TRUVEN HEALTH ANALYTICS

100 TOP HOSPITALS

# 100 Top Hospitals Study Overview, 2015

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Truven Health 100 Top Hospitals,® Study Overview, 22nd Edition


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# Introduction

## 100 Top Hospitals: The Road to Healthcare Excellence

The annual Truven Health 100 Top Hospitals® study uses independent, quantitative research that identifies U.S. hospitals with the best overall performance across multiple organizational metrics. To maintain the study's high level of integrity and eliminate bias, only quantifiable public data sources are used for calculating outcome metrics. This ensures inclusion of all hospitals across the country, and facilitates consistency of definitions and data. Hospitals do not apply for consideration, and winners do not pay for use of the 100 Top Hospitals title.

The 100 Top Hospitals National Balanced Scorecard, based on Norton and Kaplan's concept, is the foundation of our research, and is comprised of key measures of organizational functions and outcomes. These are: financial stability, operational efficiency, patient safety, quality inpatient and outpatient care, and customer perception of care. The summary and resulting score reflect the highest levels of unbiased excellence in hospital leadership.

The healthcare industry is changing quickly, and winners of the 100 Top Hospitals designation demonstrate how effective leaders manage change and achieve excellence in a dynamic environment. Winners consistently set industry benchmarks for critical performance measures like 30-day readmissions, mortality rates, customer perception of care, and profit margins.

### Distinctive Leadership in a Time of Transformation

For 22 years, the 100 Top Hospitals program has collaborated with top academics to uncover the impact organizational leadership has on the performance and best practices within the nation's top healthcare organizations. Those studies have found that leadership excellence is essential for superior performance and delivery of high value to community stakeholders. The 100 Top Hospitals program applies performance measures across multiple domains, knowing that assessing performance at a single point in time is an inadequate way to evaluate consistency or a trajectory for future standings.

This methodology creates an integrated program that identifies long-term rates of improvement, providing a clear picture of how innovative leaders can transform the performance of the entire organization over time by adjusting organizational goals for key performance domains. Higher composite scores on the 100 Top Hospitals National Balanced Scorecard reflect more effective leadership and consistent delivery of high value to communities. This approach, coupled with our objective insights into the effectiveness of hospital leadership, is what makes the 100 Top Hospitals program unique — and the standard for measuring quality of care in the United States.

## New Metric Finding

This year we added Medicare spend per beneficiary (MSPB) to the scorecard. Medicare spend is a Centers for Medicare & Medicaid Services (CMS) metric and a proxy for the cost of an episode of care for Medicare patients (including indemnity-type Medicare episodes only and not Medicare Advantage). These enhancements and efforts to continually expand the National Balanced Scorecard ensure that it reflects executives' efforts to transform the delivery system and manage the full continuum of care, including the prominent shift from inpatient to outpatient utilization.

## Equal Consideration for Hospitals in Each Category

Because different types of hospitals perform at varying levels for each metric, the 100 Top Hospitals study divides the nation's hospitals into five categories (teaching, major teaching, small community, medium community, and large community). This ensures that the benchmarks are comparable and actionable across each organization type. Each type of hospital has its own inherent set of specific challenges and opportunities, and each category requires a different level of risk tolerance.

Health systems, accountable care organizations (ACOs), and insurance networks in today's healthcare environment all continue to expect consistent outcomes and expanded transparency, regardless of hospital type — and this is only magnified by the Affordable Care Act (ACA).

While hospital types differ, our studies demonstrate year after year that leaders at the nation's best-performing hospitals are the ones who work to transform and adapt in order to meet the challenges of their respective industry categories. They use evidence-based management, driven by objective data and analytics, to help prevent the acceptance of performance patterns that, while traditional, have proven to be unnecessary or detrimental to progress. They evaluate all resources to drive new practice patterns in their categories and set targets for performance improvement initiatives.

## How Winners Compare to Their Industry Peers

Using the measures presented in our National Balanced Scorecard, this year's 100 Top Hospitals study reveals significant differences between award winners and their nonwinning peers.

The nation's best hospitals:

- Have a lower mortality index considering patient severity
- Have fewer patient complications
- Avoid adverse patient safety events
- Follow accepted care protocols
- Have lower mortality and 30-day readmission rates
- Keep expenses low
- Send patients home sooner
- Score better on patient satisfaction surveys

## The Standard of Excellence

The industry is transforming, and the ability of winning hospital leadership to adapt in kind shows why 100 Top Hospitals winners set the standards their peers seek to achieve.

