, as the Centers for Medicare & Medicaid Services will not reimburse for CLABSI for Medicaid patients unless it is present on admission.⁶
- In addition, CLABSI (in NICUs and pediatric ICUs) is one of the core set of children’s health care quality measures for voluntary public reporting by Medicaid and the Children’s Health Insurance Program.⁷
- AHRQ-funded researchers found that an intervention to implement evidence-based practices and reduce CLABSI rates (part of the Michigan Health and Hospital Association Keystone Center for Patient Safety and Quality Keystone ICU project) was successful at nearly eliminating CLABSIs in ICUs (the study included one pediatric ICU).⁸
- Studies have also shown that it is possible to reduce neonatal CLABSI rates with hospital-based interventions.^{9,10}

Recommended Practice	Details of Recommended Practice
Assess Neonatal Patients for Risk Factors	Identify the risk factors that are most common among neonates for bloodstream infection and screen patients using these criteria.
Implement Standard Infection Prevention Techniques To Prevent Neonatal Bloodstream Infections	General infection prevention practices, such as hand hygiene, along with appropriate line care may help decrease the incidence of neonatal bloodstream infections.
Prevent Early-Onset Group B Strep Bacteria	Screen all pregnant women between 35 and 37 weeks and administer antibiotics during labor for those who test positive.
Site Selection	The upper or lower extremities (or the scalp in neonates or young infants) can be used as the catheter insertion site. ¹¹

Maximal Barrier Precautions and Skin Preparation	<p>To prevent CLABSIs, providers must¹¹⁻¹⁴:</p> <ul style="list-style-type: none"> • Wash hands before and after central line insertion. • Apply maximal barrier precautions. <p>Use chlorhexidine skin prep unless contraindicated.</p>
Daily Monitoring, Assessment, and Line Access	<p>All central lines should be assessed daily for need and removed promptly if the line is no longer needed for care of the patient. Central lines should also be assessed daily for the presence of infection and to ensure that the dressing is intact.^{11,12,14}</p> <p>Disinfect hubs, needless connectors, and injection ports prior to use.¹⁵</p>

Best Processes/Systems of Care

Introduction: Essential First Steps

- Engage key procedural personnel, including nurses, physicians and other providers, technicians, and representatives from the quality improvement department, to develop evidence-based protocols for care of the neonatal patient population.
- The above team:
 - Identifies the purpose, goals, and scope and defines the target population for this guideline.
 - Analyzes problems with guideline compliance, identifies opportunities for improvement, and communicates best practices to frontline teams.
 - Establishes measures to indicate if changes are leading to improvement, identifies process and outcome metrics, and tracks performance using these metrics based on a standard performance improvement methodology (e.g., FOCUS-PDSA).
 - Determines appropriate facility resources for effective and permanent adoption of practices.

Recommended Practice: Assess neonatal patients for risk factors

- Assess all neonatal NICU patients for BSI. Risk factors for neonatal BSI include²⁻⁵:
 - Gestational age at birth <32 weeks or birth weight \leq 1,500 g
 - Low Apgar scores (i.e., \leq 7 at 1 minute)
 - Presence of specific comorbidities (e.g., respiratory distress syndrome, bronchopulmonary dysphasia)
 - History of maternal premature rupture of membranes
 - Necrotizing enterocolitis
 - Mechanical ventilation
 - Central venous catheter (including umbilical catheters)
 - High NICU space and staffing ratios
 - Transfer from an outside hospital

Recommended Practice: Implement standard infection prevention techniques to prevent neonatal bloodstream infections

- Implement general infection prevention practices:
 - General infection prevention practices, such as hand hygiene and appropriate glove use, along with appropriate line care may help decrease the incidence of neonatal BSIs.^{3, 4}
 - Although there is limited evidence that shows hand hygiene directly leads to a statistically significant reduction in BSI rates, it still remains an important foundation in infection prevention techniques.
 - Implement and continually monitor and educate staff on the importance and proper techniques of hand hygiene.
- Develop insertion checklist:
 - The multidisciplinary team defined in the introduction section must develop the central line insertion checklist. The checklist should have all of the following¹²⁻¹⁴:
 - Date, start time, end time, hands washed prior to insertion, sterile gloves, sterile gown, cap, mask, full-body sterile drape, chlorhexidine skin prep unless contraindicated, insertion site, type of catheter, circumstances for insertion, dressing type, followup chest x-ray complete, person inserting, cart used, and procedure note.
 - A central line insertion cart should include all the components and equipment needed to insert a central line. The cart should be available on all units/areas where central lines are inserted and should be brought into the room. The central line cart, at a minimum, should include all of the following^{13,14}:
 - Supplies for maximal barrier precautions: sterile gloves, masks, sterile gowns, and caps for any provider inserting or assisting in the insertion of a central line. For the patient, a full-length sterile drape. (if Pyxis is used, replenish cart and charge patient).
 - Chlorhexidine for skin prep, if not contraindicated.
 - Central venous catheter insertion kit.
 - Central venous catheters (triple lumens, Swan-Ganz catheters, peripherally inserted central catheters, umbilical catheters, etc.).
 - Supplies to dress the catheter site (sterile, transparent, semipermeable dressings are preferred but if the site is bleeding or oozing or the patient is diaphoretic, a gauze dressing is preferred).
 - Central line insertion checklist.
- Follow protocol for insertion:
 - The time-sequenced protocol includes the following for all insertions of central venous catheters:
 - Identify indications for catheter insertion and use. Patients must meet criteria for insertion, set by institution.¹²

- Define competency criteria to identify staff eligible to insert central lines and remove central lines within the institution. These procedures should be done by a nurse, physician, or other health care professional who has received appropriate education to ensure that the proper procedures are followed.¹³
- Start by first bringing the central line cart into the patient's room or within proximity of patient's room.
- The clinician assisting the procedure starts with the checklist. The health care professional assisting with the insertion completes the checklist and is empowered to stop the procedure if the central line protocol is not followed.¹²
- Obtain informed consent from patient and/or patient's caregiver(s) to insert the central line and put the consent in the medical record.
- Educate the patient, if appropriate, and caregivers about CLABSIs.¹³
- Ensure that the person inserting and anyone assisting wash their hands with antiseptic soap and water or use an alcohol-based hand rub prior to starting to prep the patient (the use of gloves does not obviate hand hygiene).¹⁴

Recommended Practice: Site Selection

- Select appropriate site for insertion of central line^{11,13,14}:
 - The upper or lower extremities or the scalp (in neonates or young infants) can be used as an insertion site.¹¹
 - The risks and benefits of a particular site must always be considered on an individual basis and clinician discretion should be used.
 - Providers (including any assistants) should wash their hands before and after palpating catheter insertion sites (palpation of the insertion site should not be performed after the application of antiseptic, unless performed with sterile gloves).

Recommended Practice: Maximal Barrier Precautions and Skin Preparation

- Prepare skin:
 - Prepare skin with chlorhexidine skin antiseptic, if not contraindicated, by first breaking the central core. Let the solution saturate the pad.
 - Apply with a back and forth motion for at least 30 seconds. Do not wipe or blot.¹²
 - Allow antiseptic solution to dry completely before puncturing the site.^{11,12}
 - If patient is allergic to chlorhexidine or contraindicated, apply substitute antiseptic (tincture of iodine, an iodophor, or 70% alcohol can be used as a substitute).
 - For an umbilical insertion site, avoid tincture of iodine because of the potential effect on the neonatal thyroid. Other iodine-containing products (e.g., povidone iodine) can be used.¹¹
 - Apply maximal barrier precautions.¹¹⁻¹⁴
 - The clinician and anyone assisting with insertion should wear a cap, mask, sterile gown, and sterile gloves.
 - The patient should be covered from head to toe with a sterile drape, leaving a small opening for the insertion site.

- Perform time-out to verify the patient ID x2, announce procedure to be performed, and verify that all medication and syringes are labeled.
- Clinician assisting is empowered to stop procedure if central line protocol is not followed.¹¹
- Select appropriate catheter for insertion. Use the minimum number of ports or lumens essential for management of patient.
- Insert central line:
 - Consider placing central line via guided ultrasound if available.¹¹
 - Place caps on lumens.
 - Suture in place or use sutureless securement device.
- Dress central line insertion site with a sterile, transparent, semipermeable dressing to cover the catheter site. If the site is bleeding or oozing or the patient is diaphoretic, a gauze dressing is preferred. Consider use of a chlorhexidine-impregnated sponge dressing for patients > 2 months old.^{11,13}
 - Date and time the dressing.
 - Do not routinely apply prophylactic topical antimicrobial or antiseptic ointment or cream to the insertion site of peripheral venous catheters.
- After inserting and dressing the catheter site, remove gown and gloves and then wash hands.
 - Confirm catheter placement via x-ray after placement.
 - Clinician inserting central line should complete progress note on checklist, sign, and put in chart.

Recommended Practice: Daily Monitoring, Assessment, and Line Access

- Review necessity of central line daily:¹¹⁻¹³
 - During multidisciplinary rounds, review necessity of line and record date and time of line placement. If the patient has a long-term CVC (tunneled or totally implantable), determine a timeframe to review necessity, such as weekly.
 - Remove promptly if line is unnecessary. Ideally, umbilical artery catheters should not stay in place for more than 5 days and umbilical venous catheters for more than 14 days.¹¹
 - Inspect central line site daily for signs of infection.
 - Do not replace catheters:
 - At scheduled time intervals.
 - Over a guide wire if the patient is suspected of having catheter-related infection.
 - Remove and do not replace umbilical artery catheters if any signs of Catheter-Related Bloodstream Infection (CRBSI), vascular insufficiency in the lower extremities, or thrombosis are present.¹¹

- Remove and do not replace umbilical venous catheters if any signs of CRBSI or thrombosis are present.
- Follow appropriate dressing assessment and replacement according to best practices specific to the age of the child, type of central line, and other patient-related factors, such as skin condition.
 - In younger pediatric patients, the risk of dislodging the catheter may outweigh the benefit of changing the dressing.¹¹
- Clean all injection ports with 70% alcohol or an iodophor before accessing the system. Also cap all stopcocks when not in use.
- Ensure patency of central line by flushing after every central line use.
- When removing central lines, follow these steps:
 - Assess developmental status of the child to determine need for restraint or sedation
 - Explain procedure to patient/caregiver (as appropriate)
 - Position patient.
 - Perform hand hygiene and put on clean gloves.
 - Remove the dressing and discard along with gloves.
 - Repeat hand hygiene and don sterile gloves.
 - Remove sutures.
 - Ask the patient to take a deep breath, hold it, and bear down (if applicable).
 - Pull the catheter slowly and gently while covering the site with sterile gauze to prevent air embolism. Stop if there is any resistance.
 - Once catheter is removed, hold pressure until bleeding stops and apply a sterile occlusive dressing.
 - Inspect the integrity of the central line to make sure it did not break off inside the vein.
- Establish standing order sets for inserting central lines, to include chest x-ray to confirm placement, type of dressing to be used, dressing changes, and daily monitoring. Mandate the use of these standing orders anytime a central line is placed.
- Assign responsibility for appropriate placement of standing orders on units (decisions based on accessibility via electronic medical record versus paper).

Recommended Practice: Prevent early-onset Group B Strep (GBS) disease

- Screen pregnant women with vaginal-rectal screening for GBS colonization at 35-37 weeks.¹⁶
- Give intrapartum antibiotic prophylaxis for¹⁶:
 - Women who delivered a previous infant with GBS disease.
 - Women with GBS bacteriuria in the current pregnancy.
 - Women with a GBS-positive screening result in the current pregnancy.
 - Women with unknown GBS status who deliver at less than 37 weeks' gestation, have an intrapartum temperature of 100.4° F or greater, or have rupture of membranes for 18 hours or longer.

- Penicillin remains the preferred agent, with ampicillin an acceptable alternative.¹⁶

Educational Recommendation

- Plan and provide education on protocols to physicians and other providers, nursing, and all other staff involved in procedural cases. Education should occur upon hire, annually, and when this protocol is added to job responsibilities.⁴

Effectiveness of Action Items

- Track compliance with elements of established protocol by using checklists, appropriate documentation, etc.
- Evaluate effectiveness of new processes, determine gaps, modify processes as needed, and reimplement practices.
- Mandate that all personnel follow the safety protocols developed by the team to prevent BSI and develop a plan of action for staff in noncompliance.
- Provide feedback to all stakeholders (physicians and other providers, nursing, and ancillary staff; senior medical staff; and executive leadership) on the level of compliance with process.⁴
- Conduct surveillance and determine prevalence to evaluate outcomes of new process.
- Monitor and evaluate performance regularly to sustain improvements achieved.⁴

Additional Resources

Systems/Processes

- CDC Group B Strep Web site
<http://www.cdc.gov/groupbstrep/about/index.html>

Policies/Protocols

- Montana State Hospital Policy and Procedure-Handwashing
http://dphhs.mt.gov/Portals/85/amdd/documents/MSH/volumeii/infectioncontrol/handwashing_1.pdf
- Policy for the Care of Patient With Short Term Central Venous Catheter. Johns Hopkins Hospital
https://cdn.community360.net/app/jh/csts/elabsi/JHH_VAD_Appendix_F_Care_Shortterm_Cath.pdf
- Policies & Procedures. Central Venous Catheters Insertion – Assisting. Saskatoon Health Region
<https://www.saskatoonhealthregion.ca/about/NursingManual/1073.pdf>

Tools

- Central Line Insertion Care Team Checklist. Johns Hopkins Health System
https://cdn.community360.net/app/jh/csts/elabsi/JHH_VAD_Appendix_C_Central_Line_Checklist.pdf
- Reducing Central Venous Catheter-associated Bloodstream Infections, CHANGE PACKAGE. CHCA Clinical Improvement Collaborative

<http://iphi.nonprofitoffice.com/vertical/Sites/%7B00CFF503-04BE-4895-B1A4-FF765B2CE512%7D/uploads/%7BA8536386-10B4-4983-A868-57FD85E3D911%7D.PDF>

Staff Required

- Physicians and other providers (in neonatology, pediatrics, infectious diseases)
- NICU registered nurses
- Laboratory staff

