AHRQ Quality Indicators™

QUALITY INDICATOR USER GUIDE: INPATIENT QUALITY INDICATORS (IQI) COMPOSITE MEASURES

Version 2020

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Agency for Healthcare Research and Quality
U.S. Department of Health and Human Services
5600 Fishers Lane
Rockville, MD 20857
http://www.qualityindicators.ahrq.gov

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Prepared by:
Mathematica
P.O. Box 2393
Princeton, NJ 08543-2393

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1.0 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 hospital/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, hospital use for identifying domains and drivers of quality, purchaser use for selection of hospitals or health plans to improve employee health and policymaker use for setting policy priorities to improve the health of a population. This document provides a technical overview for Agency for Healthcare Research and Quality (AHRQ) Quality Indicators (QI)™ users.

2.0 What Are the Composites?

The Inpatient Quality Indicators (IQI) consist of two composite measures. IQI 90 Mortality for Selected Inpatient Procedures is a weighted average of the reliability-adjusted ratios for the mortality indicators for patients undergoing selected procedures. The reliability-adjusted ratio is a weighted average of the risk-adjusted ratio and the reference population ratio, where the weight is determined empirically.

IQI 91 Mortality for Selected Inpatient Conditions is a weighted average of the reliability-adjusted ratios for the mortality indicators for patients admitted for selected conditions. The reliability-adjusted ratio is a weighted average of the risk-adjusted ratio and the reference population ratio, where the weight is determined empirically.

Table 1. AHRQ IQI Composite Measures

IQI 90 MORTALITY FOR SELECTED INPATIENT PROCEDURES
IQI 08 Esophageal Resection Mortality Rate
IQI 09 Pancreatic Resection Mortality Rate
IQI 11 Abdominal Aortic Aneurism (AAA) Repair Mortality Rate
IQI 12 Coronary Artery Bypass Graft (CABG) Mortality Rate
IQI 30 Percutaneous Coronary Intervention (PCI) Mortality Rate
IQI 31 Carotid Endarterectomy Mortality Rate
IQI 91 MORTALITY FOR SELECTED INPATIENT CONDITIONS[1]
IQI 15 Acute Myocardial Infarction (AMI) Mortality Rate
IQI 16 Heart Failure Mortality Rate
IQI 17 Acute Stroke Mortality Rate
IQI 18 Gastrointestinal Hemorrhage Mortality Rate
IQI 19 Hip Fracture Mortality Rate
IQI 20 Pneumonia Mortality Rate

[1] IQI 91 is endorsed by the National Quality Forum (NQF 0530).

3.0 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.

4.0 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 summed 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 (PR): (RR) = (OR/ER × 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 hospital (or other unit of analysis).

$$\text{RAR} = [\text{risk-adjusted ratio} \times \text{weight}] + [\text{reference population ratio} \times (1 - \text{weight})]$$

For small hospitals, the weight is closer to 0. For large hospitals, the weight is closer to 1. For a given hospital, if the denominator is 0, then the weight assigned is 0 (i.e., the RAR is the reference population ratio).

Step 4. Select the component weights

The composite measure is the weighted average of the scaled and RARs for the component indicators. The component weights provided in the IQI software for IQI 90 and IQI 91 are

denominator weights. 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.

Users may supply their own component weights. Some examples of possible weights follow, though others are possible:

Single indicator weight. In this case, the composite is simply the RAR for a single indicator. For the procedure indicators, the single indicator weight composite is a "volume-outcome" composite since the reference population rate varies with the volume of the hospital. For the condition indicators, the reference population rate is the same among all hospitals.

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 mortality. For other types of outcomes the harm might reflect the amount of excess mortality or complications associated with the adverse event.

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.

Composite = [indicator1 RAR × weight1] + [indicator2 RAR × weight2] + . . . + [indicatorN RAR × weightN]

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.

5.0 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 denominator weights are updated to reflect the indicator

technical specifications as applied to the reference population. In IQI software version 2020, no component indicators of the IQI composite measures were retired.

6.0 What Composite Weights are included in the software?

To utilize the NQF endorsed composite, users must use these NQF Denominator Weights when using the AHRQ QI™ software to compute the composite measure using their own data. These weights are included in the IQI_HOSP_Composite_Wt_v2020.sas macro. Table 2 and 3 provides the NQF weights for the composite measure. The sum of the weights for the indicators included in the same composite always equals one.

Table 2. NQF Denominator Weights for IQI 90

INDICATOR	WEIGHT
IQI 08 Esophageal Resection Mortality Rate	0.0071
IQI 09 Pancreatic Resection Mortality Rate	0.0251
IQI 11 Abdominal Aortic Aneurysm (AAA) Repair Mortality Rate	0.0492
IQI 12 Coronary Artery Bypass Graft (CABG) Mortality Rate	0.2478
IQI 30 Percutaneous Coronary Intervention (PCI) Mortality Rate	0.5784
IQI 31 Carotid Endarterectomy Mortality Rate	0.0924
SUM	1.0000

Source: 2017 State Inpatient Databases, Healthcare Cost and Utilization Program, Agency for Healthcare Research and Quality

Table 3. NQF Denominator Weights for IQI 91

INDICATOR	WEIGHT
IQI 15 Acute Myocardial Infarction (AMI) Mortality Rate	0.1611
IQI 16 Heart Failure Mortality Rate	0.3037
IQI 17 Acute Stroke Mortality Rate	0.1668
IQI 18 Gastrointestinal Hemorrhage Mortality Rate	0.1442
IQI 19 Hip Fracture Mortality Rate	0.0722
IQI 20 Pneumonia Mortality Rate	0.1520
SUM	1.0000

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, State Inpatient Databases (SID), 2017.

7.0 Additional Resources

See the AHRQ QI™ website for additional resources and downloads for the IQIs: http://www.qualityindicators.ahrq.gov/modules/iqi_resources.aspx.

Agency for Healthcare Research and Quality (2008). *Inpatient Quality Indicators (IQI) Composite Measure Workgroup Final Report*. The report is available at https://www.qualityindicators.ahrq.gov/Downloads/Modules/IQI/IQI_Composite_Development.pdf.