Key Choices in Analyzing Data

AHRQ Quality Indicators (QI) Learning Institute
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Warren Strauss, PhD, Battelle Memorial Institute
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Agenda

- Welcome
- Defining the numerator
- Defining the denominator
- Calculating the rate
- Adjusting for case-mix
- Adjusting for “reliability” (hierarchical modeling)
- Questions and discussion
Tentative Webinar Schedule

**Orientation:**
- October - Designing Your Reporting Program

**Measures/Data/Analysis:**
- November - Selecting Measures & Data
- Today - Key Choices in Analyzing Data for the Report
- January - Classifying Hospitals

**Reporting/Disseminating/Promoting:**
- February - Displaying the Data
- March - Web Site Design & Content
- April - Marketing & Promoting Your Report

**Evaluation:**
- May - Evaluation of Public Reporting Program

**Closing:**
- June - Highlights From the Learning Institute
Polling Results

What aspects of quality do you think are most salient to consumers? (Choose all that apply)

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>67%</td>
</tr>
<tr>
<td>Patient experience</td>
<td>58%</td>
</tr>
<tr>
<td>Clinical effectiveness</td>
<td>39%</td>
</tr>
<tr>
<td>Cost/efficiency</td>
<td>36%</td>
</tr>
<tr>
<td>Access/timelines</td>
<td>30%</td>
</tr>
<tr>
<td>Equity</td>
<td>3%</td>
</tr>
<tr>
<td>Other</td>
<td>3%</td>
</tr>
</tbody>
</table>
## Polling Results

What concerns about quality indicators do you most frequently receive from providers? (Choose all that apply)

<table>
<thead>
<tr>
<th>Concern</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>The risk adjustment is not adequate</td>
<td>64%</td>
</tr>
<tr>
<td>The outcome is not preventable</td>
<td>55%</td>
</tr>
<tr>
<td>The methods used are not understandable</td>
<td>45%</td>
</tr>
<tr>
<td>Collection of the measure is too burdensome</td>
<td>45%</td>
</tr>
<tr>
<td>The results are not consistent with other sources of information</td>
<td>41%</td>
</tr>
<tr>
<td>The indicator is not clinically important</td>
<td>18%</td>
</tr>
<tr>
<td>The patient(s) did not have the outcome of interest</td>
<td>18%</td>
</tr>
<tr>
<td>Other</td>
<td>9%</td>
</tr>
</tbody>
</table>
14 States Use QIs for Public Hospital Reporting

- California
- New Jersey
- Oregon
- Utah
- Colorado
- Texas
- Wisconsin (parts of state)
- New York
- Ohio
- Vermont
- Massachusetts
- Kentucky
- Florida
QILI Newsletter

What's New on the Extranet

Discussions

- SSII and patient records data elements – Planning Committee member Kim Street from the Florida Hospital Association asked about member programs link patient to data. Five members have replied to date, in a PowerPoint presentation given by Susan Maldie from Texas Tech University Health Science Center about the AHRQ/AMIA Repositories Conference. Members for this issue were also posted.

- Jeff Cygurski’s interim organization administration data – Faculty member Jeff Cygurski requested about his member program document present on administration data. Two members have replied to date.

- Key choices in analyzing data for the report – December Webinar – There is a discussion reflector for each Webinar where members can ask questions about the topics both before and after the event. After the November Webinar there was one member question about ICD-10 codes, which prevented Jeff Cygurski answered. Because the December Webinar is technical, logistically anticipate a lot of questions.

Documents

- CDC/IDSO-CEM official guidelines for coding and encoding – During the Webinar about selecting measures on November 17th there was a question about how to become familiar with ICD-10 codes. Jeff Cygurski suggested these guidelines, which have been posted in a document folder named “Administrative Data Resources.”

- AHRQ draft model reports – During the Webinar about selecting measures, presenter Keshava Ginter mentioned AHRQ’s Model Public Reports. The DRAFT reports are posted in their raw form.

- Please post your questions,反映, and relevant documents in the extranet on other issues and feedback received.

Upcoming Events

Key Choices in Analyzing Data Webinar

Monday, December 15, at 12:00 pm ET
3rd Extramural Training.

Week of January 5th.

December’s Program Profile: Texas Department of State Health Services

The University of Texas, Austin’s Health Science Center

https://ahrq.gov/newsletters/qili.html
Agenda

- Welcome
- Defining the numerator
- Defining the denominator
- Calculating the rate
- Adjusting for case-mix
- Adjusting for “reliability” (hierarchical modeling)
- Questions and discussion
Learning Objectives

You will learn how to:

- Identify common sources of variation in ICD-9-CM coding practices that might impact AHRQ QI rates
- Understand the relationship between coding design and indicator structure/denominator
- Identify and explain the difference between the various types of rates calculated for the AHRQ QI
- Identify the patient characteristics used to adjust the AHRQ QI for “case mix” and understand how that adjustment is done
- Describe the basic intent and consequence of using hierarchical modeling methods to adjust the AHRQ QI rates for “reliability”
Defining the Numerator

- The numerator of the AHRQ Quality Indicators is the number of discharges with the “outcome of interest” (e.g., mortality, adverse event)
- The AHRQ QI are based on commonly available administrative data, which are used primarily for billing, but also for other purposes
- There is a basic tension between using the data for reimbursement and for defining quality indicators
  - Submitting bills quickly versus coding from a complete record
  - Maximizing the coding of complications and comorbidities versus only coding diagnoses “out of the norm”
- Adherence to best practices in coding and compliance with coding guidelines will ensure fair reimbursement and accurate measurement of quality indicators
Defining the Numerator

- Some of the variation in AHRQ QI rates might be due to variation in:
  - Data availability (e.g., number of diagnosis codes, admission type, condition present on admission, E-codes)
  - Documentation (*ICD-9-CM and DRG coding*)
  - Performance (e.g., processes of care, staffing)

- Documentation impacts both the implementation and development of the QI

- Two questions we address here:
  - What are the sources of variation in coding practices that might impact documentation and, therefore, the QI rates?
  - How does the design of codes impact indicator development?
Dates of Procedure
Impact of not having procedure dates

- Decubitus Ulcer
- Postop Hemorrhage or Hematoma
- Postop Physio Metabol Derangement
- Postop Respiratory Failure
- Postoperative Hip Fracture
- Postoperative PE or DVT
- Postoperative Wound Dehiscence
Number of Codes

Impact of limiting data to 10 dx and 6 proc codes

-70.00%
-60.00%
-50.00%
-40.00%
-30.00%
-20.00%
-10.00%
0.00%
10.00%

Failure To Rescue
Decubitus Ulcer
Accidental Puncture/Laceration
Iatrogenic Pneumothorax
Postoperative Hip Fracture
Death In Low Mortality DRGs
Infection Due To Medical Care
Postoperative PE or DVT
Foreign Body Left In During Proc
Postoperative Wound Dehiscence
Postoperative Hemorrhage or Hematoma
Postop Respiratory Failure
Postop Physio Metabol Derangement
<table>
<thead>
<tr>
<th>Indicator Number (used in software)</th>
<th>Indicator Name</th>
<th>Use of External Cause-of-Injury Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 &amp; 25</td>
<td>Accidental puncture or laceration</td>
<td>Required. Used in both the numerator and denominator definitions.</td>
</tr>
<tr>
<td>17</td>
<td>Birth trauma</td>
<td>Not used.</td>
</tr>
<tr>
<td>1</td>
<td>Complications of anesthesia</td>
<td>Required. Used in the numerator definition.</td>
</tr>
<tr>
<td>2</td>
<td>Death in low mortality DRGs</td>
<td>Not used.</td>
</tr>
<tr>
<td>3</td>
<td>Decubitus ulcer</td>
<td>Not used.</td>
</tr>
<tr>
<td>4</td>
<td>Failure to rescue</td>
<td>Not used.</td>
</tr>
<tr>
<td>5 &amp; 21</td>
<td>Foreign body left during procedure</td>
<td>Required. Used in the numerator definition although the other ICD-9 CM codes may capture the same information.</td>
</tr>
<tr>
<td>6 &amp; 22</td>
<td>Iatrogenic pneumothorax</td>
<td>Not used.</td>
</tr>
<tr>
<td>20 &amp; 29</td>
<td>Obstetric trauma – cesarean section</td>
<td>Not used.</td>
</tr>
<tr>
<td>18 &amp; 27</td>
<td>Obstetric trauma – vaginal with instrument</td>
<td>Not used.</td>
</tr>
<tr>
<td>19 &amp; 28</td>
<td>Obstetric trauma – vaginal without instrument</td>
<td>Not used.</td>
</tr>
<tr>
<td>9</td>
<td>Postoperative hemorrhage or hematoma</td>
<td>Not used.</td>
</tr>
<tr>
<td>8</td>
<td>Postoperative hip fracture</td>
<td>Used as exclusion criteria in denominator population.</td>
</tr>
<tr>
<td>10</td>
<td>Postoperative physiologic and metabolic derangements</td>
<td>Not used.</td>
</tr>
<tr>
<td>12</td>
<td>Postoperative pulmonary embolism or deep vein thrombosis</td>
<td>Not used.</td>
</tr>
<tr>
<td>11</td>
<td>Postoperative respiratory failure</td>
<td>Not used.</td>
</tr>
<tr>
<td>13</td>
<td>Postoperative sepsis</td>
<td>Not used.</td>
</tr>
<tr>
<td>14 &amp; 24</td>
<td>Postoperative wound dehiscence</td>
<td>Not used.</td>
</tr>
<tr>
<td>7 &amp; 23</td>
<td>Selected infections due to medical care</td>
<td>Not used.</td>
</tr>
<tr>
<td>16 &amp; 26</td>
<td>Transfusion reaction</td>
<td>Required. Used in the numerator definition although the other ICD-9 CM codes may capture the same information.</td>
</tr>
</tbody>
</table>
Accidental Puncture or Laceration, Secondary Diagnosis Field (PSI 15 and 25)

Numerator:

Discharges with ICD-9-CM code denoting accidental cut, puncture, perforation or laceration during a procedure in any secondary diagnosis field.

**ICD-9-CM Accidental Puncture or Laceration diagnosis codes:**

Accidental cut, puncture, perforation, or hemorrhage during medical care:

- E8700  SURGICAL OPERATION
- E8701  INFUSION OR TRANSFUSION
- E8702  KIDNEY DIALYSIS OR OTHER PERFUSION
- E8703  INJECTION OR VACCINATION
- E8704  ENDOSCOPIC EXAMINATION
- E8705  ASPIRATION OF FLUID OR TISSUE, PUNCTURE, AND CATHETERIZATION
- E8706  HEART CATHETERIZATION
- E8707  ADMINISTRATION OF ENEMA
- E8708  OTHER SPECIFIED MEDICAL CARE
- E8709  UNSPECIFIED MEDICAL CARE

- 9982  ACCIDENTAL PUNCTURE OR LACERATION DURING A PROCEDURE
Complications of Anesthesia (PSI 1)

Numerator:

Discharges with ICD-9-CM diagnosis codes for anesthesia complications in any secondary diagnosis field.