Equipment

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

Communication

- Education on policy/protocol of monitoring and treatment of BSIs

Authority/Accountability

- Senior leaders such as chief/chairs of surgery and medicine, nursing leadership, and unit managers

References

1. The Joint Commission. CLABSI Toolkit – Preventing Central-Line Associated Bloodstream Infections: Useful Tools, An International Perspective. http://www.jointcommission.org/topics/clabsi_toolkit.aspx. Accessed May 17, 2016.
2. Leighton P, Cortina-Borja M, Millar M, et al. A toolkit for monitoring hospital-acquired bloodstream infection in neonatal intensive care. *Infect Contr Hosp Epidemiol* 2012;33(8):831-6.
3. Helder O, van den Hoogen A, de Boer C, et al. Effectiveness of non-pharmacological interventions for the prevention of bloodstream infections in infants admitted to a neonatal intensive care unit: a systematic review. *Int J Nurs Stud* 2013;50(6):819-31.
4. Apostolopoulou E, Lambridou M, Lambadaridis I. Infection control. Nosocomial bloodstream infections in a neonatal intensive care unit. *Br J Nurs* 2004;13(13):806.
5. Verstraete E, Boelens J, Blot S, et al. Healthcare-associated bloodstream infections in a neonatal intensive care unit over a 20-year period (1992-2011): trends in incidence, pathogens, and mortality. *Infect Contr Hosp Epidemiol* 2014;35(5):511-8.
6. Centers for Medicare & Medicaid Services. Hospital-Acquired Conditions (Present on Admission Indicator). http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/index.html?redirect=/hospitalacqcond/06_hospital-acquired_conditions.asp. Accessed May 17, 2016.
7. State Reporting of the Central Line-Associated Blood Stream Infection (CLABSI) Measure: Summary of Workgroup Findings and Recommendations. Children’s Health Care Quality Measures Technical Assistance and Analytic Support Program, sponsored by the Centers for Medicare & Medicaid Services. May 2012. <http://www.medicare.gov/Medicare-CHIP->

[Program-Information/By-Topics/Quality-of-Care/Downloads/CLABSI-Workgroup-Report.pdf](#). Accessed May 17, 2016.

8. Pronovost P, Needham D, Berenholtz S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU. *New Engl J Med* 2006;355(26):2725-32.
9. Wirtschafter DD, Pettit J, Kurtin P, et al. A statewide quality improvement collaborative to reduce neonatal central line-associated blood stream infections. *J Perinatolog* 2009;30(3):170-81.
10. Bizzarro MJ, Noonan M, Bonfiglio MP, et al., and Central Venous Catheter Initiative Committee. A quality improvement initiative to reduce central line-associated bloodstream infections in a neonatal intensive care unit. *Infect Contr Hosp Epidemiol* 2010;31(3):241-8.
11. O’Grady NP, Alexander M, Burns LA, et al. Guidelines for the prevention of intravascular catheter-related infections, 2011. Atlanta, GA: Centers for Disease Control and Prevention; 2011. www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf. Accessed May 17, 2016.
12. How-to Guide: Prevent Central Line-Associated Bloodstream Infections. Cambridge, MA: Institute for Healthcare Improvement; 2012. <http://www.ihl.org/resources/pages/tools/howtoguidepreventcentrallineassociatedbloodstreaminfection.aspx>. Accessed May 17, 2016.
13. Marschall J, Mermel L, Yokoe D, et al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals. *Infect Contr Hosp Epidemiol* 2008 Oct;29 Suppl 1:S22-S30.
14. Hospital: 2016 National Patient Safety Goals. Oakbrook Terrace, IL: The Joint Commission; 2016. http://www.jointcommission.org/standards_information/npsgs.aspx. Accessed May 17, 2016.
15. Chopra V, Krein SL, Olmsted RN, et al. Prevention of central line-associated bloodstream infections: brief update review. In: Shekelle PG, Wachter RM, Pronovost PJ, et al. Making Health Care Safer II: An Updated Critical Analysis of the Evidence for Patient Safety Practices. Comparative Effectiveness Review No. 211. (Prepared by the Southern California RAND Evidence-based Practice Center under Contract No. 290-2007-10062-I.) Rockville, MD: Agency for Healthcare Research and Quality; March 2013. AHRQ Publication No. 13-E001-EF. p. 88-109. www.ahrq.gov/research/findings/evidence-based-reports/ptsafetyuptp.html. Accessed May 17, 2016.
16. Group B Strep, Overview of 2010 Guidelines. Centers for Disease Control and Prevention Web site. <http://www.cdc.gov/groupbstrep/guidelines/new-differences.html>. Accessed May 17, 2016.

Gap Analysis

What is the purpose of this tool? The purpose of the gap analysis is to provide project teams with a format in which to do the following:

- Compare the best practices with the processes currently in place in your organization.
- Determine the “gaps” between your organization’s practices and the identified best practices.
- Select the best practices you will implement in your organization.

Who are the target audiences? The project liaison will be the primary individual to prepare this written gap analysis, but the entire improvement project team should be engaged in performing the gap analysis.

How can the tool help you? Upon completion of the gap analysis, project teams will have the following:

- An understanding of the differences between current practices and best practice.
- An assessment of the barriers that need to be addressed before successful implementation of best practices.

How does this tool relate to others? Information from the *Self-Assessment* (Tool A.3) about the readiness of the hospital to perform quality improvement for the Quality Indicators can be considered in the gap analysis as possible strengths or weaknesses (i.e., barriers) to be managed when implementing improvements. The best practice elements defined in the *Selected Best Practices and Suggestions for Improvement* (Tool D.4) are prefilled in the gap analysis tool. This provides the elements for the *Implementation Plan* (Tool D.6).

Instructions

1. List the expected evidence-based best practice in the header row (shaded in light gray). Replace the red text with the description of your best practice(s).
2. In Column 1, list all the steps associated with the best practice process.
3. In Column 2, document your organization’s practices and describe how they differ from each best practice element. Be specific and include information such as policies, protocols, guidelines, and staffing.
4. In Column 3, identify barriers that may hinder successful implementation of each best practice strategy. Consider systems, procedures, policies, people, equipment, etc.
5. In Column 4, indicate whether your organization will implement the best practice strategy. If not, explain why.
6. Repeat steps 2-4 for each best practice, adding rows as needed.

Gap Analysis Tool

Project:

Quality Indicator:

Individual Completing This Form:

Column 1

Column 2

Column 3

Column 4

Best Practice Strategies	How Your Practices Differ From Best Practice	Barriers to Best Practice Implementation	Will Implement Best Practice (Yes/No; why not?)
Best Practice #1: <i>[insert description of best practice here]</i>			
Best Practice #2: <i>[insert description of best practice here]</i>			

Best Practice #3: <i>[insert description of best practice here]</i>			

Implementation Plan

What is the purpose of this tool? The purpose of the implementation plan is to provide a format in which to:

- Define the tasks/actions required to implement each selected best practice.
- Develop a communication/training and implementation plan.
- Set a timeframe and target dates for the completion of tasks/actions and communication/training.

Who are the target audiences? The project liaison will be the primary individual to complete this implementation plan, but the document should be used as a working document by the entire improvement project team.

How can the tool help you? Upon completion of the implementation plan, the project team will have a customized project plan that will guide activities through established timeline to completion of implementation.

How does this tool relate to others? This tool should be used with the other tools found in the Implementing Improvements section of the toolkit (section D).

Instructions

1. In the header row (shaded in light gray), list the best practice your organization will implement, as identified in the Gap Analysis (Tool D.5). Replace the red text with the description of your best practice(s).
2. In Column 1, list the detailed tasks/actions for each best practice.
3. In Column 2, assign responsibility to team members for the completion of each detailed task/action.
4. In Column 3, replace the red text with target implementation start dates.
5. In Column 4, determine whether communication/training is required for each task. If so, replace the red text with target dates of communication/training in column 5. Once the communication/training is complete, check off the completion boxes.
6. In Column 6, replace the red text with the actual implementation start date. Once the implementation is complete, check off the completion boxes.
7. Repeat steps 1-6 for each best practice, adding rows as needed.
8. Review the implementation plan at each team meeting. If target dates are not met, determine the cause and revise the implementation plan. Ultimately, the project's executive liaison will be responsible to ensure that the team has the adequate resources to complete tasks and that the team stays on track with task deadlines.

Note: Brainstorming with team members can be helpful for generating the detailed task/action list.

It is essential to consider several categories of key tasks when generating a list of detailed tasks/actions. Consider these key task categories:

- Design/Customization of Best Practice
- Policy/Protocol Development
- Tools (documentation, forms, etc.)
- Staffing/Resources
- Equipment/Materials
- Education/Training
- Performance Evaluation

Consider the following example: If the team identifies “educate staff” as a necessary key task, the detailed tasks/actions may include developing the education inservice, developing the handouts, identifying staff members who require education, and notifying staff of the inservice dates.

Implementation Plan

Project:

Quality Indicator:

Individual completing this form:

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Detailed Tasks/Actions Associated With Implementation of Best Practice	Team Members Assigned to Each Task	Target Implementation Start Date	Communication and/or Training Required? Yes/No	Communication and/or Training Scheduled Dates	Actual Implementation Start Date
Selected Best Practice #1 Identified in Gap Analysis: <i>[insert description of best practice here]</i>					
		<i>MM/DD/YY</i>		<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No	<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No
		<i>MM/DD/YY</i>		<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No	<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No
		<i>MM/DD/YY</i>		<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No	<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Detailed Tasks/Actions Associated With Implementation of Best Practice	Team Members Assigned to Each Task	Target Implementation Start Date	Communication and/or Training Required? Yes/No	Communication and/or Training Scheduled Dates	Actual Implementation Start Date
Selected Best Practice #2 Identified in Gap Analysis: <i>[insert description of best practice here]</i>					
		<i>MM/DD/YY</i>		<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No	<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No
		<i>MM/DD/YY</i>		<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No	<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No
		<i>MM/DD/YY</i>		<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No	<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Detailed Tasks/Actions Associated With Implementation of Best Practice	Team Members Assigned to Each Task	Target Implementation Start Date	Communication and/or Training Required? Yes/No	Communication and/or Training Scheduled Dates	Actual Implementation Start Date
Selected Best Practice #3 Identified in Gap Analysis: <i>[insert description of best practice here]</i>					
		<i>MM/DD/YY</i>		<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No	<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No
		<i>MM/DD/YY</i>		<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No	<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No
		<i>MM/DD/YY</i>		<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No	<i>MM/DD/YY</i> Complete? <input type="checkbox"/> Yes <input type="checkbox"/> No

Implementation Measurement

What is the purpose of this tool? The purpose of the implementation measurement tool is to provide a format in which you can determine if best practice processes are successful in your organization. The tool provides general guidance on implementation measurement, as well as an example of an implementation measurement instrument that could be adapted for use at your hospital (using catheter-related bloodstream infections as an example).

Who are the target audiences? The tool is intended for use by the quality improvement team to assess adherence to implemented practices.

How can the tool help you? The implementation measurement tool will help you develop an approach to determine whether selected best practices have been implemented and if your team needs to change any practices. As part of the Plan-Do-Study-Act (PDSA) cycle, studying your results will help your team determine if best practices are successfully implemented. Without studying the process of change implementation, your team cannot determine why an implementation is successful or why it is not.

How does this tool relate to others? This tool should be used with the other tools found in the Implementing Improvements section of the toolkit (section D). In particular, the tool will reference the Implementation Plan (Tool D.6)

Approach to Implementation Measurement

Best practices may not be consistently performed over time and across all relevant units of the hospital, so implementation measurement is important to assess the extent to which interventions are implemented as planned. To ensure feasibility, the instrument could be used for only a subset of cases. For example, if thinking about catheter-related bloodstream infections, you could collect data on all central lines placed during a defined measurement period (e.g., 1 week) to assess implementation progress against plans. Collecting a greater amount of data on implementation will improve your accuracy in understanding the implementation of your project but will also cost more in terms of time and resources.

Implementation measurement is an important complement to outcome measurement. Outcome measurement tells you whether the quality improvement project is achieving the desired results, but not why or why not. Implementation measurement provides information about why the quality improvement project is or is not achieving those results.

Implementation measurement should be tailored to the Implementation Plan (Tool D.6). For each task/action associated with best practices that was specified in the plan, develop one or more measures to assess the extent to which the task/action is regularly being performed.

Example of Implementation Measurement

In the example below, let's assume you decided to focus on improving performance on catheter-related bloodstream infections and that your implementation plan (from Tool D.6) included tasks/actions related to the following best practices:

- (1) Follow Protocol for Insertion
- (2) Site Selection
- (3) Maximal Barrier Precautions and Skin Preparation
- (4) Daily Monitoring and Assessment

Once you have generated a list of all the activities your hospital implemented related to the above best practices, identify implementation measures for each activity. For example, for "(1) Follow Protocol for Insertion," you might want to determine adherence to several specific measures, such as use of a central line checklist and a timeout prior to insertion (see example document below), on all cases or a subset of cases. In the example below, each of the four best practices is captured by a number of questions that would allow you to measure the implementation of the best practice:

- (1) Follow Protocol for Insertion: questions A3, A4, A5, A9, A10, A11
- (2) Site Selection: question A8
- (3) Maximal Barrier Precautions and Skin Preparation: questions A6, A7
- (4) Daily Monitoring and Assessment: question B1

Once you have gathered data using an instrument such as in the example below, results may be reviewed, interpreted, and discussed. If adherence to implementation measures is high and your outcomes have also improved, you can move on to monitoring progress so that you can sustain

improvements (using tool E.1 for guidance). However, if your performance falls short on one or more implementation measures, you may want to consider restarting the PDSA cycle, particularly if your outcomes are not improving as expected.

EXAMPLE: Catheter-Related Bloodstream Infection Prevention Measurement Instrument

A. Central Line Insertion

1. Unique identifier: _____
2. Line insertion date:
Date of line insertion: __/__/____ (mm/dd/yyyy) Unknown/not documented
3. Is there documentation that a central line insertion cart was used for insertion?
 Yes
 No/unknown
 Not tracking
4. Is there documentation that consent was obtained prior to insertion?
 Yes
 No/unknown
 Not tracking
5. Is there documentation that a timeout was performed prior to insertion?
 Yes
 No/unknown
 Not tracking
6. Is there documentation in the medical record that any of the following sterile precautions were used during insertion of the central line? **(Check all that apply.)**
 Hand washing before procedure by person inserting and person assisting in inserting the line
 Sterile gloves worn by person inserting and person assisting in inserting the line
 Sterile gown worn by person inserting and person assisting in inserting the line
 Cap worn by person inserting and person assisting in inserting the line
 Mask worn by person inserting and person assisting in inserting the line
 Full body drape to cover the patient
 Use of sterile precautions/technique without specific interventions documented
 None of the above/unknown
 Not tracking
7. Indicate which of the following skin prep was used for central line insertion:
 Chlorhexidine (skip to question 8) Skin hygiene documented, agent unknown
 Betadine (iodine) Other (specify) _____
 Alcohol None of the above/unknown
 Not tracking (skip to question 8)
- 7a. Indicate reason chlorhexidine was not used:
 Patient allergy to chlorhexidine
 Other (specify) _____
 No reason indicated

8. Site of insertion: **(check one)**

- | | |
|--|--|
| <input type="checkbox"/> Subclavian (skip to question 9) | <input type="checkbox"/> Unknown/undocumented |
| <input type="checkbox"/> Internal jugular | <input type="checkbox"/> Other (specify) _____ |
| <input type="checkbox"/> Femoral | <input type="checkbox"/> Not tracking (skip to question 9) |

8a. Indicate reason subclavian not used:

- Provider discretion
 Other (specify) _____
 No reason indicated

9. Indicate which type of dressing was used: **(check one)**

- Transparent (skip to question 10)
 Gauze
 Other (specify) _____
 None of the above/unknown
 Not tracking (skip to question 10)

9a. Indicate reason a transparent dressing was not used:

- Site oozing/bleeding
 Patient diaphoretic
 Other (specify) _____
 No reason indicated

10. Is there documentation of a followup x-ray completed to verify placement?

- Yes
 No/unknown
 Not tracking

11. Is there documentation of a central line insertion checklist used for insertion?

- Yes
 No/unknown
 Not tracking

B. Central Line Days

1. Indicate if the central line was assessed for need and the central line site was inspected everyday for up to 5 days after insertion:

Day	Date				
1	__/__/__	<input type="checkbox"/> No central line present	<input type="checkbox"/> Assessment of need	<input type="checkbox"/> Site inspected	<input type="checkbox"/> Neither
2	__/__/__	<input type="checkbox"/> No central line present	<input type="checkbox"/> Assessment of need	<input type="checkbox"/> Site inspected	<input type="checkbox"/> Neither
3	__/__/__	<input type="checkbox"/> No central line present	<input type="checkbox"/> Assessment of need	<input type="checkbox"/> Site inspected	<input type="checkbox"/> Neither
4	__/__/__	<input type="checkbox"/> No central line present	<input type="checkbox"/> Assessment of need	<input type="checkbox"/> Site inspected	<input type="checkbox"/> Neither
5	__/__/__	<input type="checkbox"/> No central line present	<input type="checkbox"/> Assessment of need	<input type="checkbox"/> Site inspected	<input type="checkbox"/> Neither

Catheter-Related Bloodstream Infection Prevention Measurement: Description of Each Data Element

Section A

- A.1. Create a unique number that can be used to track your cases. This unique identifier will relate to the insertion of a central line, not a patient.
- A.3. Indicate if the cart was pulled into the room or brought within close proximity of the room for use. This information may be found on an insertion checklist.
- A.5. "The purpose of the time-out is to conduct a final assessment that the correct patient, site, and procedure are identified. During a time-out, activities are suspended to the extent possible so that team members can focus on active confirmation of the patient, site, and procedure. A designated member of the team initiates the time-out and it includes active communication among all relevant members of the procedure team. The procedure is not started until all questions or concerns are resolved." (Excerpted from Joint Commission National Patient Safety Goals Effective January 1, 2016. Available at: http://www.jointcommission.org/assets/1/6/2016_NPSG_HAP.pdf)
- A.6. This information could be found on an insertion checklist in the medical record. Indicate which sterile technique precautions were used by the provider inserting the catheter and the person assisting in insertion. If specific sterile precautions were not documented, but a general statement indicates that precautions were used, then check "Use of sterile precautions/technique without specific interventions documented."
- A.7. This information should be available on an insertion record. If no documentation can be found of skin antisepsis used during insertion, indicate "none of the above." If "chlorhexidine" or "not tracking" is answered, skip question A7a. If you choose "Other," you must specify why (e.g., age of patient).
- A.7a. Only answer this question if "chlorhexidine" was NOT answered for question A.7. Indicate the reason chlorhexidine was not used. If you choose "Other," you must specify why.
- A.8. Choose the site of entry for the central line. If you choose "Other," you must specify a location that is not available in the above list. Do not select "Other" if an existing category applies. If "subclavian" or "not tracking" is answered, then do not answer question A8a.
- A.8a. Only answer this question if "subclavian" or "not tracking" was NOT answered for question A.8. Indicate the reason the subclavian site was not chosen for insertion. If you choose "Other," you must specify why. If "provider discretion" is chosen, there must be documentation in the medical record. There must be documentation in the medical record as to reasons for selecting a specific vessel.
- A.9. Indicate what type of dressing was used to cover the central line site. If "Other" is checked, specify an answer.
- A.9a. Only answer this question if "transparent" or "not tracking" was NOT answered for question A.9. Indicate the reason a transparent dressing was not used. If you choose "Other," you must specify why.
- A.10. For each central line insertion, indicate if an x-ray was done to verify placement before central line use.
- A.11. For each central line insertion, indicate if the central line checklist was used during the procedure. The checklist can be found in the medical record. It is also acceptable if the checklist is saved for quality purposes.

Section B

- B.1. For this question, indicate if there is documentation of assessment of central line need and if the central line site was assessed. Day 1 will refer to the day after the central line was inserted. The date entered for "Day 1" in the question should be one day after the date entered in question A2. If the central line was discontinued anytime after insertion, then indicate "no central line present" in the appropriate box.

Project Evaluation and Debriefing

What is the purpose of this tool? The purpose of the project evaluation is to:

- Identify factors that contributed to the team's success.
- Identify factors that hindered the team's success.
- Identify additional clinical areas in the organization where the best practice can be implemented.
- Identify any followup work that may be needed.
- Determine how the results of the project will be communicated.

Who are the target audiences? The project liaison will be the primary individual to work with this evaluation and debriefing tool, but it also should be used by the entire improvement project team.

How can the tool help you? Upon completion of the project evaluation, project teams will accomplish:

- Project closure.
- Recognition of lessons learned.
- Plans for future activities (if applicable).

How does this tool relate to others? This tool is used to evaluate the effectiveness of the D tools for implementing performance improvements, as well as other aspects of the hospital's initiative.

Instructions

1. Indicate whether goals set for each best practice on the project charter were successfully implemented.
2. List factors that helped and hindered the team's success.
3. Determine if the best practices will be implemented in other units, clinics, or programs. If yes, describe in the space provided the plans for further implementation.
4. Check the appropriate box to indicate whether additional followup activities need to be completed. If yes, describe the followup work in the space provided.
5. Determine whether internal and external communication plans need to be developed. If yes, describe in the space provided how the results of the project will be communicated within the organization and to external stakeholders

Performance Improvement Project Evaluation

Project: _____ Performance Opportunity: _____

Institution: _____ Individual Completing This Form: _____

1. BEST PRACTICES IMPLEMENTED

- | | | |
|----------|----------------|--|
| a. _____ | Goal achieved? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| b. _____ | Goal achieved? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| c. _____ | Goal achieved? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| d. _____ | Goal achieved? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| e. _____ | Goal achieved? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| f. _____ | Goal achieved? | <input type="checkbox"/> Yes <input type="checkbox"/> No |

2. EVALUATION

What factors helped the team succeed?

What factors hindered the team's success?

- | | |
|----------|----------|
| a. _____ | a. _____ |
| b. _____ | b. _____ |
| c. _____ | c. _____ |

3. STANDARDIZATION AND INTEGRATION (FOLLOWUP)

- a. Will the best practice(s) be implemented in other units, clinics, or programs? Yes No

If yes, what are the plans for further implementation?

- b. Is there additional followup work that needs to be completed? Yes No

If yes, list followup activities and related plan.

4. COMMUNICATION

- a. Is there an internal communication plan to inform leadership, management, and staff of project results? Yes No

- b. Is there an external communication plan to inform accrediting organizations and other stakeholders of project results? Yes No

- c. Briefly describe ideas for internal and external communication plans:

Monitoring Progress for Sustainable Improvement

What is the purpose of this tool? This tool provides guidance on how to monitor and report your progress in sustaining performance improvements, including how to establish measures to track your efforts and suggested steps for the monitoring process. This tool provides the following information:

- An overview and rationale for a monitoring system to sustain improvements;
- Identification of the key elements of a monitoring system; and
- Guidance on how to establish each monitoring system element.

Who are the target audiences? The primary audiences for this tool are hospital leaders and managers, quality program staff, and analysts.

How can this tool help you? You can use this tool to guide your monitoring strategy to ensure that your hospital sustains the results achieved during your quality improvement work. The measures you monitor after implementation will include rates for the AHRQ Pediatric Quality Indicators (PDIs), as well as other process or outcome measures that you identify as representing key performance elements.

After you work successfully to achieve improvements in clinical and administrative practices, it is important to establish a mechanism to ensure that those new practices (and related outcomes) are sustainable. Many hospitals do not do this and performance gains may erode significantly later. Using this tool, you can establish a monitoring mechanism that you can use to track key performance measures, communicate trends within the hospital, and identify emerging performance issues early so that you can correct them in a timely manner.

How does this tool relate to others? This tool should be used with the tool on *Applying the Pediatric Quality Indicators to Hospital Data* (Tool B.1), which provides instructions for calculating and using PDI rates for quality improvement in your hospital, as well as the tool *Assessing PDI Rates Using Trends and Comparators* (Tool B.5). This tool also will build on the work you did using the tools on *Implementation Measurement* (Tool D.7) and *Project Evaluation and Debriefing* (Tool D.8), both of which provide guidance on measuring and evaluating improvements during your implementation period. Once you have completed your implementation actions, this tool helps you continue measurement on a more limited scale, to help sustain your improvements over time.

What Is Involved in Ongoing Monitoring?

There is no single “correct” way to build a system for monitoring sustainability of performance. Each hospital will design its system to best fit its management culture, performance priorities, and available operating and technological resources. However, any monitoring system must be able to support active vigilance by your hospital staff of performance trends and emerging issues. The following elements are essential for any effective monitoring system:

- Choose a limited set of effective measures.
- Establish a schedule for regular reporting.
- Develop report formats to communicate clearly.
- Establish procedures for acting on identified problems.
- Assess sustainability on a periodic basis.

Each element is discussed here, including suggestions for developing an effective monitoring system to support sustainability of improvements you achieved for the AHRQ Pediatric Quality Indicators (PDIs).

If your hospital already has a comprehensive system for reporting trends in performance measures on a regular basis, you should be able to incorporate the key measures related to your QI improvement initiative into that system and to specify reporting frequencies. How you will do that, and whom you will work with, will depend on whether your hospital’s reporting system is automated or paper based.

If your hospital does not have an established monitoring system, you will need to develop a process specifically for tracking the key measures you choose to monitor for your PDI improvement initiative.

Choose a Limited Set of Effective Measures

You will need to make judicious choices of which measures of PDI performance to include in your monitoring system. You will want to weigh the value of tracking key aspects of your improved processes against the added burden on hospital personnel and resources due to tracking too many measures.

You should select measures that allow you to address two “bottom line” questions about performance:

- Are we still using the new processes implemented in our improvement process, or have the processes started to erode?
- Are the outcomes the processes are intended to affect moving in the desired direction?

A negative answer to either question will require early action to diagnose what might be compromising performance, and then to correct identified problems.

Your implementation team should:

- Develop a list of candidate measures, with a rationale for the importance of each measure.
- Test each measure against the criteria described below.
- Identify and discard weak measures.
- If necessary, use a formal ranking process to identify priorities among the remaining candidate measures.

Such a process ensures that the measures are chosen carefully, and it increases the sense of ownership that participating staff have in the measures.

Criteria for measure selection may include:

- **Processes, utilization, and outcomes.** Consider both process and outcome measures for inclusion in your monitoring system. The PDIs for which you have been doing performance improvement should be included as the ultimate outcome measures (see Tool B.1, *Applying the Quality Indicators to Hospital Data*). Process measures also can be monitored to ensure that the key steps in the improved processes continue to be used over time. You can draw on the measures you used for evaluating progress in implementing your quality improvement plan (see Tool D.7, *Implementation Measurement*, and Tool D.8, *Project Evaluation and Debriefing*). This can maintain continuity between the implementation phase and subsequent operations.
- **Importance of the factor being measured.** The measures you choose should capture the most important milestones achieved for the new processes implemented—those you want to protect over time (e.g., PDI rates, use of timeouts before surgery, reduced length of stay).
- **Ability to interpret and act on findings.** An ideal measure will give clear signals that allow you to identify underlying issues that affect performance on a measure. It is sometimes difficult to determine if a change in a measure (e.g., increased length of stay, increased reporting of adverse events) is a sign of a performance problem, often because multiple factors may contribute to such a change.
- **Feasibility of measurement.** The most efficient way to collect data is to use data from existing automated information systems or to add data elements to these systems. If these sources do not provide the needed data, you can use chart abstractions, surveys, new administrative forms, or special outcome studies. However, such studies are more resource intensive and are often more vulnerable to incomplete documentation.
- **Identifiable and measurable denominators.** To produce accurate reports for measures that are calculated as rates (e.g., percentage of patients with postsurgical infections), it is important to have complete counts for the relevant patient populations (e.g., all patients who had surgery during a time period). Other measures that are not expressed as rates also can be used for monitoring, such as the occurrence of serious adverse events (e.g., a sentinel event) that would require immediate action, or counts of desirable (e.g., use of debriefs for building teamwork) or undesirable activities.

Establish a Schedule for Regular Reporting

It is critically important to regularly report trends for your selected measures to key personnel throughout the hospital (see Tool B.5, *Assessing Indicator Rates Using Trends and Comparators*). The measures serve only as an information source; the key to successful monitoring is to communicate information to relevant groups and enable them to act on it to sustain effective processes and outcomes.

You will need to make the following choices in designing your reporting process:

1. How to calculate each measure and what data to use.
2. What time period to use for tracking each measure (e.g., monthly, quarterly, annually).
3. What information you want to generate on each measure.
4. Who will receive reports on measure trends.
5. How frequently reports will be provided to each recipient group.

It is fine to track measures at different frequencies, as long as you have a rationale for that approach. For example, a measure you think will change slowly could be tracked annually, and a measure that you think could change more quickly should be tracked more frequently.

Hospital management should take a lead role in identifying the groups that will receive the monitoring reports, as well as the mechanisms used to communicate the information. To encourage engagement and action on issues, each group receiving reports should have an opportunity to participate in interpretation and discussion of the findings. Use their suggestions and perspectives to help guide actions to address any issues revealed in the trends.

Develop Report Formats To Communicate Clearly

The “best” methods to display monitoring data are the ones that work for your implementation team and other users. Some people find tables to be an effective way to communicate information; others prefer graphs. Two principles apply to all data display methods:

- Display only the most important information from your analyses to succinctly “tell the story” of trends in performance.
- Keep each table or graphic simple so that users can find the important information easily.

You should report the same results to all users of the monitoring information, but each type of user will be interested in different aspects of the information. For example, hospital leadership may want detailed information on all measures, whereas individual physicians, frontline nurses, other clinical staff, and support staff may want reports that focus on measures relevant to where they work.

You may want to use different reporting formats for the various user groups. Work closely with each user group in developing the reports so that you can understand their information needs and preferences for presentation. Remember that every step in the process will affect how receptive each group will be to the monitoring and how ready they will be to act when issues emerge that require their attention.

Establish Procedures for Acting on Identified Problems

Taking timely action to correct emerging issues is the best way to ensure the sustainability of improvements you have achieved. When you need to take action, you first will assess the situation to gain an understanding of the problem. Then you will develop and carry out an action plan to implement needed corrections. This process mirrors the one you used to implement your process improvements, for which tools in this toolkit can be used (Tools D.1 through D.8).

Assess Sustainability on a Periodic Basis

In addition to routine monitoring, it is advisable to periodically perform a more detailed assessment of the status of desired practices. Such an assessment can stimulate increased vigilance by staff, and it may yield lessons for additional improvement actions.

Return on Investment Estimation

What is the purpose of this tool? When your hospital invests in a new program, quality improvement intervention, or technology, leaders often need to know what kind of financial return the investment will yield. A return on investment (ROI) analysis is a way to calculate your net financial gains (or losses), taking into account all the resources invested and all the amounts gained through increased revenue, reduced costs, or both.

This tool provides a step-by-step method for calculating the ROI for a new set of actions implemented to improve performance on one or more of the AHRQ Pediatric Quality Indicators (PDIs). It also provides a case study of ROI calculated by a hospital for implementation of computerized physician order entry (CPOE).

Who are the target audiences? Potential users of this tool include individuals who will contribute to ROI calculations, which may include hospital or health system financial, quality, or analytic staff, as well as statisticians, data analysts, and programmers.

How can the tool help you? Examining anticipated financial outcomes data can help hospital and health system leadership make more informed decisions when prioritizing resources for quality improvement initiatives. ROI also can be used as an evaluation tool to examine the cost of an initiative after implementation.

Using ROI as a planning tool. During the planning process that precedes implementation of improvement actions, projected ROI can be used to estimate how the planned intervention will affect revenue and operating costs and to adjust the intervention to better optimize both quality and financial performance. In addition, ROI can be used to show how long it will take for an intervention to break even—that is, for the returns of the practice improvement to offset the upfront and ongoing implementation costs. This analysis can be done using data from the literature.

Using ROI as an evaluation tool. Actual ROI can be calculated after a practice improvement has been implemented to assess its value and inform decisions on future improvement actions. This analysis can be done using actual data from your hospital.

How does this tool relate to other tools in the Toolkit? The ROI tool is used as a planning tool to develop cost and return information for use in setting priorities for improvements on the AHRQ PDIs, with the results of these analyses applied in the Prioritization Matrix (Tool C.1). It also can be used as an evaluation tool along with the Project Evaluation and Debriefing tool (Tool D.8) to assess financial effects of the improvements implemented.

Calculating and Interpreting Return on Investment (ROI)

An ROI is calculated as the ratio of two financial estimates:

$$\text{ROI} = \text{Net financial returns from improvement actions} / \text{Financial investment in improvement actions}$$

Where the numerator and denominator of this ratio are defined as follows:

- *Net financial returns from improvement actions.* The financial gains from the implementation of the improvement actions, which are generated by net changes in quality, efficiency, and utilization of services, or in payments for those services.
- *Financial investment in improvement actions.* The costs of developing and operating the improvement actions.

How does ROI differ from cost-effectiveness analysis (CEA)? CEA and ROI share some common features, but they differ in the effects that are addressed. Both ROI and CEA are expressed as ratios, and they use the same dollar amounts for improvement investment costs. ROI shows how much financial gain a hospital or health system can obtain from each dollar it invests in a quality improvement program, while the results of a CEA indicate the costs to a hospital for each unit of effectiveness it achieves through quality improvement actions, such as the costs for each adverse event avoided. These differences are reflected in the formulas used to calculate the ratios.

$$\text{ROI} = \text{Financial gains} / \text{Improvement investment costs}$$

$$\text{CEA} = \text{Improvement investment costs} / \text{Effectiveness}$$

The step-by-step procedure described here can be used to perform ROI calculations to assess your financial return on improvement actions that you either are planning or have implemented. Additional information that may be useful to consider is provided in the section titled “Additional Guidance for Effective ROI Calculation.”

Throughout this document, the term “improvement actions” refers to any hospital program or initiative that aims to improve the quality or safety of hospital inpatient care, which may include a focus on improving performance on the AHRQ PDIs.

Step 1. Determine the Basic ROI Design

Before you start to calculate ROI for any given improvement actions, you need to make four design decisions that will structure your approach to the analysis:

1. **Define the scope of services affected by the improvement actions.** Some actions will be limited to making improvements in one hospital unit (e.g., the emergency department), and others will have a broader scope (e.g., across all nursing units). Carefully define the scope of services to be included in the ROI calculation, and ensure that financial estimates are specifically related to that scope of services.

2. **Define the timeline for implementation of improvement actions.** When implementing improvement actions in your hospital, those actions will occur over a period that could be as short as a few months or as long as years. The ROI analysis needs to capture when those actions change the hospital's operating procedures over time, in order to estimate both the implementation costs and the financial effects of improvement actions. If changes occur over years, you will need to adjust the estimates for inflation and discount future costs and revenues.
3. **Define the comparison group.** To estimate the numerator (net return portion) for the ROI ratio, you need to compare the hospital's finances under two conditions—with the improvement actions implemented and without them. Typically, this will be a comparison over time, with the "before" condition being the service processes before improvement actions, and the "after" condition the service processes after implementation. Other possible comparisons are comparisons across units within the same hospital, or across hospitals. If you use other units or hospitals as comparisons, be sure to choose comparison groups that have similar characteristics to your service entity except that they did not implement the improvement actions.
4. **Capture complete information on financial contributors.** To obtain the most accurate ROI estimate, you will need to identify and quantify as many of the financial contributors as possible for both the numerator and denominator of the ROI formula (e.g., personnel costs, supplies, equipment). For a planning phase ROI, you will work with your best estimates of improvement action costs and of the components of net returns. For a post-implementation ROI, you will have actual data from your financial system on those contributors. See Table 1 for categories you can consider including.

Step 2. Calculate the Return on Investment

To calculate the ROI for the improvement actions, you will develop estimates for both the numerator and denominator of the ROI ratio:

Net returns from the improvement actions (the ROI ratio numerator)
Implementation costs (the ROI ratio denominator)

Worksheets are provided here for your use in developing these estimates. Worksheet 1 can be used to estimate the costs for your investment in the improvement actions, and Worksheet 2 can be used to estimate the net returns from those actions.

Considerations When Calculating Implementation Costs. Instructions for completing Worksheet 1 are provided at the top of the worksheet. You will use the same methods to estimate these costs that you would use for program budgeting or financial accounting of actual costs. The grand total of estimated implementation costs calculated in Worksheet 1 is the ROI denominator.

The costs involved in implementing improvement actions may be incurred at different stages of the implementation process. *Your hospital's financial staff will need to estimate these costs at all stages of the program from start to end if using the ROI tool for planning. If you use the ROI tool for evaluation purposes, you will need to track costs throughout implementation.*

Table 1 shows example categories of costs at each stage of program planning, implementation, and maintenance (see descriptions of these components in Appendix I). These broad categories are meant as suggestions. Not all costs included will apply to all types of programs or quality

improvement initiatives. In addition, you may identify other relevant costs that should be included but are not shown here.

Table 1. Categories of Costs Incurred at Different Stages of Implementing a Practice or Quality Improvement Program

Cost Category	Stages of the Improvement Actions				
	Planning and Development	Training	Startup	Ongoing Operation, Monitoring, and Maintenance	Shutdown
Personnel	X	X	X	X	X
Supplies	X	X	X	X	X
Equipment			X	X	
Training	X	X	X	X	
Information systems			X	X	X
Outreach and communication			X	X	X
External consultant costs		X	X	X	

Considerations for Calculating Net Return. Instructions for completing Worksheet 2 are provided at the top of the worksheet. The grand total financial effect derived in the worksheet is the estimate for the ROI numerator.

The estimation of these financial effects is more complex—and more subtle—than estimating the implementation costs. Implementation of improvement actions may have many positive effects on patients’ outcomes and health status. For example, improvement actions might reduce hospital-associated infections, rates of pressure ulcers, or patient mortality. Although these effects do not have a direct monetary value, many of them may affect a hospital’s revenues and expenses, which should be estimated in an ROI analysis. For example, reduction in adverse events can lead to reduced length of stay, which may affect finances either positively or negatively, depending on payment structures.

You will need to capture two types of financial effects: changes in the hospital’s revenues and changes in its operating costs. For example, by reducing its infection rates, a hospital could eliminate the costs it had been incurring to provide the extra care required to treat infections. It also could enhance or protect its revenues, if insurers offered incentives for infection control or imposed penalties for occurrences of infections.

When calculating the hospital’s net return for the ROI, it is necessary to take into account that the effects on revenues and effects on costs work in opposite directions. From the hospital’s perspective, an increase in revenues is good, so a **higher revenue** due to improvement actions should be a **positive** number. On the other hand, a decrease in costs is good, so a **lower cost** due to improvement actions is good. The instructions for calculations of net return are provided on Worksheet 2.

ROI Ratio Calculation. Once you have estimated the implementation costs and the net effects on revenues and costs, the actual calculation of the ROI ratio is easy. Simply divide the estimated total net returns by the total implementation costs:

$$\text{ROI} = \text{Worksheet 2 Total (returns)} / \text{Worksheet 1 Total (investment)}$$

Cost Savings Calculation. The two worksheets can also be used to calculate cost savings, another indicator of financial effects of the quality improvement program. The cost savings may be of interest to hospital managers to answer a basic question: “How much did we save?” The cost savings is the difference between returns and costs:

$$\text{Cost Savings} = \text{Worksheet 2 Total (returns)} - \text{Worksheet 1 Total (investment)}$$

Step 3. Interpret the ROI Ratio Obtained

Once calculated, the ROI ratio needs to be interpreted. The following guidelines can be used to understand the meaning of the ROI ratio.

1. *ROI greater than or equal to 1:* When an ROI is greater than or equal to 1, the returns generated by improvement actions are greater than or equal to the costs for development and implementation. In this case, ROI is considered to be **positive**. For example, an ROI of 1.8 indicates that for every \$1 you invest in the quality improvement program, \$1.80 will be gained for the hospital.
2. *ROI less than 1:* With an ROI of less than 1, the improvement actions yield a net loss from changes in quality and utilization. In this case, ROI is considered to be **negative**. For example, an ROI of -1.5 indicates that for every \$1 invested, \$1.50 will be lost by the hospital. As another example, an ROI of 0.8 indicates that for every \$1 invested, 80 cents will be recouped by the hospital. In other words, the hospital loses 20 cents for every \$1 it spends on the quality program.

Additional Guidance for Effective ROI Calculation

This section includes additional suggestions for how to prepare for your ROI calculation and work through some key measurement issues. See Appendix II for information about existing ROI calculators.

Understanding the Point of View for ROI Calculations

When performing the ROI calculations described here, you will develop estimates that represent the perspective of the hospital—both the investments and net returns are those of the hospital itself, as is the resulting ROI ratio. It is important to note that the implementation of improvement actions is likely to also have effects on other stakeholders with different points of view. For example, reducing infections will affect costs to insurers from changes in payments made to the hospital, which will depend on the nature of each insurer’s payment policy. At the start of each ROI analysis, it will be useful to consider what the effects may be for other stakeholders and to take possible responses on their part into account when designing the improvement actions.

Assembling the ROI Team

Four groups of hospital staff, in particular, are likely to be involved in estimating the ROI, although others may be involved in some cases.

1. Initially, the quality improvement team needs to engage the *hospital's financial officers*, who can help track the investment/cost of the program.
2. *Clinical and other staff* (e.g., quality and patient safety staff at the hospital) running the quality improvement program should identify quality indicators that will be affected by the program.
3. *Statisticians, data analysts, and programmers* can help the clinical staff estimate changes in the identified indicators using data available from the hospital and relevant information from other sources (see details below).
4. Some hospitals may decide to hire *consultants for training and statistical analysis* related to quality improvement.

