Version 4.3a is a maintenance release of Version 4.3. The differences between the two versions are:

- Version 4.3a includes Version 29 of the Limited License edition of the 3M™ APR-DRG Grouper. This grouper corrects an issue found in Version 28 of the Limited License edition of the 3M™ APR-DRG Grouper. The grouper is only used with the Inpatient Quality Indicator (IQI) mortality measures. Version 4.3 includes Version 28 of the Limited License edition of the 3M™ APR-DRG Grouper, which was incorrectly assigning a Risk of Mortality (ROM) subclass for cases dated on or after 10/1/10.
- Version 4.3a allows users to calculate area-level indicators for years 2010 and 2011, correcting an issue previously identified in Version 4.3.

All other aspects of the software, including measure specifications, remain the same. Thus this document (related to Version 4.3) remains unchanged.
Contents

Chapter 1. Overview................................................................................................................................. 1
  What are the composites? ......................................................................................................................... 1
  Provider Level Composite ..................................................................................................................... 1

Chapter 2. Calculation............................................................................................................................. 2
  How are the composites created? ............................................................................................................. 2

Chapter 3. Use ........................................................................................................................................ 4
  How have the composites changed? ........................................................................................................ 4
  What are the current uses of the composites? ......................................................................................... 4
  Additional Resources ............................................................................................................................. 4

Tables
Table 1. AHRQ PDI Composite Measure Components............................................................................... 1
Table 2. NQF Weights for the Pediatric Patient Safety for Selected Indicators Composite....................... 4
Chapter 1. Overview

The goal in developing composite measures was to provide a measure that could be used to monitor performance over time or across regions and populations using a method that applied at the national, regional, State or provider/area level. Potential benefits of composite measures are to: summarize quality across multiple indicators, improve the ability to detect differences, identify important domains and drivers of quality, prioritize action for quality improvement, make current decisions about future (unknown) health care needs and avoid cognitive “shortcuts”. Despite these potential advantages there are concerns with composite measures, such as: masking important differences and relations among components, not being actionable, not being representative of parts of the health care system that contribute most to quality or detracting from the impact and credibility of reports. In weighing the benefits and concerns of composite measures there are also a number of potential uses to consider, such as: consumer use for selecting a hospital or health plan, provider use for identifying domains and drivers of quality, purchasers use for selection of hospitals or health plans to improve employee health and policymakers use for setting policy priorities to improve the health of a population. This document provides a technical overview for AHRQ QI users.

What are the Composites?

Provider-Level Composite

Applying these criteria to the PDIs, one could advocate for separate composites based on the type of adverse event (e.g., postoperative). However, in general, the component indicators apply to the same providers and show at least some positive correlation with one another. Therefore, the initial composite includes all the provider-level indicators (see table below), with the exception of foreign body (PDI #3) and transfusion reaction (PDI #13), which are reported as counts. Future development might examine sub-composites for certain indicators.

Table 1. AHRQ PDI Composite Measure Components

<table>
<thead>
<tr>
<th>Pediatric Patient Safety for Selected Indicators (PDI #19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDI #01 Accidental Puncture or Laceration Rate</td>
</tr>
<tr>
<td>PDI #02 Pressure Ulcer Rate</td>
</tr>
<tr>
<td>PDI #05 Iatrogenic Pneumothorax Rate</td>
</tr>
<tr>
<td>PDI #08 Postoperative Hemorrhage or Hematoma Rate2</td>
</tr>
<tr>
<td>PDI #09 Postoperative Respiratory Failure Rate3</td>
</tr>
<tr>
<td>PDI #10 Postoperative Sepsis Rate</td>
</tr>
<tr>
<td>PDI #11 Postoperative Wound Dehiscence Rate</td>
</tr>
<tr>
<td>PDI #12 Central Venous Catheter-Related Blood Stream Infection Rate</td>
</tr>
</tbody>
</table>

1 This composite measure (i.e., PDI #19) is endorsed by the National Quality Forum (NQF: #532).
2 This measure is not included in the NQF endorsed composite measure.
Chapter 2. Calculation

How are the Composites Created?

The composite measures are evaluated using three criteria: discrimination, forecasting, and construct validity.

*Discrimination* is the ability of the composite measure to differentiate performance as measured by statistically significant deviations from the average performance.

*Forecasting* is the ability of the composite measure to predict performance for each of the component indicators. Ideally, the forecasting performance would reflect the weighting of the components, in the sense that forecasting would maximize the differences for the most highly weighted components.

*Construct validity* is the degree of association between the composite and other aggregate measures of quality. In this report we look primarily at the consistency in the composites with one another. A broader analysis of construct validity would examine the relationship between the composites and external measures of quality or other factors that might influence quality.

Steps for creating the composite:

*Step 1. Compute the risk-adjusted rate and confidence interval*
The AHRQ QI risk-adjusted rate is computed based on a hierarchical logistic regression model for calculating a predicted value for each case. Then the predicted values among all the cases in the hospital are averaged to compute the expected rate. The risk-adjusted rate is computed using indirect standardization as the observed rate (OR) divided by the expected rate (ER), with the result multiplied by the reference population rate: \( RR = \frac{OR}{ER} \times PR \).