*ICD-9-CM Anesthesia Complications diagnosis codes:*

Adverse effects in therapeutic use, other central nervous system depressants and anesthetics:

- E8763  ENDOTRACHEAL TUBE WRONGLY PLACE DURING ANESTHETIC PROCEDURE
- E9381  HALOTHANE
- E9382  OTHER GASEOUS ANESTHETICS
- E9383  INTRAVENOUS ANESTHETICS
- E9384  OTHER AND UNSPECIFIED GENERAL ANESTHETICS
- E9385  SURFACE AND INfiltrATION ANESTHETICS
- E9386  PERIPHERAL NERVE AND PLEXUS BLOCKING ANESTHETICS
- E9387  SPINAL ANESTHETICS
- E9389  OTHER AND UNSPECIFIED LOCAL ANESTHETICS

Poisoning by other central nervous system depressants and anesthetics:

- 9681  HALOTHANE
- 9682  OTHER GASEOUS ANESTHETICS
- 9683  INTRAVENOUS ANESTHETICS
- 9684  OTHER AND UNSPECIFIED GENERAL ANESTHETICS
- 9687  SPINAL ANESTHETICS
- E8551  ACCIDENTAL POISONING, OTHER NERVOUS SYSTEM DEPRESSANTS
ICD-9-CM Coding

- Adherence to coding guidance
  - Highest level of specificity
    - Overuse of NEC* and NOS** designation
  - Coding the general and specific
    - Use of 997.xx codes without use of additional code to identify specific complication
  - Coding of secondary diagnoses
    - Only codes that impact treatment or complications
  - Coding of E-codes
  - Coding of procedures
    - Only significant procedures to be reported

*Not otherwise specified
**Not elsewhere classified
Coding: Specificity

- **Highest level of specificity**
  - Overuse of NEC and NOS designation

- **Examples:**
  - Using 586 (renal failure NOS) instead of 584.x (acute renal failure) excludes case from denominator of PSI 3 (death among surgical inpatients) and numerator of PSI 10 (postop physiologic/metabolic derangement)
  - Using 531.90 (gastric ulcer, unspec acute/chronic w/out hem or perf) instead of 531.70 (gastric ulcer, chronic w/out hem or perf) eliminates comorbidity credit in risk-adjustment of PSIs
Coding: Multiple coding

- Coding the general and specific
  - Use of 997.xx codes without additional code to identify specific complication

- Examples:
  - Use 451 or 453 code with 997.2 to describe postop DVT
  - Use 415.1x code with 997.3 to describe postop PE, or 518.81 with 997.3 to describe postop respiratory failure
  - Use 584 code with 997.5 to describe postop renal failure (physiologic/metabolic derangements)
Coding: Avoid over-coding

- Coding of secondary diagnoses
  - Assign codes only for conditions that impact evaluation or treatment

- For reporting purposes, the definition for "other diagnoses" is interpreted as additional conditions that affect patient care in terms of requiring:
  - Clinical evaluation; or
  - Therapeutic treatment; or
  - Diagnostic procedures; or
  - Extended length of hospital stay; or
  - Increased nursing care and/or monitoring.

- UHDDS*...defines Other Diagnoses as “all conditions that coexist at the time of admission, that develop subsequently, or that affect the treatment received and/or the length of stay. Diagnoses that relate to an earlier episode which have no bearing on the current hospital stay are to be excluded.”

* Uniform Hospital Discharge Data Set
Coding: Avoid over-coding

Coding of secondary diagnoses

- “Abnormal findings (laboratory, x-ray, pathologic, and other diagnostic results) are not coded and reported unless the physician indicates their clinical significance.”

- “If the findings are outside the normal range and the physician has ordered other tests to evaluate the condition or prescribed treatment, it is appropriate to ask the physician whether the abnormal finding should be added.”

- “All conditions that occur following surgery . . . are not complications . . . there must be more than a routinely expected condition or occurrence . . . there must be a cause-and-effect relationship between the care provided and the condition . . ..”

Refs: CDC ICD-9-CM Coding Guidelines; Faye Brown’s ICD-9-CM Coding Handbook 2004
Coding: Procedures

- Coding of E-codes
- Coding of procedures

“The UHDDS requires all significant procedures to be reported . . . . A significant procedure is defined as one that meets any of the following conditions:

- is surgical in nature
- carries an anesthetetic risk
- carries a procedural risk
- requires specialized training.”

Ref: Coding Clinic for ICD-9-CM 1990;7(4):5-6
Improvement through use

Data Problem

Quality Problem

Quality Indicator
Triggers Concern
(Health System Symptom)

Differential diagnosis
Data issue?
Health care quality deficiency?
Indicator limitation?

Treatment
Correct data
Implement quality improvements
Revise indicator definitions
Present on Admission (POA)

- Implemented in the UB-04 effective October 1, 2007 as a flag for each principal and secondary diagnosis code and E-codes
- POA is defined as present at the time the order for inpatient admission occurs
- If at the time of code assignment the documentation is unclear as to whether a condition was POA or not, it is appropriate to query the provider for clarification
### Table 3. Percentage of Patient Safety Indicator (PSI) Events Remaining After Removing Secondary Diagnoses That Were POA, 2003*

<table>
<thead>
<tr>
<th>Patient Safety Indicator</th>
<th>California</th>
<th></th>
<th>New York</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Events</td>
<td>Percent Remaining</td>
<td>Number of Events</td>
<td>Percent Remaining</td>
</tr>
<tr>
<td>PSI 1: Complications of Anesthesia</td>
<td>934</td>
<td>100.0</td>
<td>284</td>
<td>100.0</td>
</tr>
<tr>
<td>PSI 3: Decubitus Ulcer</td>
<td>17,789</td>
<td>11.1</td>
<td>16,425</td>
<td>14.0</td>
</tr>
<tr>
<td>PSI 5: Foreign Body Left During Procedure</td>
<td>258</td>
<td>64.3</td>
<td>169</td>
<td>75.7</td>
</tr>
<tr>
<td>PSI 6: Iatrogenic Pneumothorax</td>
<td>1,256</td>
<td>72.6</td>
<td>782</td>
<td>65.2</td>
</tr>
<tr>
<td>PSI 7: Infection Due To Medical Care</td>
<td>4,286</td>
<td>64.9</td>
<td>2,406</td>
<td>64.6</td>
</tr>
<tr>
<td>PSI 8: Postoperative Hip Fracture</td>
<td>106</td>
<td>20.8</td>
<td>69</td>
<td>26.1</td>
</tr>
<tr>
<td>PSI 9: Postoperative Hemorrhage or Hematoma</td>
<td>1,800</td>
<td>79.1</td>
<td>859</td>
<td>71.4</td>
</tr>
<tr>
<td>PSI 10: Postoperative Physiologic and Metabolic Derangement</td>
<td>686</td>
<td>76.5</td>
<td>228</td>
<td>63.6</td>
</tr>
<tr>
<td>PSI 11: Postoperative Respiratory Failure</td>
<td>2,374</td>
<td>93.5</td>
<td>1,312</td>
<td>93.2</td>
</tr>
<tr>
<td>PSI 12: Postoperative PE or DVT</td>
<td>6,715</td>
<td>45.9</td>
<td>5,318</td>
<td>42.5</td>
</tr>
<tr>
<td>PSI 13: Postoperative Sepsis</td>
<td>865</td>
<td>73.4</td>
<td>453</td>
<td>70.0</td>
</tr>
<tr>
<td>PSI 15: Accidental Puncture/Laceration</td>
<td>9,107</td>
<td>87.3</td>
<td>3,743</td>
<td>87.0</td>
</tr>
<tr>
<td>PSI 16: Transfusion Reaction</td>
<td>12</td>
<td>58.3</td>
<td>&lt;10</td>
<td>77.8</td>
</tr>
</tbody>
</table>

* POA, present on admission; PE, pulmonary embolism; DVT, deep vein thrombosis.

Not-POA rates by comparison from AHRQ PSI Validation Pilot Project:
PSI 6 = 92%; PSI 7 = 83%; PSI 12 = 84%; PSI 13 = 83%; PSI 15 = 95%
Table 4. Pearson Correlations (Weighted) Between Hospital-Level Patient Safety Indicator (PSI) Rates Before and After Dropping POA Diagnoses, 2003*

<table>
<thead>
<tr>
<th>Patient Safety Indicator</th>
<th>California</th>
<th>New York</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Observed</td>
<td>Risk Adjusted</td>
</tr>
<tr>
<td>PSI 1: Complications of Anesthesia</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>PSI 3: Decubitus Ulcer</td>
<td>.29</td>
<td>.40</td>
</tr>
<tr>
<td>PSI 5: Foreign Body Left During Procedure</td>
<td>.89</td>
<td>NA</td>
</tr>
<tr>
<td>PSI 6: Iatrogenic Pneumothorax</td>
<td>.90</td>
<td>.86</td>
</tr>
<tr>
<td>PSI 7: Infection Due To Medical Care</td>
<td>.91</td>
<td>.90</td>
</tr>
<tr>
<td>PSI 8: Postoperative Hip Fracture</td>
<td>.47</td>
<td>.47</td>
</tr>
<tr>
<td>PSI 9: Postoperative Hemorrhage or Hematoma</td>
<td>.87</td>
<td>.85</td>
</tr>
<tr>
<td>PSI 10: Postoperative Physiologic and Metabolic Derangement</td>
<td>.94</td>
<td>.92</td>
</tr>
<tr>
<td>PSI 11: Postoperative Respiratory Failure</td>
<td>.99</td>
<td>.98</td>
</tr>
<tr>
<td>PSI 12: Postoperative PE or DVT</td>
<td>.80</td>
<td>.78</td>
</tr>
<tr>
<td>PSI 13: Postoperative Sepsis</td>
<td>.72</td>
<td>.71</td>
</tr>
<tr>
<td>PSI 15: Accidental Puncture/Laceration</td>
<td>.97</td>
<td>.95</td>
</tr>
<tr>
<td>PSI 16: Transfusion Reaction</td>
<td>.72</td>
<td>NA</td>
</tr>
</tbody>
</table>

* POA, present on admission; NA, not available; PE, pulmonary embolism; DVT, deep vein thrombosis.
Plots of Hospital Rates Before and After POA Elimination for Postoperative Hemorrhage or Hematoma, 2003
Plots of Hospital Rates Before and After POA Elimination for Decubitus Ulcer, 2003
What % are “really” not POA? Present on admission coding vs. chart review

<table>
<thead>
<tr>
<th>Patient Safety Indicator</th>
<th>Percentage not POA (%)</th>
<th>Nurses vs. Coders</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AHRQ</td>
<td>NACHRI</td>
</tr>
<tr>
<td>PSI 1: Complications of Anesthesia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSI 3: Decubitus Ulcer</td>
<td>60</td>
<td>42</td>
</tr>
<tr>
<td>PSI 5: Foreign Body Left During Proc</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>PSI 6: Iatrogenic Pneumothorax</td>
<td>93</td>
<td>89</td>
</tr>
<tr>
<td>PSI 7: Infection Due To Medical Care</td>
<td>80</td>
<td>57</td>
</tr>
<tr>
<td>PSI 8: Postop Hip Fracture</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>PSI 9: Postop Hemorrhage or Hematoma</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>PSI 10: Postop Physiologic or Metabolic</td>
<td>91</td>
<td>77</td>
</tr>
<tr>
<td>PSI 11: Postop Respiratory Failure</td>
<td>96-98</td>
<td>83</td>
</tr>
<tr>
<td>PSI 12: Postop DVT or PE</td>
<td>70-90</td>
<td>67</td>
</tr>
<tr>
<td>PSI 13: Postoperative Sepsis</td>
<td>83</td>
<td>60</td>
</tr>
<tr>
<td>PSI 14: Postop Wound Dehiscence</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>PSI 15: Accidental Puncture/Laceration</td>
<td>98</td>
<td>93</td>
</tr>
<tr>
<td>PSI 16: Transfusion Reaction</td>
<td>71</td>
<td>N/A</td>
</tr>
</tbody>
</table>
ICD-10

- CMS proposed rule would replace the ICD-9-CM code sets with expanded ICD-10 code sets effective October 1, 2011
- An international consortium has adapted the AHRQ Patient Safety Indicators for use with ICD-10
- Full implementation of ICD-10 would require validation and potential expansion/refinement
  - e.g., ICD-10 specifies certain conditions in more detail by adding anatomical sites and type of injury
Agenda

- Welcome
- Defining the numerator
- Defining the denominator
- Calculating the rate
- Adjusting for case-mix
- Adjusting for “reliability” (hierarchical modeling)
- Questions and discussion
Defining the Denominator

- The denominator of the AHRQ Quality Indicators is the number of discharges in the “population at risk” (e.g., specific conditions or procedures for mortality; medical and/or surgical discharges for adverse events)

- The specifications include “exclusions” to increase the likelihood that
  - The denominator has a more than minimal risk for the outcome of interest (e.g., MDC 14 for most PSI)
  - The denominator is “homogeneous” in terms of the type of event or the cause (e.g., age 65 or greater for hip fracture mortality)
  - The numerator is not present on admission (e.g., principal diagnosis of adverse event)
  - The numerator is preventable (e.g., chest trauma for iatrogenic pneumothorax)
Defining the Denominator

Potentially preventable adverse event

Exclude: less likely to be preventable

Exclude: more likely to be present on admission

Include: population at risk

Universe of discharges
Defining the Denominator

Specificity

Sensitivity
Questions

If you would like to pose a question to any of the speakers, please post it in the Q&A box on the right-hand side of your screen and press send.
Agenda

- Welcome
- Defining the numerator
- Defining the denominator
- **Calculating the rate**
- Adjusting for case-mix
- Adjusting for “reliability” (hierarchical modeling)
- Questions and discussion
Calculating AHRQ QI Rates

- AHRQ QI software generates:
  - Observed rates
  - Expected rates and risk-adjusted rates
  - Reliability-adjusted rates

- Reference population
  - Approximately 90 million discharges from 36 States from the AHRQ State Inpatient Databases
  - Rolling 3-year population to balance continuity with data currency
  - Large sample allows estimating models for infrequent outcomes and covariates
Calculating AHRQ QI Rates

- **AHRQ QI observed rates**
  - Defined as numerator/denominator
  - The numerator is always a subset of the denominator
  - The time period is generally one year, but could be longer (e.g., three years) or shorter (e.g., three months)

- **Stratification**
  - Rates may be stratified by patient characteristics or, depending on the user’s data, provider characteristics
Calculating AHRQ QI Rates

- **Stratification example**
  - Pediatric postoperative hemorrhage or hematoma (PDI #8)
  - Patient stratification
    - Low risk: 1.5 per 1,000
    - High risk*: 18.5 per 1,000
  - Provider stratification
    - Children’s hospital: 2.1 per 1,000
    - Non-children’s hospital: 1.3 per 1,000

*specified coagulopathies and extracorporeal membrane oxygenation (ECMO)
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Adjusting for Case-mix: Rate Definitions

- The *expected rate* is the rate the provider would have if it performed the same as the reference population given the provider’s actual case-mix.

- The *risk-adjusted rate* is the rate the provider would have if it had the same case-mix as the reference population given the provider’s actual performance.

- The *population rate* is the observed rate for the reference population.
Rate Definitions cont.

- **Risk-adjusted rate =**
  
  \[
  \text{(observed rate} / \text{expected rate}) \times \text{population rate}
  \]

  - Population rate > expected rate, case-mix is less severe
  - Population rate < expected rate, case-mix is more severe

- **Indirect versus direct standardization**
  
  - Indirect standardization assumes that the same O/E ratio for a hospital applies for all patient subgroups
  
  - The relationship between observed and expected may be proportional \((O/E)\) or linear \((O-E)\)
  
  - Direct standardization requires that the hospital have patients in every subgroup
## Example #1

<table>
<thead>
<tr>
<th>Hospital A</th>
<th>Patients</th>
<th>Rate</th>
<th>Hospital B</th>
<th>Patients</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>High risk</td>
<td>5</td>
<td>0.270</td>
<td>High risk</td>
<td>20</td>
<td>0.120</td>
</tr>
<tr>
<td>Low risk</td>
<td>95</td>
<td>0.060</td>
<td>Low risk</td>
<td>80</td>
<td>0.040</td>
</tr>
<tr>
<td>Expected</td>
<td>100</td>
<td>0.056</td>
<td>Expected</td>
<td>100</td>
<td>0.071</td>
</tr>
<tr>
<td>Observed</td>
<td></td>
<td>0.071</td>
<td>Observed</td>
<td></td>
<td>0.056</td>
</tr>
<tr>
<td>O/E</td>
<td></td>
<td>1.26</td>
<td>O/E</td>
<td></td>
<td>0.79</td>
</tr>
<tr>
<td>RA</td>
<td></td>
<td>0.160</td>
<td>RA</td>
<td></td>
<td>0.100</td>
</tr>
</tbody>
</table>
### Example #2

<table>
<thead>
<tr>
<th>Hospital A</th>
<th>Patients</th>
<th>Rate</th>
<th>Hospital B</th>
<th>Patients</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
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<td>0.040</td>
</tr>
<tr>
<td>Expected</td>
<td>100</td>
<td>0.051</td>
<td>Expected</td>
<td>100</td>
<td>0.248</td>
</tr>
<tr>
<td>Observed</td>
<td></td>
<td>0.051</td>
<td>Observed</td>
<td></td>
<td>0.248</td>
</tr>
<tr>
<td>O-E</td>
<td></td>
<td>1.00</td>
<td>O-E</td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>RA</td>
<td></td>
<td>0.300</td>
<td>RA</td>
<td></td>
<td>0.300</td>
</tr>
</tbody>
</table>
Risk Adjustment

- Inpatient Quality Indicators
  - Gender, age (5-year groups), age*gender interaction and APR-DRG with risk-of-mortality subclass

- Patient Safety Indicators
  - Gender, age, modified DRG and AHRQ comorbidity

- Pediatric Quality Indicators
  - Gender, birth weight, age in days, age in years, modified DRG and AHRQ CCS
Agenda

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Hierarchical modeling accounts for:
- clustering of patients within hospitals
- small number of patients per hospital

Hierarchical modeling is useful when:
- Sample of hospitals from a population
- Test the effect of hospital characteristics

Hierarchical modeling workgroup report (2007)
- In theory, large sample sizes of patients and hospitals should lessen the importance of clustering
Hierarchical modeling “shrinks” the hospitals risk-adjusted rate closer to the overall hospital average.

Why does it do this?
- To improve “reliability” - the likelihood that the rate will “repeat” the hospital’s performance in subsequent time periods.

How does it do this?
- Reliability-adjusted = (1-W) * population rate + W * risk-adjusted rate
- W represents the “reliability” of the provider rate
- W > 0.80 suggests the difference between the population rate and the risk-adjusted rate is likely to persist.
Hierarchical Modeling

- An example for in-hospital mortality for acute stroke (IQI #17)
  - $W = 0.6088$
  - O/E ratio = 1.755
  - Reference population ratio = 1.000
  - Reliability-adjusted ratio = 
    
    $$(1 - 0.6088)\times 1.000 + 
    (0.6088\times 1.755)$$
    
    $$= 1.462$$
Hierarchical Modeling

Reliability Weight by Hospital Volume

Weight

Hospital (sorted by volume)
If you would like to pose a question to any of the speakers, please:

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  OR
- Click the “raise your hand” button to be un-muted and verbally ask a question
Next Webinar

Classifying Hospitals

January TBD, 2009, at 12:00 pm ET

Doug Staiger, Dartmouth College
Jeffrey Geppert, Battelle Memorial Institute

You are welcome to invite one data analyst from your organization
3rd Extranet Training

Week of January 5, 2009

We will send information soon
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