Getting Ready To Conduct an ROI Calculation

To use this tool for calculating the ROI of an intervention, the hospital staff needs to know:

- Elements of the program (including practices, technology, process or product).
- Resources needed to implement the intervention.
- Target population.
- Measures of health care quality likely to be affected by the intervention.
- Measures of health care utilization likely to be affected by the intervention.

Using Existing Literature To Estimate ROI

Although not ROI studies *per se*, many studies have reported on costs or hospital charges related to patient safety events (for example, Zhan and Miller using Healthcare Cost and Utilization Project data; Rivard, et al., using Veterans Affairs data; and Foster using MedPAR data). See details about these papers in the section “Other Information Sources To Assist With Calculating ROI.”) Their results might be useful for ROI calculation. Few ROI analyses have been published in the health-services literature because they are not typically performed as research studies.

Selecting the Time Horizon for ROI Calculation

Because a quality improvement program may continue for a number of years, ROI can be calculated for part of the program period (e.g., the first year of a 5-year program) or for the entire program (e.g., the entire 5 years of a 5-year program). The choice of the time horizon for the ROI calculation will affect results of the calculation in two ways:

- First, the costs of a quality improvement program usually are incurred at the beginning of the program while the hospital has to wait for some time to see the return. So, if the ROI is calculated at the initial stage of the program, the result is likely to be negative. In comparison, if the ROI is calculated in the long run, the chance of having positive results will increase.
- Second, if the time horizon is only 1 year, the cost calculation may not need to consider the issues of inflation, discounting, and depreciation. In comparison, if the time horizon for an ROI analysis is 2 years or longer, the analysis has to adjust for these issues, as described in the next section.

Making Adjustments for Future Costs and Savings

- *Inflation* refers to rises in the prices of goods and services over a period of time. The ROI calculation can adjust for inflation by using constant dollars to measure the costs of a program over time.
- *Discounting* is simply the difference between the original amount in the present and the same amount in the future. In other words, \$100 next year is worth less than \$100 this year. Thus, future money has to be discounted to be comparable to current money.
- *Depreciation of equipment* is the reduction in the value of an asset due to usage, passage of time, wear and tear, technological outdating or obsolescence, depletion, inadequacy, or other factors. Among the several methods for calculating depreciation, straight-line depreciation is the simplest and most often used technique, which can be expressed as:

$$\text{Annual depreciation} = [(\text{Original cost}) - (\text{salvage value})] / \text{Years of life}$$

Where the salvage value is an estimate of the value of the asset at the time it will be sold or disposed of; it may be zero or even negative.

Determining Differences Between Costs and Charges

Costs represent the amount of resources the hospital needs to use to provide inpatient care services, while charges are the amount of money the hospital reports on the bill and expects the patient and the insurer to pay. It is increasingly rare for the insurer to pay the full charges since Medicare, Medicaid, and many private insurers can obtain discounts of 50 percent or more.

While charges appear on hospital discharge data, costs should be calculated for the ROI analysis. The charges can be translated into costs using the hospital's cost-to-charge ratio, which is usually available at the hospital financial department. Because hospitals need to know their own costs to assess the performance of departments and the merits of specific programs, they typically report a cost-to-charge ratio for the hospital as a whole and cost-to-charge ratios for individual departments. These ratios can be used to calculate the costs of the quality improvement program.

Using Micro Costing Versus Gross Costing

Micro and gross costing are the two commonly used methods for estimating health care costs. In *micro costing*, a cost is derived for each element of an intervention: staff time, supplies and medications, and so on. In comparison, *gross costing* uses mathematical models to determine the mean cost of a day of inpatient care or an outpatient visit. With gross costing, there is no detail available on the cost of any component of the hospital stay or visit.

Some experts recommend that when detailed data are available, micro costing be used as the method of choice. Other experts suggest that the choice between micro and gross costing be carefully considered and driven by the needs of the analysis and the precision of the estimates.

Worksheet 1. Calculating Implementation Costs (ROI Denominator)

Instructions for completing Worksheet 1 (Note: These are costs for implementation, NOT the subsequent changes in service finances.)

1. Prepare these costs using the same methods used for program budgeting. When the ROI is calculated during planning for a set of improvement actions, it is in fact a budget for that set of actions. Use the same line items for calculating actual costs after implementation. Some costs might be drawn from your hospital financial statements; others you will need to calculate yourself.
2. Enter the estimated costs for each line item (personnel, supplies, etc.) that is relevant to the improvement actions for each implementation stage (planning, training, etc.).
3. Sum the costs across rows to obtain a total cost estimate for each line item.
4. Sum the costs down the columns to obtain a total cost estimate for each improvement stage.
5. Obtain the grand total costs by summing the line item total costs (the highlighted box). *This is the denominator for the ROI calculation.*

Category of Implementation Costs	Implementation Costs by Stage of Improvement Action Implementation					Total Costs
	Planning and Development	Training	Startup	Ongoing Operation and Maintenance	Shutdown	
Personnel						
Supplies						
Equipment and depreciation						
Training						
Information systems						
Outreach and communication						
External consultant costs						
Total Costs						GRAND TOTAL

Worksheet 2. Calculating Net Returns (ROI Numerator)

Instructions for completing this worksheet: (Note: These are changes in service revenues and operating costs resulting from implementing the improvement actions.)

1. Identify items for which the improvement actions will have financial effects and list them in first column. The top set lists effects on revenues; the bottom set lists effects on costs. The ones listed here are examples; you may use different sets of items.
2. Estimate the costs for each item for the comparison group (e.g., before) and following implementation. If the comparison periods involve more than 1 year, you may need to adjust some of the costs for inflation or discount future costs to reflect time preference for money.
3. Calculate net change in revenues = B minus A (increase in revenue). Calculate net change in costs = A minus B (decrease in cost).
4. Sum the line item net changes to obtain the total net change (highlighted box). *This is the numerator for the ROI calculation.*

	(Real) Financial Effects of Improvement Actions			NOTES
	A Comparison Period	B Implementation Period	Net Change	(Description of Effects Involved in Revenue or Cost Changes)
Changes in Revenues:			(B minus A)	
Admissions, readmissions, length of stay				
Payments from insurers				
New services provided	0			
Avoidance of penalties from insurers for “never events”				
Other effects on revenues				
Changes in Costs:			(A minus B)	
Service operating costs: staffing, supplies, equipment, other due to _____				
Admissions, readmissions, length of stay				
Intensity of care				
Productivity/efficiency changes				
Avoidance of liability litigation				
Other effects on costs				
Net Financial Effect (Total)				

Case Study: ROI Calculation for CPOE Implementation

This case study is summarized from a published journal article that evaluated the financial impact of implementing a computerized physician order entry (CPOE) system at Brigham and Women's Hospital (BWH).¹ Few ROI analyses have been published in the health services literature because they are not typically performed as research studies. Although it is not specific to a pediatric setting, the example helps identify the process and types of costs that should be considered in an ROI analysis.

Calculating implementation costs (denominator). Costs were determined for each stage of practice implementation from 1992 to 2002. First, the capital costs of developing and implementing the CPOE system were estimated to be \$3.7 million, based on internal documents and interviews with the developers. Sixty percent of this cost was attributed to the first year of the study period (development costs) and 20 percent was attributed to each of the next 2 years (startup).

Next, operational costs starting in year 2 of the study period were calculated. These costs included hardware (workstations and printers), software, network, leadership, and training. They did not include costs for the pharmacy system, medication administration system, or clinical data repository. Operational costs ranged from \$600,000 to \$1.1 million per year. Development, implementation, and operation of the CPOE system cost \$11.8 million over 10 years.

Calculating net returns from the program (numerator). To estimate the savings generated from the CPOE system, the ROI team retrospectively identified each way the practice saved money (for a detailed description of each element of the program and its method of cost savings, see Kaushal, et al., 2006). The benefits were determined using published literature, key informant interviews, and internal documents. For many components of the CPOE, the number of estimated adverse drug events (ADEs) averted was multiplied by an average cost per ADE.

Other types of cost savings identified included decreased drug costs (decreased use and shift from use of intravenous to oral medications, decreased laboratory tests, reduction in use of inappropriate radiology tests, savings in nursing and provider time by improved workflow). Drugs and tests were valued using charge amounts and applying a 0.2 cost-to-charge ratio).

Because different elements of the CPOE system were introduced in stages, benefits were only calculated for those elements starting on the first day of the month after the element was implemented. This process was repeated for every intervention and area of cost savings; they found that the system saved the hospital \$28.5 million over the 10 years. Note that cost savings identified in their net return analysis does not take implementation costs, the denominator, into account.

¹ Kaushal R, Jha AK, Franz C, et al. Return on investment for a computerized physician order entry system. *J Am Med Inform Assoc* 2006;13(3):261-6.

Selecting the time horizon. The staff assessed the ROI of the CPOE system over a period of 10 years to allow enough time to see a return. Because the time horizon was longer than 2 years, they needed to make adjustments for the following issues:

- *Inflation:* Dollar values for costs and benefits were converted to a constant dollar basis to adjust for inflation. They used the Bureau of Labor Statistics’ Producer Price Index time series for General Medical and Surgical Hospitals to standardize values to 2002 currency.
- *Discounting:* All costs and benefits were discounted at a 7 percent annual percentage rate as recommended by the U.S. Office of Management and Budget for economic analyses performed for the Federal Government, representing a societal discount rate as opposed to a hospital-specific rate. Costs were discounted using a “beginning-of-period” convention and benefits were discounted using an “end-of-period” convention.
- *Annualization:* Annualized values were calculated by converting all the discounted costs and benefits into a series of equal annual payments.

Interpreting the results. The ROI analysis yielded a positive return on investment—the CPOE system saved the hospital about \$2.2 million per year over the 10-year period. It took more than 5 years for the system to have a net benefit.

Table 2. Information BWH Used To Conduct an ROI Analysis for CPOE Implementation

Element of Analysis	Measure(s) or Values	Description or Inclusions
Costs (denominator)	\$11.8 million total: \$3.7 million in capital costs; \$600,000 to \$1.1 million per year in operational costs	Workstations and printers, software, network, leadership, and training
Returns (numerator)	\$28.5 million	Averted adverse drug events; medication cost savings; decreased laboratory test usage for redundant or unnecessary tests; improved workflow (staff and resource savings); decreased length of stay; streamlined workflow; improved information access for patients at time of discharge; decreased radiological utilization
Discount rate	7% annualized rate	
Consumer Price Index	Bureau of Labor Statistics’ Producer Price Index time series for General Medical and Surgical Hospitals to standardize values to a 2002 base year	
Prospective Reimbursement Rate (cost-to-charge ratio)	80%	
Live date (returns)	First day of the month following activation of the intervention or midpoint of the year (July 1) when only annual data were available	This is the date when they started counting the number of cost-saving events and calculating the associated cost savings.
Live date (start of calculating operational costs)	January 1, 1993	This is the date when the practice began to accrue operational costs.
End date	December 31, 2002	This date signifies the end of the study period.

Other Information Sources To Assist with Calculating ROI

Books

Drummond M, O'Brien B, Stoddart G, et al. *Methods for the economic evaluation of health care programmes*. 2nd ed. New York, NY: Oxford University Press; 1997.

Wage Rates

The U.S. Bureau of Labor Statistics provides information about wage rates of more than 800 occupations in 50 States and the District of Columbia (<http://www.bls.gov/oes/current/oesrst.htm>). The information is useful for calculating personnel costs, such as doctors and nurses, which is part of the ROI analysis.

Inflation Rates

The U.S. Bureau of Labor Statistics also provides information about inflation rates across the Nation and over time (<http://www.bls.gov/CPI/>), including price index of medical care (<http://www.bls.gov/cpi/cpifact4.htm>).

Pharmaceutical Prices

The Red Book by Thomson Reuters provides comprehensive drug product and pricing data (<http://www.micromedex.com/products/redbook/database/>).

Literature Estimating Costs of Medical Errors and Adverse Events

Bates DW, Spell N, Cullen DJ, et al. The cost of adverse drug events in hospitalized patients. *JAMA* 1997;277:307-11.

Bishop CE, Gilden D, Blom J, et al. Medicare spending for injured elders: are there opportunities for savings? *Health Aff (Millwood)*. 2002 Nov-Dec;21(6):215-23.

Chen LM, Rein MS, Bates DW. Costs of quality improvement: a survey of four acute care hospitals. *Jt Comm J Qual Patient Saf* 2009 Nov;35(11):544-50.

Classen DC, Pestotnik SL, Evans RS, et al. Adverse drug events in hospitalized patients: excess length of stay, extra costs, and attributable mortality. *JAMA* 1997;277:301-6.

Kaushal R, Bates DW, Franz C, et al. Costs of adverse events in intensive care units. *Crit Care Med* 2007;35(11):2637-8.

Pappas SH. The cost of nurse-sensitive adverse events. *J Nurs Adm* 2008;38(5):230-6.

Rivard PE, Luther SL, Christiansen CL, et al. Using patient safety indicators to estimate the impact of potential adverse events on outcomes. *Med Care Res Rev* 2008;65:67-87.

Rothschild JM, Bates DW, Franz C, et al. The costs and savings associated with prevention of adverse events by critical care nurses. *J Crit Care* 2009 Sep;24(3):471.e1-7.

Swensen, SJ, Dilling, JA, McCarty, PM et al. The business case for health care quality improvement. *J Pat Saf* 2013 Mar;9(1):44-52.

Zhan C, Miller MR. Excess length of stay, charges, and mortality attributable to medical injuries during hospitalization. *JAMA* 2003;290:1868-74.

