NATIONAL QUALITY FORUM

Measure Evaluation 4.1
December 2009

This form contains the measure information submitted by stewards. Blank fields indicate no information was provided. Attachments also may have been submitted and are provided to reviewers. The subcriteria and most of the footnotes from the evaluation criteria are provided in Word comments within the form and will appear if your cursor is over the highlighted area. Hyperlinks to the evaluation criteria and ratings are provided in each section.

TAP/Workgroup (if utilized)**:** Complete all yellow highlighted areas of the form. Evaluate the extent to which each subcriterion is met. Based on your evaluation, summarize the strengths and weaknesses in each section.

Note: *If there is no TAP or workgroup, the SC also evaluates the subcriteria (yellow highlighted areas).*

Steering Committee: Complete all pink highlighted areas of the form. Review the workgroup/TAP assessment of the subcriteria, noting any areas of disagreement; then evaluate the extent to which each major criterion is met; and finally, indicate your recommendation for the endorsement. Provide the rationale for your ratings.

Evaluation ratings of the extent to which the criteria are met
C = Completely (unquestionably demonstrated to meet the criterion)
P = Partially (demonstrated to partially meet the criterion)
M = Minimally (addressed BUT demonstrated to only minimally meet the criterion)
N = Not at all (NOT addressed; OR incorrectly addressed; OR demonstrated to NOT meet the criterion)
NA = Not applicable (only an option for a few subcriteria as indicated)

(for NQF staff use) **NQF Review #:** 0359 **NQF Project:** Surgery Endorsement Maintenance 2010
MEASURE DESCRIPTIVE INFORMATION
De.1 **Measure Title:** Abdominal Aortic Aneurysm (AAA) Repair Mortality Rate (IQI 11)
De.2 **Brief description of measure***:* Percent of adult hospital discharges in a one-year time period with a procedure code of AAA repair and a diagnosis of AAA with an in-hospital death.
1.1-2 **Type of Measure:** Outcome De.3 **If included in a composite or paired with another measure, please identify composite or paired measure** Abdominal Aortic Artery (AAA) Repair Volume (IQI 4) (NQF #0357)
De.4 **National Priority Partners Priority Area:** Safety De.5 **IOM Quality Domain**: Effectiveness, Safety De.6 **Consumer Care Need:** Getting better

CONDITIONS FOR CONSIDERATION BY NQF	
Four conditions must be met before proposed measures may be considered and evaluated for suitability as voluntary consensus standards:	NQF Staff
A. The measure is in the public domain or an intellectual property (measure steward agreement) is signed. *Public domain only applies to governmental organizations. All non-government organizations must sign a measure steward agreement even if measures are made publicly and freely available.* A.1 **Do you attest that the measure steward holds intellectual property rights to the measure and the right to use aspects of the measure owned by another entity (e.g., risk model, code set)?** Yes A.2 **Indicate if Proprietary Measure** (*as defined in measure steward agreement*)**:** A.3 **Measure Steward Agreement:** Government entity and in the public domain - no agreement necessary A.4 **Measure Steward Agreement attached:**	**A** Y☐ N☐
B. The measure owner/steward verifies there is an identified responsible entity and process to maintain and update the measure on a schedule that is commensurate with the rate of clinical innovation, but at least	**B** Y☐

every 3 years. Yes, information provided in contact section	N☐
C. The intended use of the measure includes both public reporting and quality improvement. ▶**Purpose:** Public Reporting, Quality Improvement (Internal to the specific organization)	**C** Y☐ N☐
D. The requested measure submission information is complete. Generally, measures should be fully developed and tested so that all the evaluation criteria have been addressed and information needed to evaluate the measure is provided. Measures that have not been tested are only potentially eligible for a time-limited endorsement and in that case, measure owners must verify that testing will be completed within 12 months of endorsement. **D.1Testing:** Yes, fully developed and tested **D.2 Have NQF-endorsed measures been reviewed to identify if there are similar or related measures?** Yes	**D** Y☐ N☐
(for NQF staff use) **Have all conditions for consideration been met?** **Staff Notes to Steward** (*if submission returned*):	**Met** Y☐ N☐
Staff Notes to Reviewers (*issues or questions regarding any criteria*):	
Staff Reviewer Name(s):	

TAP/Workgroup Reviewer Name:	
Steering Committee Reviewer Name:	
1. IMPORTANCE TO MEASURE AND REPORT	
Extent to which the specific measure focus is important to making significant gains in health care quality (safety, timeliness, effectiveness, efficiency, equity, patient-centeredness) and improving health outcomes for a specific high impact aspect of healthcare where there is variation in or overall poor performance. ***Measures must be judged to be important to measure and report*** *in order to be evaluated against the remaining criteria.* (evaluation criteria) **1a. High Impact**	Eval Rating
(for NQF staff use) **Specific NPP goal**:	
1a.1 Demonstrated High Impact Aspect of Healthcare: Patient/societal consequences of poor quality **1a.2** **1a.3 Summary of Evidence of High Impact:** The correlation between hospital or physician characteristics and in-hospital mortality in most studies supports the validity of in-hospital mortality as a measure of quality. [1] [2] Finally, excessive blood loss, which is a potentially preventable complication of surgery, has been identified as the most important predictor of mortality after elective AAA repair. [3] Empirical evidence shows that AAA repair mortality is positively related to other post-procedural mortality measures, such as craniotomy (r=.28, p<.0001) and coronary artery bypass graft (CABG) (r=.17, p<.01). [4] **1a.4 Citations for Evidence of High Impact:** Updated citations will be presented in the May Steering Committee meeting [1] Pearce WH, Parker MA, Feinglass J, et al. The importance of surgeon volume and training in outcomes for vascular surgical procedures. J Vasc Surg 1999;29(5):768-76. [2] Rutledge R, Oller DW, Meyer AA, et al. A statewide, population-based time-series analysis of the outcome of ruptured abdominal aortic aneurysm. Ann Surg 1996;223(5):492-502. [3] Pilcher DB, Davis JH, Ashikaga T, et al. Treatment of abdominal aortic aneurysm in an entire state over 7½ years. Am J Surg 1980;139(4):487-94. [4] Nationwide Inpatient Sample.	**1a** C☐ P☐ M☐ N☐
1b. Opportunity for Improvement **1b.1 Benefits (improvements in quality) envisioned by use of this measure:** Abdominal aortic aneurysm	**1b** C☐ P☐

(AAA) repair is a relatively rare procedure that requires proficiency with the use of complex equipment; and technical errors may lead to clinically significant complications, such as arrhythmias, acute myocardial infarction, colonic ischemia, and death. Better processes of care may reduce mortality for AAA repair, which represents better quality care.

M☐
N☐

1b.2 **Summary of data demonstrating performance gap (variation or overall poor performance) across providers:**
Adjusted per 1,000 rates by patient/hospital characteristics, 2007

Estimate	Standard error	Age: for conditions affecting any age
*	*	18-44
23.652	1.960	45-64
66.393	1.451	65 and over

Estimate	Standard error	Age: for conditions affecting elderly
43.864	2.381	65-69
50.251	2.498	70-74
79.688	3.095	75-79
72.624	3.695	80-84
107.763	6.188	85 and over

Estimate	Standard error	Gender
51.876	1.339	Male
90.433	3.249	Female

Estimate	Standard error	Median income of patient´s ZIP code
59.088	2.445	First quartile (lowest income)
54.793	2.336	Second quartile
58.174	2.397	Third quartile
54.942	2.561	Fourth quartile (highest income)

Estimate	Standard error	Location of patient residence (NCHS)
48.893	2.572	Large central metropolitan
57.852	2.538	Large fringe metropolitan
57.678	2.492	Medium metropolitan
64.648	3.682	Small metropolitan
56.657	3.484	Micropolitan
62.375	4.327	Not metropolitan or micropolitan

Estimate	Standard error	Expected payment source
45.140	3.185	Private insurance
57.658	1.353	Medicare
85.285	9.645	Medicaid
76.100	9.933	Other insurance
73.418	9.344	Uninsured / self-pay / no charge

Estimate	Standard error	Hospital Ownership/control
56.433	1.380	Private, not-for-profit
56.869	3.651	Private, for-profit

58.869	3.602	Public

Estimate	Standard error	Teaching status
52.177	1.899	Teaching
59.950	1.582	Nonteaching

Estimate	Standard error	Location of hospital
49.673	2.096	Large central metropolitan
59.498	2.865	Large fringe metropolitan
57.560	2.322	Medium metropolitan
68.001	3.190	Small metropolitan
60.056	4.952	Micropolitan
*	*	Not metropolitan or micropolitan

Estimate	Standard error	Bed size of hospital
55.838	6.706	Less than 100
66.185	2.122	100 - 299
54.707	1.998	300 - 499
48.492	2.343	500 or more

1b.3 **Citations for data on performance gap:**
See the following report for a complete treatment of the methodology: "Methods: Applying AHRQ Quality Indicators to Healthcare Cost and Utilization Project (HCUP) Data for the National Healthcare Quality Report" [URL: http://hcupnet.ahrq.gov/QI%20Methods.pdf?JS=Y]

1b.4 **Summary of Data on disparities by population group:**
Information on results by geographic areas noted below. Also 1b2 provides results by age, gender, income, micropolitian and metropolitian and payer.

Adjusted per 1,000 rates by patient and hospital characteristics, 2007

Mean	Standard error	Location	P-value: Relative to Northeast
61.859	2.711	Northeast	1.000
49.824	2.554	Midwest	0.001
53.232	2.053	South	0.011
65.177	2.577	West	0.375

RACE / ETHNICITY
Rate per 100

White	4.52
Black	5.48
Hispanic	5.40
Asian and NH/PI	5.33
Amer Indian/AN	4.58
Other	4.66

Source: 2008 State Inpatient Databases (SID) (N=39,963)

1b.5 **Citations for data on Disparities:**
See the following report for a complete treatment of the methodology: "Methods: Applying AHRQ Quality Indicators to Healthcare Cost and Utilization Project (HCUP) Data for the National Healthcare Quality Report"

[URL: http://hcupnet.ahrq.gov/QI%20Methods.pdf?JS=Y]

1c. Outcome or Evidence to Support Measure Focus

1c.1 **Relationship to Outcomes** (*For non-outcome measures, briefly describe the relationship to desired outcome. For outcomes, describe why it is relevant to the target population*): Abdominal aortic aneurysm (AAA) repair is a relatively rare procedure that requires proficiency with the use of complex equipment; and technical errors may lead to clinically significant complications, such as arrhythmias, acute myocardial infarction, colonic ischemia, and death. Better processes of care may reduce mortality for AAA repair, which represents better quality care.

1c.2-3. **Type of Evidence:** Expert opinion, Systematic synthesis of research

1c.4 **Summary of Evidence** (*as described in the criteria; for outcomes, summarize any evidence that healthcare services/care processes influence the outcome*):
Most studies published since 1985 showed a significant association between either hospital or surgeon volume and inpatient mortality after AAA repair, although these findings may be limited by inadequate risk adjustment of the outcome measure and differ by type of aneurysms (intact vs. ruptured) being considered. Several studies have explored whether experience on related, but not identical, cases may lead to improved outcomes. One study found that hospital volume of surgery for ruptured aneurysms was not associated with postoperative inpatient mortality, but it was associated with fewer inpatient deaths for ruptured aneurysms, suggesting that high-volume hospitals may manage ruptured aneurysms more aggressively. [1] One study that evaluated the impact of total vascular surgery volume found a significant effect for both ruptured and intact aneurysms. [2] Empirical evidence shows that AAA repair volume and mortality—after adjusting for age, sex, and APR-DRG—are independently and negatively correlated with each other ($r=-.35$, $p<.001$). [3]

In some recent studies, in-hospital mortality rates for Abdominal Aortic Aneurysm (AAA) Repair Mortality were unchanged over time. The IQIs are easily applied to VA administrative data. They can be useful to tracks rate trends over time, reveal variation between sites, and for trend comparisons with other healthcare systems. [4]

The existence of a board quality committee was associated with higher likelihoods of adopting various oversight practices and lower mortality rates for abdominal aortic aneurysm repair measured by the Agency for Healthcare Research and Quality´s Inpatient Quality Indicators and the State Inpatient Databases. [5]

In assessing the ability of hospital mortality rankings to predict future performance, reliability adjustment was particularly important for pancreatic resection and AAA repair, hospital rankings based on reliability-adjusted mortality were superior at identifying hospitals likely to have the lowest future mortality. Without reliability adjustment, hospitals in the "best" quintile (2003-2004) with pancreatic resection had a mortality of 7.6 percent in 2005-2006; with reliability adjustment, the "best" hospital quintile had a mortality of 2.7 percent in 2003-2006. Similarly, without reliability adjustment, hospitals in the "best" quintile (2003-2004) with AAA repair had a mortality of 4.0 percent in 2005-2006; with reliability adjustment, the "best" hospital quintile had a mortality of 3.2 percent in 2005-2006. [6]

1c.5 **Rating of strength/quality of evidence** (*also provide narrative description of the rating and by whom*):
B. Testing, rating, and review were conducted by the project team. A full report on the literature review and empirical evaluation can be found in Refinement of the HCUP Quality Indicators by the UCSF-Stanford EPC, Detailed coding information for each QI is provided in the document Prevention Quality Indicators Technical Specifications. Rating of performance on empirical evaluations, ranged from 0 to 26. The scores were intended as a guide for summarizing the performance of each indicator on four empirical tests of precision (signal variance, area-level share, signal ratio, and R-squared) and five tests of minimum bias (rank correlation, top and bottom decile movement, absolute change, and change over two deciles)

1c.6 **Method for rating evidence:** The project team conducted extensive empirical testing of all potential indicators using the 1995-97 HCUP State Inpatient Databases (SID) and Nationwide Inpatient Sample (NIS) to determine precision, bias, and construct validity. The 1997 SID contains uniform data on inpatient stays in community hospitals for 22 States covering approximately 60% of all U.S. hospital discharges. The NIS is designed to approximate a 20% of U.S. community hospitals and includes all stays in the sampled hospitals. Each year of the NIS contains between 6 million and 7 million records from about 1,000 hospitals. The NIS

1c
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P☐
M☐
N☐

combines a subset of the SID data, hospital-level variables, and hospital and discharge weights for producing national estimates. The project team conducted tests to examine three things: precision, bias, and construct validity.
Precision. The first step in the analysis involved precision tests to determine the reliability of the indicator for distinguishing real differences in provider performance. For indicators that may be used for quality improvement, it is important to know with what precision, or surety, a measure can be attributed to an actual construct rather than random variation.
For each indicator, the variance can be broken down into three components: variation within a provider (actual differences in performance due to differing patient characteristics), variation among providers (actual differences in performance among providers), and random variation. An ideal indicator would have a substantial amount of the variance explained by between-provider variance, possibly resulting from differences in quality of care, and a minimum amount of random variation. The project team performed four tests of precision to estimate the magnitude of between-provider variance on each indicator:

- Signal standard deviation was used to measure the extent to which performance of the QI varies systematically across hospitals or areas.
- Provider/area variation share was used to calculate the percentage of signal (or true) variance relative to the total variance of the QI.
- Signal-to-noise ratio was used to measure the percentage of the apparent variation in QIs across providers that is truly related to systematic differences across providers and not random variations (noise) from year to year.
- In-sample R-squared was used to identify the incremental benefit of applying multivariate signal extraction methods for identifying additional signal on top of the signal-to-noise ratio.

In general, random variation is most problematic when there are relatively few observations per provider, when adverse outcome rates are relatively low, and when providers have little control over patient outcomes or variation in important processes of care is minimal. If a large number of patient factors that are difficult to observe influence whether or not a patient has an adverse outcome, it may be difficult to separate the "quality signal" from the surrounding noise. Two signal extraction techniques were applied to improve the precision of an indicator:

- Univariate methods were used to estimate the "true" quality signal of an indicator based on information from the specific indicator and 1 year of data.
- Multivariate signal extraction (MSX) methods were used to estimate the "true" quality signal based on information from a set of indicators and multiple years of data. In most cases, MSX methods extracted additional signal, which provided much more precise estimates of true hospital or area quality.

Bias. To determine the sensitivity of potential QIs to bias from differences in patient severity, unadjusted performance measures for specific hospitals were compared with performance measures that had been adjusted for age and gender. All of the PQIs and some of the Inpatient Quality Indicators (IQIs) could only be risk-adjusted for age and sex. The 3M™ APR-DRG System Version 12 with Severity of Illness and Risk of Mortality subclasses was used for risk adjustment of the utilization indicators and the in-hospital mortality indicators, respectively. Five empirical tests were performed to investigate the degree of bias in an indicator:

- Rank correlation coefficient of the area or hospital with (and without) risk adjustment—gives the overall impact of risk adjustment on relative provider or area performance.
- Average absolute value of change relative to mean—highlights the amount of absolute change in performance, without reference to other providers' performance.
- Percentage of highly ranked hospitals that remain in high decile—reports the percentage of hospitals or areas that are in the highest deciles without risk adjustment that remain there after risk adjustment is performed.
- Percentage of lowly ranked hospitals that remain in low decile—reports the percentage of hospitals or areas that are in the lowest deciles without risk adjustment that remain there after risk adjustment is performed.
- Percentage that change more than two deciles—identifies the percentage of hospitals whose relative rank changes by a substantial percentage (more than 20%) with and without risk adjustment.

Construct validity. Construct validity analyses provided information regarding the relatedness or independence of the indicators. If quality indicators do indeed measure quality, then two measures of the same construct would be expected to yield similar results. The team used factor analysis to reveal underlying patterns among large numbers of variables—in this case, to measure the degree of relatedness between indicators. In addition, they analyzed correlation matrices for indicators.

1c.7 **Summary of Controversy/Contradictory Evidence:** Some users have questioned the inclusion of both ruptured and unruptured AAA in the denominator. However, the risk-adjustment model was well calibrated

for these classes of patients. We also included ruptured status as a covariate in the model to improve the calibration further. 1c.8 **Citations for Evidence** (*other than guidelines*): Updated citations will be presented in the May Steering Committee meeting [1] Kantonen I, Lepantalo M, Brommels M, et al. Mortality in ruptured abdominal aortic aneurysms. The Finnvasc Study Group. . Eur J Vasc Endovasc Surg 1999;17(3):208-12. [2] Amundsen S, Skjaerven R, Trippestad A, et al. Abdominal aortic aneurysms. Is there an association between surgical volume, surgical experience, hospital type and operative mortality? Members of the Norwegian Abdominal Aortic Aneurysm Trial. Acta Chir Scand 1990;156(4):323-7; discussion 327-8. [3] Nationwide Inpatient Sample (NIS). http://hcupnet.ahrq.gov/ [4] Borzecki AM, Christiansen CL, Loveland S, Chew P, Rosen AK. Trends in the inpatient quality indicators: the Veterans Health Administration experience. Med Care. 2010 Aug;48(8):694-702. [5] Jiang, H. Joanna; Lockee, Carlin; Bass, Karma; Fraser, Irene; Kiely, Robert. (2008). Board engagement in quality: findings of a survey of hospital and system leaders. Journal of Healthcare Management, 53, 2, 121(15) [6] Dimick, Justin B.; Staiger, Douglas O.; Birkmeyer, John D. Ranking hospitals on surgical mortality: the importance of reliability adjustment. Health Serv Res. 2010 Dec;45(6 Pt 1):1614-29. doi: 10.1111/j.1475-6773.2010.01158.x. Epub 2010 Aug 16. 1c.9 **Quote the Specific guideline recommendation** (*including guideline number and/or page number*): EVAR for AAA represents an advance in patient care, serving as an effective alternative to traditional open surgical AAA repair, and is now the most common treatment method for AAA repair in the United States. 1c.10 **Clinical Practice Guideline Citation:** http://www.sirweb.org/clinical/cpg/QI12.pdf 1c.11 **National Guideline Clearinghouse or other URL:** Not Applicable 1c.12 **Rating of strength of recommendation** (*also provide narrative description of the rating and by whom*): Not Applicable 1c.13 **Method for rating strength of recommendation** (*If different from USPSTF system, also describe rating and how it relates to USPSTF*): Not Applicable 1c.14 **Rationale for using this guideline over others:** Not Applicable	
TAP/Workgroup: What are the strengths and weaknesses in relation to the subcriteria for *Importance to Measure and Report?*	**1**
Steering Committee: Was the threshold criterion, *Importance to Measure and Report*, met? **Rationale:**	**1** **Y☐** **N☐**
2. SCIENTIFIC ACCEPTABILITY OF MEASURE PROPERTIES	
Extent to which the measure, as specified, produces consistent (reliable) and credible (valid) results about the quality of care when implemented. (evaluation criteria)	**Eval Rating**
2a. MEASURE SPECIFICATIONS	
S.1 **Do you have a web page where current detailed measure specifications can be obtained?** S.2 **If yes, provide web page URL:** **2a. Precisely Specified**	**2a-specs** **C☐** **P☐** **M☐** **N☐**
2a.1 **Numerator Statement** (*Brief, text description of the numerator - what is being measured about the target population, e.g. target condition, event, or outcome*): Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator	

2a.2 Numerator Time Window (*The time period in which cases are eligible for inclusion in the numerator***):**
Time window can be determined by user, but is generally a calendar year. Note that the reliablity weights are calculated on one year of data.

2a.3 Numerator Details (*All information required to collect/calculate the numerator, including all codes, logic, and definitions***):**
Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator.

2a.4 Denominator Statement (*Brief, text description of the denominator - target population being measured***):**
Discharges, age 18 years and older, with ICD-9-CM AAA repair code procedure and a diagnosis of AAA in any field. The denominator may be stratified by open vs. endovascular procedures, and ruptured vs. un-ruptured AAA.

2a.5 Target population gender: Female, Male
2a.6 Target population age range: 18 and older

2a.7 Denominator Time Window (*The time period in which cases are eligible for inclusion in the denominator***):**
Time window can be determined by user, but is generally a calendar year. Note that the reliablity weights are calculated on one year of data.

2a.8 Denominator Details (*All information required to collect/calculate the denominator - the target population being measured - including all codes, logic, and definitions***):**
Discharges, age 18 years and older, with ICD-9-CM AAA repair code procedure and a diagnosis of AAA in any field.
ICD-9-CM AAA repair procedure codes:
3834
AORTA RESECTION & ANAST
3844
RESECT ABDM AORTA W REPL
3864
EXCISION OF AORTA
3971
ENDO IMPLANT OF GRAFT IN AORTA

ICD-9-CM AAA diagnosis codes:
4413
RUPT ABD AORTIC ANEURYSM
4414
ABDOM AORTIC ANEURYSM

2a.9 Denominator Exclusions (*Brief text description of exclusions from the target population***):** Exclude cases:
• missing discharge disposition (DISP=missing), gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing) or principal diagnosis (DX1 =missing)
• transferring to another short-term hospital (DISP=2)
• MDC 14 (pregnancy, childbirth, and puerperium)

2a.10 Denominator Exclusion Details (*All information required to collect exclusions to the denominator, including all codes, logic, and definitions***):**
Exclude cases:
• missing discharge disposition (DISP=missing), gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing) or principal diagnosis (DX1 =missing)
• transferring to another short-term hospital (DISP=2)
• MDC 14 (pregnancy, childbirth, and puerperium)

2a.11 Stratification Details/Variables (*All information required to stratify the measure including the stratification variables, all codes, logic, and definitions***):**

Gender, age (5-year age groups), race / ethnicity, primary payer, custom

The stratification of the denominator for open vs. endovascular and ruptureved vs. unruptured involves the following codes in the denominator specification:
AAA Repair
ICD-9-CM Procedure Codes:
OPEN
´3834´ = ´1´ /* AORTA RESECTION & ANAST */
´3844´ = ´1´ /* RESECT ABDM AORTA W REPL */
´3864´ = ´1´ /* EXCISION OF AORTA */
ENDOVASCULAR
´3971´ = ´1´ /* ENDO IMPL GRFT ABD AORTA */

AAA
ICD-9-CM Diagnosis Codes:
RUPTURED
´4413 ´ = ´1´ /* RUPT ABD AORTIC ANEURYSM */
UNRUPTURED
´4414 ´ = ´1´ /* ABDOM AORTIC ANEURYSM */

2a.12-13 **Risk Adjustment Type:** Risk adjustment method widely or commercially available

2a.14 **Risk Adjustment Methodology/Variables (***List risk adjustment variables and describe conceptual models, statistical models, or other aspects of model or method***):**
The predicted value for each case is computed using a hierarchical model (logistic regression with hospital random effect) and covariates for gender, age in years (in 5-year age groups), All Patient Refined-Diagnosis Related Group (APR-DRG) and APR-DRG risk-of-mortality subclass. The reference population used in the model is the universe of discharges for states that participate in the HCUP State Inpatient Databases (SID) for the year 2008 (updated annually), a database consisting of 43 states and approximately 30 million adult discharges and 4,000 hospitals. The expected rate is computed as the sum of the predicted value for each case divided by the number of cases for the unit of analysis of interest (i.e., hospital). The risk adjusted rate is computed using indirect standardization as the observed rate divided by the expected rate, multiplied by the reference population rate.

Risk adjustment factors: sex
age 18-24; age 25-29; age 30-34; age 35-39; age 40-44; age 45-49; age 50-54; age 55-59; age 60-64; age 65-69; age 70-74; age 75-79; age 80-84; age 85+
ADRG 1731 (other vascular procedures-minor)
ADRG 1732 (other vascular procedures-moderate)
ADRG 1733 (other vascular procedures-major)
ADRG 1734 (other vascular procedures-extreme)
ADRG 1691 (major thoracic and abdominal vascular procedures-minor)
ADRG 1692 (major thoracic and abdominal vascular procedures-moderate)
ADRG 1693 (major thoracic and abdominal vascular procedures-major)
ADRG 1694 (major thoracic and abdominal vascular procedures-extreme
MDC 5 (Cardiovascular)
Transfer-in status

2a.15-17 **Detailed risk model available Web page URL or attachment:** URL None
http://qualityindicators.ahrq.gov/Downloads/Software/SAS/V43/Risk%20Adjustment%20Tables%20IQI%204.3.pdf

2a.18-19 **Type of Score:** Rate/proportion
2a.20 **Interpretation of Score:** Better quality = Lower score
2a.21 **Calculation Algorithm (***Describe the calculation of the measure as a flowchart or series of steps***):**
There are four rates calculated, one for each stratum (open vs. endovascular, ruptured vs. un-ruptured). Each stratum indicator is expressed as a rate, and is defined as outcome of interest / population at risk or numerator / denominator. The AHRQ Quality Indicators (AHRQ QI) software performs several steps to produce the rates. 1) Discharge-level data is used to identify inpatient records containing the outcome of interest and

2) the population at risk. For provider indicators, the population at risk is derived from hospital discharge records; 3) Calculate observed rates. Using output from steps 1 and 2, rates are calculated for user-specified combinations of stratifiers. 4) Calculate expected rates. Regression coefficients from a reference population database are applied to the discharge records and aggregated to the provider level. 5) Calculate risk-adjusted rate. Use the indirect standardization to account for case-mix. 6) Calculate smoothed rate. A multi-variate shrinkage factor is applied to the risk-adjusted rates. The shrinkage estimate reflects a reliability adjustment unique to each indicator and hospital, and takes into account both the signal (between provider variance) and noise (within provider variance) for the indicator in each stratum, but also the covariance with the indicators across stratum. The smoothed rate is a weighted average of the hospital- and stratum-specific risk-adjusted rate and the volume- and stratum-specific risk-adjusted rate, where the weight is the multi-variate shrinkage factor; 7) Calculate combined rate across stratum. The overall rate is a weighted average of the stratum-specific rates. The "disease" weights are the relative frequency of ruptured and un-ruptured cases in the reference population. The "procedure" weights are the relative frequency of open and endovascular cases in the hospital. The stratum weight is the disease weight multiplied by the procedure weight and the sum of weights across stratum is normalized to 1.0

Additional information on calculation algorithms and specifications can be found at http://qualityindicators.ahrq.gov/Downloads/Resources/Publications/2011/QI%20Empirical%20Methods%2005-03-11.pdf

2a.22 **Describe the method for discriminating performance** *(e.g., significance testing)*:
Significance testing is not prescribed by the software. Users may calculate a confidence interval for the risk-adjusted rates and a posterior probability interval for the smoothed rates at a 95% or 99% level. Users may define the relevant benchmark and the methods of discriminating performance according to their application.

2a.23 **Sampling (Survey) Methodology** *If measure is based on a sample (or survey), provide instructions for obtaining the sample, conducting the survey and guidance on minimum sample size (response rate)*:
Not applicable.

2a.24 **Data Source** (*Check the source(s) for which the measure is specified and tested)*
Administrative claims

2a.25 **Data source/data collection instrument** (*Identify the specific data source/data collection instrument, e.g. name of database, clinical registry, collection instrument, etc.*):
The data source is hospital discharge data such as the HCUP State Inpatient Databases (SID) or equivalent using UB-04 coding standards. The data collection instrument is public-use AHRQ QI software available in SAS or Windows versions

2a.26-28 **Data source/data collection instrument reference web page URL or attachment:** URL None
http://qualityindicators.ahrq.gov/software/default.aspx

2a.29-31 **Data dictionary/code table web page URL or attachment:** URL None
http://qualityindicators.ahrq.gov/Downloads/Software/WinQI/V43/AHRQ%20QI%20Software%20Instructions,%20WinQI.pdf

2a.32-35 **Level of Measurement/Analysis** (*Check the level(s) for which the measure is specified and tested)*
Facility

2a.36-37 **Care Settings** (*Check the setting(s) for which the measure is specified and tested)*
Hospital/Acute Care Facility

2a.38-41 **Clinical Services** (*Healthcare services being measured, check all that apply*)
Clinicians: Physicians (MD/DO)

TESTING/ANALYSIS

2b. Reliability testing

2b.1 **Data/sample** *(description of data/sample and size)*: AHRQ 2007 State Inpatient Databases (SID) with 4,000 hospitals and 30 million adult discharges

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2b.2 Analytic Method *(type of reliability & rationale, method for testing)*:
Literature summary, expert panels and empirical analysis

2b.3 Testing Results *(reliability statistics, assessment of adequacy in the context of norms for the test conducted)*:
The relatively small number of AAA resections performed by each hospital suggests that mortality rates at the hospital level are likely to be unreliable. Empirical evidence shows that his indicator is precise, with a raw provider level mean of 21.5% and a substantial standard deviation of 26.8%.87
Relative to other indicators, a higher percentage of the variation occurs at the provider level, rather than the discharge level. The signal ratio (i.e., the proportion of the total variation across providers that is truly related to systematic differences in provider performance rather than random variation) is low, at 30.7%, indicating that some of the observed differences in provider performance.

2. The signal to noise ratio is the ratio of the between hospital variance (signal) to the within hospital variance (noise). The formula is signal / (signal + noise). The ratio itself is only a diagnostic for the degree of variance in the risk-adjusted rate systematically associated with the provider. Therefore, what matters is the magnitude of the variance in the "smoothed" rate (that is, the variance in the risk-adjusted rate after the application of the univariate shrinkage estimator based on the signal ratio). What the data demonstrate is systematic variation in the provider level rate of 2.6 to 7.6 per 100 from the 5th to 95th percentile after a signal ratio of 0.307 is applied as the shrinkage estimator (that is, after accounting for variation due to random factors). An additional technique applied to the indicator is the use of multivariate signal extraction (an extension of univariate shrinkage estimator) to increase effective sample size to the extent that individual measures are correlated (Staiger, et. al., 2009)

Staiger DO, Dimick JB, Baser O, Fan Z, Birkmeyer JD. Empirically derived composite measures of surgical performance. Med Care. 2009 Feb;47(2):226-33

Table 3. Risk Adjustment Coefficients for IQI #11— AAA Repair Mortality

Parameter	Label	DF	Estimate	Standard Error	Wald Chi-Square	Pr > Chi-Square
Intercept		1	-6.6044	0.1713	1486.04	0.0000
Sex	Female	1	0.4539	0.0747	36.95	0.0000
Age	65 to 74	1	0.4879	0.1072	20.72	0.0000
Age	75 to 79	1	0.8737	0.1201	52.97	0.0000
Age	80 to 84	1	1.1092	0.1200	85.50	0.0000
Age	85+	1	1.4440	0.1359	112.97	0.0000
APR-DRG	'1691' to '1692'	1	1.6789	0.1623	107.05	0.0000
APR-DRG	'1693' to '1694'	1	3.9127	0.1523	659.72	0.0000
APR-DRG	'1733' to '1734'	1	3.1568	0.1676	354.55	0.0000
MDC	5	1	2.6400	0.1483	316.85	0.0000
MDC	Other	1	2.9536	0.2252	172.05	0.0000
RUPTURED		1	2.0565	0.0808	647.42	0.0000
c-statistic	0.937					

2c. Validity testing

2c.1 Data/sample *(description of data/sample and size)*: AHRQ 2007 State Inpatient Databases (SID) with 4,000 hospitals and 30 million adult discharges surgery, has been identified as the most important predictor of mortality after elective AAA repair.93
Empirical evidence shows that AAA repair mortality is positively related to other post-procedural mortality measures, such as craniotomy (r=.28, p<.0001) and coronary artery bypass graft (CABG) (r=.17, p<.01).94

Veterans Integrated Service Networks´ (VISNs); and VA versus non-VA (Nationwide Inpatient Sample) using VA inpatient data (2004-2007). [1]

A survey of hospital and system leaders (presidents/chief executive officers (CEOs)) that was conducted in the first six months of 2006 with a total of 562 respondents. Hospital-level data for these composite measures were produced by applying the IQI to the State Inpatient Databases (SID) of the Healthcare Cost and

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Utilization Project (HCUP) sponsored by AHRQ. The SID includes all-payer data on inpatient stays from virtually all community hospitals in each participating state. [2]

We used 100 percent national analytic files from the CMS for the calendar years 2003 through 2006. Medicare Provider Analysis and Review (MEDPAR) files, which contain hospital discharge abstracts for all fee-for-service acute care hospitalizations of all U.S. Medicare recipients, were used to create our main analytical datasets. The Medicare denominator file was used to assess patient vital status at 30 days. Using appropriate procedure codes fiom the International Classification of Diseases, version 9 (ICD-9 codes), we identified all patients aged 65-99 undergoing elective AAA repair and pancreatectomy. [3]

2c.2 **Analytic Method** *(type of validity & rationale, method for testing)*:
Literature summary, expert panels and empirical analysis

VA-and VISN-level IQI observed rates, risk-adjusted rates, and observed to expected ratios (O/Es). We examined the trends in VA-and VISN-level rates using weighted linear regression, variation in VISN-level O/Es, and compared VA to non-VA trends. [1]

A t-test was used to determine the significance of differences in quality measures. [2]

We first estimated risk-adjusted hospital mortality rates during 2003-2004. We defined mortality as death within 30 days of operation or before hospital discharge. We adjusted for patient age, gender, race, urgency of operation, median ZIP-code income, and coexisting medical conditions. Using logistic regression, we estimated the expected number of deaths in each hospital and then divided the observed deaths by this expected number of deaths to obtain the ratio of observed to expected mortality (O/E ratio). We then multiplied the O/E ratio by the average mortality rate to obtain a risk-adjusted mortality rate for each hospital. We next used hierarchical modeling techniques to adjust these mortality estimates for reliability. Using random effects logistic regression models, we generated empirical Bayes predictions of mortality for each hospital. [3]

2c.3 **Testing Results** *(statistical results, assessment of adequacy in the context of norms for the test conducted)*:
The correlation between hospital or physician characteristics and in-hospital mortality in most studies supports the validity of in-hospital mortality as a measure of quality.[1, 2] Finally, excessive blood loss, which is a potentially preventable complication of surgery, has been identified as the most important predictor of mortality after elective AAA repair.[3]
Empirical evidence shows that AAA repair mortality is positively related to other post-procedural mortality measures, such as craniotomy (r=.28, p<.0001) and coronary artery bypass graft (CABG) (r=.17, p<.01).94
References:

[1] WH, Parker MA, Feinglass J, et al. The importance of surgeon volume and training in outcomes for vascular surgical procedures. J Vasc Surg 1999;29(5):768-76.

[2] Rutledge R, Oller DW, Meyer AA, et al. A statewide, population-based time-series analysis of the outcome of
ruptured abdominal aortic aneurysm. Ann Surg 1996;223(5):492-502.

[3]Pilcher DB, Davis JH, Ashikaga T, et al. Treatment of abdominal aortic aneurysm in an entire state over 7½ years. Am J Surg 1980;139(4):487-94.

[4]Nationwide Inpatient Sample.
VA in-hospital mortality rates for Abdominal Aortic Aneurysm (AAA) Repair Mortality were unchanged over time. The IQIs are easily applied to VA administrative data. They can be useful to tracks rate trends over time, reveal variation between sites, and for trend comparisons with other healthcare systems. [1]

The existence of a board quality committee was associated with higher likelihoods of adopting various oversight practices and lower mortality rates for abdominal aortic aneurysm repair measured by the Agency for Healthcare Research and Quality´s Inpatient Quality Indicators and the State Inpatient Databases. [2]

In assessing the ability of hospital mortality rankings to predict future performance, reliability adjustment was particularly important for pancreatic resection and AAA repair, hospital rankings based on reliability-adjusted mortality were superior at identifying hospitals likely to have the lowest future mortality. Without reliability adjustment, hospitals in the "best" quintile (2003-2004) with pancreatic resection had a mortality of 7.6 percent in 2005-2006; with reliability adjustment, the "best" hospital quintile had a mortality of 2.7 percent in 2003-2006. Similarly, without reliability adjustment, hospitals in the "best" quintile (2003-2004) with AAA repair had a mortality of 4.0 percent in 2005-2006; with reliability adjustment, the "best" hospital quintile had a mortality of 3.2 percent in 2005-2006. [3]

References

[1] Borzecki AM, Christiansen CL, Loveland S, Chew P, Rosen AK. Trends in the inpatient quality indicators: the Veterans Health Administration experience. Med Care. 2010 Aug;48(8):694-702.
[2] Jiang, H. Joanna; Lockee, Carlin; Bass, Karma; Fraser, Irene; Kiely, Robert. (2008). Board engagement in quality: findings of a survey of hospital and system leaders. Journal of Healthcare Management, 53, 2, 121(15)
[3] Dimick, Justin B.; Staiger, Douglas O.; Birkmeyer, John D. Ranking hospitals on surgical mortality: the importance of reliability adjustment. Health Serv Res. 2010 Dec;45(6 Pt 1):1614-29. doi: 10.1111/j.1475-6773.2010.01158.x. Epub 2010 Aug 16.

The following analytic results were achieved with the specifcation modification:

Table 1. Reference Population Rate and Volume

	Open, Ruptured	Open, Un-ruptured	Endovascular,Ruptured	Endovascular,Un-ruptured	Original(Composite)
Population Rate					
2004	39.04%	4.43%	29.11%	1.05%	6.09%
2005	41.10%	4.45%	28.06%	1.03%	5.76%
2006	41.11%	4.53%	29.18%	0.93%	5.22%
2007	39.77%	4.48%	24.84%	1.16%	4.88%
2008	38.27%	4.82%	27.17%	1.02%	4.61%
%Change	-2.0%	8.5%	-6.9%	-2.9%	-27.9%
Volume					
2004	3,241	15,723	456	17,438	36,768
2005	2,876	12,941	568	19,981	36,292
2006	2,652	11,152	647	22,778	37,156
2007	2,445	9,693	799	25,101	37,970
2008	2,352	8,851	1,068	28,103	40,293
%Change	-32.1%	-57.5%	85.1%	47.7%	9.2%

Source: State Inpatient Databases (SID), Healthcare Cost and Utilization Project (HCUP)

2d. Exclusions Justified

2d.1 **Summary of Evidence supporting exclusion(s):**
Exclusions remove cases where the outcome of interest is less likely to be preventable or more likely to be preventable or with no or very low risk

2d.2 **Citations for Evidence:**
Updated citations will be presented in the May Steering Committee meeting

Refinement of the HCUP Quality Indicators (Technical Review), May 2001
http://qualityindicators.ahrq.gov/Downloads/Modules_Non_Software/Modules%20Development%20Bullet/iqi_development.zip

2d.3 **Data/sample** *(description of data/sample and size)*: AHRQ 2007 State Inpatient Databases (SID) with 4,000 hospitals and 30 million adult discharges

2d.4 **Analytic Method** *(type analysis & rationale)*:
Expert panel and descriptive analyses stratified by exclusion categories

2d.5 **Testing Results** *(e.g., frequency, variability, sensitivity analyses)*:
Refinement of the HCUP Quality Indicators (Technical Review), May 2001

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NA ☐

http://qualityindicators.ahrq.gov/downloads/technical/qi_technical_review.zip

2e. Risk Adjustment for Outcomes/ Resource Use Measures

2e.1 **Data/sample** *(description of data/sample and size)*: AHRQ 2007 State Inpatient Databases (SID) with 4,000 hospitals and 30 million adult discharges

2e.2 **Analytic Method** *(type of risk adjustment, analysis, & rationale)*:
Risk-adjustment models use a standard set of categories based on readily available classification systems for demographics, severity of illness and comorbidities. Within each category, covariates are initially selected based on a minimum of 30 cases in the outcome of interest. Then a stepwise regression process on a development sample is used to select a parsimonious set of covariates where p<.05. Model is then tested on a validation sample

2e.3 **Testing Results** *(risk model performance metrics)*:
c 0.909

Table 2A. Model Covariates, 2008

	Open, Ruptured	Open, Un-ruptured	Endovascular, Rupture	Endovascular, Un-ruptured	Original(Composite)
Frequency					
N	2,284	8,729	1,038	27,989	39,963
Female	23.5%	27.3%	21.5%	17.8%	20.3%
18 - 24	0.0%	0.0%	0.0%	0.0%	0.0%
25 - 29	0.1%	0.1%	0.0%	0.0%	0.0%
30 - 34	0.0%	0.1%	0.0%	0.0%	0.0%
35 - 39	0.0%	0.1%	0.1%	0.0%	0.1%
40 - 44	0.1%	0.5%	0.0%	0.1%	0.1%
45 - 49	0.8%	0.9%	0.8%	0.3%	0.5%
50 - 54	1.9%	2.4%	1.8%	1.2%	1.5%
55 - 59	4.7%	6.3%	5.8%	3.5%	4.3%
60 - 64	11.0%	12.5%	9.0%	9.4%	10.2%
70 - 74	18.7%	21.4%	14.9%	20.1%	20.2%
75 - 79	19.7%	20.5%	16.4%	22.2%	21.6%
80 - 84	17.3%	11.5%	19.7%	17.3%	16.1%
85 - high	10.0%	4.3%	16.8%	9.4%	8.5%
169-1	0.0%	26.7%	0.1%	0.6%	6.3%
169-2	0.0%	30.2%	0.0%	1.1%	7.3%
169-3	0.1%	21.1%	0.0%	0.5%	5.0%
169-4	88.4%	14.5%	6.2%	0.4%	8.6%
173-2	0.0%	0.0%	0.0%	35.1%	24.6%
173-3	0.0%	0.0%	0.1%	7.6%	5.3%
173-4	0.0%	0.0%	84.4%	2.3%	3.8%
MDC 5	11.5%	7.5%	9.2%	2.1%	4.0%
Transfer-in	14.5%	2.4%	18.5%	1.6%	2.9%

Source: State Inpatient Databases (SID), Healthcare Cost and Utilization Project (HCUP). APR-DRG 169 (MAJOR THORACIC & ABDOMINAL VASCULAR PROCEDURES); APR-DRG 173 (OTHER VASCULAR PROCEDURES)

Table 2B. Model Covariates, 2008

	Open, Ruptured	Open, Un-ruptured	Endovascular, Ruptured	Endovascular, Un-ruptured	Original (Composite)
Odds Ratios					
Female	1.116	1.063	1.548*	1.386*	1.143*
18 - 24					
25 - 29					
30 - 34					
35 - 39					
40 - 44					

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45 - 49	0.538		0.634		0.387	
50 - 54	0.445	0.483	1.761		0.637	
55 - 59	0.547*	0.713	0.526	1.068	0.644*	
60 - 64	0.910	0.814	1.048	1.613	0.999	
70 - 74	1.721*	1.023	1.699	1.138	1.328*	
75 - 79	1.804*	1.410	1.800*	1.862*	1.569*	
80 - 84	2.941*	2.459*	2.346*	2.002*	2.499*	
85 - high		4.225*	2.469*	2.052*	2.717*	3.006*
169-1		0.052*		41.786*	13.066*	
169-2		0.070*		15.660*	13.998*	
169-3		0.284*		71.019*	55.144*	
169-4	1.375*	2.372*	1.587			
173-2				1.576	1.470	
173-3				32.328*	30.741*	
173-4			0.789			
MDC 5	1.000	1.000	1.000	1.000	1.000	
Transfer-in		0.948	0.779	1.011	1.824*	1.251*
C-statistic		0.659	0.868	0.626	0.942	0.940

Source: State Inpatient Databases (SID), Healthcare Cost and Utilization Project (HCUP); * - significant at p<.05

2e.4 **If outcome or resource use measure is not risk adjusted, provide rationale:** Not applicable

2f. Identification of Meaningful Differences in Performance

2f.1 **Data/sample from Testing or Current Use** *(description of data/sample and size)*: AHRQ 2007 State Inpatient Databases (SID) with 4,000 hospitals and 30 million adult discharges

2f.2 **Methods to identify statistically significant and practically/meaningfully differences in performance** *(type of analysis & rationale)*:
Posterior probability distribution parameterized using the Gamma distribution

2f.3 **Provide Measure Scores from Testing or Current Use** *(description of scores, e.g., distribution by quartile, mean, median, SD, etc.; identification of statistically significant and meaningfully differences in performance)*:

5th	25th	Median	75th	95th
0.025908	0.036333	0.045065	0.055099	0.071948

Table 2. Hospital Discrimination, 2008

Open, Ruptured Open, Un-ruptured Endovascular,Ruptured Endovascular, Un-ruptured Original(Composite)

Hospitals		1,015	1,343	507	1,439	1,711
Best Performing	24.74%	10.20%	12.91%	0.00%	4.64%	
Worst Performing		26.53%	24.26%	39.11%	0.75%	5.52%
5th	32.15%	2.25%	20.14%	0.16%	3.02%	
10th	33.42%	2.67%	21.52%	0.24%	3.32%	
25th	35.60%	3.49%	23.98%	0.46%	3.86%	
Median	38.14%	4.59%	26.91%	0.84%	4.53%	
75th	40.79%	5.90%	30.08%	1.39%	5.27%	
90th	43.28%	7.27%	33.14%	2.04%	6.00%	
95th	44.82%	8.18%	35.06%	2.52%	6.47%	

Source: State Inpatient Databases (SID), Healthcare Cost and Utilization Project (HCUP). Best performing is below the median at 95% probability; worst performing is above the median at 95% probability.

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2g. Comparability of Multiple Data Sources/Methods

2g.1 **Data/sample** *(description of data/sample and size)*: Not applicable

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2g.2 Analytic Method *(type of analysis & rationale)*: Not applicable **2g.3 Testing Results** *(e.g., correlation statistics, comparison of rankings)*: Not applicable	N☐ NA ☐
2h. Disparities in Care **2h.1 If measure is stratified, provide stratified results** *(scores by stratified categories/cohorts)*: Information on results are noted below. Also 1b2 provides results by age, gender, micropolitian and metropolitian and payer. Median income of patient´s ZIP code: 1) Estimate 2) Standard error 3) P-value: Relative to marked group-c 4) P-value: 2007 relative to 2006 First quartile (lowest income) 59.088 2.445 0.242 0.002 Second quartile 54.793 2.336 0.966 0.011 Third quartile 58.174 2.397 0.357 0.085 Fourth quartile (highest income)c 54.942 2.561 0.060 From previous testing, known predictors of in-hospital mortality include whether the aneurysm is intact or ruptured, age, female gender, admission through an emergency room, various comorbidities such as renal failure and dysrhythmias, and Charlson's comorbidity index.[1, 2, 3] References: [1] Manheim LM, Sohn MW, Feinglass J, et al. Hospital vascular surgery volume and procedure mortality rates in California, 1982-1994. J Vasc Surg 1998;28(1):45-56. [2] Hannan EL, Kilburn H, Jr., O'Donnell JF, et al. A longitudinal analysis of the relationship between in-hospital mortality in New York state and the volume of abdominal aortic aneurysm surgeries performed. Health Serv Res 1992;27(4):517-42. [3] Wen SW, Simunovic M, Williams JI, et al. Hospital volume, calendar age, and short term outcomes in patients undergoing repair of abdominal aortic aneurysm: the Ontario experience, 1988-92. J Epidemiol Community Health 1996;50(2):207-13. RACE/ETHNICITY Rate per 100 White 4.52 Black 5.48 Hispanic 5.40 Asian NH/PI 5.33 Amer Indian/AN 4.58 Other 4.66 Source: 2008 State Inpatient Databases (SID) (N=39,963) **2h.2 If disparities have been reported/identified, but measure is not specified to detect disparities, provide follow-up plans:** Users may stratify based on gender and race/ethnicity	2h C☐ P☐ M☐ N☐ NA ☐
TAP/Workgroup: What are the strengths and weaknesses in relation to the subcriteria for *Scientific Acceptability of Measure Properties?*	2
Steering Committee: Overall, to what extent was the criterion, *Scientific Acceptability of Measure Properties*, met? **Rationale:**	2 C ☐ P ☐ M ☐ N ☐
3. USABILITY	
Extent to which intended audiences (e.g., consumers, purchasers, providers, policy makers) can understand	Eval

the results of the measure and are likely to find them useful for decision making. (evaluation criteria)	Rating
3a. Meaningful, Understandable, and Useful Information 3a.1 **Current Use:** In use 3a.2 **Use in a public reporting initiative (disclosure of performance results to the public at large)** (*If used in a public reporting initiative, provide name of initiative(s), locations, Web page URL(s). If not publicly reported, state the plans to achieve public reporting within 3 years*)**:** California (state) Hospital Inpatient Mortality Indicators for California http://www.oshpd.ca.gov/HID/Products/PatDischargeData/AHRQ/iqi-imi_overview.html Florida (state) Florida Health Finder http://www.floridahealthfinder.gov/ Kentucky (Norton Healthcare, a hospital system) Norton Healthcare Quality Report http://www.nortonhealthcare.com/body.cfm?id=157 Kentucky (state hospital association) Kentucky Hospital Association Quality Data http://info.kyha.com/QualityData/IQISite/ Maine (state) Maine Health Data Organization http://gateway.maine.gov/mhdo2008Monahrq/home.html Massachusetts (state) My HealthCare Options http://www.mass.gov/healthcareqc Minnesota (Minnesota Community Measurement) Minnesota Health Scores www.mnhealthscores.org New Jersey (state) Find and Compare Quality Care in NJ Hospitals http://www.nj.gov/health/healthcarequality/ New York (health care coalition) New York State Hospital Report Card http://www.myhealthfinder.com/ Oregon (state) Oregon Hospital Quality Indicators http://www.oregon.gov/OHPPR/HQ/ Texas (state) Reports on Hospital Performance http://www.dshs.state.tx.us/thcic/ Vermont (state) Dept of Banking, Insurance, Securities & Health Care Administration Comparison Report http://www.bishca.state.vt.us/health-care/hospitals-health-care-practitioners/2009-vermont-hospital-report-card	**3a** **C**☐ **P**☐ **M**☐ **N**☐

Washington (health care coalition)
Washington State Hospital Report Card
http://www.myhealthfinder.com/wa09/index.php

Wisconsin (state hospital association)
CheckPoint
http://www.wicheckpoint.org/index.aspx

The measure is also reported on HCUPnet:
http://hcupnet.ahrq.gov/HCUPnet.jsp?Id=EB57801381F71C41&Form=MAINSEL&JS=Y&Action=%3E%3ENext%3E%3E&_MAINSEL=AHRQ%20Quality%20Indicators

This measure is used in the MONAHRQ system that is provided for public reporting and quality improvement throughout the United States: http://monahrq.ahrq.gov/

3a.3 **If used in other programs/initiatives (***If used in quality improvement or other programs/initiatives, name of initiative(s), locations, Web page URL(s). If not used for QI, state the plans to achieve use for QI within 3 years***):**
University Healthcare Consortium - An alliance of 103 academic medical centers and 219 of their affiliated hospitals. Reporting the AHRQ QIs to their member hospitals. (see www.uhc.edu. Note: measure results reported to hospitals; not reported on site).

Dallas Fort Worth Hospital Council – Reporting on measure results to over 70 hospitals in Texas (see www.dfwhc.ord. Note: measure results reported to hospitals; not reported on site).

Norton Healthcare - a multi-hospital system in Kentucky (see http://www.nortonhealthcare.com/about/Our_Performance/index.aspx)

Ministry Health Care - a multi-hospital system in Wisconsin (see http://ministryhealth.org/display/router.aspx. Note: measure results reported to hospitals; not reported on site).

Minnesota Hospital Association
http://www.mnhospitals.org/ Note: measure used in quality improvement. Not reported publicly by the association)

Premier - Premier´s "Quality Advisor" tool provides performance reports to approximately 650 hospitals for their use in monitoring and improving quality. Hospitals receive facility specific reports on this measure in Quality Advisor.

This measure is used in the MONAHRQ system that is provided for public reporting and quality improvement throughout the United States: http://monahrq.ahrq.gov/

Testing of Interpretability (*Testing that demonstrates the results are understood by the potential users for public reporting and quality improvement*)
3a.4 **Data/sample** *(description of data/sample and size)***:** AHRQ 2007 State Inpatient Databases (SID) with 4,000 hospitals and 30 million adult discharge

3a.5 **Methods** *(e.g., focus group, survey, QI project)***:**
A research team from the School of Public Affairs, Baruch College, under contracts with the Department of Public Health, Weill Medical College and Battelle, Inc., has developed a pair of Hospital Quality Model Reports at the request of the Agency for Healthcare Research & Quality (AHRQ). These reports are designed specifically to report comparative information on hospital performance based on the AHRQ Quality Indicators (QIs). The work was done in close collaboration with AHRQ staff and the AHRQ Quality Indicators team.
The Model Reports (discussed immediately above) are based on:
• Extensive search and analysis of the literature on hospital quality measurement and reporting, as well as public reporting on health care quality more broadly;
• Interviews with quality measurement and reporting experts, purchasers, staff of purchasing coalitions, and

executives of integrated health care delivery systems who are responsible for quality in their facilities; • Two focus groups with chief medical officers of hospitals and/or systems and two focus groups with quality managers from a broad mix of hospitals; • Four focus groups with members of the public who had recently experienced a hospital admission; and • Four rounds of cognitive interviews (a total of 62 interviews) to test draft versions of the two Model Reports with members of the public with recent hospital experience, basic computer literacy but widely varying levels of education. 3a.6 **Results** *(qualitative and/or quantitative results and conclusions)*: Given the above review of the literature and original research that was conducted, a Model report was the result that could help sponsors use the best evidence on public reports so they are most likely to have the desired effects on quality.	
3b/3c. Relation to other NQF-endorsed measures 3b.1 **NQF # and Title of similar or related measures:**	
(for NQF staff use) **Notes on similar/related endorsed or submitted measures:**	
3b. Harmonization If this measure is related to measure(s) already endorsed by NQF (e.g., same topic, but different target population/setting/data source or different topic but same target population): 3b.2 **Are the measure specifications harmonized? If not, why?** The Leapfrog measure is based on the AHRQ specification, but is not risk-adjusted	**3b** **C**☐ **P**☐ **M**☐ **N**☐ **NA** ☐
3c. Distinctive or Additive Value 3c.1 **Describe the distinctive, improved, or additive value this measure provides to existing NQF-endorsed measures:** The AHRQ indicator is risk-adjusted and maintained annually 5.1 **If this measure is similar to measure(s) already endorsed by NQF (i.e., on the same topic and the same target population), Describe why it is a more valid or efficient way to measure quality:** The AHRQ indicator is paired with a volume indicator, is included in a composite, and is risk-adjusted	**3c** **C**☐ **P**☐ **M**☐ **N**☐ **NA** ☐
TAP/Workgroup: What are the strengths and weaknesses in relation to the subcriteria for *Usability?*	**3**
Steering Committee: Overall, to what extent was the criterion, *Usability*, met? **Rationale:**	**3** **C**☐ **P**☐ **M**☐ **N**☐
4. FEASIBILITY	
Extent to which the required data are readily available, retrievable without undue burden, and can be implemented for performance measurement. (evaluation criteria)	Eval Rating
4a. Data Generated as a Byproduct of Care Processes 4a.1-2 **How are the data elements that are needed to compute measure scores generated?** Coding/abstraction performed by someone other than person obtaining original information (E.g., DRG, ICD-9 codes on claims, chart abstraction for quality measure or registry)	**4a** **C**☐ **P**☐ **M**☐ **N**☐
4b. Electronic Sources 4b.1 **Are all the data elements available electronically?** (*elements that are needed to compute measure scores are in defined, computer-readable fields, e.g., electronic health record, electronic claims*) Yes	**4b** **C**☐ **P**☐ **M**☐ **N**☐

4b.2 **If not, specify the near-term path to achieve electronic capture by most providers.**	
4c. Exclusions 4c.1 **Do the specified exclusions require additional data sources beyond what is required for the numerator and denominator specifications?** No 4c.2 **If yes, provide justification.**	**4c** **C**☐ **P**☐ **M**☐ **N**☐ **NA** ☐
4d. Susceptibility to Inaccuracies, Errors, or Unintended Consequences 4d.1 **Identify susceptibility to inaccuracies, errors, or unintended consequences of the measure and describe how these potential problems could be audited. If audited, provide results.** Coding professionals follow detailed guidelines, are subject to training and credentialing requirements, peer review and audit.	**4d** **C**☐ **P**☐ **M**☐ **N**☐
4e. Data Collection Strategy/Implementation 4e.1 **Describe what you have learned/modified as a result of testing and/or operational use of the measure regarding data collection, availability of data/missing data, timing/frequency of data collection, patient confidentiality, time/cost of data collection, other feasibility/ implementation issues:** None 4e.2 **Costs to implement the measure** (*costs of data collection, fees associated with proprietary measures*): Administrative data are collected as part of the routine operations. Some staff time is required to download and execute the software from the AHRQ webs site, which is available at no cost. 4e.3 **Evidence for costs:** Administrative data are collected as part of the routine operations. Some staff time is required to download and execute the software from the AHRQ webs site, which is available at no cost. 4e.4 **Business case documentation:** Administrative data are collected as part of the routine operations. Some staff time is required to download and execute the software from the AHRQ webs site, which is available at no cost.	**4e** **C**☐ **P**☐ **M**☐ **N**☐
TAP/Workgroup: What are the strengths and weaknesses in relation to the subcriteria for *Feasibility?*	**4**
Steering Committee: Overall, to what extent was the criterion, *Feasibility*, met? **Rationale:**	**4** **C**☐ **P**☐ **M**☐ **N**☐
RECOMMENDATION	
(for NQF staff use) **Check if measure is untested and only eligible for time-limited endorsement.**	**Time-limited** ☐
Steering Committee: Do you recommend for endorsement? **Comments:**	**Y**☐ **N**☐ **A**☐
CONTACT INFORMATION	
Co.1 **Measure Steward (Intellectual Property Owner)** Co.1 **<u>Organization</u>** Agency for Healthcare Research and Quality, 540 Gaither Road, Rockville, Maryland, 20850	

Co.2 Point of Contact
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Measure Developer If different from Measure Steward
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Co.5 Submitter If different from Measure Steward POC
John, Bott, MSSW, MBA, John.Bott@AHRQ.hhs.gov, 301-427-1317-, Agency for Healthcare Research and Quality

Co.6 Additional organizations that sponsored/participated in measure development
UC Davis,
Stanford University,
Battelle Memorial Institute

ADDITIONAL INFORMATION

Workgroup/Expert Panel involved in measure development
Ad.1 Provide a list of sponsoring organizations and workgroup/panel members' names and organizations. Describe the members' role in measure development.
None

Ad.2 If adapted, provide name of original measure: None
Ad.3-5 If adapted, provide original specifications URL or attachment

Measure Developer/Steward Updates and Ongoing Maintenance
Ad.6 Year the measure was first released: 2001
Ad.7 Month and Year of most recent revision: 08, 2011
Ad.8 What is your frequency for review/update of this measure? Annual
Ad.9 When is the next scheduled review/update for this measure? 12, 2011

Ad.10 Copyright statement: The AHRQ QI software is publicly available; no copyright disclaimers

Ad.11 Disclaimers: None

Ad.12 -14 Additional Information web page URL or attachment: URL None
http://qualityindicators.ahrq.gov/Downloads/Modules_Non_Software/Modules%20Development%20Bullet/iqi_development.zip

Date of Submission (*MM/DD/YY*)**:** 02/01/2011

AAA Repair
7/25/11

Table 1. Reference Population Rate and Volume

	Open, Ruptured	Open, Un-ruptured	Endovascular, Ruptured	Endovascular, Un-ruptured	Original (Composite)
Population Rate					
2004	39.04%	4.43%	29.11%	1.05%	6.09%
2005	41.10%	4.45%	28.06%	1.03%	5.76%
2006	41.11%	4.53%	29.18%	0.93%	5.22%
2007	39.77%	4.48%	24.84%	1.16%	4.88%
2008	38.27%	4.82%	27.17%	1.02%	4.61%
%Change	-2.0%	8.5%	-6.9%	-2.9%	-27.9%
Volume					
2004	3,241	15,723	456	17,438	36,768
2005	2,876	12,941	568	19,981	36,292
2006	2,652	11,152	647	22,778	37,156
2007	2,445	9,693	799	25,101	37,970
2008	2,352	8,851	1,068	28,103	40,293
%Change	-32.1%	-57.5%	85.1%	47.7%	9.2%

Source: State Inpatient Databases (SID), Healthcare Cost and Utilization Project (HCUP)

Table 2. Hospital Discrimination, 2008

	Open, Ruptured	Open, Un-ruptured	Endovascular, Ruptured	Endovascular, Un-ruptured	Original (Composite)
Hospitals	1,015	1,343	507	1,439	1,711
Best Performing	24.74%	10.20%	12.91%	0.00%	4.64%
Worst Performing	26.53%	24.26%	39.11%	0.75%	5.52%
5th	32.15%	2.25%	20.14%	0.16%	3.02%
10th	33.42%	2.67%	21.52%	0.24%	3.32%
25th	35.60%	3.49%	23.98%	0.46%	3.86%
Median	38.14%	4.59%	26.91%	0.84%	4.53%
75th	40.79%	5.90%	30.08%	1.39%	5.27%
90th	43.28%	7.27%	33.14%	2.04%	6.00%
95th	44.82%	8.18%	35.06%	2.52%	6.47%

Source: State Inpatient Databases (SID), Healthcare Cost and Utilization Project (HCUP). Best performing is below the median at 95% probability; worst performing is above the median at 95% probability.

Table 2A. Model Covariates, 2008

	Open, Ruptured	Open, Un-ruptured	Endovascular, Ruptured	Endovascular, Un-ruptured	Original (Composite)
Frequency					
N	2,284	8,729	1,038	27,989	39,963
Female	23.5%	27.3%	21.5%	17.8%	20.3%
18 - 24	0.0%	0.0%	0.0%	0.0%	0.0%
25 - 29	0.1%	0.1%	0.0%	0.0%	0.0%
30 - 34	0.0%	0.1%	0.0%	0.0%	0.0%
35 - 39	0.0%	0.1%	0.1%	0.0%	0.1%
40 - 44	0.1%	0.5%	0.0%	0.1%	0.1%
45 - 49	0.8%	0.9%	0.8%	0.3%	0.5%
50 - 54	1.9%	2.4%	1.8%	1.2%	1.5%
55 - 59	4.7%	6.3%	5.8%	3.5%	4.3%
60 - 64	11.0%	12.5%	9.0%	9.4%	10.2%
70 - 74	18.7%	21.4%	14.9%	20.1%	20.2%
75 - 79	19.7%	20.5%	16.4%	22.2%	21.6%
80 - 84	17.3%	11.5%	19.7%	17.3%	16.1%
85 - high	10.0%	4.3%	16.8%	9.4%	8.5%
169-1	0.0%	26.7%	0.1%	0.6%	6.3%
169-2	0.0%	30.2%	0.0%	1.1%	7.3%
169-3	0.1%	21.1%	0.0%	0.5%	5.0%
169-4	88.4%	14.5%	6.2%	0.4%	8.6%
173-2	0.0%	0.0%	0.0%	35.1%	24.6%
173-3	0.0%	0.0%	0.1%	7.6%	5.3%
173-4	0.0%	0.0%	84.4%	2.3%	3.8%
MDC 5	11.5%	7.5%	9.2%	2.1%	4.0%
Transfer-in	14.5%	2.4%	18.5%	1.6%	2.9%

Source: State Inpatient Databases (SID), Healthcare Cost and Utilization Project (HCUP). APR-DRG 169 (MAJOR THORACIC & ABDOMINAL VASCULAR PROCEDURES); APR-DRG 173 (OTHER VASCULAR PROCEDURES)

Table 2B. Model Covariates, 2008

	Open, Ruptured	Open, Un-ruptured	Endovascular, Ruptured	Endovascular, Un-ruptured	Original (Composite)
Odds Ratios					
Female	1.116	1.063	1.548*	1.386*	1.143*
18 - 24					
25 - 29					
30 - 34					
35 - 39					
40 - 44					
45 - 49	0.538		0.634		0.387
50 - 54	0.445	0.483	1.761		0.637
55 - 59	0.547*	0.713	0.526	1.068	0.644*
60 - 64	0.910	0.814	1.048	1.613	0.999
70 - 74	1.721*	1.023	1.699	1.138	1.328*
75 - 79	1.804*	1.410	1.800*	1.862*	1.569*
80 - 84	2.941*	2.459*	2.346*	2.002*	2.499*
85 - high	4.225*	2.469*	2.052*	2.717*	3.006*
169-1		0.052*		41.786*	13.066*
169-2		0.070*		15.660*	13.998*
169-3		0.284*		71.019*	55.144*
169-4	1.375*	2.372*	1.587		
173-2				1.576	1.470
173-3				32.328*	30.741*
173-4			0.789		
MDC 5	1.000	1.000	1.000	1.000	1.000
Transfer-in	0.948	0.779	1.011	1.824*	1.251*
C-statistic	0.659	0.868	0.626	0.942	0.940

Source: State Inpatient Databases (SID), Healthcare Cost and Utilization Project (HCUP); * - significant at p<.05