100 TOP HOSPITALS®: HEALTH SYSTEM QUALITY/EFFICIENCY BENCHMARKS STUDY

1ST EDITION

THOMSON REUTERS
TOP HOSPITALS
HEALTH SYSTEMS

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INTRODUCING THE THOMSON REUTERS 100 TOP HOSPITALS®: HEALTH SYSTEM QUALITY/ EFFICIENCY BENCHMARKS STUDY

MOVING TRANSPARENCY TO THE NEXT LEVEL

Thomson Reuters is proud to introduce the next step in healthcare performance measurement, the **100 Top Hospitals: Health System Quality/ Efficiency Benchmarks** study.

For the first time, the quality provided by a health system as single organization, regardless of ownership, religious affiliation, location, size, or purpose, can be objectively measured and compared with other health systems as well as national benchmarks for quality and efficiency. By assessing clinical performance across the system, leaders can understand where they stand on their own journey to excellence relative to the progress of other systems. The study highlights the potential for health systems to impact quality initiatives, improve perceptions, and increase value to the communities they serve.

Our study group included every system with two or more acute-care member hospitals, and like all 100 Top Hospitals studies, used publicly available data and objective statistical analysis. Performance measures, which focus on clinical quality and efficiency, reflect aggregated data across the entire system, including critical access hospitals. For full details on how winners were chosen, see the Methodology section of this document.

THE 100 TOP HOSPITALS: HEALTH SYSTEM QUALITY/ EFFICIENCY BENCHMARKS AWARD WINNERS

Transforming the health care system will demand that providers rapidly increase their value, by providing higher quality and efficiency for the dollars spent. To develop actionable benchmarks to help health systems target higher performance, we selected the 10 highest-performing health systems in the study population, based on a composite score of five measures of quality and efficiency.

WINNING HEALTH SYSTEM	LOCATION
Advocate Health Care	Oak Brook, IL
Catholic Healthcare Partners	Cincinnati, OH
Health Alliance of Greater Cincinnati	Cincinnati, OH
HealthEast Care System	Saint Paul, MN
Henry Ford Health System	Detroit, MI
Kettering Health Network	Dayton, OH
OhioHealth	Columbus, OH
Prime Healthcare Services, Inc.	Victorville, CA
Trinity Health	Novi, MI
University Hospitals Health System	Cleveland, OH

The winners of this award outperformed their peers by a wide margin — they provided better care, followed standards of care more closely, saved more lives, had fewer patient complications, and made fewer patient safety errors. For more details on the performance of the top health systems, see the Findings section of this document.

Although the winning health systems have excellence in quality and efficiency in common, they differ in many ways — including their ownership, religious affiliation, size, and the geographic distribution of their member hospitals. These health systems tend to be headquartered in the Midwest, similar to the concentration of the 100 Top Hospitals: National Benchmarks award winners. Another similarity to the 100 Top Hospitals National award winners may exist among the health system award winners — their leadership may be focused on excellent communication, unrelenting performance measurement, and insistence on performance improvement. Understanding the similarities and differences between high-, median-, and low-performing health systems will be a focus of our research over the next few years.

This study and the scores of many systems raise difficult questions regarding the health system mission, effective achievement of mission and goals, and accountability to communities and patients served. The range of results between high- and low-performing systems is significant in terms of patient survival, complications, patient safety, and how quickly patients may return to daily life. By developing these health system benchmarks, we aim to help health system boards and executives grapple with these questions and to set higher system-wide targets for performance improvement. The meaning and use of the health system brand is also an important topic of discussion.

THE 100 TOP HOSPITALS PROGRAM

Since 1993, the 100 Top Hospitals program has been setting standards for the industry by naming top hospital performers using peer-reviewed methods based on a balanced scorecard and objective statistical analysis of public data.

The basis of our studies is the 100 Top Hospitals: National Balanced Scorecard, designed to enable healthcare leaders to compare a hospital's performance to national benchmarks and to target higher performance. All benchmarks are a result of objective statistical analysis of public data. The measurement and integration of rates of improvement and the resultant level of achievement are designed to shed light on the challenges and complexity of changing organizational performance.

The 100 Top Hospitals program currently includes the following annual studies:

- The 100 Top Hospitals: Health System Quality/ Efficiency Benchmarks study described here
- The flagship 100 Top Hospitals: National Benchmarks study, identifying the highest performers in the nation on the 100 Top Hospitals National Balanced Scorecard
- The 100 Top Hospitals: Everest Award for National Benchmarks study, recognizing the boards, executives, and medical-staff leaders who have developed and executed strategies that drove the highest rate of long-term improvement, resulting in the highest performance in the country at the end of a five-year period
- The 100 Top Hospitals: Cardiovascular Benchmarks study, which identifies hospitals that demonstrate the highest performance in hospital cardiovascular services

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HEALTH SYSTEM BENCHMARKS STUDY METHODOLOGY

OVERVIEW

The 100 Top Hospitals®: Health System Quality/Efficiency Benchmarks study is the latest addition to the Thomson Reuters 100 Top Hospitals family. It is a quantitative study that identifies 10 health systems with the highest level of achievement on a modified clinical and efficiency version of the 100 Top Hospitals National Balanced Scorecard. This study is based on five measures that provide a valid comparison of health system performance using publicly available data. The health systems with the highest level of achievement are those with the highest ranking on a composite score of the five measures. This study includes only short-term, acute care, nonfederal U.S. hospitals that treat a broad spectrum of patients.

Following are the primary steps we take in selecting the top 10 health systems:

- Build the database of hospitals, including special selection and exclusion criteria
- Identify which hospitals are members of health systems
- Score systems on a set of performance measures using a methodology that aggregates hospital-level data to the system level and accounts for hospital size and teaching status
- Determine 10 top performers by ranking health systems on their aggregate performance measure scores

The following document is intended to be an overview of these steps. To request more detailed information on any of the study concepts outlined here, please e-mail us at *healthcare.pubs@thomsonreuters.com* or call +1 800 568 3282.

BUILDING THE DATABASE OF HEALTH SYSTEMS

The 100 Top Hospitals: Health System Quality/Efficiency Benchmarks study uses two primary sources of data: the publicly available Medicare Provider Analysis and Review (MedPAR) data set and the Centers for Medicare and Medicaid Services (CMS) Hospital Compare data set. Residency program information, used in classifying teaching hospitals as part of the performance measures comparisons, is from the American Medical Association (ACGME-accredited programs) and the American Osteopathic Association (AOA).

The MedPAR data set is used to obtain patient-level medical record information for the calculation of mortality, complications, patient safety, and length of stay. This data set contains information on the approximately 12 million Medicare patients who are discharged from the nation's acute-care hospitals annually. We used the most recent two federal fiscal years of MedPAR data available, 2006 and 2007, in this study.[1]

To be included in the systems study, a hospital must have both years of data available. In addition, we use the hospital-specific demographic information and home office identification filed by hospitals on the Medicare cost report to create our proprietary database.

We and many others in the healthcare industry have used the MedPAR and Medicare Cost Report databases for several years. We believe them to be accurate and reliable sources for the types of analyses performed in this study. Performance based on Medicare data has been found to be highly representative of all-payer information. Medicare patients usually represent 30 to 40 percent of a hospital's revenue, and many previous academic and economic studies of healthcare in the United States have been based on the assumption that Medicare data are representative of the all-payer activity at hospitals.

After building the database, we excluded a number of hospitals that would have skewed the study results. Excluded from the study were:

- Specialty hospitals (e.g., children's, women's, psychiatric, substance abuse, rehabilitation, cardiac, orthopedic, heart, cancer, and long-term acute-care hospitals)
- Federally owned hospitals
- Non-U.S. Hospitals (such as those in Guam, Puerto Rico, and the Virgin Islands)
- Hospitals with fewer than 25 acute-care beds
- Hospitals with fewer than 100 Medicare patient discharges in federal fiscal year 2007
- Hospitals with Medicare average lengths of stay longer than 30 days
- Hospitals with mortality rates (number of deaths divided by total discharges) of less than 1 percent
- Patients who were discharged to another short-term facility (this is done to avoid double-counting)
- Patients who were not at least 65 years old
- Rehabilitation and psychiatric/substance-abuse patient records
- Patient records coded for palliative care
- Hospitals missing data required to calculate performance measures

CLASSIFYING HOSPITALS INTO HEALTH SYSTEMS

To be included, a health system must contain at least two short-term general acute-care hospitals, as identified using the 100 Top Hospitals® specialty algorithm, and after hospital exclusions have been applied. In addition, any Critical Access Hospitals (CAH) that passed the exclusion rules, cited above, were also included. The "parent" system was identified by finding the "related organization" or "home office," as reported on the hospitals' 2007 Medicare cost report. Although many large health systems have regional or other subdivisions, these are not reliably identified on the Medicare cost report, so we did not subdivide these systems in the study.

To analyze health system performance, we aggregate data from all of a system's included hospitals. Following, we provide specific details about the formulas used for each performance measure and how these measures were aggregated to determine system performance.

The final study group, after exclusions, included 252 health systems with the following profile:

SYSTEM CATEGORY	SYSTEMS	MEMBER HOSPITALS	PATIENT DISCHARGES IN 2007
Winning Systems	10	84	658,907
Nonwinning Systems	242	1,636	9,150,493
TOTAL SYSTEMS	252	1,720	9,809,400

SCORING HEALTH SYSTEMS ON WEIGHTED PERFORMANCE MEASURES

Selection of Performance Measures

For all of the 100 Top Hospitals studies, we use a balanced scorecard based on public data to select the measures most useful for Boards and CEOs in the current operating environment. Throughout the life of the study, we have worked hard to meet this vision. We gather feedback from industry leaders, hospital executives, academics, and internal experts; review trends in the healthcare market; and survey hospitals in demanding marketplaces to learn which measures are valid and reflective of top performance. As the market has changed, our methods have evolved.

In addition to a lack of reliable, publicly available financial data for health systems, measures of financial health and efficiency could not be fairly compared across such a wide variety of operating conditions. For this health systems study, we focused on clinical and efficiency measures only, striving for a balance of measures to evaluate patient outcomes, process of care, and efficiency of care delivery. The measures for this study are:

1. Risk-adjusted mortality index
2. Risk-adjusted complications index
3. Risk-adjusted patient safety index
4. Core measures mean percent
5. Severity-adjusted average length of stay

We weighted each measure equally in the final ranking process.

The risk-adjusted mortality index, risk-adjusted complications index, risk-adjusted patient safety index, and the core measures mean percent are all vital measures of clinical excellence. The mortality and complications measures are time-tested barometers of how hospitals are meeting the most basic and essential care standards: survival and quality of life. Patient safety has more recently become an important measure of hospital quality. The risk-adjusted patient safety index is based on the Agency for Healthcare Research and Quality (AHRQ) Patient Safety Indicators (PSIs).[2] Patient safety measures are reflective of both clinical quality and the effectiveness of systems within the hospital. Because they use hospital administrative data and focus on surgical complications and other iatrogenic events, we feel that AHRQ's PSIs provide an unbiased look at many aspects of patient safety inside hospitals. Such objective analysis is central to the 100 Top Hospitals® mission. The risk-adjusted patient safety index facilitates comparison of national and individual hospital performance using a group of eight patient safety indicators, which allows us to gauge the results of hospital-wide patient safety performance.

To be truly balanced, a scorecard must include various measures of quality. To this end, we also include an aggregate core measures mean percent. Core measures were developed by the National Quality Forum as minimum basic care standards. They are a widely accepted method for measuring patient care quality that includes specific guidelines for heart attack, heart failure, pneumonia, pregnancy and related conditions, and surgical infection prevention. Our core measures score is based on the heart attack, heart failure, pneumonia, and surgical infection prevention areas of this program, using Hospital Compare data reported on the CMS web site.[3]

The methodology surrounding each of the measures is detailed in the following pages.

Considering Hospital Size and Teaching Status

Bed size, teaching status, and residency program involvement have a profound effect on the types of patients a hospital treats and the scope of services it provides. We assigned each hospital to one of five comparison groups, or classes, according to its size and teaching status. These five classes are identical to the classes used in the 100 Top Hospitals: National Benchmarks study. In addition, we added a separate class for Critical Access Hospitals. We then used this classification to normalize system aggregate expected values for mortality, complications, PSI, and average length of stay, based on the distribution of hospitals by class in each system.

Our classification methodology draws a significant distinction between the peer groups, Major Teaching Hospitals and Teaching Hospitals by measuring the magnitude and type of teaching programs, and by accounting for their level of involvement in physician education and research. This methodology de-emphasizes the role of bed size and focuses more on teaching program involvement. Through this methodolgy, we seek to measure both the depth and breadth of teaching involvement and recognize teaching hospitals' tendency to reduce beds and concentrate on true tertiary care.

Our formula for defining the teaching comparison groups includes each hospital's bed size, residents-to-beds ratio, and involvement in graduate medical education programs accredited by either the Accreditation Council for Graduate Medical Education (ACGME)[4] or the AOA.[5] The definition includes both the magnitude (number of programs) and type (sponsorship or participation) of GME program involvement. In this study, AOA residency program involvement was treated as being equivalent to ACGME program sponsorship.

The classes, and their parameters, are as follows:

Major Teaching Hospitals

There are three ways to qualify:

1. 400 or more acute-care beds in service plus an intern and resident-per-bed ratio of at least 0.25, and
   - sponsorship of at least 10 GME programs or
   - involvement in at least 20 programs overall
2. Involvement in at least 30 GME programs overall (regardless of bed size or intern and resident-per-bed ratio)
3. An intern and resident-per-bed ratio of at least 0.60 (regardless of bed size or GME program involvement)

Teaching Hospitals

- 200 or more acute-care beds in service, and
- either an intern and resident-per-bed ratio of at least 0.03 or involvement in at least 3 GME programs overall

Large Community Hospitals

- 250 or more acute-care beds in service, and
- not classified as a teaching hospital per definitions above

Medium Community Hospitals

- 100–249 acute-care beds in service, and
- not classified as a teaching hospital per definitions above

Small Community Hospitals

- 25–99 acute-care beds in service, and
- not classified as a teaching hospital per definitions above

Critical Access Hospitals

- Medicare ID third and forth digits are ”13,” and
- 25 or more beds in service

PERFORMANCE MEASURES USED IN THE STUDY

RISK-ADJUSTED MORTALITY INDEX

WHY WE INCLUDE THIS ELEMENT	CALCULATION	COMMENT
Patient survival is a universally accepted measure of hospital quality. The lower the mortality index, the greater the survival of the patients in the hospital, considering what would be expected based on patient characteristics. While all hospitals have patient deaths, this measure can show where deaths did not occur, but were expected given the patient's condition.	We calculate an index value based on the aggregate number of actual deaths in 2006 and 2007 combined, for all hospitals in each system, divided by the aggregate number expected, given the risk of death for each patient. We normalize the index based on the observed and expected deaths for each hospital class. This measure is based on our proprietary risk-adjusted mortality index model, which is designed to predict the likelihood of a patient's death based on patient-level characteristics (age, sex, presence of complicating diagnoses, and other characteristics) and factors associated with the hospital (size, teaching status, geographic location, and community setting). Postdischarge deaths are not considered. For more details on the model, see Appendix B. The reference value for this index is 1.00; a value of 1.15 indicates 15 percent more deaths occurred than were predicted, and a value of 0.85 indicates 15 percent fewer deaths than predicted.	We based the scoring on the difference between observed and expected deaths, expressed in normalized standard deviation units (z-score).[6,7] Health systems with the fewest deaths, relative to the number expected, after accounting for standard binomial variability, received the most favorable scores. We used two years of MedPAR data (2006 and 2007) to reduce the influence of chance fluctuation. Normalization was done by hospital class, based on the hospitals within each system. Health systems with aggregate values that were extreme high outliers were not eligible to be named as study winners (see "Eliminating Outliers" on page 10).

RISK-ADJUSTED COMPLICATIONS INDEX

WHY WE INCLUDE THIS ELEMENT	CALCULATION	COMMENT
Keeping patients free from potentially avoidable complications is an important goal for all healthcare providers. A lower complications index indicates fewer patients with complications, considering what would be expected based on patient characteristics. Like the mortality index, this measure can show where complications did not occur, but were expected given the patient's condition.	We calculate an index value based on the aggregate number of cases with complications in 2006 and 2007, combined, for all hospitals in each system, divided by the aggregate number expected, given the risk of complication for each patient. We normalize the index based on the observed and expected complications for each hospital class. This measure uses our proprietary expected complications rate index models. These models account for patient-level characteristics (age, sex, principal diagnosis, comorbid conditions, and other characteristics), as well as differences in hospital characteristics (size, teaching status, geographic location, and community setting). Complications rates are calculated from normative data for two patient risk groups: medical and surgical. For more details on the model, see Appendix B. The reference value for this index is 1.00; a value of 1.15 indicates 15 percent more complications occurred than were predicted, and a value of 0.85 indicates 15 percent fewer complications than predicted.	We based the scoring on the difference between the observed and expected number of patients with complications, expressed in normalized standard deviation units (z-score).[6,7] Health systems with the fewest observed complications, relative to the number expected, after accounting for standard binomial variability, received the most favorable scores. We used two years of MedPAR data (2006 and 2007) to reduce the influence of chance fluctuation. Normalization was done by hospital class, based on the hospitals within each system. Health systems with aggregate values that were extreme high outliers were not eligible to be named study winners (see "Eliminating Outliers" on page 10).

RISK-ADJUSTED PATIENT SAFETY INDEX

WHY WE INCLUDE THIS ELEMENT	CALCULATION	COMMENT
Patient safety has become an increasingly important measure of hospital quality. Patient safety measures are reflective of both clinical quality and the effectiveness of systems within the hospital. AHRQ, a public health service agency within the federal government's Department of Health and Human Services, has developed a set of Patient Safety Indicators (PSIs). These indicators are widely used as a means of measuring hospital safety. Because they use hospital administrative data and include surgical complications and other iatrogenic events, we feel that AHRQ's PSIs provide an unbiased look at the quality of care inside hospitals. Such objective analysis is central to the 100 Top Hospitals® mission.	For each of the eight included PSIs (see Appendix B for a list), we calculated an index value based on the aggregate number of actual PSI occurrences for 2006 and 2007 combined, for all hospitals in each system, divided by the aggregate number of normalized expected occurrences, given the risk of the PSI event for each patient. Values were normalized by comparison group. The hospital-level PSI methodology from AHRQ was applied to the 2006 and 2007 MedPAR acute-care data, using program code provided by AHRQ to adjust for risk.[2] The reference value for this index is 1.00; a value of 1.15 indicates 15 percent more events than predicted, and a value of 0.85 indicates 15 percent fewer.	We based the scoring on the difference between the observed and expected number of patients with PSI events, for each of the eight selected PSIs, expressed in standard deviation units (z-score).[6,7] A mean z-score was developed as an aggregate PSI score. Z-scores were normalized by hospital class, based on the hospitals within each system. Health systems with the fewest observed PSIs, relative to the number expected, accounting for binomial variability, received the most favorable scores. We used two years of MedPAR data (2006 and 2007) to reduce the influence of chance fluctuation. Health systems with aggregate values that were extreme high outliers were not eligible to be named study winners (see "Eliminating Outliers" on page 10).

CORE MEASURES SCORE

WHY WE INCLUDE THIS ELEMENT	CALCULATION	COMMENT
To be truly balanced, a scorecard must include various measures of quality. Core Measures were developed by the National Quality Forum as minimum basic care standards. They are a widely accepted method for measuring patient care quality that includes specific guidelines for heart attack, heart failure, pneumonia care, and surgical infection prevention.	Core measures values are from the CMS Hospital Compare Web site for calendar year 2007. We included all reported heart attack (acute myocardial infarction), congestive heart failure, pneumonia, and surgical infection prevention core measures — a total of 24. For a list of the measures used, see Appendix B. For each hospital, we calculate the mean of the reported core measures percent values for all available core measures. We consider reported core measures percents with patient counts that are less than or equal to 25, or that have relative standard error values greater than or equal to 0.30 to be statistically unreliable. In these cases, we substitute the class median percent value for the affected core measure.	We base the scoring on each health system's core measures mean percent. The core measures mean percent is calculated by taking the mathematical average of the hospital mean percent values for the hospitals included in the health system.

SEVERITY-ADJUSTED AVERAGE LENGTH OF STAY		
WHY WE INCLUDE THIS ELEMENT	**CALCULATION**	**COMMENT**
A lower severity-adjusted length of stay generally indicates more efficient consumption of hospital resources and reduced risk to patients.	This measure uses MedPAR data for 2007 only. We calculate the patient length of stay (LOS) index for each health system, adjusted for differences in severity of illness. Adjustments are made using the refined diagnosis-related group (RDRG) methodology, based on MedPAR records only. Patients are assigned a weight corresponding to the relative severity of their condition. These weights are then used to compute an expected length of stay for each patient, given the characteristics of that patient. We calculate observed and expected LOS for each system, based on the sum of the values for the hospitals in the system. Values are normalized based on the observed and expected LOS of each hospital's class. An aggregate average length of stay in days (ALOS) is computed for each health system by multiplying the LOS index by the grand mean length of stay for all National Benchmarks in-study hospitals.	We score this measure by ranking the ALOS.

DETERMINING THE 10 TOP HEALTH SYSTEMS

Eliminating Outliers

We used the interquartile range methodology (IQR) to identify health systems with extreme high outlier values, indicating unusually poor performance. In this study, we use the IQR methodology for the following patient outcomes measures:

- Risk-adjusted mortality index
- Risk-adjusted complications index
- Risk-adjusted patient safety index

Health systems identified as having extreme high outlier values for these measures were not eligible to be named benchmarks.

IQR Outlier Methodology

1. Determine the first quartile (Q1). This is the 25th percentile value of all records in the population.
2. Determine the third quartile (Q3). This is the 75th percentile value of all records in the population.
3. Calculate the interquartile range (IQR) by subtracting Q1 from Q3 (IQR = Q3 – Q1)
4. Calculate the outlier trim points:
   Upper Trim = Q3 + (3.0 * IQR)
5. A measure is considered an outlier if it is greater than the upper limit.

Ranking

We ranked health systems on the basis of their performance on each of the five measures relative to the other included systems. We then summed each system's individual performance-measure rankings and reranked overall to arrive at a final rank for the system. The top 10 health systems with the best final rank were selected as the winners.

FINDINGS

THE 100 TOP HOSPITALS®: HEALTH SYSTEM QUALITY/EFFICIENCY BENCHMARKS — SETTING STANDARDS FOR THE INDUSTRY

Through the years, the objective data in the 100 Top Hospitals studies have provided numerous examples of excellence in clinical care and operational efficiency. The 100 Top Hospitals: Health Systems Quality/Efficiency Benchmarks award winners are true leaders in the industry. For their competitors and peers, they offer a valuable example to follow.

Systematic performance improvement is a new concept for many health systems, and questions remain about how to make it work and its place in the system's mission. Nonetheless, the findings we present here give health system leaders benchmarks for targeting top performance. By showing what the top performers have achieved, we offer concrete goals for the entire industry.

Based on the results of this study, we estimate that if all Medicare inpatients received the same level of care as that received in the 100 Top Hospitals award-winning hospitals:

- More than 47,000 additional patients would survive each year.
- Nearly 92,000 patient complications would be avoided annually.
- The average patient stay would decrease by more than half a day.

If the same standards were applied to all inpatients, the impact would be even greater.

Data in the table below show how the 100 Top Hospitals: Health System Quality/Efficiency Benchmarks winners, as a group, scored on the study's performance measures, and how this performance compared with their peers (nonwinning health systems).

TABLE 1. NATIONAL HEALTH SYSTEM PERFORMANCE COMPARISONS

PERFORMANCE MEASURE	MEDIANS[1]		BENCHMARK COMPARED WITH PEER GROUP		
	WINNING HEALTH SYSTEMS	PEER GROUP OF U.S. HEALTH SYSTEMS	DIFFERENCE	PERCENT DIFFERENCE	
Mortality Index[2]	0.82	1.00	0.18	17.6%	Fewer mortalities
Complications Index[2]	0.83	1.00	0.17	16.8%	Fewer complications
Patient Safety Index[2]	0.97	1.00	0.03	3.0%	Better patient safety
Core Measures Average Score (%)	93.5	88.7	4.8	N/A[3]	Better core measure performance
Average Length of Stay (days)	5.0	5.6	0.6	10.7%	Shorter ALOS

1. Data are based on MedPAR 2007 with the exception of Core Measures, which is based on CMS Hospital Compare 2007. See the Methodology section for performance measure definitions.
2. Based on national norms, ratings greater than 1.0 indicate more adverse events than expected; ratings less than 1.0 indicate fewer.
3. We do not calculate percentage difference for this measure. See Appendix B for an explanation.

The top health systems are providing higher quality care, as judged by fewer mortalities and patient complications, and better adherence to patient safety standards and core measures of care.

The winners' patient mortality index of 0.82 means that they had 18 percent fewer mortalities than expected, considering patient severity. With an index of 1.00, their peers, on the other hand, had as many deaths as expected given patient condition. And with a median complications index of 0.83, the award winners had 17 percent fewer patient complications than expected, while their peers had as many as expected.

The top health systems are also doing a better job avoiding adverse patient safety events and following accepted care standards more closely. A patient safety index of 0.97 tells us that winning hospitals had 3 percent fewer adverse patient safety events than expected, given patient severity.

By contrast, their peers had as many adverse events as expected. The winning hospitals' higher core measures mean percentage (nearly 5 percentage points higher) tells us that they had better adherence to recommended core measures of care than their peers.

Winning health systems are treating patients more efficiently — they are achieving the better clinical outcomes outlined above and releasing patients sooner. Winning systems have a median average length of stay of 5.0 days, which is more than half a day less than their peers' median of 5.6 days.

In Table 2, we provide the 100 Top Hospitals®: Health Systems Quality/Efficiency Benchmarks study winners' scores for each of the study's five performance measures. For comparative purposes, we also repeat the group medians for all winners and all nonwinners in this table and show, with color shading, the quintile of performance the score fell into.

TABLE 2. WINNING HEALTH SYSTEMS PERFORMANCE MEASURES RESULTS[1]

WINNING SYSTEM NAME	RISK-ADJUSTED MORTALITY INDEX[2]	RISK-ADJUSTED COMPLICATIONS INDEX[2]	RISK-ADJUSTED PATIENT SAFETY INDEX[2]	CORE MEASURES MEAN PERCENT (%)	SEVERITY-ADJUSTED ALOS (DAYS)
Advocate Health Care	0.82	0.68	1.04	94.6	5.2
Catholic Healthcare Partners	0.85	0.84	0.99	90.8	5.4
Health Alliance of Greater Cincinnati	0.63	0.83	0.92	91.6	4.8
HealthEast Care System	0.99	0.80	0.75	91.8	4.8
Henry Ford Health System	0.81	0.85	0.96	93.1	5.4
Kettering Health Network	0.64	0.68	0.96	95.8	4.7
OhioHealth	0.99	0.90	1.04	94.2	5.2
Prime Healthcare Services, Inc.	0.70	0.71	1.00	95.2	4.1
Trinity Health	0.96	0.89	1.03	93.8	5.0
University Hospitals Health System	0.83	0.84	0.96	91.9	5.0
Benchmark Median	0.82	0.83	0.97	93.5	5.0
Peer Median	1.00	1.00	1.00	88.7	5.6

1. Data are based on MedPAR 2007 with the exception of Core Measures, which is based on CMS Hospital Compare 2007. See the Methodology section for performance measure definitions.
2. Based on national norms, ratings greater than 1.0 indicate more adverse events than expected; ratings less than 1.0 indicate fewer.

QUINTILE PERFORMANCE KEY

QUINTILE	PERCENTILE RANGE	PERFORMANCE LEVEL
1	> 80 to 100	Best
2	> 60 to 80	
3	> 40 to 60	
4	> 20 to 40	
5	> 0 to 20	Worst

CHARACTERISTICS OF THE TOP HEALTH SYSTEMS

For comparative purposes, we divided the 252 health systems in the study into quintiles, based on how they scored on the study's performance measures. Analyzing the performance of the top quintile versus the bottom quintile yielded some interesting results.

In Table 3, we highlight the differences between the top and bottom groups in both performance measure scores and a variety of characteristics. Table 4 lists all of the systems in the top-performing quintile.

TABLE 3. PERFORMANCE AND CHARACTERISTICS OF HEALTH SYSTEMS IN THE TOP AND BOTTOM QUINTILES OF PERFORMANCE

PERFORMANCE MEASURE/ CHARACTERISTIC	TOP QUINTILE	BOTTOM QUINTILE	TOP QUINTILE VERSUS BOTTOM QUINTILE
Median Mortality Index[1]	0.85	1.14	25% fewer mortalities
Median Complications Index[1]	0.87	1.08	19% fewer complications
Median Patient Safety Index[1]	0.95	1.08	13% fewer patient safety incidents
Median Core Measures Score	90.7%	87.0%	Better core measures compliance[2]
Median Average Length of Stay	0.92 days	1.09 days	16% shorter length of stay
% of Systems Located in Midwest	70%	7%	Midwest dominates top quintile[2]
Number of Hospitals Overall	348	532	35% fewer total hospitals
Average Number of Hospitals Per System	7.0	10.4	33% fewer hospitals per system
% Teaching Hospitals in System	22.7%	11.1%	Significantly more teaching hospitals[2]
% Critical Access Hospitals (CAH) In System	11.2%	3.4%	Significantly more CAHs[2]
Median Case Mix Index	1.58	1.50	5% higher case mix index (sicker patients)
Median Operating Profit Margin	5.2%	2.7%	Higher profitability[2]
Median Expense Per Adjusted Discharge	$6,415	$6,672	4% lower expense per discharge
Percent Operational Integration[3]	11.3%	7.0%	Higher level of operational integration[2]

1. Based on national norms, ratings greater than 1.0 indicate more adverse events than expected; ratings less than 1.0 indicate fewer.
2. We do not calculate percent difference when values being compared are percents. See Appendix B for an explanation.
3. We define Percent Operational Integration as related organization amount of allowable cost as a percent of total operating expense.

TOP HEALTH SYSTEMS PERFORM BETTER DESPITE STRESSES

Overall, we found that the top-performing systems have fewer hospitals than systems in the bottom quintile (an average of 7 versus 10 hospitals per system). They treat sicker patients (a 5 percent higher median case mix index), and have a higher percentage of member hospitals that are teaching facilities and/or critical access hospitals.

Despite their sicker patient load, the top systems have fewer mortalities, complications, and adverse patient safety events. They are more efficient, releasing patients sooner (16 percent shorter average length of stay), and have higher profitability (a median 5.2 percent operating profit margin versus 2.7 percent), 4 percent lower expenses, and a higher level of operational integration than their lower-performing counterparts.

MIDWESTERN HEALTH SYSTEMS LEAD THE NATION

Through the years of conducting the 100 Top Hospitals® studies, we've noticed a trend of top performance in the Midwestern states. In the two most recent 100 Top Hospitals: National Benchmarks studies, the Midwest was the clear frontrunner. Nearly 92 percent of all states in this region were in the top two performance quintiles in both study years. What's more, no states in this region fell into the bottom two performance quintiles. In this 100 Top Hospitals: Health System Quality/Efficiency Benchmarks study, 9 of the 10 winning systems were headquartered and had member hospitals in the Midwest.

TABLE 4. THE TOP QUINTILE: 50 BEST-PERFORMING SYSTEMS BASED ON 252 ORGANIZATIONS ANALYZED, PRESENTED IN ALPHABETICAL ORDER

SYSTEM NAME	LOCATION
Advocate Health Care	Oak Brook, IL
Affinity Health System	Menasha, WI
Alexian Brothers Health System	Arlington Heights, IL
Allina Health System	Minneapolis, MN
Ascension Health	Saint Louis, MO
Aurora Health Care	Milwaukee, WI
Avera Health	Sioux Falls, SD
Baptist Health System of East Tennessee	Knoxville, TN
Baycare Health System	Clearwater, FL
Beaumont Hospitals	Royal Oak, MI
Cascade Healthcare Community	Bend, OR
Catholic Health Initiatives	Denver, CO
Catholic Healthcare Partners	Cincinnati, OH
Centegra Health System	Crystal Lake, IL
Clarian Health Partners	Indianapolis, IN
Cleveland Clinic	Cleveland, OH
Community Health Network	Indianapolis, IN
Community Healthcare System	Hammond, IN
Detroit Medical Center	Detroit, MI
East Region Hospitals of the Cleveland Clinic Health System	Independence, OH
Exempla Healthcare, Inc.	Denver, CO
Fairview Health Services	Minneapolis, MN
Genesis Health System	Davenport, IA
Guthrie Healthcare System	Sayre, PA
Health Alliance of Greater Cincinnati	Cincinnati, OH
HealthEast Care System	Saint Paul, MN
Henry Ford Health System	Detroit, MI
Iowa Health System	Des Moines, IA
Kettering Health Network	Dayton, OH
Maury Regional Healthcare System	Columbia, TN
Mayo Foundation	Rochester, MN
McLaren Health Care Corporation	Flint, MI
MedStar Health	Columbia, MD
Memorial Health Services	Long Beach, CA
MidMichigan Health	Midland, MI
Oakwood Healthcare, Inc.	Dearborn, MI
OhioHealth	Columbus, OH
PeaceHealth	Bellevue, WA
Premier Health Partners	Dayton, OH
Prime Healthcare Services, Inc.	Victorville, CA
Provena Health	Mokena, IL
Resurrection Health Care	Chicago, IL

Current study winners are listed in bold.

TABLE 4. (CONT.)	
SYSTEM NAME	**LOCATION**
Spectrum Health	Grand Rapids, MI
SSM Health Care	Saint Louis, MO
St. Mary's/Duluth Clinic Health System	Duluth, MN
Trinity Health	Novi, MI
University Hospitals Health System	Cleveland, OH
University of Pittsburgh Medical Center	Pittsburgh, PA
Via Christi Health System	Wichita, KS
Wheaton Franciscan Southeast Wisconsin	Glendale, WI

Current study winners are listed in bold.

APPENDIX A

100 Top Hospitals®: Health System Quality/Efficiency Benchmarks Winners and Their Member Hospitals

SYSTEM/HOSPITAL NAME	HOSPITAL LOCATION	HOSPITAL MEDICARE ID
Advocate Health Care, Oak Brook, IL		
EHS Trinity Hospital	Chicago, IL	140048
Advocate Northside Health System	Chicago, IL	140182
Christ Hospital	Oak Lawn, IL	140208
Advocate Lutheran General Hospital	Park Ridge, IL	140223
South Suburban Hospital	Hazelcrest, IL	140250
Good Samaritan Hospital	Downers Grove, IL	140288
Good Shepherd Hospital	Barrington, IL	140291
Catholic Healthcare Partners, Cincinnati, OH		
Lourdes Hospital	Paducah, KY	180102
Marcum & Wallace Memorial Hospital	Irvine, KY	181301
Mercy Hospital Anderson	Cincinnati, OH	360001
Mercy Hospital of Hamilton/Fairfield	Hamilton, OH	360056
Saint Elizabeth Health Center	Youngstown, OH	360064
St. Rita's Medical Center	Lima, OH	360066
St. Charles Hospital	Oregon, OH	360081
Mercy Medical Center	Springfield, OH	360086
Mercy Hospital Tiffin	Tiffin, OH	360089
St. Vincent Medical Center	Toledo, OH	360112
Mercy Franciscan Western Hills	Cincinnati, OH	360113
Saint Joseph's Health Center	Warren, OH	360161
Community Health Partners	Lorain, OH	360172
Community Hospital	Springfield, OH	360187
Mercy Franciscan Mt. Airy	Cincinnati, OH	360234
Clermont County Hospital	Batavia, OH	360236
Saint Anne Mercy Hospital	Toledo, OH	360262
Sisters of Mercy of Willard	Willard, OH	361310
Mercy Memorial Hospital	Urbana, OH	361312
St. Mary's Medical Center of Campbell County	La Follette, TN	440033
St. Mary's Jefferson Memorial Hospital	Jefferson City, TN	440056
St. Mary's Medical Center	Knoxville, TN	440120
Health Alliance of Greater Cincinnati, Cincinnati, OH		
University Hospital	Cincinnati, OH	360003
Jewish Hospital of Cincinnati	Cincinnati, OH	360016
Fort Hamilton Hospital	Hamilton, OH	360132

SYSTEM/HOSPITAL NAME	HOSPITAL LOCATION	HOSPITAL MEDICARE ID
HealthEast Care System, Saint Paul, MN		
HealthEast St. Joseph's Hospital	Saint Paul, MN	240063
HealthEast St. John's Hospital	Saint Paul, MN	240210
HealthEast Woodwinds Hospital	Saint Paul, MN	240213
Henry Ford Health System, Detroit, MI		
Henry Ford Macomb Hospital	Mount Clemens, MI	230047
Henry Ford Medical Centers	Detroit, MI	230053
Wyandotte General Hospital	Wyandotte, MI	230146
Bi-County Community Hospital	Warren, MI	230204
Kettering Health Network, Dayton, OH		
Kettering Memorial Hospital	Dayton, OH	360079
Grandview Hospital	Dayton, OH	360133
Sycamore Hospital	Miamisburg, OH	360239
OhioHealth, Columbus, OH		
Riverside Methodist Hospital	Columbus, OH	360006
Southern Ohio Medical Center	Portsmouth, OH	360008
Marion General	Marion, OH	360011
Grant Medical Center	Columbus, OH	360017
Doctors Hospital West	Columbus, OH	360152
Grady Memorial Hospital	Delaware, OH	360210
Doctor's Hospital Nelsonville	Nelsonville, OH	361305
Hardin Memorial Hospital	Kenton, OH	361315
Prime Healthcare Services, Inc., Victorville, CA		
West Anaheim Medical Center	Anaheim, CA	050426
Huntington Beach Hospital	Huntington Beach, CA	050526
La Palma Intercommunity Hospital	La Palma, CA	050580
Chino Valley Medical Center	Chino, CA	050586
Desert Valley Hospital	Victorville, CA	050709
Sherman Oaks Hospital & Health Center	Sherman Oaks, CA	050755
Trinity Health, Novi, MI		
Saint Agnes Medical Center	Fresno, CA	050093
Saint Alphonsus Regional Medical Center	Boise, ID	130007
Saint Joseph Regional Medical Center — South Bend	South Bend, IN	150012
Saint Joseph Regional Medical Center — Mishawaka	Mishawaka, IN	150029
Saint Joseph Regional Medical Center — Plymouth	Plymouth, IN	150076
Mercy Medical Center — North Iowa	Mason City, IA	160064
Mercy Medical Center — Dubuque	Dubuque, IA	160069
Mercy Medical Center	Clinton, IA	160080
Holy Cross Hospital	Silver Spring, MD	210004
St. Mary Mercy Hospital	Livonia, MI	230002
Mercy General Health Partner	Muskegon, MI	230004
St. Joseph Mercy — Oakland	Pontiac, MI	230029
Mercy Hospital — Port Huron	Port Huron, MI	230031
Mercy Hospital Grayling	Grayling, MI	230058

SYSTEM/HOSPITAL NAME	HOSPITAL LOCATION	HOSPITAL MEDICARE ID
Trinity Health, Novi, MI		
Saint Mary's Health Care	Grand Rapids, MI	230059
Hackley Hospital	Muskegon, MI	230066
St. Joseph Mercy Livingston Hospital	Howell, MI	230069
Battle Creek Health System	Battle Creek, MI	230075
Mercy Hospital Cadillac	Cadillac, MI	230081
St. Joseph Mercy Hospital	Ann Arbor, MI	230156
St. Joseph Mercy Saline Hospital	Saline, MI	230212
St. Ann's Hospital	Westerville, OH	360012
Mount Carmel Health	Columbus, OH	360035
University Hospitals Health System, Cleveland, OH		
UH Richmond Medical Center	Cleveland, OH	360075
UHHS/Bedford Medical Center	Bedford, OH	360115
University Hospitals of Cleveland	Cleveland, OH	360137
UHHS/Geauga Regional Hospital	Chardon, OH	360192
UH Conneaut Medical Center	Conneaut, OH	361308

APPENDIX B

Methodology Details

METHODS FOR IDENTIFYING COMPLICATIONS OF CARE

Risk-Adjusted Mortality Index Models

Without adjusting for differences, comparing outcomes among hospitals is like comparing the proverbial apples to oranges: hard, if not impossible, to do. To make valid normative comparisons of hospital outcomes, it is necessary to adjust raw data to accommodate for differences that result from the variety and severity of admitted cases. It is necessary also to account for individual facility characteristics that affect quality of care measures, such as the hospital's geographic location, size, teaching status, and community setting (urban versus rural).

We are able to make valid normative comparisons of mortality and complications rates by using patient-level data to control effectively for case mix and severity differences. We do this by evaluating ICD-9-CM diagnosis and procedure codes to adjust for severity within clinical case mix groupings. Conceptually, we group patients with similar characteristics (i.e., age, sex, principal diagnosis, procedures performed, admission type, and comorbid conditions) to produce expected, or normative, comparisons. In the same way, we group facilities with similar characteristics. Through extensive testing, we have found that this methodology produces valid normative comparisons using readily available administrative data, eliminating the need for additional data collection.

We construct a normative database of case-level data from our Projected Inpatient Data Base (PIDB) national all-payer database containing more than 20 million all-payer discharges annually, obtained from approximately 2,500 hospitals, representing more than 50 percent of all discharges from short-term, general, nonfederal hospitals in the United States. The data include age, sex, length of stay, diagnosis related groups (DRG) or refined diagnosis related groups (RDRG), ICD-9-CM principal and secondary diagnoses, ICD-9-CM principal and secondary procedures, hospital identification, admission source and type, and discharge status. Hospital characteristics are obtained by linking each hospital's identification number with American Hospital Association and Medicare Cost Report data.

From the model, we exclude long-term care facilities; psychiatric, rehabilitation, or other specialty facilities; and federally owned or controlled facilities. Excluded patient groups are newborns, cases coded as palliative care (ICD-9-CM code V66.7), cases transferred to other short-term hospitals, and cases with stays shorter than one day.

We use a standard logistic regression model to estimate the risk of mortality or complications for each patient. This is done by weighting the patient records of the client hospital by the logistic regression coefficients associated with the corresponding terms in the model and the intercept term. This produces the expected probability of an outcome for each eligible patient (numerator) based on the experience of the norm for patients with similar characteristics (age, clinical grouping, severity of illness, and so forth) at similar institutions (bed size, census division, teaching status, urban or rural community setting).[8-12] This methodology also ensures that facilities are compared to other facilities with similar characteristics.

Thomson Reuters staff physicians have suggested important clinical patient characteristics that were also incorporated into the models. After assigning the predicted probability of the outcome for each patient, the patient-level data can then be aggregated across a variety of groupings including hospital, service, or the DRGs and RDRGs classification systems, which were developed at Yale University in the 1980s.

Expected Complications Rate Index Models

Risk-adjusted complications refer to outcomes that may be of concern when they occur at a greater than expected rate among groups of patients, possibly reflecting systemic quality-of-care issues.

The Thomson Reuters complications model uses clinical qualifiers to identify complications that have probably occurred in the inpatient setting. Examples of expected complications include wound infections, postprocedural hemorrhage, and postoperative pneumonia.

A normative database of case-level data including age, sex, length of stay, clinical grouping (DRG or RDRG), comorbid conditions, and hospital identification is constructed using our national all-payer database. Hospital characteristics are obtained by linking each hospital's identification number with American Hospital Association and Medicare Cost Report data. The method includes patients from approximately 2,000 short-term, general, nonfederal hospitals that are generally representative of short-term, general, nonfederal hospitals in the United States. Excluded groups are neonates, cases transferred to other short-term hospitals, and cases with stays shorter than one day. Also, clinical groupings such as psychiatry/mental illness, substance abuse, rehabilitation, obstetrics, and pediatrics (under 17 years of age) require special consideration with regard to complications outcomes, and are thus excluded from the general risk-adjusted complications measure.

Complications rates are calculated from normative data for two patient risk groups: medical and surgical. A standard regression model is used to estimate the risk of experiencing a complication for each patient. This is done by weighting the patient records of the client hospital by the regression coefficients associated with the corresponding terms in the prediction models and intercept term. This method produces the expected probability of a complication for each patient based on the experience of the norm for patients with similar characteristics at similar institutions. After assigning the predicted probability of a complication for each patient in each risk group, it is then possible to aggregate the patient-level data across a variety of groupings.[13-16]

Patient Safety Indicators

AHRQ is a public health service agency within the federal government's Department of Health and Human Services. The agency's mission includes translating research findings into better patient care and providing policymakers and other healthcare leaders with information needed to make critical healthcare decisions. We use AHRQ's PSIs in calculating our risk-adjusted patient safety index performance measure. This information on PSIs is from the AHRQ Web site (www.ahrq.gov):

> "The AHRQ Quality Indicators measure healthcare quality by using readily available hospital inpatient administrative data. Patient Safety Indicators are a set of indicators providing information on potential in-hospital complications and adverse events following surgeries, procedures, and childbirth. The PSIs were developed after a comprehensive literature review, analysis of ICD-9-CM codes, review by a clinician panel, implementation of risk adjustment, and empirical analyses. The Patient Safety Indicators provide a perspective on patient safety events using hospital administrative data. Patient Safety Indicators also reflect quality of care inside hospitals, but focus on surgical complications and other iatrogenic events.[17] "

For the risk-adjusted patient safety index performance measure, we began our research with all PSIs that occurred with sufficient frequency to generate provider-specific output. Of these 20 PSIs, only 15 produced nonzero PSI rates on the Medicare data. Four measures are for birth or other obstetrical-related conditions, which do not occur in the age group under study here. Transfusion reactions generated rates that were too low for the AHRQ PSI software to generate provider-specific output. Due to the unreliability of E coding, we also excluded complications of anesthesia (PSI 1), foreign body left in during procedure (PSI 5), postoperative hip fracture (PSI 8), and accidental puncture and laceration (PSI 15), which rely on E codes. Since the original analysis was done, PSI 2 (death in low-mortality DRGs) no longer has risk values in the model. This year, we also have excluded decubitis ulcer (PSI 3) and postoperative pulmonary embolism or deep vein thrombosis (PSI 12) because our research shows they are primarily present on admission.

The final set of eight PSIs included in this study:

- Failure to rescue (PSI 4)
- Iatrogenic pneumothorax (PSI 6)
- Selected infections due to medical care (PSI 7)
- Postoperative hemorrhage or hematoma (PSI 9)
- Postoperative physiologic and metabolic derangement (PSI 10)
- Postoperative respiratory failure (PSI 11)
- Postoperative sepsis (PSI 13)
- Postoperative wound dehiscence in abdominopelvic surgical patients (PSI 14)

For each of the eight included PSIs, we calculated an index value based on the aggregate number of actual PSI occurrences for 2006 and 2007 combined, for all hospitals in each system, divided by the aggregate number of normalized expected occurrences, given the risk of the PSI event for each patient. Values were normalized by comparison group. The hospital-level PSI methodology from AHRQ was applied to the 2006 and 2007 MedPAR acute-care data, using the program code provided by AHRQ to adjust for risk.[2]

We based the scoring on the difference between the observed and expected number of patients with PSI events for each of the eight selected PSIs, expressed in standard-deviation units (z-score).[6,7] A mean z-score was developed as an aggregate PSI score. Z-scores were normalized by hospital class, based on the hospitals within each system. Health systems with the fewest observed PSIs relative to the number expected, accounting for binomial variability, received the most favorable scores. We used two years of MedPAR data (2006 and 2007) to reduce the influence of chance fluctuation. Health systems with aggregate values that were extreme high outliers were not eligible to be named study winners (see "Eliminating Outliers" on page 10).

ECRI and PSI: Complementary Methodologies

Given its high level of importance, we chose to increase our emphasis on patient safety by using both the PSI and expected complications rate index (ECRI) methodologies. Both PSI and ECRI are methodologies for identifying complications of care. Although the definitions have some similarities, there are enough differences that make the two complementary. ECRI is an overall complication methodology in which the outcome is the occurrence of one or more of 48 complications of care. Whereas the AHRQ PSIs used in our study are based on eight separate models that evaluate the occurrence of eight distinct complications of care, one of which is mortality related — an adverse outcome that is not included in ECRI.

Index Interpretation

An outcome index is a ratio of an observed number of outcomes to an expected number of outcomes in a particular population. This index is used to make normative comparisons and is standardized in that the expected number of events is based on the occurrence of the event in a normative population. The normative population used to calculate expected numbers of events is selected to be similar to the comparison population with respect to relevant characteristics including age, sex, region, and case mix.

The index is simply the number of observed events divided by the number of expected events and can be calculated for outcomes that involve counts of occurrences (e.g., deaths or complications). Interpretation of the index relates the experience of the comparison population relative to a specified event to the expected experience based on the normative population.

Examples:
10 events observed ÷ 10 events expected = 1.0:
The observed number of events is equal to the expected number of events based on the normative experience.

10 events observed ÷ 5 events expected = 2.0:
The observed number of events is twice the expected number of events based on the normative experience.

10 events observed ÷ 25 events expected = 0.4:
The observed number of events is 60 percent lower than the expected number of events based on the normative experience.

Therefore, an index value of 1.0 indicates no difference between observed and expected outcome occurrence. An index value greater than 1.0 indicates an excess in the observed number of events relative to the expected based on the normative experience. An index value less than 1.0 indicates fewer events observed than would be expected based on the normative experience. An additional interpretation is that the difference between 1.0 and the index is the percentage difference in the number of events relative to the norm. In other words, an index of 1.05 indicates 5 percent more outcomes than expected, and an index of 0.90 indicates 10 percent fewer outcomes than expected based on the experience of the norm. The index can be calculated across a variety of groupings (e.g., hospital, service, and DRG).

CORE MEASURES

Core Measures were developed by the National Quality Forum as minimum basic care standards. They are a widely accepted method for measuring patient care quality that includes specific guidelines for heart attack (acute myocardial infarction or AMI), congestive heart failure (CHF), pneumonia, pregnancy and related conditions, and surgical infection prevention. Our core measures score is based on the AMI, CHF, pneumonia, and surgical infection prevention areas of this program, using hospital compare data reported on the Centers for Medicare and Medicaid Services (CMS) Web site.

In this study, we have included all 24 available core measures. The comparison group median core-measures value was substituted for a missing core measure. In addition, the comparison group median core-measures value was substituted when the hospital reported core measures with patient counts less than or equal to 25 or with Relative Standard Error values greater than or equal to 0.30. This was done because the original reported values were considered statistically unreliable.

AMI Core Measures

1. Patients given ACE inhibitor or angiotensin II receptor blocker (ARB) for left ventricular systolic dysfunction
2. Patients given aspirin at arrival
3. Patients given aspirin at discharge
4. Patients given beta blocker at arrival
5. Patients given beta blocker at discharge
6. Patients given PCI within 90 minutes of arrival
7. Patients given smoking cessation counseling
8. Patients given fibrinolytic medication within 30 minutes of arrival

CHF Core Measures

9. Patients given ACE inhibitor or ARB for left ventricular systolic dysfunction
10. Patients given discharge instructions
11. Patients given assessment of left ventricular function
12. Patients given smoking cessation counseling

Pneumonia Core Measures

13. Patients given oxygenation assessment
14. Patients whose initial emergency room blood culture was performed prior to the administration of the first hospital dose of antibiotics
15. Patients given the most appropriate initial antibiotic(s)
16. Patients assessed and given pneumococcal vaccination
17. Patients given initial antibiotic(s) within six hours of arrival
18. Patients given smoking cessation counseling
19. Patients assessed and given influenza vaccination

Surgical Infection Prevention Core Measures

20. Patients who received preventive antibiotics one hour before incision
21. Patients whose preventive antibiotic(s) were stopped within 24 hours after surgery
22. Patients who received the appropriate preventive antibiotics for their surgery
23. Patients who received treatment to prevent blood clots within 24 hours before or after selected surgeries
24. Patients whose doctors ordered treatments to prevent blood clots (venous thromboembolism) for certain types of surgeries

LENGTH OF STAY WEIGHT METHODOLOGIES

Grouper-based methodologies allow us to produce risk-adjusted performance comparisons on length of stay (LOS) between or across virtually any arbitrary subgroup of inpatients. These patient groupings can be based on DRGs, hospitals, product lines, geographic regions, physicians, etc. The grouper adjusts for differences in diagnosis type and illness severity. A grouper and its associated LOS weights allow group comparisons on a national level, and in a specific market area. Grouper-based weights are calculated for LOS from the largest and most representative inpatient database in existence.

Normalized LOS Weights

LOS weights are calculated for RDRGs using our nationally representative PIDB, which contains more than 20 million inpatient discharges annually. RDRG weights for Medicare patients are calculated by dividing the average LOS for each RDRG by the average LOS of all Medicare patients in the universe of short-term, general, nonfederal hospitals in the U.S.

WHY WE HAVE NOT CALCULATED PERCENT CHANGE IN SPECIFIC INSTANCES

Percent change is a meaningless statistic when the underlying quantity can be positive, negative, or zero. The actual change may mean something, but dividing it by a number that may be zero or of the opposite sign does not convey any meaningful information because the amount of change is not proportional to its previous value.[18]

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2. See AHRQ Quality Indicators — Guide to Patient Safety Indicators. Rockville, MD: Agency for Healthcare Research and Quality, 2003. Version 3.1, (March 2007). AHRQ Pub.03-R203. For a description of the AHRQ PSI methodology, see www.ahrq.gov.

3. See CMS Hospital Compare Web site: *http://www.cms.hhs.gov/HospitalQualityInits/25_HospitalCompare.asp#TopOfPage*.

4. We obtain ACGME program involvement data annually from the American Medical Association (AMA). This year's study is based on the ACGME file received from the AMA on April 30, 2007.

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