Appendix I. Components of Implementation Costs

Stages of Improvement Action Implementation

Implementation of improvement actions may be divided into the following stages:

- **Planning and program development.** This is the first stage of any program. Right from the start, the hospital needs to spend money on planning and program development activities, such as conducting situational analysis, searching the literature, identifying target areas and populations for the quality improvement program, assembling a team to work on the program, purchasing equipment, and setting up an information system.
- **Training.** Some training sessions may be part of planning and program development while other training sessions may happen in later stages of program implementation. It is also common to have training sessions during the implementation process to refresh the knowledge or skills of hospital staff members. Therefore, training is listed here as a separate item.
- **Startup.** The hospital needs to pay for running the quality program, including costs of personnel, supplies, equipment, and information system.
- **Ongoing operation, monitoring, and maintenance.** During the implementation process, the hospital needs to make sure its quality program is functioning as planned. Data about quality, utilization, costs, and revenue indicators should be collected to monitor changes in these indicators. The hospital also needs to spend on maintenance services for both the information system and the equipment for the quality improvement program.
- **Shutdown costs for time-limited intervention or failures.** While some quality programs may last a long period and become routine operation for the hospital, other programs might just be temporary, or may fail and have to be shut down after a short time. In these cases, there may be costs associated with shutting down the program.

Categories of Costs for Program Planning, Implementation, and Maintenance

- **Personnel** includes all the people involved in developing and implementing the practice or quality improvement program, such as doctors, nurses, assistants, and administrators.
- **Supplies** include both office and medical supplies needed for development and implementation of the program.
- **Equipment** includes medical equipment purchased for use by the program.
- **Training** includes training of clinical, financial, or other staff involved in the quality improvement initiative both before the program starts and during different stages of program implementation.
- **Information systems** include computers, software, network infrastructure, and information technology professionals to set up a database of clinical and financial records.
- **Outreach and communication** includes communications among different professional groups, such as doctors, nurses, and administrators, and across different hospital departments, such as clinical and financial departments, and the hospital's board of directors.
- **External consultant costs** may include external trainers for developing and implementing the program, or an external statistician for analyzing data to estimate the changes in quality and utilization of hospital inpatient care.

Appendix II. Examples of Existing ROI Calculators

ROI Forecasting Calculator for Quality Initiatives

The ROI Forecasting Calculator for Quality Initiatives was developed by the Center for Health Care Strategies, which is a nonprofit health policy center. It is a Web-based tool designed to help State Medicaid agencies, health plans, and other stakeholders assess and demonstrate the cost-savings potential of efforts to improve quality. It provides step-by-step instructions for users to calculate ROI for the proposed quality initiatives. It can be used online at <http://www.chcsroi.org/Welcome.aspx>. Users enter a variety of assumptions before starting the calculation, including target population characteristics, program costs, and expected changes in health care utilization, to estimate potential savings.

Adverse Events Prevented Calculator

Developed by the Institute for Healthcare Improvement, this tool allows users to track the change in rate of any type of adverse event over time. When appropriate data are added, the user also can track the consequent change in unnecessary deaths (“lives saved”), real and additional potential cost savings, and ROI of quality improvement work targeting those adverse events. The tool and its user guides are free for download at <http://www.ihl.org/resources/Pages/Tools/AdverseEventsPreventedCalculator.aspx>.

Available Comprehensive Quality Improvement Guides

What is the purpose of this tool? This tool provides information on other quality improvement guides. You may find these additional resources helpful in your quality improvement efforts.

Who are the target audiences? The primary audiences are quality officers and members of the implementation teams responsible for carrying out performance improvements. These resources also might be of interest to hospital senior leadership and managers.

How can it help you? As you work to improve the quality of care in your hospital and use the AHRQ Pediatric Quality Indicators, these additional resources may help guide the actions you take.

How does this tool relate to others? Additional information on guides to help with specific analytic or action steps is included in *Specific Tools To Support Change* (Tool G.2).

Descriptions of Tools Available Free of Charge

CAHPS® Ambulatory Care Improvement Guide

<https://cahps.ahrq.gov/quality-improvement/improvement-guide/improvement-guide.html>

The Consumer Assessment of Healthcare Providers and Systems (CAHPS) program develops a comprehensive and evolving series of standardized patient surveys pertaining to the patient's experiences with the health care system. The surveys cover topics such as:

- Access,
- Claims processing,
- Communication with physicians,
- Customer service,
- Communication about costs of care,
- Coordination/integration of care,
- Health promotion/education,
- Preventive services, and
- Shared decisionmaking.

The CAHPS Improvement Guide is a comprehensive resource for health care organizations seeking to improve their performance in the domains of quality measured by CAHPS surveys. The guide includes:

- Information on assessing whether the hospital is ready to improve,
- Methods for analyzing the CAHPS survey results,
- Steps for quality improvement,
- Interventions designed to improve consumers' and patients' experiences with care, and
- A list of resources related to quality improvement.

Many of the recommended actions apply to hospitals.

A Guide to Achieving High Performance in Multi-Hospital Health Systems

Julie Yonek, Stephen Hines, and Maulik Joshi

Health Research & Educational Trust (HRET)

<http://www.commonwealthfund.org/Publications/Fund-Reports/2010/Mar/A-Guide-to-Achieving-High-Performance-in-MultiHospital-Health-Systems.aspx>

This guide was the product of an effort to identify and disseminate best practices associated with high-performing health systems. The information is organized into four major best practice categories, with 17 specific best practices that have a demonstrated association with high performance in multi-hospital health systems. The major categories include:

1. Establish a systemwide strategic plan with measurable goals;
2. Create alignment across the health system with goals and incentives;
3. Leverage data and measurement across the organization; and
4. Standardize and spread best practices across the health system.

Putting Practice Guidelines to Work in the Department of Defense Medical System: A Guide for Action

Will Nicholas, Donna O. Farley, Mary E. Vaiana, Shan Cretin
RAND Corporation

http://www.rand.org/pubs/monograph_reports/MR1267.html

This improvement guide was written to assist military treatment facilities (MTFs) in achieving evidence-based practice and contains considerable information of use to civilian hospitals. The guide includes:

- An overview of the stages of the process of achieving evidence-based practice and keys to success that should be implemented during each stage of the process,
- Guidance on how to organize and lead an effective implementation team,
- A step-by-step process for creating an implementation action plan,
- Strategies for implementing changes outlined in the implementation action plan, and
- Assistance with monitoring these changes and measuring the effects of the implementation strategies.

The material has been influenced by lessons learned from hands-on field experience at Army MTFs that participated in the Army Medical Department (AMEDD)/RAND Guideline Implementation Project, which are included in the improvement guide. The goal of this project was to establish a system for implementing selected practice guidelines throughout AMEDD and for monitoring the effects of those guidelines on clinical care and outcomes. AMEDD, RAND, and participating MTFs tested and refined the guideline implementation methods in a “continuous improvement” cycle before systemwide adoption.

Overview of IHI Tools

<http://www.ihl.org/resources/Pages/Tools/default.aspx>

The Institute for Healthcare Improvement has developed and adapted tools to help organizations accelerate improvement. In addition, many organizations have developed tools in the course of their improvement efforts, such as successful protocols and instructions and guidelines for implementing key changes, and are making them available on IHI.org for others to use or adapt in their own organizations.

Specific Tools To Support Change

What is the purpose of this tool? This tool provides information on tools developed by other organizations that may be used instead of or in addition to the resources in the QI Toolkit to help support specific actions you take to improve your performance on the AHRQ Pediatric Quality Indicators (PDIs).

Who are the target audiences? The primary audiences are quality officers and members of the implementation teams responsible for carrying out performance improvements. These resources also might be of interest to hospital senior leadership and managers.

How can the tool help you? As you work to improve the quality of care in your hospital and use the AHRQ PDIs, these additional resources may help inform the specific steps you take along the way.

How does this tool relate to others? Additional information on guides that focus more broadly on supporting quality improvement is included in *Available Comprehensive Quality Improvement Guides* (Tool G.1).

Tools Available Free of Charge

Organization	Type of Resource	Name	Description	Source
Change Management Toolbook, ChangeSource	Analysis Tool	A Matrix for Training Needs Analysis	Free tools and training materials to help guide and conduct a training needs analysis.	http://www.change-management-toolbook.com
Imperial College London	Analysis Tool	Project Stakeholder Analysis	Identify stakeholders and their interest in and influence over the innovation.	http://www.imperial.ac.uk/workspace/projectmanagement/public/Templates%20for%20download/Stakeholder%20analysis.doc
Institute for Healthcare Improvement	Analysis Tool	Failure Modes and Effects Analysis Tool	<p>Failure Modes and Effects Analysis (FMEA) is a systematic, proactive method for evaluating a process to identify where and how it might fail and to assess the relative impact of different failures, in order to identify the parts of the process that are most in need of change. FMEA includes review of the following:</p> <ul style="list-style-type: none"> • Steps in the process • Failure modes (What could go wrong?) • Failure causes (Why would the failure happen?) • Failure effects (What would be the consequences of each failure?) 	http://www.ihp.org/knowledge/Pages/Tools/FailureModesandEffectsAnalysisTool.aspx

Organization	Type of Resource	Name	Description	Source
Academic Pediatrics	Article	Quality Improvement in Pediatric Health Care Supplement	This supplement is intended to make readers aware of key developments in QI policy, practice, education, and evaluation research. Our goal is to stimulate additional sharing of lessons learned, whether through research publications or other means, and to encourage health care providers and researchers to become full participants in the current national movement toward the triple aim of better care, better population health, and more affordable care.	http://www.academicpedsjnl.net/issue/S1876-2859(13)X0007-5
Focused Performance	Article	Taking Advantage of Resistance to Change (and the TOC Thinking Processes) to Improve Improvements	Explains how to use the TOC thinking processes to leverage change resistance to improve on original ideas and gain buy-in.	http://www.focusedperformance.com/articles/resistance.html
Free Management Library	Article	Major Types of Organizational Change	Outlines the major types of organizational change.	http://www.managementhelp.org/misc/types-of-orgl-change.pdf
Health Services Research	Article	The Quantitative Measurement of Organizational Culture in Health Care: A Review of the Available Instruments	Review of the quantitative instruments available to health service researchers who want to measure culture and cultural change.	http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1360923/

Organization	Type of Resource	Name	Description	Source
Graduate School of Banking at Colorado (University of Colorado)	Assessment Tool	Organizational Culture Assessment Instrument	Assesses the six key dimensions of organizational culture.	http://my.ilstu.edu/~lilippe/com435/survey_ocai_culture.pdf
Institute for Healthcare Improvement	Assessment Tool	Assessment Scale for Collaboratives	<p>This scale gives information on how to assess a team’s progress throughout an IHI Breakthrough Series Collaborative improvement project.</p> <p>The Collaborative Assessment Scale was developed at IHI to assess teams participating in IHI Breakthrough Series Collaborative projects. The tool allows collaborative directors and improvement advisors to determine how well teams are doing, on a scale of 1 to 5, in meeting improvement goals and implementing changes.</p>	http://www.ihl.org/knowledge/Pages/Tools/AssessmentScaleforCollaboratives.aspx
Institute for Healthcare Improvement	Assessment Tool	Project Planning Form	The Project Planning Form is a useful tool for planning an entire improvement project, including a list of all the changes that the team is testing, all the Plan-Do-Study-Act (PDSA) cycles for each change, the person responsible for each test of change, and the timeframe for each test. The form allows a team to see at a glance the overall picture of the project.	http://www.ihl.org/knowledge/Pages/Tools/ProjectPlanningForm.aspx
Institute of Behavioral Research, Texas Christian University	Assessment Tool	Organizational Readiness for Change	Assess organizational climate and readiness for change.	http://ibr.tcu.edu/forms/organizational-staff-assessments/

Organization	Type of Resource	Name	Description	Source
Kaiser Permanente	Assessment Tool	RE-AIM Planning Tool	Provides a checklist for key issues that should be addressed when planning an intervention.	http://www.re-aim.hnfe.vt.edu/resources_and_tools/measures/planningtool.pdf
Venture Philanthropy Partners	Assessment Tool	McKinsey Capacity Assessment Grid (appendix of a report)	Assess organizational capacity.	http://www.vpppartners.org/sites/default/files/reports/full_rpt.pdf
Agency for Healthcare Research and Quality	Case Study	Buffalo Hospital Uses TeamSTEPPS® To Improve Pediatric Patient Safety	This case study demonstrates how a women and children’s hospital implemented an AHRQ-designed patient safety program (TeamSTEPPS) to improve care for children with bronchiolitis.	http://www.ahrq.gov/policymakers/case-studies/201504.html
Institute for Healthcare Improvement	Diagram/Chart	Cause and Effect Diagram	A cause and effect diagram, also known as an Ishikawa or “fishbone” diagram is a graphic tool used to explore and display the possible causes of a certain effect. The classic fishbone diagram can be used when causes group naturally under the categories of Materials, Methods, Equipment, Environment, and People. A process-type cause and effect diagram can show causes of problems at each step in the process.	http://www.ihp.org/knowledge/Pages/Tools/CauseandEffectDiagram.aspx

Organization	Type of Resource	Name	Description	Source
Institute for Healthcare Improvement	Diagram/Chart	Flowchart	Flowcharts allow you to draw a picture of the way a process works so that you can understand the existing process and develop ideas about how to improve it. A high-level flowchart, showing 6 to 12 steps, gives a panoramic view of a process. A detailed flowchart is a close-up view of the process, typically showing dozens of steps.	http://www.ihc.org/knowledge/Pages/Tools/Flowchart.aspx
Institute for Healthcare Improvement	Diagram/Chart	Histogram	Often, summary statistics alone do not give a complete and informative picture of the performance of a process. A histogram is a special type of bar chart used to display the variation in continuous data such as time, weight, size, or temperature. A histogram enables a team to recognize and analyze patterns in data that are not apparent simply by looking at a table of data, or by finding the average or median.	http://www.ihc.org/knowledge/Pages/Tools/Histogram.aspx

Organization	Type of Resource	Name	Description	Source
Institute for Healthcare Improvement	Diagram/Chart	Pareto Diagram	According to the “Pareto Principle,” in any group of things that contribute to a common effect, a relatively few contributors account for most of the effect. A Pareto diagram is a type of bar chart in which the various factors that contribute to an overall effect are arranged in order according to the magnitude of their effect. This ordering helps identify the “vital few,” the factors that warrant the most attention. Using a Pareto diagram helps a team concentrate its efforts on the factors that have the greatest impact. It also helps a team communicate the rationale for focusing on certain areas.	http://www.ihl.org/knowledge/Pages/Tools/ParetoDiagram.aspx
Institute for Healthcare Improvement	Diagram/Chart	Run Chart Tool	Improvement takes place over time. Determining if improvement has really happened and if it is lasting requires observing patterns over time. Run charts are graphs of data over time and are one of the single most important tools in performance improvement. Run charts can: <ul style="list-style-type: none"> • Help improvement teams formulate aims by depicting how well (or poorly) a process is performing. • Help in determining when changes are truly improvements by displaying a pattern of data that you can observe as you make changes. • Give direction as you work on improvement and provide information about the value of particular changes. 	http://www.ihl.org/knowledge/Pages/Tools/RunChart.aspx

Organization	Type of Resource	Name	Description	Source
Institute for Healthcare Improvement	Diagram/Chart	Scatter Diagram	A scatter diagram is a graphic representation of the relationship between two variables. Scatter diagrams help teams identify and understand cause-effect relationships.	http://www.ih.org/knowledge/Pages/Tools/ScatterDiagram.aspx
Mind Tools	Diagram/Chart	Critical Path Analysis and PERT Charts	Critical path analysis and PERT charts are tools to help schedule and manage complex projects.	http://www.mindtools.com/critpath.html
Mind Tools	Diagram/Chart	Gantt Charts	Information on how to use Gantt charts.	http://www.mindtools.com/pages/article/newPPM03.htm
Agency for Healthcare Research and Quality	Fact Sheet	10 Patient Safety Tips for Hospitals	This 2-page fact sheet provides 10 tips that hospitals can implement to improve patient safety. The tips focus on staffing, resource use, and procedures.	http://www.ahrq.gov/sites/default/files/publications/files/10-tips-for-hospitals.pdf
Institute for Healthcare Improvement	Glossary	Glossary of Improvement Terms	A glossary of common improvement terminology.	http://www.ih.org/knowledge/Pages/Tools/GlossaryImprovementTerms.aspx
Agency for Healthcare Research and Quality	Guide	CAHPS Pocket Reference Guide	The Consumer Assessment of Healthcare Providers and Systems (CAHPS) Pocket Reference Guide for Adult Surveys is a standardized reference guide that summarizes adult surveys developed by the CAHPS Consortium.	http://www.ahrq.gov/sites/default/files/wysiwyg/cahps/quality-improvement/measurements/CAHPS_FAC_PG_041310.pdf

Organization	Type of Resource	Name	Description	Source
Agency for Healthcare Research and Quality	Guide	Confidential Physician Feedback Reports: Designing for Optimal Impact on Performance	This guide is a practical resource designed to inform readers, particularly developers of confidential physician feedback reports (e.g., medical groups, health plans, payers, professional societies, regional collaboratives, and dissemination and implementation campaigns), about evidence-based strategies to consider when developing or refining a feedback reporting system.	http://www.ahrq.gov/sites/default/files/publications/files/confidreportguide_0.pdf
Agency for Healthcare Research and Quality	Guide	Guide to Patient and Family Engagement in Hospital Quality and Safety	The Guide to Patient and Family Engagement in Hospital Quality and Safety helps hospitals engage patients and families. It contains information to help hospitals address selecting, implementing, and evaluating one of the following strategies: <ul style="list-style-type: none"> • Involvement of patients and families as advisors at the organizational level • Communication among patients, family members, clinicians, and hospital staff to improve quality • Safe handoff of care between nurses by involving the patient and family in the change of shift • Reduction in preventable readmissions by engaging patients and family members in the transition from hospital to home 	http://www.ahrq.gov/professionals/systems/hospital/engagingfamilies/index.html

Pediatric Toolkit for Using the AHRQ Quality Indicators
How To Improve Hospital Quality and Safety

Organization	Type of Resource	Name	Description	Source
Commonwealth Fund; University of Vermont College of Medicine; Vermont Child Health Improvement Program (VCHIP); Vermont Department of Health	Guide	Establishing a Child Health Improvement Partnership: A How-to Guide	The guide outlines the necessary strategies for developing and implementing an IP and highlights success stories drawn from the interviews conducted with child health innovators from across the country.	http://healthandwelfare.idaho.gov/Portals/0/MedicaidCHIP/EstablishingAChildHealthIPGuide.pdf
Community Tool Box, Kansas University	Guide	Criteria for Choosing Promising Practices and Community Interventions	This guide includes a checklist and tools to help adapt an innovation.	http://ctb.ku.edu/en/tablecontents/section_1152.aspx
Department of Veterans Affairs Quality Enhancement Research Initiative (QUERI)	Guide	QUERI Implementation Guide	This guide provides an introduction to various approaches to conducting research implementation.	http://www.queri.research.va.gov/implementation
Free Management Library	Guide	Organizational Change and Development	This guide includes approaches and methods for managing change.	http://www.managementhelp.org/org_chng/org_chng.htm

Organization	Type of Resource	Name	Description	Source
Health Research & Educational Trust	Guide	Pathways for Medication Safety SM	HRET and the Institute for Safe Medication Practices ISMP, in collaboration with the American Hospital Association, have developed three important tools to assist hospitals in reducing medication errors via the Pathways for Medication Safety SM initiative: <ul style="list-style-type: none"> • Leading a Strategic Planning Effort • Looking Collectively at Risk • Assessing Bedside Bar-Coding Readiness 	http://www.ismp.org/tools/pathwaysection1.pdf
Health Services Research and Development Service Department of Veterans Affairs	Guide	Organizational Change Primer	Provides an introduction to expand understanding, information, and knowledge about the concepts and application of organizational change processes.	http://www.hsrd.research.va.gov/publications/internal/organizational_change_primer.pdf
Innovation Network Resource Exchange Center	Guide	Evaluation Plan Workbook	An introduction to the concepts and processes of planning a program evaluation.	http://www.innonet.org/client_docs/File/evaluation_plan_workbook.pdf
Institute for Healthcare Improvement	Guide	Executive Review of Improvement Projects	Executive reviews of projects can be a powerful method for channeling leadership attention to quality initiatives. This primer helps organizational leaders conduct effective project reviews that focus on results, diagnose problems with projects, help projects succeed, and facilitate spread of good ideas across the organization.	http://www.ihl.org/knowledge/Pages/Tools/ExecutiveReviewofProjectsIHI.aspx

Organization	Type of Resource	Name	Description	Source
Institute for Healthcare Improvement	Guide	Huddles	The idea of using quick huddles, as opposed to the standard 1-hour meeting, arose from a need to speed up the work of improvement teams. Huddles enable teams to have frequent but short briefings so that they can stay informed, review work, make plans, and move ahead rapidly.	http://www.ihp.org/knowledge/Pages/Tools/Huddles.aspx
Institute for Healthcare Improvement	Guide	Idea Generation Tools: Brainstorming, Affinity Grouping, and Multivoting	Brainstorming, affinity grouping, and multivoting are tools for generating, categorizing, and choosing among ideas in a group of people. Using these techniques to generate, categorize, and choose among ideas has a number of benefits: <ul style="list-style-type: none"> • Every group member has a chance to participate. • Many people can contribute, instead of just one or two people. • Group members can get ideas while they listen to others' ideas. • The group can generate a substantial list of ideas, rather than just the few things that first come to mind; categorize ideas creatively; and choose among ideas or options thoughtfully. 	http://www.ihp.org/knowledge/Pages/Tools/BrainstormingAffinityGroupingandMultivoting.aspx

Organization	Type of Resource	Name	Description	Source
Institute for Healthcare Improvement	Guide	Interviewing Guide: Using the Interview as a Source of Data, Information, and Learning	This tool will guide users through the process of planning, conducting, and analyzing interviews. It is useful for anyone who plans to conduct interviews to learn about a topic, assess current knowledge around an improvement area, or evaluate an improvement project. It is simple and generic enough to be used in most disciplines. The guide covers how to select subjects to interview and how to construct questions that will generate rich responses. It also discusses how to structure an interview, how to take notes or tape the interview, and how to analyze completed interviews.	http://www.ihp.org/knowledge/Pages/Tools/InterviewGuideUsingtheinterviewasasourceofdatainformationandlearning.aspx
Institute for Healthcare Improvement	Guide	Overview of IHI tools	The Institute for Healthcare Improvement has developed and adapted a basic set of tools to help organizations accelerate improvement. These include tools for gathering information (e.g., Walk-through); analyzing processes (e.g., Cause and Effect Diagrams, Pareto Diagrams, Run Charts, Flowcharts); gathering data (e.g., Sampling); working in groups (e.g., Affinity Grouping, Multivoting); and documenting work (e.g., Project Planning Forms, Plan-Do-Study-Act Worksheets, Storyboards). In addition, many organizations have developed tools during their improvement efforts and are making them available on IHI.org for others to use or adapt in their own organizations.	http://www.ihp.org/knowledge/Pages/Tools/default.aspx

Organization	Type of Resource	Name	Description	Source
Institute for Healthcare Improvement	Guide	Sampling (links to Simple Data Collection Planning)	<p>Measurement should speed improvement, not slow it down. Often, organizations get bogged down in measurement and delay making changes until they have collected all the data they believe they need. Instead of measuring the entire process (e.g., all patients waiting in the clinic during a month), measuring a sample (e.g., every sixth patient for one week; the next eight patients) is a simple and efficient way to help a team understand how a system is performing. Sampling saves time and resources while accurately tracking performance.</p> <p>Simple data collection planning is a process to ensure that the data collected for performance improvement are useful and reliable, without being unnecessarily costly and time consuming to obtain.</p>	<p>http://www.ihc.org/knowledge/Pages/Tools/Sampling.aspx</p> <p>Also refer to Simple Data Collection Planning at: http://www.ihc.org/knowledge/Pages/Tools/SimpleDataCollectionPlanning.aspx.</p>
Institute for Healthcare Improvement	Guide	Storyboards	<p>Storyboards are a useful tool for effectively presenting a team’s work to a variety of audiences—to other groups within the organization, to other organizations, and to the larger community.</p>	<p>http://www.ihc.org/knowledge/Pages/Tools/Storyboards.aspx</p>

Organization	Type of Resource	Name	Description	Source
Institute for Healthcare Improvement	Guide	Walk-Through Tool	<p>Walk-throughs enable providers to better understand the experience of care from the patient’s and family’s points of view by going through the experience themselves. This tool is most useful in answering question 1 in the Model for Improvement (What are we trying to accomplish?). Using the Walk-through tool can:</p> <ul style="list-style-type: none"> • Provide firsthand knowledge of what it is like to be a patient in an organization. • Build the will and provide incentive for an organization to improve care and enhance the patient experience. • Generate data that address the total experience of the patient, including direct observations as well as feelings such as frustration and fear. • Generate ideas for process improvement and innovation. 	http://www.ihc.org/knowledge/Pages/Tools/Walkthrough.aspx
Sharon Martin Community Health Fund	Guide	A SMART Fund Guide to Using Outcomes to Design & Manage Community Health Activities	This guides supports understanding and developing measures to manage projects.	http://www.smartfund.ca/docs/smart_outcomes_guide.pdf

Organization	Type of Resource	Name	Description	Source
State of Connecticut	Guide	SMART Objectives	Develop specific, measurable, attainable, relevant, and timely objectives.	http://www.ct.gov/dph/lib/dph/state_health_planning/planning_guide_v2-1_2009.pdf
W.K. Kellogg Foundation	Guide	Logic Model Development Guide	Develop a logic model and plan evaluation.	http://www.wkcf.org/resource-directory/resource/2006/02/wk-kellogg-foundation-logic-model-development-guide
Institute for Healthcare Improvement	Guidelines	Guidelines for Successful Visiting	Visiting another organization can be a great help to teams working on improvement. Visiting exposes the team to insights unavailable by any other method. The face-to-face nature of visiting allows more interaction and accelerates improvement. These guidelines can help organizations arrange and run a visit.	http://www.ihc.org/knowledge/Pages/Tools/GuidelinesforSuccessfulVisiting.aspx

Organization	Type of Resource	Name	Description	Source
Agency for Healthcare Research and Quality	Indicator or Measure	CAHPS Hospital Survey: Global Rating	<p>The survey includes one global rating (an overall rating of the hospital):</p> <ul style="list-style-type: none"> • Question 21. Using any number from 0 to 10, where 0 is the worst hospital possible and 10 is the best hospital possible, what number would you use to rate this hospital? <p>In addition, the survey asks respondents about their willingness to recommend the facility:</p> <ul style="list-style-type: none"> • Question 22: Would you recommend this hospital to your family and friends? Possible responses are: Definitely no, Probably no, Probably yes, Definitely yes. 	https://cahps.ahrq.gov/surveys-guidance/hospital/about/index.html
Agency for Healthcare Research and Quality	Indicator or Measure	CAHPS Hospital Survey: Individual Items	<p>The survey includes two individual items that can be reported separately:</p> <ul style="list-style-type: none"> • Cleanliness of the hospital environment: Question 8. During this hospital stay, how often were your room and bathroom kept clean? • Quietness of the hospital environment: Question 9. During this hospital stay, how often was the area around your room quiet at night? 	https://cahps.ahrq.gov/surveys-guidance/hospital/about/index.html

Organization	Type of Resource	Name	Description	Source
Agency for Healthcare Research and Quality	Indicator or Measure	CAHPS [®] Hospital Survey: Composite Measures	The survey generates six composite measures of the quality of inpatient care: <ul style="list-style-type: none"> • Communication with nurses • Communication with provider • Communication about medicines • Responsiveness of hospital staff • Information about recovery • Pain control 	https://cahps.ahrq.gov/surveys-guidance/hospital/about/index.html
Institute for Healthcare Improvement	Indicator or Measure	Rate of Spread	Monitor spread of innovation.	http://www.ihp.org/knowledge/Pages/Measures/RateofSpread.aspx
National Committee for Quality Assurance	Indicator or Measure	HEDIS [®] measures (Healthcare Effectiveness Data and Information Set)	HEDIS is a tool used by more than 90 percent of America’s health plans to measure performance on important dimensions of care and service. Altogether, HEDIS consists of 71 measures across 8 domains of care. Because so many plans collect HEDIS data, and because the measures are so specifically defined, HEDIS makes it possible to compare the performance of health plans on an “apples-to-apples” basis. Health plans also use HEDIS results themselves to see where they need to focus their improvement efforts.	http://www.ncqa.org/HEDISQualityMeasurement/HEDISMeasures.aspx