*Step 2. Scale the risk-adjusted rate using the reference population*
The relative magnitudes of the rates vary from indicator to indicator. To combine the component indicators using a common scale, each indicator’s risk-adjusted rate is divided by the reference population rate to yield a ratio. The components of the composite are therefore defined in terms of a ratio to the reference population rate for each indicator. The component indicators are scaled by the reference population rate, so each indicator reflects the degree of deviation from the overall average performance.

*Step 3. Compute the reliability-adjusted ratio*
The reliability-adjusted ratio (RAR) is computed as the weighted average of the risk-adjusted ratio and the reference population ratio, where the weights vary from 0 to 1, depending on the degree of reliability for the indicator and provider (or other unit of analysis).

\[
RAR = [\text{risk-adjusted ratio} \times \text{weight}] + [\text{reference population ratio} \times (1 – \text{weight})]
\]
For small providers, the weight is closer to 0. For large providers, the weight is closer to 1. For a
given provider, if the denominator is 0, then the weight assigned is 0 (i.e., the reliability-adjusted
ratio is the reference population ratio).

**Step 4. Select the component weights**
The composite measure is the weighted average of the scaled and reliability-adjusted ratios for
the component indicators. Some examples of possible weights follow, though others are possible:

*Single indicator weight.* In this case, the composite is simply the reliability-adjusted ratio for
a single indicator. The reference population rate is the same among all providers.

*Equal weight.* In this case, each component indicator is assigned an identical weight based on
the number of indicators. That is, the weight equals 1 divided by the number of indicators in
the composite (e.g., 1/8 = 0.1250).

*Numerator weight.* A numerator weight is based on the relative frequency of the numerator
for each component indicator in the reference population. In general, a numerator weight
reflects the amount of harm in the outcome of interest, in this case a potentially preventable
adverse event. One might also use weights that reflect the amount of excess mortality or
complications associated with the adverse event, or the amount of confidence one has in
identifying events (i.e., the positive predictive value).

*Denominator weight.* A denominator weight is based on the relative frequency of the
denominator for each component indicator in the reference population. In general, a
denominator weight reflects the amount of risk of experiencing the outcome of interest in a
given population. For example, the denominator weight might be based on the demographic
composition of a health plan, the employees of a purchaser, a State, an individual hospital, or
a single patient.

*Factor weight.* A factor weight is based on some sort of analysis that assigns each component
indicator a weight that reflects the contribution of that indicator to the common variation
among the indicators. The component indicator that is most predictive of that common
variation is assigned the highest weight.

**Step 5. Construct the composite measure**
The composite measure is the weighted average of the component indicators using the selected
weights and the scaled and reliability-adjusted indicators.

\[
\text{Composite} = [\text{indicator}_1 \text{ RAR} \times \text{weight}_1] + [\text{indicator}_2 \text{ RAR} \times \text{weight}_2] + \ldots + [\text{indicator}_N \text{ RAR} \times \text{weight}_N]
\]

The confidence interval of the composite is based on the standard error of the composite, which
is the square root of the variance. The variance is computed based on the signal variance
covariance matrix and the reliability weights.
Chapter 3. Use

How Have the Composites Changed?

With each new release of the AHRQ QI, the reference population is updated to the most current HCUP data available. The numerator and denominator weights are updated to reflect the indicator technical specifications as applied to the reference population.

What Are the Current Uses of the Composites?

Users must use these “NQF Weights” when using the AHRQ QI software to compute the composite measures using their own data and when comparing the results of the software with the results reported under the Hospital Inpatient Quality Reporting (IQR) Program (formerly known as the Reporting of Hospital Quality Data for Annual Payment Update (RHQDAPU) program). The following table provides the NQF weights for this composite measure. The sum of the weights for the indicators included in the same composite always equals one.

Table 2. NQF Weights for the Pediatric Patient Safety for Selected Indicators Composite

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Label</th>
<th>Weight USEPOA = 0&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Weight USEPOA = 1&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDI 01</td>
<td>Accidental Puncture or Laceration Rate</td>
<td>0.2431</td>
<td>0.2608</td>
</tr>
<tr>
<td>PDI 02</td>
<td>Pressure Ulcer Rate</td>
<td>0.1122</td>
<td>0.1413</td>
</tr>
<tr>
<td>PDI 05</td>
<td>Iatrogenic Pneumothorax Rate</td>
<td>0.0548</td>
<td>0.0547</td>
</tr>
<tr>
<td>PDI 08</td>
<td>Postoperative Hemorrhage or Hematoma Rate</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>PDI 09</td>
<td>Postoperative Respiratory Failure Rate</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>PDI 10</td>
<td>Postoperative Sepsis Rate</td>
<td>0.2257</td>
<td>0.2119</td>
</tr>
<tr>
<td>PDI 11</td>
<td>Postoperative Wound Dehiscence Rate</td>
<td>0.0072</td>
<td>0.009</td>
</tr>
<tr>
<td>PDI 12</td>
<td>Central Venous Catheter-Related Blood Stream Infection Rate</td>
<td>0.3569</td>
<td>0.3223</td>
</tr>
<tr>
<td>SUM</td>
<td></td>
<td>0.9999</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

<sup>1</sup> The use of POA results in different weights for the composite. Without POA, USEPOA = 0; With POA, USEPOA = 1.


Note: in Version 3.2, PDI #2 is labeled “Decubitus Ulcer” and PDI #12 is labeled “Selection Infection due to Medical Care.”

Additional Resources

See the AHRQ QI website for additional resources and downloads: