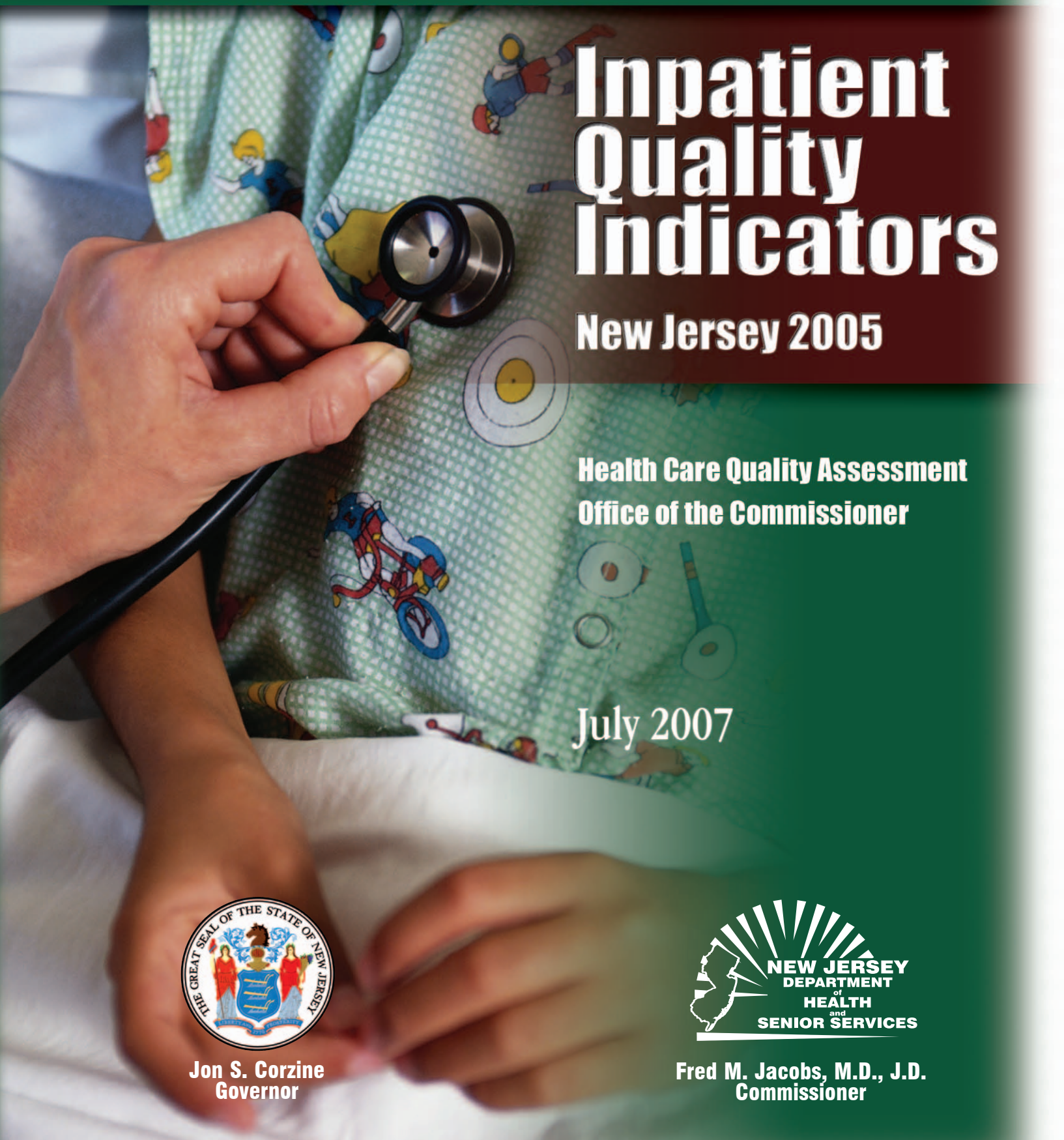
HCQA Health Care Quality Assessment



Inpatient Quality Indicators

New Jersey 2005

Health Care Quality Assessment
Office of the Commissioner

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Office of Health Care Quality Assessment

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Introduction

The Office of Health Care Quality Assessment (HCQA) of the New Jersey Department of Health and Senior Services (Department) assesses health care quality through collecting and analyzing qualitative and quantitative data reported by hospitals and other sources to support performance monitoring. Specifically, the HCQA group produces consumer reports on cardiac surgery, bariatric surgery and hospital performance; collects and reviews confidential reports and root cause analyses of serious medical errors; and maintains specialized databases to support licensure requirements. In an effort to enhance the information the Department makes available to the public on hospital care, HCQA staff has applied analytical tools developed by the Federal Agency for Healthcare Research and Quality (AHRQ) to New Jersey hospital inpatient discharge data.

This report is based on an application of the AHRQ Inpatient Quality Indicator (IQI) module (Software, Version 3.0) to the 2005 New Jersey hospital discharge (or Uniform Billing) data. The report is organized into the following sections: *Background of the AHRQ Modules; Inpatient Quality Indicators; Interpretation of IQI Measures Presented in this Report; Inpatient Quality Indicator Analysis Results; State-Level Aggregate IQI Measures; and Summary of findings.* Definitions of Inpatient Quality Indicators and a guide to interpreting the software generated rates are provided in Appendices 1-2.

Background on the AHRQ Quality Indicators

AHRQ designed its quality assessment tools to employ Uniform Billing (UB) data, since this data set is readily available for large numbers of patients, thus increasing the statistical power of the analysis while avoiding the high cost of separately collecting data. The UB form is nationally standardized and contains a rich array of data. Each UB data submission contains information on the patient's primary and secondary diagnoses, procedures performed on the patient, whether the patient died or, if discharged alive, the discharge destination (e.g. home, to another hospital, to a skilled nursing facility, etc.), length of stay, charges billed, and patient demographic information, such as age, gender, race and ethnicity. In New Jersey a record of every hospital inpatient discharge, which is essentially a copy of the claim submitted to insurers for payment, is collected by the State and used for a wide variety of public health purposes. Over one million hospital inpatient UB records are collected each year in New Jersey. Additionally, because the UB is a standardized form and because AHRQ collects UB data from more than 40 states through its Healthcare Cost and Utilization Project (HCUP) State Inpatient Database (SID), application of these indicators permits computation of national rates that may be used for comparative benchmarking purposes.

There are, however, well-recognized limitations to UB data sets for health research purposes. Although derived from medical records, UB data elements are

developed by hospitals primarily for administrative billing purposes rather than clinical use. Not all clinically relevant data are included in the UB form, and the accuracy of data elements not most relevant to billing concerns, e.g. demographic data or discharge destination, has been questioned. Despite the limitations, however, UB data have been used by researchers for many important studies, including studies that focus on health care quality, access to care, health care costs, health disparities, and outcome studies. A recent Yale University study conducted under contract with the Centers for Medicare & Medicaid Services (CMS) found a strong correlation between UB and medical abstract data and demonstrated that models using UB data can be developed that have properties that would make them suitable for public reporting and meet the criteria necessary for statistical credibility.

It is clear that health care quality should not be judged solely on the basis of UB data. In fact, AHRQ emphasizes that no single source of information can be used to determine the quality of care in a hospital. Many factors affect the selection of a hospital, and quality indicators generated from application of the AHRQ modules are only one source of information to consider. Other factors that may affect a consumer's selection of a hospital include services a health plan covers, convenience, hospital where the doctor practices, and recommendations from family and friends. Nonetheless, AHRQ believes that information available in UB data can contribute to an assessment of hospital performance. Consumers can use the information provided in this report, along with other sources of information from the Department, such as the Hospital Performance Report, the Cardiac Surgery Report and the Bariatric Surgery Report, to talk with their doctor and take a more active role in making health care decisions.

Since the development in the early 1990's of the initial HCUP Quality Indicators, there has been considerable change in the field of health care services quality measurement. Risk-adjustment methods have become more readily available and new measures have been developed. In 2001, AHRQ funded a project to refine and further develop the HCUP Quality Indicators modules, utilizing the expertise of the University of California at San Francisco (UCSF)-Stanford Evidence-based Practice Center (EPC). The result is the current set of AHRQ Quality Indicators (QIs).

The AHRQ QIs are a set of quality indicators organized into four modules, each of which measures quality associated, by and large, with patient care that occurred in an outpatient or inpatient setting. These are:

- **Prevention Quality Indicators (PQI)** or ambulatory care sensitive conditions: These indicators identify hospital admissions that evidence suggests could have been avoided, at least in part, through high-quality primary care;

- **Inpatient Quality Indicators (IQI):** These indicators reflect quality of care inside hospitals. The indicators include five groups of measures, namely: *i) volume of procedures for which there is evidence that a higher volume of procedures is associated with lower mortality; ii) inpatient mortality for*

medical conditions; iii) inpatient mortality for surgical procedures; iv) hospital-level utilization of procedures for which there are questions of overuse, underuse, and misuse; and v) area-level (county-level) utilization of procedures.

- **Patient Safety Indicators (PSI):** These indicators reflect quality of care inside hospitals with focus on potentially preventable and other iatrogenic events, resulting from exposure to the health care system.

- **Pediatric Quality Indicators (PDIs):** These indicators reflect quality of pediatric healthcare with focus on potentially preventable complications and iatrogenic events for pediatric patients treated in hospitals, and on preventable hospitalizations among pediatric patients. This module, which includes 13 provider-level and 5 area-level indicators, became available in February, 2006.

According to the AHRQ, the quality indicators are developed to:

- Help hospitals and hospital systems to compare their performance with other hospitals or statewide and national averages. For example, they would easily find answers to such questions as: *'How does our hospital's cesarean section rate compare to the statewide or the national rate?'*; *'Do other hospitals have similar mortality rates following hip replacement as our hospital?'*; *'How does the volume of coronary artery bypass graft in our hospital compare with other hospitals?'; etc.*

- Allow State agencies and community health partnerships to ask questions that would help provide initial feedback about clinical areas appropriate for further, more in-depth analysis. For example, a community health partnership would be able to find helpful feedback by asking such questions as: *'How does the hysterectomy rate in our county compare with other counties, the State and the national average?'; 'Where does our county stand in terms of its CABG rate?'; etc.*

- Help state hospital associations, managed care organizations, business-health coalitions, and others to do assessment of health care quality by providing answers to such questions as: *'Can we design community interventions in areas surrounding hospitals with high rates of diabetes complications?'; 'Which quality indicators can be incorporated into performance management initiatives for our member hospitals?', etc.*

This report presents findings resulting from the application of the Inpatient Quality Indicators to the 2005 New Jersey hospital discharge data. Reports on the Prevention Quality Indicators, the Patient Safety Indicators and the Pediatric Quality Indicators will be presented separately in the future.

Performances of hospitals covered in this report can be affected by factors that are not within the hospitals' control, such as patient or physician preferences, stage of illness, age, or other accompanying illnesses or conditions. While the data analysis method adjusts for some of these factors, it does not account for all possible factors.

Physicians direct the medical care that is delivered at hospitals, providing diagnoses and prescribing tests and treatments, including medications, surgical procedures, etc. This report does not separate the effect of the physician from the effect of the hospital. The quality of care provided in a hospital is dependent not only upon the skill of individual physician, but also on how well physicians, nurses, pharmacists, technicians, support staff and management work together, as well as on what technology and other resources are available in the facility. If a major change affecting one or more of these factors occurs - such as the departure of a key surgeon or the addition of new technology - the impact on care may be dramatic and quite sudden.

Inpatient Quality Indicators

The IQI module contains 32 indicators that reflect the in-hospital quality of inpatient care. These indicators are grouped into three major categories: *volume indicators, mortality indicators and utilization indicators*.

- **Volume indicators show the volume of cases for selected inpatient procedures for which there is a demonstrated link between the number of procedures performed and the outcomes, such as mortality or complication rates.**

Volume Indicators:

01. Esophageal Resection
02. Pancreatic Resection
04. Abdominal Aortic Aneurysm
05. Coronary Artery Bypass Graft (CABG)
06. Percutaneous Transluminal Coronary Angioplasty (PTCA)
07. Carotid Endarterectomy

- **Mortality indicators measure death rates for selected common surgical procedures or medical conditions.**

Surgical Procedures:

08. Esophageal Resection
09. Pancreatic Resection
11. Abdominal Aortic Aneurysm
12. Coronary Artery Bypass Graft (CABG)
13. Craniotomy (Surgical opening of the skull)
14. Hip Replacement
30. Percutaneous Transluminal Coronary Angioplasty
31. Carotid Endarterectomy

Medical Conditions:
15. Acute Myocardial Infarction (AMI)
16. Congestive Heart Failure
17. Acute Stroke
18. Gastrointestinal (GI) Hemorrhage
19. Hip Fracture
20. Pneumonia
32. AMI, Without Transfer Cases

- **Utilization indicators focus on the volume of selected procedures for which research has suggested issues of overuse, underuse, or misuse.**

Hospital-level:
21. Cesarean Section Delivery
22. Vaginal Birth After Cesarean, Uncomplicated
23. Laparoscopic Cholecystectomy
24. Incidental Appendectomy in the Elderly
25. Bi-lateral Cardiac Catheterization
33. Primary Cesarean Delivery
34. Vaginal Birth After Cesarean, All

Area-level:
26. Coronary Artery Bypass Graft (CABG)
27. Percutaneous Transluminal Coronary Angioplasty (PTCA)
28. Hysterectomy
29. Laminectomy or Spinal Fusion

The IQI module software produces *observed rates*, *expected rates*, *risk-adjusted rates*, and *smoothed rates* for mortality and utilization indicators. This report focuses on hospital-level risk-adjusted rates for each indicator. However, a brief explanation of the other rates is given in Appendix 2.

Observed Rates - An observed mortality rate is defined as the number of patient deaths for a specific condition or surgical procedure divided by the total number of patients admitted for the condition or surgical procedure being treated. Similarly, an observed utilization rate is defined as the number of patient cases for a specific procedure divided by the total number of patients admitted for the condition being treated. Consumers can consider observed rates as crude measures of performance. By comparing observed rates to risk-adjusted rates, consumers can see the impact of patient case-mix on that hospital's performance.

Risk-adjusted rates - In order for provider performance profiles to present an accurate indicator of quality of care, the data must be adjusted to account for differences in patients' severity of illness and risk of mortality. "All Patient Refined Diagnosis Related Groups" ("APR-DRGs") is a proprietary tool of the 3M Health Information Systems Corporation designed to use UB data to adjust for these patient differences. The AHRQ quality indicators methodology requires use of APR-DRGs in the analysis of UB data. APR-DRG variables take advantage of available UB data on patient co-morbidities and non-operating room

procedures and allow the interaction of the patient's secondary diagnoses, principal diagnoses, and age to influence the assignment of that patient to one of four classes of severity and risk of mortality classes: low, moderate, high and very high. This risk adjustment enables comparisons among hospitals, counties, and/or states with different mixes of patients.

AHRQ's risk-adjusted rates are derived from applying to the observed rates the average case-mix of a baseline data file derived from the 2003 HCUP State Inpatient Data (SID) from 38 states. The risk-adjusted rate is the best estimate of what the hospital's rates would have been if the hospital had a mix of patients identical to a national-average patient mix for that year. The risk-adjusted rates reflect the age and sex distribution as well as the APR-DRG distribution of the data in the baseline file.

Interpretation of IQI Measures Presented in this Report

- The information in this report should be combined with that of other reports, including the Department of Health and Senior Services' annual Hospital Performance report, which focuses on how often hospitals apply proven processes of care in the treatment of certain conditions; the Cardiac Surgery report, which measures isolated bypass mortality; and other similar reports.
    - Please note that the Cardiac Surgery report is based on a more detailed clinical data on New Jersey open heart surgery patients collected separately from the UB data collection system. There are also differences in the type of open-heart procedures reviewed in this report and the Department's Cardiac Surgery report. Despite such data and methodology differences, consistency is expected between the measures derived from either approach.
    - Differences in data and methodology might also lead to conflicting hospital performance levels for the Hospital Performance Report and the AHRQ Inpatient Quality Indicators. This reinforces the need to consider a wide range of information on hospital performance.

- An individual hospital's performance is measured by comparing the confidence interval for a hospital to the statewide mortality or utilization rate. The hospital's performance is measured by whether the 95% confidence interval for its risk-adjusted estimate contains the statewide estimate for the indicator.

- If a hospital's confidence interval contains the statewide risk-adjusted rate, the hospital's risk-adjusted rate is not statistically significantly different from the statewide rate.

- If a hospital's confidence interval falls entirely below the statewide risk-adjusted rate, the hospital's risk-adjusted rate is significantly lower than the statewide rate. In the tables, these rates are marked by single asterisk.

- If a hospital's confidence interval falls entirely above the statewide risk-adjusted rate, the hospital's risk-adjusted rate is significantly higher than the statewide rate. In the tables, these rates are marked by double asterisks.

- Hospitals are arranged alphabetically. You may wish to compare the performances of hospitals in your area or those that are covered by your health insurance plan.

- As with all data, context and appropriate interpretation are needed for the information to be meaningful and useful. Talk with your physician, your family, and friends about their experiences and seek recommendations as you make your decision on where to go for hospital care.

- This report is only a guide for consumers and should not be used by itself to draw a conclusion about a particular hospital's overall performance.

Inpatient Quality Indicator Analysis Results

Volume Indicators

There are six volume indicators for inpatient surgical procedures for which there is evidence that a higher volume of procedures is associated with lower mortality. These indicators are considered indirect or 'proxy' measures of quality, in that the volume of procedures is often related to outcome measures such as post-operative mortality and complications. Volume is simply the count of admissions during the year on which surgical procedures were performed. Definitions of the six volume indicators are provided in Appendix 1. For each volume indicator, two types of thresholds have been established by AHRQ based on extensive review of literature related to each of the selected volume indicators. Threshold 1 represents the lowest annual volume of procedures performed by a hospital considered necessary to relate volume with achievement of better healthcare outcomes, while Threshold 2 represents a higher desired volume level. Annual volume indicator thresholds associated with each indicator are:

Volume Indicators	Threshold 1	Threshold 2
Esophageal resection	6	7
Pancreatic rescetion	10	11
AAA repair	10	32
CABG	100	200
PTCA	200	400
Carotid endarterectomy	50	101

Table 1 presents volume of procedures performed by New Jersey hospitals in 2005. Where the cell entry is missing (.), it means that the hospital did not perform that particular procedure during the year. Color shades indicate whether the hospital meets Threshold 1 or the count is a possible coding error.

Table 1. Volume of Procedures

Hospital Name	ESOPHAGEAL RESECTION	PANCREATIC RESECTION	AAA REPAIR	CABG	PTCA*	CAROTID ENDARTE-RECTOMY
Volume Threshold 1:	*6*	*10*	*10*	*100*	*200*	*50*
Volume Threshold 2:	*7*	*11*	*32*	*200*	*400*	*101*
Statewide	**60**	**158**	**1,147**	**7,253**	**26,148**	**3,214**
Atlanticare Regional Medical Center-City	.	.	8	.	.	2
Atlanticare Regional Medical Center-Mainland	.	.	1	193	989	32
Barnert Hospital	1	.	.	.	.	1
Bayonne Medical Center	2	.	7	.	.	13
Bayshore Community Hospital	.	.	2	.	.	27
Bergen Regional Medical Center	.	.	.	.	.	.
Cape Regional Medical Center	1	.	5	.	.	15
Capital Health System at Fuld	1	.	4	.	.	14
Capital Health System at Mercer	.	.	4	.	3	21
Cathedral-St. James Hospital	.	.	.	.	.	.
Cathedral-St. Michael's Medical Center	.	1	6	479	2,109	21
CentraState Medical Center	.	1	9	.	.	64
Chilton Memorial Hospital	1	.	19	.	32	39
Christ Hospital	1	.	5	.	.	16
Clara Maass Medical Center	.	.	23	.	18	56
Columbus Hospital	.	.	.	.	.	4
Community Medical Center	.	.	38	.	62	166
Cooper Hospital/University Medical Center	4	10	25	309	1,115	60
Deborah Heart and Lung Center	.	.	33	397	1,585	70
East Orange General Hospital	.	.	.	.	.	.
Englewood Hospital and Medical Center	2	2	36	197	707	93
Greenville Hospital	.	.	.	.	.	.
Hackensack University Medical Center	5	5	60	743	2,314	157
Hackettstown Community Hospital	.	.	.	.	.	.
Hoboken University Medical Center	1	1	1	.	.	10
Holy Name Hospital	.	1	13	.	.	36
Hunterdon Medical Center	.	.	.	.	12	11
Irvington General Hospital	.	.	.	.	.	3
Jersey City Medical Center	.	1	.	54	302	1
Jersey Shore University Medical Center	1	8	25	740	2,561	139
JFK Community Medical Center-Edison	1	2	22	.	.	111
Kennedy Memorial Hospitals UMC-Cherry Hill	.	.	.	.	.	2
Kennedy Memorial Hospitals UMC-Stratford	.	1	11	.	.	68
Kennedy Memorial Hospitals UMC-Wash. Twp.	.	1	4	.	.	35
Kimball Medical Center	1	.	1	.	.	16
Lourdes Medical Center of Burlington Cty.	.	.	1	.	.	9
Meadowlands Hospital Medical Center	.	.	.	.	.	1
Memorial Hospital of Salem County	.	.	.	.	.	21
Monmouth Medical Center	1	.	22	.	22	78
Morristown Memmorial Hospital	4	15	108	963	2,211	186
Mountainside Hospital	1	.	11	.	41	35
Muhlenberg Regional Medical Center	1	.	6	.	40	27
Newark Beth Israel Medical Center	.	.	42	366	1,378	37
Newton Memorial Hospital	.	.	.	.	.	.
Ocean Medical Center	.	.	26	.	46	77
Our Lady of Lourdes Medical Center	.	.	34	414	2,111	93
Overlook Hospital	1	4	17	.	54	31
Palisades Medical Center of New York	.	.	2	.	.	7
Pascack Valley Hospital	.	.	8	.	37	15

Table 1. Volume of Procedures

Hospital Name	ESOPHAGEAL RESECTION	PANCREATIC RESECTION	AAA REPAIR	CABG	PTCA*	CAROTID ENDARTE-RECTOMY
Volume Threshold 1:	*6*	*10*	*10*	*100*	*200*	*50*
Volume Threshold 2:	*7*	*11*	*32*	*200*	*400*	*101*
PBI - Regional Hospital	2	1	14	217	398	61
Raritan Bay Medical Center-Old Bridge	.	.	2	.	.	19
Raritan Bay Medical Center-Perth Amboy	1	.	7	.	57	13
Riverview Medical Center	.	.	10	.	35	44
RWJ University Hospital	15	32	91	802	2,758	119
RWJ University Hospital at Hamilton	1	.	5	.	64	47
RWJ University Hospital at Rahway	.	1	11	.	.	43
Shore Memorial Hospital	1	.	7	.	.	55
Somerset Medical Center	1	1	12	.	72	39
South Jersey Healthcare Regional MC	.	.	11	.	.	29
South Jersey Hospital-Bridgeton	.	.	.	.	.	.
South Jersey Hospital-Elmer	.	.	2	.	.	15
Southern Ocean County Hospital	.	.	19	.	.	85
St. Barnabas Medical Center	.	10	47	392	925	69
St. Clare's Hospital-Denville	.	1	11	.	78	58
St. Clare's Hospital-Dover	.	2	.	.	.	4
St. Clare's Hospital-Sussex	.	.	.	.	.	.
St. Francis Medical Center-Trenton	1	.	3	143	635	24
St. Joseph's Hospital and Medical Center	.	1	27	317	1,210	54
St. Joseph's Wayne Hospital	.	.	6	.	.	13
St. Mary's Hospital (Passaic)	.	.	.	.	.	4
St. Peter's University Hospital	.	1	28	.	.	56
Trinitas Hospital	.	1	6	.	35	17
UMDNJ-University Hospital	4	15	2	135	647	3
Underwood-Memorial Hospital	.	2	35	.	.	94
Union Hospital	.	.	1	.	.	11
University Medical Center at Princeton	.	.	17	.	.	43
Valley Hospital	1	32	58	392	1,485	84
Virtua-Memorial Hospital Burlington Cty.	.	2	19	.	.	77
Virtua-West Jersey Hospital Berlin	.	.	.	.	.	3
Virtua-West Jersey Hospital Camden	.	.	.	.	.	.
Virtua-West Jersey Hospital Marlton	2	1	40	.	.	47
Virtua-West Jersey Hospital Voorhees	.	.	8	.	.	42
Warren Hospital	.	2	8	.	.	13
William B. Kessler Memorial Hospital	1	.	1	.	.	9

= Possible coding error

= Meets Threshold 1

* = PTCA includes Primary PTCA. UB does not distinguish between interventional PTCA and Primary PTCA. Hence, hospitals that perform Primary PTCA only are included.

. = Hospital did not perform the procedure during the year.

Note: AHRQ conducted literature review to find out the most commonly recommended threshold levels for each volume indicator. The lowest threshold level reported in the literature is set as Threshold 1, while the highest threshold level reported is set as Threshold 2. Providers exceeding these thresholds are considered high volume providers. Volume thresholds for each indicator represent procedures performed by a given hopsital in a year.

- Esophageal resection was performed by 29 hospitals in New Jersey in 2005, of which only one hospital (RWJ University Hospital) met both volume thresholds. One-fourth of the 60 total statewide esophageal resection procedures performed during the year were done in this hospital. Four other hospitals (Cooper Hospital/University Medical Center, Hackensack University Medical Center, Morristown Memmorial Hospital, and UMDNJ-University Hospital) together performed 17 (28.3%) procedures.

- Only six of 30 hospitals performing pancreatic resection in 2005 met any of the volume thresholds for the procedure. As a group, these six hospitals performed close to 72 percent of the 158 statewide procedures during the year.

- 64 hospitals performed a total of 1,147 abdominal aortic aneurism (AAA) repairs, but only 34 met the minimum threshold volume of 10 cases, and of these, only 12 hospitals met the higher volume threshold of 32 cases.

- Seventeen of 18 New Jersey hospitals licensed in 2005 to perform cardiac surgery met the minimum standard of 100 coronary artery bypass graft surgery (CABG) cases, and all but five met the higher volume standard of 200 cases. Note that the State licensure minimum volume standard is 350 cases, and that hospitals that fall below this level are subjected to an alternative, outcomes-based assessment.

- There were 26,148 PTCA procedures performed by 35 hospitals in 2005, eighteen of which were licensed to perform both emergency and elective PTCA. The remaining 17 were licensed only to perform emergency PTCA on patients in the middle of a heart attack, for which the State licensure standards set a minimum volume of 36 cases per year within one year of start-up. All eighteen comprehensive PTCA centers met both AHRQ threshold volumes, and only 11 of the 17 emergency angioplasty centers met the State standards. (Note: there are currently 42 hospitals licensed to perform emergency angioplasty including the 18 cardiac surgery hospitals).

- 75 hospitals performed a total of 3,214 carotid endarterectomies, with twenty-five meeting the minimum threshold of 50 cases. Of this group, six hospitals met the higher threshold.

Mortality Indicators

There are 15 inpatient mortality indicators for surgical procedures and for medical conditions whose mortality rates vary substantially across hospitals and for which, according to AHRQ, evidence suggests that higher mortality rates may be associated with deficiencies in the quality of care. In general, a mortality rate is defined as the number of deaths divided by the number of patients admitted for a given procedure or condition, after adjusting for risk factors that AHRQ has built in the model. Eight of these indicators are for mortality due to surgical procedures, while the other seven are for in-hospital mortality due to medical conditions. Two of the eight indicators for mortality due to

surgical procedures - PTCA and carotid endarterectomy - are recommended by AHRQ to be reviewed only in conjunction with the corresponding volume measures. Definitions for each of the 15 mortality indicators are provided in Appendix 1.

Mortality Rates for Surgical Procedures

Table 2 presents hospital-level risk-adjusted mortality rates for the eight indicators of mortality due to surgical procedures. Esophageal resection and pancreatic resection are comparatively rare procedures; the other procedures, although more common on a statewide basis, may also be rare within a given hospital. It is very difficult, if not impossible, to obtain reliable estimates from a statistical analysis of small numbers, since any one case can have a large impact on the analysis. Even though, risk-adjusted hospital-level data is presented in this table, hospital-specific results that are based on small numbers should be interpreted with caution.

- Comparison of a specific hospital-level IQI rate to the statewide average for the same indicator is the appropriate way to see how well a hospital does among its peers. Note, however, that small numbers make it difficult to determine if the difference between an individual hospital's rate and the statewide average is meaningfully significant.

- Only one (RWJ University Hospital) of the 11 hospitals that performed esophageal resection, met the standard volume threshold for the procedure, while five of the 29 pancreatic resection performing hospitals met the standard volume threshold. There is no clear relationship between risk-adjusted rate and meeting the volume threshold for esophageal resection and pancreatic resection, as the hospitals that performed these procedures are very few, and a majority of them did not even meet the minimum thresholds. Hence, the estimates for these two indicators need to be taken with caution.

- The statewide risk-adjusted mortality rate for AAA repair is 8.9 percent with a 95% confidence interval of 7.5% - 10.3%. Rates for all hospitals but one (Cape Regional Medical Center) are statistically the same as the statewide average. Another way of comparing hospital specific rates is to assess the range between the highest and the lowest rates for hospitals that met the minimum threshold and those that did not. The range of risk-adjusted mortality rates was narrower for hospitals that met the minimum threshold of 10 cases (0.0% to 16.7%) compared to the range for all hospitals performing this procedure (0.0% to 23.3%).

- Risk-adjusted mortality rates for CABG surgery, where all hospitals met the minimum volume threshold of 100 cases, ranged from a low of 1.5% to a high of 5.4%. None of the 18 CABG performing hospitals had a risk-adjusted mortality rate that is statistically significantly higher or lower than the statewide average of 2.5%.

Table 2. Risk Adjusted Mortality Rates for Surgical Procedures (Deaths per 100 procedures)

Hospital Name	Eso-phageal Resection	Pan-creatic Resection	AAA Repair	CABG	PTCA	Carotid Endarte-rectomy	Cranio-tomy	Hip Replace-ment
Lower Confidence Limit	*0.0*	*3.6*	*7.5*	*2.1*	*1.1*	*0.4*	*7.8*	*0.2*
Upper Confidence Limit	*21.0*	*10.9*	*10.3*	*2.8*	*1.3*	*0.9*	*9.1*	*0.5*
Statewide	**9.9**	**7.3**	**8.9**	**2.5**	**1.2**	**0.7**	**8.4**	**0.3**
Atlanticare Regional Medical Center-City	.	.	17.1	.	.	11.8 **	4.9	0.0
Atlanticare Regional Medical Center-Mainland	.	.	23.3	2.7	0.9	0.0	14.8	0.0
Barnert Hospital	.	.	.	.	.	0.0	18.0	0.0
Bayonne Medical Center	.	.	8.3	.	.	0.0	8.1	0.5
Bayshore Community Hospital	.	.	17.9	.	.	0.0	17.7 **	0.0
Bergen Regional Medical Center	.	.	.	.	.	.	0.0	0.0
Cape Regional Medical Center	.	.	33.5 **	.	.	0.0	4.5	4.2 **
Capital Health System at Fuld	27.8	.	0.0	.	.	0.0	1.5 *	0.0
Capital Health System at Mercer	.	.	0.0	.	.	0.0	9.2	2.0 **
Cathedral-St. James Hospital	.	.	.	.	.	.	0.0	0.0
Cathedral-St. Michael's Medical Center	.	0.0	0.0	2.8	1.6	0.0	7.8	0.0
CentraState Medical Center	.	0.0	0.0	.	.	0.0	7.3	4.5 **
Chilton Memorial Hospital	.	.	8.1	.	1.8	0.0	8.1	1.3
Christ Hospital	0.0	.	20.9	.	.	8.4 **	9.2	5.7 **
Clara Maass Medical Center	.	.	0.0	.	6.1	0.0	5.9	0.0
Columbus Hospital	.	.	.	.	.	0.0	3.2	0.0
Community Medical Center	.	.	8.9	.	1.9	1.1	13.1 **	0.5
Cooper Hospital/University Medical Center	0.0	0.0	16.2	3.9	1.2	1.0	9.8	0.0
Deborah Heart and Lung Center	.	.	0.0	2.2	1.4	0.0	18.0 **	.
East Orange General Hospital	.	.	.	.	.	.	2.5	0.0
Englewood Hospital and Medical Center	.	8.2	5.6	3.4	1.6	0.0	5.9	0.0
Greenville Hospital	.	.	.	.	.	.	5.7	.
Hackensack University Medical Center	0.0	0.0	8.3	1.6	0.9	0.8	8.3	0.4
Hackettstown Community Hospital	.	.	.	.	.	.	0.0	0.0
Hoboken University Medical Center	.	0.0	0.0	.	.	5.8 **	4.4	0.0
Holy Name Hospital	.	0.0	12.7	.	.	3.5	8.5	0.0
Hunterdon Medical Center	.	.	.	.	0.0	0.0	17.4 **	0.0
Irvington General Hospital	.	.	.	.	.	0.0	13.0	0.0
Jersey City Medical Center	.	0.0	.	5.4	2.0	0.0	0.0	0.0
Jersey Shore University Medical Center	.	0.0	8.9	2.0	1.3	1.4	7.6	0.0
JFK Community Medical Center-Edison	0.0	0.0	12.9	.	.	0.5	6.8	0.0
Kennedy Memorial Hospitals UMC-Cherry Hill	.	.	.	.	.	0.0	2.5	0.0
Kennedy Memorial Hospitals UMC-Stratford	.	0.0	10.0	.	.	0.0	7.6	0.0
Kennedy Memorial Hospitals UMC-Wash. Twp.	.	18.3	0.0	.	.	0.0	14.5	0.0
Kimball Medical Center	.	.	.	.	.	0.0	9.0	0.6
Lourdes Medical Center of Burlington Cty.	.	.	13.8	.	.	0.0	11.1	0.0
Meadowlands Hospital Medical Center	.	.	.	.	.	0.0	0.0	0.0
Memorial Hospital of Salem County	.	.	.	.	.	0.0	0.0	7.0 **
Monmouth Medical Center	0.0	.	11.6	.	0.0	0.0	2.2 *	0.0
Morristown Memmorial Hospital	0.0	0.0	4.8	2.8	0.7	1.1	8.8	0.2
Mountainside Hospital	.	.	0.0	.	1.7	0.0	10.1	0.0
Muhlenberg Regional Medical Center	.	.	0.0	.	1.9	0.0	0.0	0.0
Newark Beth Israel Medical Center	.	.	10.0	3.2	1.1	4.3 **	10.2	0.0
Newton Memorial Hospital	.	.	.	.	.	.	15.0	0.0
Ocean Medical Center	.	.	2.5	.	0.6	0.0	5.4	0.5
Our Lady of Lourdes Medical Center	.	.	16.7	3.1	1.0	0.9	16.7 **	0.0
Overlook Hospital	.	0.0	15.7	.	1.0	0.0	7.6	0.0
Palisades Medical Center of New York	.	.	10.5	.	.	0.0	9.1	0.0
Pascack Valley Hospital	.	.	0.0	.	0.0	0.0	9.3	0.0

Table 2. Risk Adjusted Mortality Rates for Surgical Procedures (Deaths per 100 procedures)

Hospital Name	Eso-phageal Resection	Pan-creatic Resection	AAA Repair	CABG	PTCA	Carotid Endarte-rectomy	Cranio-tomy	Hip Replace-ment
PBI - Regional Hospital	23.0	.	9.6	2.2	1.4	1.9 **	10.8	0.0
Raritan Bay Medical Center-Old Bridge	.	.	0.0	.	.	0.0	3.3	0.0
Raritan Bay Medical Center-Perth Amboy	.	.	0.0	.	0.9	0.0	7.9	0.0
Riverview Medical Center	.	.	0.0	.	2.5	0.0	10.0	0.0
RWJ University Hospital	0.0	12.9 **	13.9	2.9	1.9 **	0.0	8.9	0.0
RWJ University Hospital at Hamilton	.	.	18.9	.	0.0	0.0	7.6	0.0
RWJ University Hospital at Rahway	.	22.9	20.3	.	.	0.6	9.6	0.0
Shore Memorial Hospital	.	.	0.0	.	.	0.0	5.1	0.0
Somerset Medical Center	.	0.0	13.0	.	3.2 **	0.0	6.7	3.4 **
South Jersey Healthcare Regional MC	.	.	10.9	.	.	0.0	7.2	0.0
South Jersey Hospital-Bridgeton	.	.	.	.	.	.	.	.
South Jersey Hospital-Elmer	.	.	0.0	.	.	0.0	12.2	0.0
Southern Ocean County Hospital	.	.	8.6	.	.	1.0	10.6	0.0
St. Barnabas Medical Center	.	0.0	0.0	1.5	0.8	0.0	9.3	0.0
St. Clare's Hospital-Denville	.	0.0	0.0	.	3.8 **	0.0	11.6	0.0
St. Clare's Hospital-Dover	.	0.0	.	.	.	0.0	7.0	0.0
St. Clare's Hospital-Sussex	.	.	.	.	.	.	0.0	.
St. Francis Medical Center-Trenton	.	.	0.0	3.2	0.7	0.0	8.1	1.4
St. Joseph's Hospital and Medical Center	.	0.0	11.7	2.6	0.9	0.0	10.9	0.0
St. Joseph's Wayne Hospital	.	.	0.0	.	.	0.0	4.4	0.0
St. Mary's Hospital (Passaic)	.	.	.	.	.	0.0	21.5	0.0
St. Peter's University Hospital	.	.	8.7	.	.	0.0	8.7	0.0
Trinitas Hospital	.	19.8	0.0	.	2.7	0.0	9.7	0.0
UMDNJ-University Hospital	0.0	0.0	22.5	3.1	1.2	0.0	9.7	0.0
Underwood-Memorial Hospital	.	0.0	9.1	.	.	0.0	5.9	0.0
Union Hospital	.	.	0.0	.	.	0.0	11.6	4.6 **
University Medical Center at Princeton	.	.	0.0	.	.	0.0	8.8	0.0
Valley Hospital	.	0.0	6.8	1.6	0.8	0.0	7.3	0.7
Virtua-Memorial Hospital Burlington Cty.	.	15.1	0.0	.	.	0.0	9.0	0.0
Virtua-West Jersey Hospital Berlin	.	.	.	.	.	0.0	0.0	0.0
Virtua-West Jersey Hospital Camden	.	.	.	.	.	.	.	.
Virtua-West Jersey Hospital Marlton	0.0	.	11.6	.	.	0.0	6.6	0.0
Virtua-West Jersey Hospital Voorhees	.	.	0.0	.	.	0.0	2.7	0.0
Warren Hospital	.	0.0	0.0	.	.	0.0	9.2	0.0
William B. Kessler Memorial Hospital	.	.	0.0	.	.	0.0	11.1	0.0

= Meets Threshold 1

= Rates based on denominators less than 30 (should be taken with caution).

* = Statistically significantly below the state average, ** = Statistically significantly above the state average.

. = Hospital did not perform the procedure during the year; or it performed less than 3 procedures (risk-adjusted rates are not computed when the denominator is less than 3).

PTCA includes Primary PTCA. UB data does not distinguish between interventional PTCA and Primary PTCA.

- The risk-adjusted mortality rate for PTCA ranged from 0.0% to 6.1%. However, when hospitals that are allowed to perform both elective and emergency angioplasty are reviewed as a group, the risk-adjusted mortality rate ranged from 0.7% to 2.0%, while the range for hospitals performing only the higher-risk emergency angioplasty ranged 0.0% to 6.1%. It is not surprising that mortality rates would be higher in a group of patients in the middle of a heart attack compared to a group mixing emergency and elective patients.

- The statewide risk-adjusted mortality rate for craniotomy was 8.4% with a 95% confidence interval ranging from 7.8% to 9.1%. Hospital specific rates for this indicator ranged from a low of 0.0% to a high of 21.5%. However, the highest rate hospital (St. Mary's Hospital - Passaic) is one of 11 hospitals that have small numbers (less than 30 craniotomy cases). Two hospitals - Capital Health System at Fuld (1.5%) and Monmouth Medical Center (2.2%) had mortality rates that are statistically significantly lower than the statewide average, while five others had rates that are statistically significantly higher than the average. The remaining hospitals had risk-adjusted mortality rates that are statistically significantly the same as the statewide average.

- Mortality from surgical procedures of carotid-endarterectomy and hip replacement is relatively low. There were 3,194 carotid-endarterectomy cases in New Jersey in 2005, with 25 deaths, for an observed mortality rate of 0.8%. Likewise, there were 5,315 hip replacement cases, with 16 deaths, for an observed mortality rate of 0.3%. The statewide risk-adjusted mortality rates for carotid-endarterectomy and hip replacement are 0.7% and 0.3%, respectively.

- The range of carotid-endarterectomy mortality rate was 0.0% to 11.8% while the range for those that met the minimum threshold of 50 cases was 0.0% to 1.9%. All but five hospitals had rates that were statistically the same as the statewide rate of 0.7%. Of the five hospitals that were statistically significantly different (higher rates) from the statewide average, only one (PBI - Regional Hospital) had met the minimum volume threshold of 50 cases.

- Hospital specific risk-adjusted rates for hip replacement ranged from 0.0% to 7.0%. Among hospitals that performed 30 or more procedures, Cape Regional Medical Center (4.2%), Capital Health System at Mercer (2.0%), Somerset Medical Center (3.4%), and Union Hospital (4.6%) had rates that are statistically significantly higher than the statewide mortality rate of 0.3%.

- The data shows that, by and large, there is little consistency in a hospital's performance, compared to the statewide average, across the indicators.

Mortality Rates for Medical Conditions

Table 3 presents hospital-specific risk-adjusted mortality rates for selected medical conditions, i.e. *acute myocardial infarction (AMI) or heart attack, AMI excluding cases transferred into the hospital from another hospital, congestive heart failure, stroke, gastrointestinal hemorrhage, hip fracture, and pneumonia.* In contrast with surgical procedures, these medical conditions are much more common and there are fewer instances where hospital-specific data are suppressed due to low volume. Nevertheless, hospital-specific volumes can still present reliability concerns because of small numbers.

- There were 15,673 AMI cases in New Jersey in 2005, with 1,442 deaths, for an observed mortality rate of 9.2%. The statewide risk-adjusted AMI mortality rate was 8.0% with a 95% confidence interval of 7.6% to 8.3%. On a hospital-specific basis, the risk-adjusted rate for AMI ranged from a low of 3.0% to a high of 12.6%. The risk-adjusted AMI mortality rates for three hospitals - Hackensack University Medical Center (6.0%), Raritan Bay Medical Center - Old Bridge (3.9%), and Warren Hospital (3.0) were statistically significantly lower than the statewide average of 8.0%, while the rate for Kimball Medical Center (11.8%) was statistically significantly higher than the statewide average.

- Statewide, there were 11,307 AMI cases excluding transfer-in cases, of whom 1,238 were dead, for an observed mortality rate of 10.9% and a risk-adjusted mortality rate of 8.8%. Hospital-specific risk-adjusted mortality rates for non transfer-in AMI cases ranged from a low of 3.3% for Warren Hospital to a high of 13.9% for Cape Regional Medical Center. Risk-adjusted rates for Cape Regional Medical Center (13.9%), Kimball Medical Center (13.0%), RWJ University Hospital (13.6%), and Trinitas Hospital (13.4%) were statistically significantly higher than the statewide average, while those of Atlanticare Regional Medical Center – Mainland (5.4%), Raritan Bay Medical Center – Old Bridge (4.3%), and Warren Hospital (3.3%) were statistically significantly lower than the statewide average of 8.8%.

- There were 38,517 patients treated for congestive heart failure in New Jersey in 2005, of whom, 1,674 died, resulting in an observed mortality rate of 4.3% and a risk-adjusted mortality rate of 3.5% with a 95% confidence interval of 3.4% to 3.7%. By hospital, the risk-adjusted rate ranged from a low of 1.0% (RWJ University Hospital at Hamilton) to a high of 5.6% (PBI - Regional Hospital). Risk-adjusted rates for Deborah Heart and Lung Center (1.8%), Hackensack University Medical Center (2.1%), and St. Francis Medical Center – Trenton (1.4%) were statistically significantly lower than the statewide average of 3.5%.

- Of the 14,381 stroke patients treated in New Jersey hospitals in 2005, 1,628 died, for an observed mortality rate of 11.3% and a risk-adjusted rate of 10.0%. Hospital-specific risk-adjusted stroke mortality rates ranged from a low of 3.9% to a high of 19.9%. South Jersey Hospital – Elmer (19.9%), Lourdes Medical Center of Burlington County (16.4%), St. Mary Hospital – Hoboken (14.3%) and

Holy Name Hospital (12.9%) had risk-adjusted rates statistically significantly higher than the statewide average, while Monmouth Medical Center (3.9%), Raritan Bay Medical Center - Perth Amboy (4.6%), Jersey Shore University Medical Center (6.3%), Mountainside Hospital (6.4%), Clara Maas Medical Center (7.1%), and JFK Community Medical Center - Edison (7.1%) had rates that are statistically significantly lower than the statewide average of 10.0%.

- Of the 17,930 gastrointestinal hemorrhage patients treated in New Jersey Hospitals in 2005, only 507 died, for an observed mortality rate of 2.8% and a risk-adjusted rate of 2.6%. By hospital, risk-adjusted gastrointestinal hemorrhage mortality rates ranged from a low of 0.0% to a high of 5.9%. Risk-adjusted rates for St. Joseph's Wayne Hospital (5.9%), Cape Regional Medical Center (5.4%), and St. Barnabas Medical Center (4.5%) were statistically significantly higher than the statewide average of 2.6%.

- There were 36,017 pneumonia patients in New Jersey hospitals in 2005, of whom 2,489 died, for an observed mortality rate of 6.9%. The statewide pneumonia risk-adjusted mortality rate was 6.5% with a 95% confidence interval of 6.3% to 6.8%. The hospital-specific risk-adjusted pneumonia mortality rate ranged from 2.3% to 10.4%. Clara Maass Medical Center (3.8%), JFK Community Medical Center – Edison (4.7%), Kennedy Memorial Hospital – Cherry Hill (4.0%), Memorial Hospital at Salem County (3.5%), Monmouth Medical Center (2.3%), had significantly lower pneumonia mortality rates than the statewide average. By comparison, Englewood Hospital and Medical Center (8.8%), St. Clare's Hospital –Denville (10.4%), Trinitas Hospital (10.0%), and Union Hospital (10.4%) had statistically significantly higher pneumonia mortality rates than the statewide average of 6.5%.

- Once again, there appears to be little consistency across conditions when a hospital's mortality rate is compared to the statewide average.

Table 3. Risk Adjusted Mortality Rates for Medical Conditions (deaths per 100 Conditions)

Hospital Name	AMI	AMI, without Transfer-in Cases	Congestive Heart Failure	Stroke	GI Hemorrhage	Hip Fracture	Pneumonia
Lower Confidence Limit	*7.6*	8.4	*3.4*	*9.6*	*2.4*	*2.3*	*6.3*
Upper Confidence Limit	*8.3*	9.2	*3.7*	*10.4*	*2.8*	*3.0*	*6.8*
Statewide	**8.0**	**8.8**	**3.5**	**10.0**	**2.6**	**2.7**	**6.5**
Atlanticare Regional Medical Center-City	9.4	10.4	1.9	11.4	1.7	1.3	8.5
Atlanticare Regional Medical Center-Mainland	6.1	5.4 *	3.4	8.3	2.2	1.2	8.0
Barnert Hospital	6.8	7.5	2.7	4.9	3.5		8.9
Bayonne Medical Center	9.9	10.9	3.2	10.8	0.6	3.1	7.8
Bayshore Community Hospital	8.6	9.5	3.9	10.6	1.3	5.3	4.4
Bergen Regional Medical Center					3.7		9.8
Cape Regional Medical Center	12.6	13.9 **	3.0	12.6	5.4 **	2.5	7.4
Capital Health System at Fuld	5.8	6.5	2.9	7.2	1.0	1.8	7.0
Capital Health System at Mercer	4.6	5.1	5.2	9.8	1.8	4.8	6.2
Cathedral-St. James Hospital			5.3	12.5	3.4		6.8
Cathedral-St. Michael's Medical Center	11.9	10.0	3.6	9.3	5.5		8.2
CentraState Medical Center	7.5	8.3	3.2	11.1	1.9	3.6	7.0
Chilton Memorial Hospital	8.6	9.5	3.4	8.6	3.4	3.7	7.7
Christ Hospital	9.4	10.3	5.2	10.7	3.3	7.7 **	7.3
Clara Maass Medical Center	7.1	7.9	2.8	7.1 *	3.6	1.9	3.8 *
Columbus Hospital	10.9	12.0	4.6	10.1	2.9		6.2
Community Medical Center	8.0	8.8	3.3	10.7	2.3	1.5	5.1
Cooper Hospital/University Medical Center	7.6	11.1	4.0	10.6	1.7	3.5	7.7
Deborah Heart and Lung Center	7.1		1.8 *			.	
East Orange General Hospital	6.7	7.4	4.4	8.2	2.0		6.0
Englewood Hospital and Medical Center	8.3	9.1	2.7	11.2	2.2	0.8	8.8 **
Greenville Hospital			4.3	7.5	0.0	2.1	7.1
Hackensack University Medical Center	6.0 *	7.4	2.1 *	8.9	2.3	2.4	6.1
Hackettstown Community Hospital	6.5	7.2	3.7	14.8	2.0	0.0	6.6
Hoboken University Medical Center	7.1	7.8	5.1	14.3 **	1.8	4.3	5.1
Holy Name Hospital	9.0	10.0	3.1	12.9 **	3.0	3.0	7.1
Hunterdon Medical Center	6.7	7.4	2.2	7.1	3.0	3.5	5.6
Irvington General Hospital			2.2	6.9	3.9		7.5
Jersey City Medical Center	12.5	13.2	4.6	10.6	0.0		3.7
Jersey Shore University Medical Center	7.7	8.0	3.9	6.3 *	3.2	3.1	5.9
JFK Community Medical Center-Edison	6.0	6.6	2.9	7.1 *	2.6	1.2	4.7 *
Kennedy Memorial Hospitals UMC-Cherry Hill	9.8	10.8	4.2	7.6	2.7	1.1	4.0 *
Kennedy Memorial Hospitals UMC-Stratford	8.7	9.6	4.2	4.4	2.5	2.3	6.3
Kennedy Memorial Hospitals UMC-Wash. Twp.	6.1	6.8	3.3	8.1	1.5	3.2	6.1
Kimball Medical Center	11.8 **	13.0 **	3.6	11.7	3.3	0.7	6.0
Lourdes Medical Center of Burlington Cty.	5.2	5.8	4.6	16.4 **	2.9	0.0	8.6
Meadowlands Hospital Medical Center			5.1	13.7	1.7		8.3
Memorial Hospital of Salem County			3.7	4.6	2.8	0.0	3.5 *
Monmouth Medical Center	4.9	5.4	2.4	3.9 *	1.2	1.4	2.3 *
Morristown Memmorial Hospital	6.1	6.2	4.2	12.3	3.2	1.5	6.7
Mountainside Hospital	8.4	9.2	3.1	6.4 *	1.3	4.5	5.6
Muhlenberg Regional Medical Center	10.4	11.4	3.5	6.6	1.2	0.0	6.9
Newark Beth Israel Medical Center	9.7	8.2	3.3	13.1	3.6	0.0	3.5
Newton Memorial Hospital	9.3	10.3	5.0	6.6	2.8	3.8	7.8
Ocean Medical Center	9.2	10.1	3.0	11.4	3.0	3.0	4.6
Our Lady of Lourdes Medical Center	7.3	8.0	3.4	10.6	1.9	2.5	7.9
Overlook Hospital	7.7	8.6	4.7	10.9	1.9	2.7	7.4
Palisades Medical Center of New York	11.9	13.2	5.2	13.2	4.6	2.6	8.7

Table 3. Risk Adjusted Mortality Rates for Medical Conditions (deaths per 100 Conditions)

Hospital Name	AMI	AMI, without Transfer-in Cases	Congestive Heart Failure	Stroke	GI Hemorrhage	Hip Fracture	Pneumonia
Pascack Valley Hospital	7.9	8.7	3.8	11.8	0.7	2.6	6.2
PBI - Regional Hospital	9.9	11.0	5.6 **	12.9	1.4	3.8	8.8
Raritan Bay Medical Center-Old Bridge	3.9 *	4.3 *	3.5	4.6 *	2.3	2.5	5.7
Raritan Bay Medical Center-Perth Amboy	6.2	6.9	4.0	6.8	2.5	5.2	7.3
Riverview Medical Center	8.4	9.3	4.3	8.6	3.5	1.5	6.4
RWJ University Hospital	10.5	13.6 **	4.2	9.9	3.2	2.2	6.6
RWJ University Hospital at Hamilton	6.3	7.0	1.0	7.5	1.8	0.9	4.9
RWJ University Hospital at Rahway	10.6	11.7	3.9	6.9	2.8	4.1	5.2
Shore Memorial Hospital	7.8	8.6	3.9	11.4	2.8	2.3	7.6
Somerset Medical Center	8.6	9.5	2.4	11.2	1.2	0.0	5.8
South Jersey Healthcare Regional MC	9.3	10.3	4.7	12.3	2.5	5.3 **	8.2
South Jersey Hospital-Bridgeton	.	.	.	.	.	.	.
South Jersey Hospital-Elmer			4.0	19.9 **	2.7	2.2	6.1
Southern Ocean County Hospital	10.3	11.3	3.0	11.6	3.9	2.8	6.7
St. Barnabas Medical Center	6.2	6.9	3.6	8.9	4.5 **	3.2	6.5
St. Clare's Hospital-Denville	9.4	10.3	2.8	12.5	2.1	5.1	10.4 **
St. Clare's Hospital-Dover			4.4	7.2	2.0	0.0	9.3
St. Clare's Hospital-Sussex			4.1		2.3		8.7
St. Francis Medical Center-Trenton	6.2	8.0	1.4 *	8.3	2.5	3.5	4.0
St. Joseph's Hospital and Medical Center	9.8	9.7	3.8	12.2	2.9	4.1	6.2
St. Joseph's Wayne Hospital	8.5	9.4	3.5	5.1	5.9 **	1.1	7.0
St. Mary's Hospital (Passaic)			2.7	5.1	4.3		8.4
St. Peter's University Hospital	5.5	6.1	4.3	11.2	1.3	3.0	7.0
Trinitas Hospital	11.8	13.4 **	5.5	13.1	3.6	1.3	10.0 **
UMDNJ-University Hospital	8.8	8.4	1.6	10.5	1.6	4.0	5.7
Underwood-Memorial Hospital	11.8	13.1	3.2	7.9	2.2	2.3	8.1
Union Hospital	11.3	12.4	3.3	10.5	4.1	4.4	10.4 **
University Medical Center at Princeton	4.7	5.2	3.7	10.7	2.5	1.0	6.8
Valley Hospital	6.8	8.2	2.5	10.7	2.2	2.6	6.3
Virtua-Memorial Hospital Burlington Cty.	4.9	5.4	4.8	7.2	2.9	2.3	6.8
Virtua-West Jersey Hospital Berlin	7.9	8.7	5.5	9.8	2.5	4.5	2.8
Virtua-West Jersey Hospital Camden	.	.	.	.		.	.
Virtua-West Jersey Hospital Marlton	8.3	9.1	5.2	12.8	3.9	0.8	7.4
Virtua-West Jersey Hospital Voorhees	6.7	7.4	4.7	9.8	3.6	2.8	5.6
Warren Hospital	3.0 *	3.3 *	3.8	9.5	0.6	3.2	6.7
William B. Kessler Memorial Hospital			3.6	13.7	3.0	4.4	6.0

= Rates suppressed because they are based on denominators less than 30.

= State-level rates include hospitals that are suppressed due to low volume.

* = Statistically significantly below the state average, ** = Statistically significantly above the state average.

. = Hospital did not perform the procedure during the year; or it performed less than 3 procedures (risk-adjusted rates are not computed when the denominator is less than 3).

Utilization Indicators

There are seven hospital-level and four area-level utilization indicators of surgical procedures where the literature suggests there is significant potential for overuse, underuse, or misuse. When measured at a hospital level, high or low rates of utilization could suggest inappropriate or inefficient delivery of care by hospitals, leading to worse outcomes, increased cost, or both. These indicators are reported as rates, such as the number of Cesarean-sections per birth in a hospital, the number of laparoscopic cholecystectomy per admission (with cholecystectomy), etc. It should be noted that there is no clear clinical consensus on appropriate utilization levels for these procedures, and that use of these indicators is likely to provoke debate among physicians.

Most of the utilization indicators are potentially overused procedures. The exceptions are VBAC and laparoscopic cholecystectomy, which may potentially be underused. For most of these procedures there are no "right rates," meaning there are no gold standards by which to measure performance. Very high rates could indicate an inappropriate overuse of procedure utilization while very low rates could signal inappropriate underutilization of procedures. Thus, peer group averages (in this case, statewide averages) may be the best comparison available. Notable exceptions are bi-lateral cardiac catheterization and incidental appendectomy, where the appropriate rates are likely to be very small, and cesarean delivery and Vaginal Birth After Cesarean (VBAC) rates, which have established national Healthy People 2010 goals (15 cesarean deliveries per 100 births for first-time cesareans, and 37 VBACs per 100 births in women with previous cesarean section)[1]. However, the expert opinion on appropriate indications for C-section is very unsettled, and there are disagreements as to whether New Jersey's high C-section rate ought to be a matter for concern.

Most provider-level utilization indicators are risk-adjusted using age, sex, and APR-DRGs. However, a few indicators cannot be adjusted this way, since the population at risk is characterized by a single APR-DRG without severity classification. For example, cesarean section delivery, primary cesarean delivery and VBAC rates are risk-adjusted by age only. Likewise, laparoscopic cholecystectomy rate is risk-adjusted by sex only. The risk-adjusted C-section and laparoscopic cholecystectomy rates imply that hospitals have higher or lower risk of utilizing the procedure due to the demographic composition of the population in their service area, for example, younger population in the case of C-section, or a greater proportion of the lower-risk gender for laparoscopic cholecystectomy.

The area-level utilization indicators are reported for a given geographic area, which AHRQ defines as a county or a Metropolitan Statistical Area. Both hospital-level and area-level utilization indicators are discussed in this report.

[1] Additional information on the Healthy People 2010 Maternal, Infant and Child Health Goals is available at http://www.healthypeople.gov/document/html/volume2/16mich.htm#_Toc494699664.

Hospital-level Utilization Rates

Table 4 presents the seven hospital-level risk-adjusted procedure utilization rates. The indicators used are cesarean section delivery, primary cesarean delivery, vaginal birth after cesarean (VBAC) - uncomplicated; vaginal birth after cesarean (VBAC) - all, laparoscopic cholecystectomy (gall bladder removal), incidental appendectomy in the elderly, and bi-lateral cardiac catheterization.

- The national observed cesarean delivery rate increased from 5.5% in 1970 to 24.7% in 1988, and fell to 20.7% in 1996. More recent data show that cesarean delivery rate was 27.5% in 2003 and 29.1% in 2004. There is considerable debate as to whether the increase has been driven by changing clinical indications, by concerns with potential malpractice suits, or by patient and physician preference for scheduled births.

- The statewide risk-adjusted cesarean section delivery rate for New Jersey in 2005 was 28.9% with a 95% confidence interval of 28.6% to 29.2%. Table 6 shows that risk-adjusted rates by hospital ranged from a low of 14.8% to a high of 43.8%. Note that 24 hospitals had risk-adjusted rates that were statistically significantly higher than the statewide average, while 14 others had rates that were statistically significantly lower than the state average.

- Hospital-specific rates for primary cesarean delivery ranged from a low of 7.5 to a high of 32.3%. The statewide average was 18.5%.

- The statewide risk-adjusted rate for VBAC - uncomplicated is 8.5%. By hospital, rates raged from a low of 0.0% (Memorial Hospital of Salem County) to 33.4% (Kimball Medical Center). Note that higher VBAC rates represent better quality. The indicator is defined as the number of in-hospital vaginal births per 100 births to women with previous history of cesarean delivery (denominator excludes patients with abnormal presentation, preterm delivery, fetal death, multiple gestation diagnosis codes, and breech procedure codes in any diagnosis field). In the case of Kimball Medical Center, 33.4% of women who have had cesarean delivery in the past had vaginal birth without complications.

- Hospital-specific rates for VBAC - all ranged from a low of 0.0% to a high of 32.2%. The statewide average was 8.7%.

- Because laparoscopic, or minimally invasive, cholecystectomy is identified as an underused procedure compared to traditional cholecystectomy, a higher hospital-specific rate is presumed to represent a better quality of care. The hospital-specific risk-adjusted laparoscopic cholecystectomy rate ranged from 71.0% (RWJ University Hospital at Hamilton) to 97.0% (Pascack Valley Hospital). All in all, nine hospitals had rates that are statistically significantly higher than the statewide average of 88.0%. Likewise, 15 hospitals had rates that are statistically significantly lower than the statewide average.

- A lower incidental appendectomy rate is presumed to represent a better quality of care. The procedure is not recommended in the elderly because they have both a lower risk for developing appendicitis and a higher risk of complications after surgery. The statewide risk-adjusted incidental appendectomy utilization rate was 2.0%, meaning that, on average, only 2.0 of every 100 patients aged 65 or older in New Jersey who had an intra-abdominal procedure also had their appendix removed at the same time. Hospital-specific rates ranged from 0.0% to 17.2%.

- Bi-lateral cardiac catheterization is considered appropriate only in the presence of certain clinical indications, such as suspected pulmonary hypertension or significant right-sided valvular abnormalities, congestive heart failure, congenital heart disease, pericardial disease, and cardiac transplantation. The American College of Cardiology (ACC) and the American Heart Association (AHA) published expert consensus guidelines for cardiac catheterization laboratories stating that "without specific indications, routine right-side catheterizations are unnecessary." As a result, higher levels of bi-lateral cardiac catheterization may be an indicator of overuse. The statewide risk-adjusted bi-lateral cardiac catheterization rate was 8.6% in 2005. Hospital-specific rates ranged from 1.3% (Bayshore Community Hospital) to 27.3% (Virtua-West Jersey Hospital, Voorhees).

Table 4. Risk Adjusted Hospital-level Procedure Utilization Rates (procedures per 100 admissions)

Hospital Name	Cesarean section delivery	Primary cesarean delivery	VBAC, uncompl-icated	VBAC, All	Laparo-scopic cholecy-stectomy	Incidental append-ectomy in the elderly	Bi-lateral cardiac catheteri-zation
Lower Confidence Limit	*28.6*	*18.2*	*7.9*	*8.1*	*87.4*	*1.7*	*8.4*
Upper Confidence Limit	*29.2*	*18.7*	*9.2*	*9.3*	*88.6*	*2.3*	*8.9*
Statewide	**28.9**	**18.5**	**8.5**	**8.7**	**88.0**	**2.0**	**8.6**
Atlanticare Regional Medical Center-City	35.6 **	23.1 **	12.0	11.8	85.4	3.1	15.6 **
Atlanticare Regional Medical Center-Mainland	33.4 **	21.5 **	2.6 *	3.4	88.8	1.0	15.4 **
Barnert Hospital	43.8 **	31.5 **	0.8 *	2.2	77.0 *		.
Bayonne Medical Center	42.0 **	32.3 **			87.7	3.9	3.5 *
Bayshore Community Hospital	.	.	.	.	92.0	0.0	1.3 *
Bergen Regional Medical Center	.	.	.	.	.	.	.
Cape Regional Medical Center	30.4	17.2	2.7	3.7	84.7	0.0	
Capital Health System at Fuld	.	.	.	.	74.8 *	2.5	
Capital Health System at Mercer	21.0 *	13.0 *	18.7 **	18.4 **	89.3	0.0	4.0 *
Cathedral-St. James Hospital	38.5 **	27.1 **	3.9	3.7	90.7		.
Cathedral-St. Michael's Medical Center	.	.	.	.	68.7 *		3.9 *
CentraState Medical Center	37.3 **	26.2 **	2.0 *	1.9	91.7	0.7	
Chilton Memorial Hospital	27.7	17.1	3.5	3.4	91.5	0.9	13.3 **
Christ Hospital	38.9 **	27.0 **	3.5	5.5	89.1	2.8	5.7
Clara Maass Medical Center	32.1 **	19.0	5.2	5.4	93.6 **	0.0	4.0 *
Columbus Hospital	34.0 **	20.6	7.0	6.7	91.4	5.7	.
Community Medical Center	33.5 **	21.0 **	2.8 *	3.0	82.2 *	3.1	7.5
Cooper Hospital/University Medical Center	24.0 *	13.7 *	16.5 **	16.9 **	74.9 *	0.9	18.5 **
Deborah Heart and Lung Center	.	.	.	.	.	.	8.3
East Orange General Hospital	.	.	.	.	76.8		.
Englewood Hospital and Medical Center	24.7 *	15.2 *	10.9	10.8	93.9 **	0.7	8.2
Greenville Hospital	.	.	.	.	65.9 *		
Hackensack University Medical Center	35.7 **	25.5 **	5.6	5.6	85.0	1.5	4.9 *
Hackettstown Community Hospital	21.3 *	12.1 *	2.6	2.5	87.0	2.8	.
Hoboken University Medical Center	27.1	18.9	15.7 **	14.3	91.8	3.6	
Holy Name Hospital	28.9	18.8	5.5	5.9	90.4	1.0	4.5 *
Hunterdon Medical Center	25.3 *	17.3	15.1 **	15.7 **	91.3	0.0	9.6
Irvington General Hospital	.	.	.	.	76.0 *	16.1 **	.
Jersey City Medical Center	30.9	17.9	14.6 **	17.6 **	80.7 *	0.0	3.9 *
Jersey Shore University Medical Center	27.5	17.6	7.4	8.3	82.9 *	6.3 **	3.4 *
JFK Community Medical Center-Edison	28.3	17.9	6.7	6.4	83.1 *	1.2	7.0
Kennedy Memorial Hospitals UMC-Cherry Hill	.	.	.	.	90.9		19.4 **
Kennedy Memorial Hospitals UMC-Stratford	29.8	17.5	4.1	5.7	86.5	3.6	
Kennedy Memorial Hospitals UMC-Wash. Twp.	28.6	18.5	9.5	8.6	90.3	0.9	19.2 **
Kimball Medical Center	15.6 *	7.7 *	33.4 **	32.2 **	87.0	0.0	3.7
Lourdes Medical Center of Burlington Cty.	32.7 **	22.1 **	3.6	3.2	84.7	1.3	
Meadowlands Hospital Medical Center	34.9 **	26.1 **	7.7	7.8	87.7		19.8 **
Memorial Hospital of Salem County	29.3	20.9	0.0	0.0	92.8		25.3 **
Monmouth Medical Center	20.8 *	12.4 *	19.3 **	19.1 **	93.7 **	3.5	2.9 *
Morristown Memmorial Hospital	23.4 *	14.2 *	11.3	10.1	88.6	0.7	4.9 *
Mountainside Hospital	31.0	22.3 **	9.8	10.7	95.5 **	0.0	7.8
Muhlenberg Regional Medical Center	15.9 *	7.5 *	5.8	6.3	86.6	1.0	4.5 *
Newark Beth Israel Medical Center	30.2	17.1	8.4	9.8	78.9 *	2.3	8.7

Table 4. Risk Adjusted Hospital-level Procedure Utilization Rates (procedures per 100 admissions)

Hospital Name	Cesarean section delivery	Primary cesarean delivery	VBAC, uncompl-icated	VBAC, All	Laparo-scopic cholecy-stectomy	Incidental append-ectomy in the elderly	Bi-lateral cardiac catheteri-zation
Newton Memorial Hospital	21.3 *	11.8 *	13.0	13.4	93.8 **	4.0	.
Ocean Medical Center	30.7	20.6	5.9	5.6	81.9	1.8	8.3
Our Lady of Lourdes Medical Center	26.7	15.7 *	15.2 **	16.5 **	87.0	0.0	12.6 **
Overlook Hospital	27.0 *	17.2	5.2	5.2	93.8 **	2.4	4.9 *
Palisades Medical Center of New York	24.9 *	14.6 *	10.9	10.1	88.6	0.0	5.1 *
Pascack Valley Hospital	25.1 *	14.7 *	13.3	14.1	97.0 **	0.0	7.0
PBI - Regional Hospital	33.3 **	16.9	4.3	4.8	91.9	0.8	13.4 **
Raritan Bay Medical Center-Old Bridge	.	.	.	.	90.0	0.0	7.9
Raritan Bay Medical Center-Perth Amboy	31.7 **	17.2	2.8	2.8	90.8	0.0	4.9 *
Riverview Medical Center	30.1	19.1	3.0	3.1	91.7	0.0	12.0 **
RWJ University Hospital	30.1	16.7	10.4	10.4	77.7 *	0.4	7.8
RWJ University Hospital at Hamilton	24.4 *	15.7 *	13.2	13.7	71.0 *	0.9	3.4 *
RWJ University Hospital at Rahway	.	.	.	.	86.9	1.5	1.9 *
Shore Memorial Hospital	30.6	20.6 **	10.0	9.9	91.4	0.0	20.0 **
Somerset Medical Center	28.3	19.5	8.4	8.2	93.8 **	0.0	9.8
South Jersey Healthcare Regional MC	31.1 **	19.5	3.7	3.4	89.7	2.2	16.5 **
South Jersey Hospital-Bridgeton	.	.	.	.	.	.	.
South Jersey Hospital-Elmer	14.8 *	7.8 *			92.7	0.0	
Southern Ocean County Hospital	40.2 **	27.9 **	4.2	4.2	94.7 **	1.1	2.4
St. Barnabas Medical Center	32.7 **	23.0 **	5.7	5.8	83.8	1.5	7.1
St. Clare's Hospital-Denville	27.2	15.7 *	8.7	8.0	90.9	6.7 **	7.8
St. Clare's Hospital-Dover	.	.	.	.	92.4		
St. Clare's Hospital-Sussex	.	.	.	.	96.3		
St. Francis Medical Center-Trenton	.	.	.	.	83.6	2.1	4.4 *
St. Joseph's Hospital and Medical Center	33.9 **	21.4 **	4.7	6.0	83.8	2.0	7.3
St. Joseph's Wayne Hospital	.	.	.	.	87.7	17.2 **	7.7
St. Mary's Hospital (Passaic)	29.3	14.2 *	3.6	3.8	85.7	2.2	
St. Peter's University Hospital	27.5 *	19.1	10.9	10.4	89.0	0.3	5.8 *
Trinitas Hospital	26.9	16.4 *	13.9 **	14.1 **	89.3	3.1	9.4
UMDNJ-University Hospital	27.4	16.0 *	17.1 **	20.3 **	76.9 *	0.0	1.8 *
Underwood-Memorial Hospital	26.8	16.9	9.9	9.8	89.9	3.8	9.9
Union Hospital	.	.	.	.	88.1	0.0	.
University Medical Center at Princeton	20.6 *	11.4 *	5.1	5.0	95.5 **	2.4	9.5
Valley Hospital	30.9 **	20.4 **	2.8	2.8	88.9	2.9	22.8 **
Virtua-Memorial Hospital Burlington Cty.	30.7	21.1 **	7.9	8.1	90.4	3.1	7.3
Virtua-West Jersey Hospital Berlin	.	.	.	.	87.1		14.1
Virtua-West Jersey Hospital Camden	.	.	.	.	.	.	.
Virtua-West Jersey Hospital Marlton	.	.	.	.	90.1	2.1	11.4
Virtua-West Jersey Hospital Voorhees	30.9 **	21.3 **	8.8	8.7	89.0	2.4	27.3 **
Warren Hospital	34.5 **	25.1 **	2.3	2.1	89.0	3.3	7.2
William B. Kessler Memorial Hospital	.	.	.	.	88.3		.

= Rate suppressed because denominator is less than 30.

= State-level rates include hospitals that are suppressed due to low volume.

* = Statistically significantly below the state average, ** = Statistically significantly above the state average.

. = Hospital did not perform the procedure during the year; or it performed less than 3 procedures (risk-adjusted rates are not computed when the denominator is less than 3).

Area-Level Utilization Rates

Table 5 presents county-level risk-adjusted procedure utilization rates for the four area-level quality indicators (CABG, PTCA, Hysterectomy, and Laminectomy or spinal fusion).

- CABG is considered an elective procedure that can be overused. There is no ideal elective area-level CABG rate that has been established as a benchmark. AHRQ recommends that users employ State averages as points of reference. Therefore, rates that are less than the State average are assumed to represent better utilization. An area-level rate is defined as the number of CABG procedures per 100,000 county population.

- Table 5 shows that the statewide risk-adjusted CABG utilization rate in 2005 was 183.2 per 100,000. The variation across counties is very large and deserves some explanation. CABG utilization rate in Cape May, for example, was very low (52.8 per 100,000) compared to the statewide average, which is the benchmark for comparison of county-level rates. Rates for Atlantic, Burlington, Camden, Cumberland, Mercer, Gloucester, Hunterdon, Salem, and Warren were also statistically significantly lower than the state average. Conversely, rates for Ocean and Passaic counties were statistically significantly higher than the state average.

- PTCA has been identified as a potentially overused procedure. Therefore, rates that are lower than the State average are assumed to indicate better quality of utilization. Table 5 shows that the statewide PTCA utilization rate is 653.9 per 100,000 population (age 40 years and older). County-level PTCA utilization rates range from a low of 234.4 per 100,000 in Cape May to a high of 851.4 in Ocean. Four counties (Hudson, Middlesex, Ocean and Passaic) had statistically significantly higher than state average utilization rates, while 12 counties had significantly lower than average rates.

- Hysterectomy is another indicator, identified as a potentially overused procedure. Therefore, rates that are lower than the State average are assumed to represent better quality of care. The indicator is measured as the number of hysterectomies per 100,000 county resident population (age 18 years or older). The statewide average rate for New Jersey in 2005 was 290.3 per 100,000. The county rates range from a low of 211.2 per 100,000 in Bergen to a high of 479.5 per 100,000 in Cumberland.

- Laminectomy has also been identified as a potentially overused procedure. Therefore, rates that are lower than the State average are assumed to represent better quality of care. The indicator shows the number of laminectomies per 100,000 resident county or state population (age 18 years and older). For New Jersey, the utilization rate in 2005 was 175.9 per 100,000. The lowest utilization rate was reported for Hudson County (86.1 per 100,000), while the highest was in Atlantic county (299.3 per 100,000).

- Use of neighboring States' facilities, which are not accounted for in the UB data, may explain the low utilization rates for some counties (for example, CABG and PTCA for Cape May, which are very low compared to other Counties). It is possible that Cape May residents cross to Delaware or Maryland States for such services because of their proximity.

Table 5. Risk Adjusted Area-Level Utilization Rates (procedures per 100,000 population)

COUNTY	Coronary Artery Bypass Graft (CABG)	Percutaneous Transluminal Coronary Angioplasty (PTCA)	Hysterectomy	Laminectomy or Spinal Fusion
Lower Confidence Limit	*178.3*	*646.6*	*283.1*	*172.2*
Upper Confidence Limit	*188.2*	*661.2*	*297.6*	*179.7*
Statewide	**183.2**	**653.9**	**290.3**	**175.9**
Atlantic	114.0 *	606.6 *	296.3	299.3 **
Bergen	171.5	536.7 *	211.2 *	144.1 *
Burlington	129.2 *	537.5 *	290.7	169.2
Camden	132.9 *	654.6	248.1 *	124.6 *
Cape May	52.8 *	234.4 *	359.5 **	250.8 **
Cumberland	155.6	513.1 *	479.5 **	199.2
Essex	183.5	668.4	319.1 **	123.4 *
Gloucester	130.9 *	644.8	290.3	145.6 *
Hudson	188.5	746.8 **	239.0 *	86.1 **
Hunterdon	98.8 *	376.2 *	240.5	204.8
Mercer	107.3 *	436.6 *	296.2	158.0
Middlesex	199.9	694.7 **	261.2 *	181.7
Monmouth	188.2	659.5	284.1	189.9
Morris	177.6	480.0 *	231.8 *	198.0 **
Ocean	232.5 **	851.4 **	391.4 **	204.3 **
Passaic	217.3 **	710.9 **	350.0 **	173.7
Salem	139.1	356.3 *	358.8	131.8
Somerset	137.5	498.6 *	264.3	193.0
Sussex	215.0	607.1	267.4	263.0 **
Union	189.3	566.5 *	293.5	161.7
Warren	147.1	413.7 *	271.6	226.1 **

* = Statistically significantly below state average, ** = Statistically significantly above state average.

State-level Aggregate IQI Measures

Tables 6 and 7 below present statewide aggregate IQI measures from 2002 to 2005. The IQI measures discussed in this report are derived from the 2005 UB data. However, HCQA had initially analyzed the 2002 and 2003 UB data and the statewide aggregate measures for 2002 and 2003 are included in these summary tables. In addition, national IQI measures for 2002 are included to show how New Jersey compares. Volume indicator measures are shown in Table 6 while measures for mortality and utilization indicators are presented in Table 7.

Table 6 presents 1) the number of hospitals in the state performing the surgical procedure; 2) the average number of procedures per hospital; 3) the number of hospitals in the state, meeting at least Threshold 1 for any particular procedure; and 4) percent of hospitals meeting Threshold 1. For national volume measures, the average number of procedures per hospital is presented.

- The average number of Esophageal Resection and Pancreatic Resection procedures performed per hospital in New Jersey is about the same as the national average, while the average for AAA Repair (except for 2005) and Carotid-endarterectomy is slightly lower than the national average. Conversely, New Jersey's per hospital average for CABG and PTCA procedures is much higher than the nationwide average. For PTCA, however, it is important to note that hospitals performing primary or emergency PTCA cases only are excluded from calculation of the 'per hospital average' since the terms of their license limits these hospitals to perform PTCA only on patients in the middle of a heart attack. New Jersey's licensure standards require a minimum of 36 cases per year for primary PTCA hospitals, compared to minimum threshold of 200 cases per year for hospitals that may also perform elective PTCA.

- Percent of hospitals meeting the minimum threshold is another way of looking at hospital performance. In New Jersey, all hospitals that performed CABG and PTCA met the minimum threshold. In the case of carotid-endarterectomy, the percent of hospitals meeting the minimum threshold has consistently been about 33%.

- In 2005, 53.1% of the 64 hospitals that performed AAA Repair met the minimum AHRQ threshold of 10 cases per year.

Table 6. Comparison of State-Level Volume Measures with National Volume Measures

Categories		Volume Indicators					
		Esophageal Resection	Pancreatic Resection	AAA	CABG	PTCA	Carotid Endarte-rectomy
National 2002	Average per Hospital	3	4	15	365	507	58
New Jersey 2002	# of Hospitals Performing Procedure	15	32	72	17	17	78
	Average per Hospital	2	3	9	536	1,273	49
	# of Hospitals meeting Threshold 1	1	5	23	17	17	26
	% hospitals meeting Threshold 1	6.7	15.6	31.9	100.0	100.0	33.3
New Jersey 2003	# of Hospitals Performing Procedure	13	28	71	17	17	75
	Average per Hospital	3	4	7	510	1,399	47
	# of Hospitals meeting Threshold 1	3	2	18	17	17	24
	% hospitals meeting Threshold 1	23.1	7.1	25.4	100.0	100.0	32.0
New Jersey 2005	# of Hospitals Performing Procedure	29	30	64	18	18	73
	Average per Hospital	2	5	18	403	1,413	44
	# of Hospitals meeting Threshold 1	1	6	34	17	18	25
	% hospitals meeting Threshold 1	3.4	20.0	53.1	94.4	100.0	34.2

Note: National estimates represent hospital-level averages for 4,289 hospitals in the HCUP data from 35 states.

Note: For New Jersey, hospitals with known coding errors for CABG and PTCA, are excluded from calculation of averages. Also, hospitals that perform Primary PTCA only, are excluded from calculating the average for PTCA. It is important to note that hospitals with coding errors may not have been excluded in the calculation of national averages.

Table 7 presents risk-adjusted IQI mortality and utilization rates. The 2002 national numbers are shown along with those of New Jersey for 2002, 2003 and 2005 to see where the State stands in terms of the its health care quality.

- Looking at the 2002 data, New Jersey's performance in terms of quality of care was equal to or better than the national average for 11 out of 15 (73%) mortality indicators. For utilization indicators, however, making comparison needs some caution. It is important to remember that four of the seven hospital-level utilization indicators (i.e. cesarean section delivery, primary cesarean delivery, incidental appendectomy, and bi-lateral catheterization) are indicators of overuse. For these indicators, lower rate implies better performance. The other three indicators (i.e. vaginal birth after cesarean-all, vaginal birth after cesarean-uncomplicated, and laparoscopic cholecystectomy) are indicators of underuse, and a higher rate for these indicators implies a better performance. Using these criteria, New Jersey is better than the national average for only three of seven utilization indicators (43%).

- New Jersey's rates for 2002, 2003 and 2005 show consistent declines in mortality rates for almost all mortality indicators except esophageal resection. On the utilization indicators, however, both cesarean section delivery and primary cesarean delivery increased while bi-lateral cardiac catheterization shows a slight decline. Conversely, two indicators of underuse (VBAC, Uncomplicated and VBAC, all) show a decline trend while laparoscopic cholecystectomy shows a slight improvement.

Table 7. Comparison of State-level IQI Risk-adjusted Rates with National Rates

IQIs (Mortality and Utilization Indicators)	Risk-Adjusted Rates (%)			
	National 2002	New Jersey 2002	New Jersey 2003	New Jersey 2005
Mortality Indicators for Surgical Procedures				
08. Esophageal Resection	13.3	5.6	13.8	9.9
09. Pancreatic Resection	9.4	8.5	6.6	7.3
11. Abdominal Aortic Aneurysm	17.1	16.7	13.6	8.9
12. Coronary Artery Bypass Graft	3.7	3.7	3.5	2.5
13. Craniotomy	9.3	8.4	8.6	8.4
14. Hip Replacement	0.5	0.0	0.0	0.3
30. PTCA	1.9	1.7	1.6	1.2
31. Carotid Endarterectomy	1.0	0.9	0.7	0.7
Mortality Indicators for Medical Conditions				
15. Acute Myocardial Infarction	15.3	12.0	10.9	8.0
16. Congestive Heart Failure	5.5	4.6	4.3	3.5
17. Acute Stroke	11.0	12.1	11.2	10.0
18. Gastrointestinal Hemorrhage	3.4	0.0	0.0	2.6
19. Hip Fracture	4.0	4.3	3.8	2.7
20. Pneumonia	8.0	11.4	10.6	6.5
32. AMI, Without Transfer Cases	15.4	13.5	11.9	8.8
Utilization Indicators for Procedures				
21. Cesarean Section Delivery	23.3	24.1	26.1	28.9
22. VBAC, Uncomplicated	16.3	16.2	13.4	8.5
23. Laparoscopic Cholecystectomy	74.2	86.2	86.7	88.0
24. Incidental Appendectomy	2.7	1.8	1.6	2.0
25. Bi-lateral Cardiac Catheterization	9.5	11.3	10.2	8.6
33. Primary Cesarean Delivery	14.4	15.2	16.6	18.5
34. VBAC, All	15.8	16.4	13.7	8.7

IQI #s 26, 27 28 and 29 which indicate area-level utilization rates are not shown here.

Note: National estimates represent hospital-level averages for 4,289 hospitals in the 2002 HCUP data from 35 states.

Overall Findings

- A number of New Jersey hospitals are performing fewer than the minimum volume threshold of certain surgical procedures, particularly high risk procedures such as esophageal and pancreatic resections, and AAA repairs.

- New Jersey data appears to show over utilization than the national average for cesarean section delivery including primary cesarean delivery.

- Statewide risk-adjusted surgical and medical mortality rates are generally in line with or better than the national average.

- When one looks at a hospital's performance across all surgical or medical mortality indicators, there is no clearly discernible pattern. In other words, although some hospitals showed some level of consistency across all measures, the majority of hospitals display considerable variation. There is insufficient evidence to conclude whether this lack of consistency across measures reflects the situation within hospitals accurately, or whether it is an indicator of the limitations of measures based on UB data and often involving very small number of cases.

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Appendices

Appendix 1. Definitions of Inpatient Quality Indicators

Volume Indicators

01: Esophageal Resection (Surgical removal of the throat): The esophagus is the tube that carries food from the mouth to the stomach. It sometimes has to be removed, usually due to cancer. This procedure is rarely done, and few hospitals do even one such operation in a year. Caution should be used in comparing hospital performance based on these rates. Volume for esophageal resection includes all discharges with ICD-9-CM codes of 4240 through 4242 in any procedure field, and a diagnosis code of esophageal cancer in any field.

02: Pancreatic Resection (Surgical removal of the pancreas): The pancreas is an organ that lies deep in the abdomen and produces important hormones, such as insulin. If cancer develops in the pancreas, removing the organ by surgery may be lifesaving. This procedure is rarely done, and few hospitals do even one such operation in a year. Caution should be used in comparing hospital performance based on these rates. Volume for pancreatic resection includes all discharges with ICD-9-CM codes of 526 or 527 in any procedure field, and a diagnosis code of pancreatic cancer in any field.

04: Abdominal Aortic Aneurysm: An aneurysm is a defect or swelling in the wall of a weak or damaged artery. Aneurysms may form in the aorta, the main artery carrying blood from the heart. Aneurysms that occur in the part of the aorta within the abdomen are called abdominal aortic aneurysms. When the vessel swells to a certain size, it is likely to rupture, often causing death. This may be prevented by repair of the swelling before it bursts. In some cases, once the aneurysm has burst, the patient may be saved by emergency surgery to repair the vessel. Volume for AAA includes all discharges with ICD-9-CM codes of 3834, 3844, and 3864 in any procedure field with a diagnosis code of AAA in any field.

05: Coronary Artery Bypass Graft (CABG): A coronary artery bypass graft (CABG) is a surgical procedure to reroute or 'bypass' blockages in the arteries which carry blood to the heart. A CABG may be done to reduce chest pain, prevent heart attack or to treat other heart problems caused by blockages in the coronary arteries. Volume for CABG includes all discharges with ICD-9-CM codes of 3610 through 3619 in any procedure field on patients aged 40 years and older. AHRQ recommends that CABG volume should be used in conjunction with measures of mortality to assess quality. As noted in the literature, higher volumes of CABG have been associated with fewer deaths. However, the American Heart Association (AHA) and the American College of Cardiology (ACC) recommend that since some low-volume hospitals have very good outcomes, other

measures besides volume should be used to evaluate individual surgeon's or hospital's performance.

06: Percutaneous Transluminal Coronary Angioplasty (PTCA): This procedure is a catheter-based interventional treatment to open blockages in the arteries that carry blood to the heart muscle. Volume for PTCA includes all discharges with ICD-9-CM codes 3601, 3602, 3605, or 3606 in any procedure field on patients 40 years old or more. The QI software also calculates in-hospital mortality for PTCA, so that the volumes for this procedure can be examined in conjunction with mortality. However, AHRQ states that the mortality measure should not be examined independently, because it did not meet AHRQ's criteria to stand alone as a measure.

07: Carotid Endarterectomy (CEA): The carotid arteries are the major arteries in the neck, which carry blood from the heart to the brain. If blockages develop in these arteries, stroke or other brain problems can result. Carotid endarterectomy is a surgery to remove blockages from these arteries and reduce the chance of stroke. All discharges with ICD-9-CM codes of 3812 in any procedure field are included in the volume for CEA. Generally, higher volume indicates better outcome, but caution is warranted in drawing conclusions about performance solely based on this indicator. The QI software calculates mortality for CEA (see IQI #31), so that the volumes for this procedure can be examined in conjunction with mortality.

Mortality Indicators

Mortality due to Surgical Procedures

08: Esophageal Resection (Surgical removal of the throat): The removal of the esophagus involves manipulation of vital organs in both the chest and the abdomen, together with reconstruction of a way to replace the function of the esophagus. The indicator is measured by the number of deaths per 100 patients with discharge procedure code of esophageal resection (discharges with ICD-9-CM codes of 4240 through 4242 in any procedure field, and a diagnosis code of esophageal cancer in any field).

09: Pancreatic Resection (Surgical removal of the pancreas): Surgical removal of the pancreas may be the only treatment option for those with cancer of the pancreas. The indicator is measured by the number of deaths per 100 patients with discharge procedure code of pancreatic resection (discharges with ICD-9-CM codes of 526 or 527 in any procedure field, and a diagnosis code of pancreatic cancer in any field).

11: Abdominal Aortic Aneurysm (AAA) Repair: Surgery may be performed to prevent rupture of a ballooning vessel (aneurysm). Patients with a diagnosed AAA are monitored to determine when surgical intervention is required. Patients requiring this procedure usually have disease of other major vessels as well, which may lead to stroke or heart attack during or after the major surgery required to repair the abdominal aorta. This surgery usually is performed by surgeons who specialize in repair of blood vessels, and at

hospitals where other specialists are available to deal with the expected complications. The type of aneurysm and other patient-related factors greatly affect the mortality rate for this procedure. The mortality rate is defined as the number of deaths per 100 patients with procedure code of AAA repair (discharges with ICD-9-CM codes of 3834, 3844, and 3864 in any procedure field and a diagnosis code of AAA in any field).

12: Coronary Artery Bypass Graft (CABG): AHRQ states that coronary artery bypass graft is a relatively common procedure that requires proficiency with the use of complex equipment; technical errors may lead to clinically significant complications such as myocardial infarction, stroke, and death. CABG mortality is one of the most widely used and publicized post-procedural mortality indicators. Demographics, comorbidities, and clinical characteristics of severity of disease are important predictors of outcome that may vary systematically by hospital. AHRQ recommends that this indicator be considered with length of stay and transfer rates to account for differing discharge practices among hospitals. The indicator is defined as the number of deaths per 100 patients with procedure code of CABG (discharges with ICD-9-CM codes of 3610 through 3619 in any procedure field).

13: Craniotomy (Surgical opening of the skull): Craniotomy for repair of aneurysms (ballooning or bursting of blood vessels) is a demanding operation that is almost always associated with high risk of disability or death. Nevertheless, it may be the only option available when a blood vessel ruptures deep in the brain. The mortality rate for this operation may be high even in the hands of an extremely experienced neurosurgical team, who are likely receiving the more difficult cases by transfer. The adjustments used in this model to control for risk factors may not fully reflect the many types of risks associated with this complex surgery, which often is performed on an emergency basis. Hence, its use as quality indicator needs caution. In any rate, it represents the number of deaths per 100 patients (age >17) with DRG code for craniotomy (i.e., DRG 001, 002, 528, 529, 530, and 543), with and without comorbidities and complications.

14: Hip Replacement: Planned replacement of a diseased hip joint with an artificial joint is a common procedure to treat disabling pain or improve hip function. It is an elective procedure performed among patients with chronic osteoarthritis, rheumatoid arthritis, or other degenerative processes involving the hip joint. The mortality rate is low for this procedure, as would be expected in a procedure designed to improve function rather than extend life. The patients are often elderly, and many have multiple medical conditions. The indicator is defined as the number of deaths per 100 patients with discharge procedure code of partial or full hip replacement (discharges with diagnosis codes for osteoarthrosis of hip in any field).

30: Percutaneous Transluminal Coronary Angioplasty: The indicator is defined as the number of deaths per 100 patients with PTCA codes in any procedure field (discharges with ICD-9-CM codes 3601, 3602, 3605, or 3606 in any procedure field; age 40 years and older). AHRQ recommends that PTCA mortality rate must be used in conjunction with PTCA volume rather than as a stand-alone indicator.

31: Carotid Endarterectomy (CEA): The mortality rate for CEA is defined as the number of deaths per 100 CEA cases (discharges with ICD-9-CM codes of 3812 in any procedure field). AHRQ recommends that CEA mortality rate must be used in conjunction with CEA volume rather than as a stand-alone indicator.

Mortality due to Medical Conditions

15: Acute Myocardial Infarction (AMI): According to the American Heart Association, if a heart attack victim gets to an emergency room fast enough, prompt care dramatically reduces heart damage. Timely and effective treatments for acute myocardial infarction (AMI), which are essential for patient survival, include appropriate use of revascularization or thrombolytic therapy. The indicator is defined as the number of deaths per 100 patients with a principal diagnosis code of AMI (age 18 years and older).

32: Acute Myocardial Infarction without transfers: This quality measure was added in Revision 3 of the AHRQ IQI Software to reflect the desire of users, to have an alternative method of measuring AMI mortality that excluded patients transferred from another hospital. Hospitals that routinely admit transfer cases from another short-term hospital(s) may see an unusually high AMI mortality rate. Thus, IQI-32 excludes AMI patients transferred-in from another hospital. The negative side of this method is that transferred AMI patients are excluded from any quality measurement (since outgoing transfers are already excluded from transferring-out hospitals. For that reason, some users prefer to use the AMI Mortality Rate (IQI #15) to ensure the inclusion of all AMI patients.

16: Congestive Heart Failure (CHF): CHF is one of the most common and severe heart diseases affecting Americans, and one of the most common reasons for hospitalization. Congestion is the presence of an abnormal amount of fluid in the tissues, usually because of limitations in the body's ability to return the flow of blood from the arms or legs to the heart and lungs. Though CHF has many possible underlying causes, the end result is an inability of the heart muscle to function well enough to meet the demands of the rest of the body. CHF mortality is influenced greatly by other medical problems, including lung disease, high blood pressure, cancer and liver disease. The mortality rate for this measure is defined as the number of deaths per 100 patients with principal diagnosis code of CHF (age 18 years and older).

17: Acute Stroke: A stroke is a disruption in the blood supply to the brain. A stroke occurs when a blood vessel bringing oxygen and nutrients to the brain bursts, or is clogged by a blood clot or some other particle. Treatment for stroke must be timely and efficient to prevent brain tissue death, and differs significantly based on which of the two types of stroke a patient has suffered. For example, clot-busting drugs are appropriate for strokes caused by clots, but could be fatal in the case of a burst blood vessel. Mortality rates will vary based on the cause of the stroke, the severity of the stroke, other patient illnesses, speed of arrival at the hospital, and speed of diagnosis of the type of stroke. Moreover, clinical factors, including use of mechanical ventilation on the first day, may vary by hospital and influence mortality. The mortality rate for Acute Stroke is defined as the number of deaths per 100 patients with principal diagnosis code of stroke (age 18

years and older). Risk adjustment for clinical factors (or at a minimum, APR-DRGs) is recommended.

18: Gastrointestinal (GI) Hemorrhage: GI hemorrhage is the loss of blood from the esophagus, stomach, small intestine or colon. While many cases are relatively minor, some are life-threatening or fatal. The risk of death mostly is related to the reason why the bleeding began, along with patient factors, such as age and other illnesses. Quality of care by providers is reflected in their ability to control and manage severely ill patients with comorbidities. However, the evidence for substantial variance in mortality rates being due to differences in provider performance is weak. Thus, the indicator should be interpreted with caution. The rate is defined as the number of deaths per 100 discharges with principal diagnosis code of GI hemorrhage (age 18 years and older).

19: Hip Fracture: Hip fracture is a common cause for hospitalization in the elderly, and usually happens to individuals with several co-morbid conditions. Many people die in the first six months after hip fracture, and most of these deaths do not occur in the hospital. Older men admitted from nursing homes are the most likely to die of hip fracture in the hospital. The evidence for substantial variance in mortality rates being due to differences in provider performance is limited, and this indicator should be interpreted with caution. The mortality rate is defined as the number of deaths per 100 patients with principal diagnosis code of hip fracture (age 18 years and older).

20: Pneumonia: Pneumonia involves an infection in the lungs. Pneumonia typically is treated with antibiotics, sometimes in an outpatient setting. However, death may occur even when the patient is in the hospital, especially in patients with weakened respiratory systems or other chronic health problems. There is a significant impact on outcomes from patient co-morbid factors as well as physician admitting practices (since there is variation in the criteria physicians use to admit patients for inpatient treatment). In-hospital pneumonia mortality rate is defined as deaths per 100 discharges with principal diagnosis code of pneumonia (age 18 years and older).

Utilization Indicators

Hospital-specific Utilization Indicators

21: Cesarean Section Delivery: Cesarean delivery is the most common operative procedure performed in the United States and is associated with higher costs than vaginal delivery. Cesarean delivery rate for the U.S. has increased from 5.5% in 1970 to a high of 24.7% in 1988 and decreased to 20.7% in 1996. The AHRQ rate based on the 2002 HCUP data from 35 States is 23.3%. Despite a recent decrease in the rate of cesarean deliveries, many organizations have aimed to monitor and reduce the rate. Babies in the breech position, prior c-section(s), the number of previous births, placental or umbilical cord complications, infections, and high or low birth weight are factors that may cause a woman to have a c-section. Hospitals that serve as referral centers for high risk pregnancies, those with intensive care units for very sick babies, and those serving

mothers who have not had the benefit of prenatal care can be expected to have higher c-section rates. The relationship to quality is that cesarean delivery has been identified as an overused procedure. As such, lower rates represent better quality of care. The rate is defined as the number of cesarean deliveries identified by DRG, or by ICD-9-CM procedure codes per 100 deliveries.

33: Primary Cesarean Delivery: This represents number of cesarean section deliveries among women with no history of previous cesarean delivery. The relationship to quality is that cesarean delivery has been identified as an overused procedure. As such, lower rates represent better quality. The indicator is defined as the number of cesarean deliveries per 100 deliveries by mothers who had no previous cesarean section (the denominator excludes patients with abnormal presentation, preterm delivery, fetal death, multiple gestation diagnosis codes, breech procedure codes, or a previous cesarean delivery diagnosis in any diagnosis field).

22: Vaginal Birth after Cesarean (VBAC), Uncomplicated: Just because a woman has had one cesarean section delivery does not necessarily mean she must deliver future babies by c-section. Many women have normal deliveries even though they had a c-section in the past. The model provides information on the proportion of vaginal births that occurred to mothers who had delivered previously by cesarean section. The relationship to quality is that VBAC has been identified as a potentially underused procedure. As such, higher rates represent better quality. The indicator is defined as the number of in-hospital vaginal births per 100 births to women with previous history of cesarean delivery (denominator excludes patients with abnormal presentation, preterm delivery, fetal death, multiple gestation diagnosis codes, and breech procedure codes in any diagnosis field).

34: Vaginal Birth after Cesarean (VBAC), All: This indicator includes all vaginal deliveries among women with previous cesarean deliveries. The relationship to quality is that higher VBAC rates represent better quality. The indicator is defined as the number vaginal births in a hospital per 100 births to women with previous cesarean deliveries (the denominator includes all deliveries with a previous cesarean delivery diagnosis in any diagnosis field but excludes patients with abnormal presentation, preterm delivery, fetal death, multiple gestation diagnosis codes, or breech procedure codes in any diagnosis field).

23: Laparoscopic Cholecystectomy: Surgical removal of the gall bladder (cholecystectomy) performed with a laparoscope has been identified as an underused procedure. Laparoscopic cholecystectomy is associated with less morbidity in less severe cases. AHRQ states that cholecystectomy is now performed with a laparoscope in about 75% of uncomplicated cases. In less severe cases, the laparoscopic technique is associated with fewer complications than the traditional open method. However, the laparoscopic technique might not be possible due to patient condition or anatomy. Since the model includes only those cases that are performed on hospital inpatients, it does not present a complete picture of the occurrence of this procedure. Nonetheless, the relationship to quality is that higher rates represent better quality. The utilization

rate for this indicator is defined as the number of laparoscopic cholecystectomies per 100 cholecystectomies (the denominator includes all discharges with any procedure code of cholecystectomy in any procedure field).

24: Incidental Appendectomy in the Elderly: Removal of the appendix incidental to other abdominal surgery - such as urological, gynecological, or gastrointestinal surgeries - is intended to eliminate the risk of future appendicitis. However, incidental appendectomy is not recommended in the elderly because they have both a lower risk for developing appendicitis and a higher risk of complications after surgery. As such, lower rates represent better quality. The indicator reports the number of incidental appendectomies per 100 elderly patients (age 65 or older) with intra-abdominal procedure.

25: Bi-lateral Cardiac Catheterization: Cardiac catheterization is a diagnostic test that can show if blood vessels to the heart are narrowed or blocked. This indicator reports the proportion of patients who received right-side coronary catheterization incidental to left-side catheterization. It is usually not recommended unless clinical indications suggest that right-side catheterization be done incidental to left-side catheterization. It is an indicator of procedure overuse. The indicator reports provider-level bilateral cardiac catheterizations (simultaneous right and left heart catheterizations) per 100 discharges with procedure code of heart catheterization (the denominator includes all heart catheterizations in any procedure field).

Area-Level Utilization

26: Coronary Artery Bypass Graft: CABG may be an elective procedure that can be overused. Since no ideal elective CABG rate has been established as a benchmark, AHRQ employs State averages as points of reference. Therefore, rates that are less than the State average are presumed to represent better utilization quality. The indicator reports the number of all CABGs discharges (age 40 years and older) in any procedure field per 100,000 resident county population. For statewide rates, the indicator is defined as the number of CABGs per 100,000 Statewide population.

27. Percutaneous Transluminal Coronary Angioplasty: Elective PTCA has been identified as a potentially overused procedure. Therefore, rates that are lower than the State average are presumed to indicate better quality of utilization. PTCA as an area-level utilization indicator is defined as the number of PTCA procedures per 100,000 resident county population (age 40 years and older).

28. Hysterectomy (Surgical removal of whole or part of the womb): This indicator has been identified as a potentially overused procedure. Hysterectomy is performed on patients with a number of indications, such as recurrent uterine bleeding, chronic pelvic pain, or menopause, usually in some combination. Since no ideal rate for hysterectomy has been established as a benchmark, area-level rates are compared against State averages. Therefore, rates that are lower than the State average are presumed to represent

better quality of care. The indicator reports the number of hysterectomies per 100,000 resident county population (age 18 years or older) or per 100,000 Statewide population, in the case of State-level rates.

29. Laminectomy or spinal fusion (Surgical removal of the posterior vertebral arch): Laminectomy is performed on patients with a herniated disc or spinal stenosis (decrease in diameter). Laminectomy has been identified as a potentially overused procedure, although no ideal rate has been established for reference purposes. Therefore, rates that are lower than the State average represent better quality of care. The indicator is defined as the number of laminectomies per 100,000 resident county population (age 18 years and older).

Appendix 2. Explanation of Rates

Observed Rates

The observed mortality rate is defined as the number of patient deaths for a specific condition or surgical procedure divided by the total number of patients admitted for the condition or surgical procedure being treated, while the observed utilization rate is defined as the number of patient cases for a specific procedure divided by the total number of patients admitted for the condition being treated. Consumers should consider observed rates as crude measures of performance, since they take no account of the variation in patient risk factors among hospitals.

Expected Rates

Unlike observed rates, expected rates are derived from applying the average case-mix of a reference population file that reflects a large proportion of the U.S. hospitalized or residential population. Calculation of these rates is made possible in the latest version of the IQI software (Version 3.0). The expected mortality rate for a hospital is the hospital's observed rate divided by the hospital's risk-adjusted rate, multiplied by the state average risk-adjusted rate. This adjustment is done to reflect an expectation of hospital performance if that hospital had performed at the level of the state average. While comparing a hospital's risk-adjusted rate to its expected mortality rate provides a measure of the hospital's performance, this comparison will not show if a hospital's mortality rate statistically is significantly different from the state's average mortality rate.

Risk-adjusted rates

In order for provider performance profiles to present an accurate indicator of quality of care, the data must be adjusted to account for differences in patients' severity of illness and risk of mortality. "All Patient Refined Diagnosis Related Groups" ("APR-DRGs") is a proprietary tool of the 3M Health Information Systems Corporation designed to use UB data to adjust for these patient differences. The AHRQ quality indicators methodology requires use of APR-DRGs in the analysis of UB data. APR-DRG variables take advantage of available UB data on patient co-morbidities and non-operating room procedures and allow the interaction of the patient's secondary diagnoses, principal diagnosis, and age to influence the assignment of that patient to one of four classes of severity and risk of mortality classes: low, moderate, high and very high. This risk adjustment enables comparisons among hospitals, counties, and/or states with different mixes of patients.

AHRQ's risk-adjusted rates are derived from applying to the observed rates the average case-mix of a baseline data file derived from the 2002 HCUP State Inpatient

Data (SID) from 35 states. The risk-adjusted rate is the best estimate of what the hospital's rates would have been if the hospital had a mix of patients identical to a national-average patient mix for that year. The risk-adjusted rates reflect the age and sex distribution as well as the APR-DRG distribution of the data in the baseline file.

Smoothed rates

Risk adjustment using observed patient factors such as age, sex, or APR-DRG can be made to account for differences in case-mix by hospital or by county. However, there are many other clinical and non-clinical factors that cannot be observed. AHRQ notes that many factors other than quality can influence the observed rate and states that indicators defined on relatively small populations per provider or indicators based on relatively rare events are very noisy measures. The multivariate signal extraction (MSX) method estimates how much of an impact, random differences in these factors across providers or areas have on the observed rate. Smoothed rates are risk-adjusted estimates obtained after removing fluctuations due to random variation over time. Shrinkage factors are applied to the risk-adjusted rates for each IQI in a process called multivariate signal extraction (MSX). These shrinkage factors were calculated from the 2002 HCUP SID on data from 35 states. For each IQI, the shrinkage estimate reflects a 'reliability adjustment' unique to each indicator. The less reliable the IQI over time and across hospitals or areas, the more the estimate 'shrinks' the IQI toward the overall area mean. The resulting rate will appear "smoother" than the observed rate, meaning the year-to-year fluctuations in performance are likely to be reduced.

The model does not calculate smoothed rates for two indicators, *esophageal resection (#08) and carotid endarterectomy (#31)*. These events are so infrequent that analysis based on such rare cases could not detect enough systematic provider-level variation to compute the smoothed rates.

While risk-adjustment eliminates differences among providers by population characteristics, smoothing levels the field by removing random variation that arises over time among providers. In essence, smoothing describes how persistent a provider's rate would be from year to year.

Comparing Observed Rates with Risk-adjusted Rates

The purpose of the analysis determines which rates the user should look at in evaluating the performance of a provider or an area. If the user's primary interest is to focus on a particular provider or area without any comparisons to other providers or areas, simply examine the overall observed rate for the entire provider or area, as well as further breakdowns by age, sex, payer, and race/ethnicity.

If the purpose of the analysis is to compare the performance of a particular provider or area with national, state, or regional averages or performances of other

selected providers or areas, then both observed and risk-adjusted rates should be examined. Variation in observed rates across providers or areas is attributable to a variety of factors including differences in patient case-mix or population demographics, disparity in access to and quality of care, and other provider or area characteristics ('systematic factors'), and random factors (non-systematic factors or 'noise'). Comparing observed and risk-adjusted rates can reveal if there is any difference between the provider/area's population and the population of other providers/areas. If the difference is minimal, one can compare the observed rate with the overall average across all providers or areas. However, to account for differences in patient case-mix or population demographics among different providers or areas, risk-adjusted rates should be used for provider or area-by-area comparisons.

If observed rate > risk-adjusted rate then:

- For mortality indicators - The provider's patient population for the condition or procedure has a *higher* risk of mortality due to its case-mix (for example, older or a greater proportion of a higher-risk APR-DRG).
- For utilization indicators - The provider/area's population has a *higher* risk of receiving the procedure due to its demographic composition (for example, older or a greater proportion of a higher-risk gender).

If observed rate < Risk-adjusted rate then:

- For mortality indicators - The provider's patient population for the condition or procedure has a *lower* risk of mortality due to its case-mix (for example, younger or a greater proportion of a lower-risk APR-DRG).
- For utilization indicators - The provider/area's population has a *lower* risk of receiving the procedure due to its demographic composition (for example, younger or a greater proportion of a lower-risk gender).

If observed rate = risk-adjusted rate then:

- For mortality indicators - The provider's patient case-mix for the condition or procedure is similar to other providers', suggesting that patient composition is not a contributing factor to the provider's performance for the mortality indicator.
- For utilization indicators - The provider/area's population is similar to other providers/areas' in demographic composition.

Inpatient Quality Indicators

Application of the AHRQ Module to New Jersey Data

C1108