Organization	Type of Resource	Name	Description	Source
Oregon Health Policy Commission and Office for Oregon Health Policy and Research	Indicator or Measure	Oregon Hospital Guide	Volume indicators are simply a count of hospital admissions for a given procedure. The counts presented here are of relatively rare and specialized procedures for which scientific research suggests that performing more of the procedure often leads to better patient outcomes. In the accompanying displays, volumes are shown compared to a “threshold” number identified by AHRQ as the point at which improved patient outcomes have been observed. While volume is not a direct measure of quality of care, it is useful in gauging how much experience a particular hospital has for a given procedure.	http://www.orhospitalquality.org/

Organization	Type of Resource	Name	Description	Source
Oregon Health Policy Commission and Office for Oregon Health Policy and Research	Indicator or Measure	Oregon Hospital Guide	Death rate indicators represent the number of patients admitted for a specific procedure or condition who died in the hospital, divided by the total number of patients admitted for that procedure or condition. However, because the patients' age, sex, or severity of condition may increase their risk of death, the death rates for each hospital are adjusted to account for these factors. Other factors—for example, that some hospitals may transfer out all but the most mild or most severe cases—are not accounted for in the risk-adjustment methods used here. Hence, while death rates constitute a more sensitive indicator of quality than mere procedure counts, they too should be considered in tandem with comments submitted by hospitals, as well as with other information about quality of care.	http://www.orphospitalquality.org/index.php

Organization	Type of Resource	Name	Description	Source
Organization for Economic Co-operation and Development (OECD)	Indicator or Measure	Health at a Glance: OECD Indicators	<p>Several indicators have been identified, including:</p> <ul style="list-style-type: none"> • Hospital-acquired infections: ventilator-associated pneumonia, wound infection, infection due to medical care, decubitus ulcer. • Operative and postoperative complications: complications of anesthesia, postoperative hip fracture, postoperative pulmonary embolism or deep vein thrombosis, postoperative sepsis, technical difficulty with procedure. • Sentinel events: transfusion reaction, wrong blood type, wrong-site surgery, foreign body left in during procedure, medical equipment-related adverse events, medication errors. • Obstetrics: birth trauma - injury to neonate, obstetric trauma - vaginal delivery, obstetric trauma - cesarean section, problems with childbirth. • Other care-related adverse events: patient falls, in-hospital hip fracture or fall 	http://www.oecd.org/els/health-systems/49105858.pdf

Organization	Type of Resource	Name	Description	Source
Washington State Hospital Association	Indicator or Measure	Hospital Quality Measures	Measures include aspirin at arrival, aspirin at discharge, angiotensin-converting enzyme inhibitor for left ventricular systolic dysfunction, smoking cessation advice, beta blocker at discharge, fibrinolytics at arrival, percutaneous coronary intervention at arrival, 30-day mortality, 30-day readmission	http://www.wahospitalquality.org/
Agency for Healthcare Research and Quality	Report	Becoming a High Reliability Organization: Operational Advice for Hospital Leaders	This document is written for hospital leaders interested in providing patients with safer and higher quality care. It presents the thoughts, successes, and failures of hospital leaders who have used concepts of high reliability to make patient care better. Creating an organizational culture and set of work processes that reduce system failures and effectively respond when failures do occur is the goal of high reliability thinking.	http://archive.ahrq.gov/professionals/quality-patient-safety/quality-resources/tools/hroadvice/hroadvice.pdf
Canadian Health Services Research Foundation	Report	Local Opinion Leaders: Effects on Professional Practice and Health Care Outcomes	Summary of a systematic review showing how identifying opinion leaders can have an impact on how health care professionals use research evidence in their clinical practice.	http://www.chsrf.ca/Migrated/PDF/InsightAction/insight_action31_e.pdf

Organization	Type of Resource	Name	Description	Source
Children’s Hospital of Philadelphia	Report	Common Cause Analysis: A Hospital’s Review of Vulnerabilities During Which Common Themes Are Identified, Prioritized, and Addressed	Children’s Hospital of Philadelphia annually reviews all findings from root cause analyses of serious safety events, with the goal of identifying and addressing systemwide vulnerabilities. Known as common cause analysis, this review identifies common themes from the many recommended changes produced by root cause analysis findings. Once identified, themes are prioritized based on frequency of occurrence and professional judgment.	https://innovations.ahrq.gov/profiles/common-cause-analysis-hospitals-review-vulnerabilities-during-which-common-themes-are
Agency for Healthcare Research and Quality	Software	My Own Network, Powered by AHRQ (MONAHRQ®)	MONAHRQ is a desktop software tool that enables organizations to quickly and easily generate a health care reporting Web site. MONAHRQ lets you create a Web site using your own inpatient discharge data, emergency department data, precalculated AHRQ Quality Indicators results, inpatient and outpatient measures from CMS Nursing Home and Hospital Compare, and/or HCAHPS survey measures.	http://www.ahrq.gov/professionals/systems/monahrq/index.html
National Committee for Quality Assurance	Software	QualityCompass	QualityCompass 2011 is a tool for selecting a health plan, conducting competitor analysis, examining quality improvement, and benchmarking plan performance.	http://www.ncqa.org/tabid/177/Default.aspx

Organization	Type of Resource	Name	Description	Source
University of Alberta (funded by Institute for Healthcare Improvement)	Software	Queueing ToolPak 4.0	The Queueing ToolPak (QTP) is a Microsoft Excel add-in that performs basic calculations for waiting line analysis. The functions allow integration of queueing performance measures into spreadsheet models without the limitations imposed by templates with fixed input and output areas that are commonly used for analysis of waiting lines.	http://queueingtoolpak.org/
Agency for Healthcare Research and Quality	Survey	Hospital Survey on Patient Safety Culture	In 2004, AHRQ released the Hospital Survey on Patient Safety Culture, a staff survey designed to help hospitals assess the culture of safety in their institutions.	http://www.ahrq.gov/professionals/quality-patient-safety/patientsafetyculture/hospital/index.html
Institute for Healthcare Improvement	Survey	Short Survey	Short surveys are intended to provide just enough simple and prompt feedback to indicate whether attempts to improve are going in the right direction. Teams can also use them to pinpoint certain areas of interest (e.g., did the patients find the new form easy to understand?). These surveys are useful for answering question 2 in the Model for Improvement (How will we know that a change is an improvement?) and in running Plan-Do-Study-Act (PDSA) cycles.	http://www.ihl.org/knowledge/Pages/Tools/ShortSurvey.aspx

Organization	Type of Resource	Name	Description	Source
The Leapfrog Group	Survey	The Leapfrog Group Hospital and Safety Survey	The Leapfrog Group is a coalition of large public and private purchasers who are leveraging their purchasing power to encourage significant improvements in patient safety and quality of care, and ultimately, cost savings. Leapfrog focuses on computerized provider order entry (CPOE), intensive care unit (ICU) provider staffing, evidence-based hospital referral (track record and experience with certain high-risk procedures), and the National Quality Foundation's endorsed set of practices for safer health care. Almost 1,200 hospitals submitted data to the Leapfrog Group in 2005.	http://www.leapfroggroup.org/survey-materials/survey-and-cpoe-materials

Organization	Type of Resource	Name	Description	Source
University of Nebraska Medical Center	Survey	Rural-Adapted Hospital Survey on Patient Safety Culture	<p>This toolkit includes resources for small rural hospitals to conduct and interpret the AHRQ Hospital Survey on Patient Safety Culture. They can help create an infrastructure for reporting, collecting, and analyzing data about voluntarily reported medication errors.</p> <p>The tools are organized by the four components of a safe, informed culture: reporting culture, just culture, flexible culture, and learning culture.</p> <p>Within each component, tools are provided to:</p> <ul style="list-style-type: none"> • Engage the audience about the importance of the change. • Educate the audience about what they need to do. • Ensure that the audience can execute the change. • Evaluate whether the change made a difference. 	http://www.unmc.edu/patient-safety/surveys/rural-hospital-survey.html
Agency for Healthcare Research and Quality	Toolkit	Child Health Care Quality Toolbox: Measuring Quality in Children's Health Programs	This Web site contains concepts, tips, and tools for evaluating the quality of health care for children.	http://www.ahrq.gov/research/findings/factsheets/children/toolbox/index.html

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Agency for Healthcare Research and Quality	Toolkit	TeamSTEPPS	<p>TeamSTEPPS is a teamwork system designed for health care professionals that is:</p> <ul style="list-style-type: none"> • A powerful solution to improve patient safety within your organization. • An evidence-based teamwork system to improve communication and teamwork skills among health care professionals. 	http://www.ahrq.gov/professionals/education/curriculum-tools/teamstepps/index.html
Health Research & Educational Trust	Toolkit	Health Research & Educational Trust Disparities Toolkit	This toolkit is designed to help hospitals, health systems, community health centers, medical group practices, health plans, and other users understand the importance of collecting accurate data on race, ethnicity, and primary language of persons with limited English proficiency, deafness, or hearing impairments. By using this toolkit, health care organizations can assess their organizational capacity to collect information and implement a systematic framework designed specifically for obtaining race, ethnicity, and primary language data directly from patients/enrollees or their caregivers in an efficient, effective, and respectful manner.	http://www.hretdisparities.org/index.php
National Academy for State Health Policy	Toolkit	Patient Safety Map & Toolkit	This electronic toolbox provides States with tools they can use or modify as they develop or improve adverse event reporting systems. The toolbox includes information (policies, practices, forms, reports, methods, and contracts) related to States' reporting systems, links to other Web resources, and fast facts and issues related to patient safety.	http://www.nashp.org/pst-welcome

Organization	Type of Resource	Name	Description	Source
Agency for Healthcare Research and Quality	Web-Based Resource	HCUPnet	This interactive tool is used for identifying, tracking, analyzing, and comparing statistics on hospital care. It is part of the Healthcare Cost and Utilization Project (HCUP). With HCUPnet, users have easy access to national statistics and trends and selected State statistics about hospital stays. HCUPnet generates statistics using data from the Nationwide Inpatient Sample (NIS), the Kids' Inpatient Database (KID), and State Inpatient Databases (SID) for States that participate. HCUPnet also provides statistics based on the AHRQ Quality Indicators, which have been applied to the HCUP NIS. These statistics provide insight into potential quality of care problems.	http://hcupnet.ahrq.gov/
Agency for Healthcare Research and Quality	Web-Based Resource	Health Care Innovations Exchange	This Web site includes a searchable database of innovations with evidence of their effectiveness and includes innovation attempts that did not work as planned.	http://www.innovations.ahrq.gov

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Agency for Healthcare Research and Quality	Web-Based Resource	National Guideline Clearinghouse	The NGC is a Web-based resource that contains guidelines submitted by health care organizations, associations, medical societies, and Federal agencies. The site provides an accessible and comprehensive source of clinical practice guidelines—in both summary and full text (where available) format—saving users hours of researching to find similar information. The NGC was originally developed by AHRQ in partnership with the American Medical Association and the American Association of Health Plans.	http://www.guideline.gov/
Agency for Healthcare Research and Quality	Web-Based Resource	National Quality Measures Clearinghouse	Designed as a Web-based one-stop shop for hospitals, health systems, health plans, and others who may be interested in quality measurement and improvement, the NQMC has the most current evidence-based quality measures and measure sets available to evaluate health care quality. Users can search the NQMC for measures that target a particular disease or condition, treatment, age range, gender, vulnerable population, setting of care, or contributing organization. Visitors also can compare attributes of two or more quality measures side by side to determine which measures best suit their needs.	http://www.qualitymeasures.ahrq.gov/

Organization	Type of Resource	Name	Description	Source
Agency for Healthcare Research and Quality	Web-Based Resource	QualityTools Web site	Part of the Healthcare Innovations Exchange, this online clearinghouse allows users to search for tools that target a disease/condition, audience, tool category, or vulnerable population. The QualityTools providers' page provides links to resources (including Web sites, benchmarks, guidelines, data, and measures) to help hospitals and other provider organizations assess and improve care delivery.	https://psnet.ahrq.gov/resources/resource/1434/qualitytools
CMS	Web-Based Resource	Hospital Compare	Hospital Compare is a consumer-oriented Web site that provides information on how well hospitals provide recommended care to their patients. This information can help consumers make informed decisions about health care. Hospital Compare allows consumers to select multiple hospitals and directly compare performance measure information related to heart attack, heart failure, pneumonia, surgery, and other conditions. These results are organized by: <ul style="list-style-type: none"> • Patient Survey Results. • Timely and Effective Care. • Readmissions, Complications, and Deaths. • Use of Medical Imaging. • Linking Quality to Payment. • Medicare Volume. 	http://www.hospitalcompare.hhs.gov/

Organization	Type of Resource	Name	Description	Source
Institute for Healthcare Improvement	Web-Based Resource	Improvement Tracker	Monitor the impact of an innovation.	http://app.ihl.org/Workspace/tracker/
SCORE	Web-Based Resource	5 Tips on Preparing for Change (subtopic on Web page)	Tips on managing change.	http://www.scorerochester.org/help/tips/planning.php
Vermont Child Health Improvement Program (VCHIP)	Web-Based Resource	Vermont Child Health Improvement Program: Tools and Resources	This Web site provides tools and resources developed by VCHIP that can assist in carrying out quality improvement projects. The tools and resources are a combination of tools developed through VCHIP's various projects, relevant Web pages, and key publications of active and completed projects.	http://www.uvm.edu/medicine/vchip/?Page=tools.html
Institute for Healthcare Improvement	Worksheet	Plan, Do, Study, Act (PDSA) and PDSA Worksheet	PDSA enables people to carry out small tests of change. The PDSA Worksheet is a useful tool for documenting a test of change. The PDSA cycle is shorthand for testing a change by developing a plan to test the change (Plan), carry out the test (Do), observe and learn from the results (Study), and determine what modifications should be made to the test (Act).	http://www.ihl.org/resources/Pages/Tools/PlanDoStudyActWorksheet.aspx