In fact, study projections indicate that if the new national benchmarks of high performance were achieved by all hospitals in the U.S.:

- Nearly 126,500 additional lives could be saved
- Nearly 109,000 additional patients could be complication-free
- $1.8 billion in inpatient costs could be saved
- The typical patient could be released from the hospital half a day sooner
- Episode-of-illness expense would be 2 percent lower than the peer median

This analysis, conducted by comparing study winners with a peer group of nonwinners, is based only on Medicare patients included in this study. If the same standards were applied to all inpatients, the impact would be even greater.

Since 1993, 100 Top Hospitals award winners have proven that better care and operational efficiency can be achieved simultaneously — even during tumultuous industry change. That tradition continues this year.

## The Versatility of the 100 Top Hospitals Program

To increase understanding of trends in specific areas of the industry, the 100 Top Hospitals program includes a range of studies and reports:

- 100 Top Hospitals and Everest Award studies, highly anticipated research that annually recognizes the best hospitals in the nation based on overall organizational performance, as well as long-term rates of improvement
- 50 Top Cardiovascular Hospitals, an annual study identifying hospitals that demonstrate the highest performance in hospital cardiovascular services
- 15 Top Health Systems, a groundbreaking study introduced in 2009 that provides an objective measure of health system performance as a sum of its parts
- The 100 Top Hospitals Performance Matrix, a two-dimensional analysis — available for nearly all U.S. hospitals — that provides a clear view of how long-term improvement and current performance overlap and compare with national peers
- A variety of custom benchmark reports designed to help executives understand how their performance compares with their peers within health systems, states, and markets

You can read more about these studies and see lists of all winners by visiting **100tophospitals.com**.

## About Truven Health Analytics

At Truven Health Analytics,™ we're dedicated to delivering the answers our clients need to improve healthcare quality and access, and reduce costs. Our unmatched data assets, technology, analytic expertise, and comprehensive perspective have served the healthcare industry for more than 30 years. Everyday our insights and solutions give hospitals and clinicians, employers and health plans, state and federal government, life sciences researchers, and policymakers the confidence they need to make the right decisions.

Truven Health Analytics owns some of the most trusted brands in healthcare, such as Micromedex, ActionOI, 100 Top Hospitals, MarketScan, and Advantage Suite. Truven Health has its principal offices in Ann Arbor, Mich.; Chicago; and Denver. For more information, please visit **truvenhealth.com**.

# Award Winners

Truven Health Analytics™ is proud to present the 2015 Truven Health 100 Top Hospitals® award winners. We stratify winners by five separate peer comparison groups: major teaching, teaching, large community, medium community, and small community hospitals.

To see a full list of *Winners Through the Years,* please *visit* **100tophospitals.com/studies_and_winners/100_top_hospitals**.

| Major Teaching Hospitals* | | | |
|---|---|---|---|
| **Hospital** | **Location** | **Medicare ID** | **Total Year(s) Won** |
| Advocate Christ Medical Center | Oak Lawn, IL | 140208 | Seven |
| Advocate Illinois Masonic Medical Center | Chicago, IL | 140182 | Six |
| Advocate Lutheran General Hospital | Park Ridge, IL | 140223 | Sixteen |
| **Christiana Care Health System** | Newark, DE | 080001 | Three |
| Duke University Hospital | Durham, NC | 340030 | Three |
| Emory University Hospital | Atlanta, GA | 110010 | Two |
| Froedtert & the Medical College of Wisconsin | Milwaukee, WI | 520177 | Three |
| **OhioHealth Doctors Hospital** | Columbus, OH | 360152 | Five |
| **Providence Hospital and Medical Center** | Southfield, MI | 230019 | Seven |
| Rush University Medical Center | Chicago, IL | 140119 | Two |
| St. Joseph Mercy Hospital | Ann Arbor, MI | 230156 | Seven |
| St. Luke's University Hospital - Bethlehem | Bethlehem, PA | 390049 | Three |
| Stanford Hospital | Stanford, CA | 050441 | Two |
| UC San Diego Medical Center | San Diego, CA | 050025 | Four |
| University of Michigan Hospitals & Health Centers | Ann Arbor, MI | 230046 | Nine |

*Everest Award winners are bolded.

| Teaching Hospitals* | | | |
|---|---|---|---|
| **Hospital** | **Location** | **Medicare ID** | **Total Year(s) Won** |
| Abbott Northwestern Hospital | Minneapolis, MN | 240057 | Two |
| **Aspirus Wausau Hospital** | Wausau, WI | 520030 | Three |
| Banner Boswell Medical Center | Sun City, AZ | 030061 | Five |
| Billings Clinic Hospital | Billings, MT | 270004 | Three |
| Kettering Medical Center | Kettering, OH | 360079 | Eleven |
| LDS Hospital | Salt Lake City, UT | 460006 | Two |
| McKay-Dee Hospital Center | Ogden, UT | 460004 | Five |
| Mercy Medical Center | Cedar Rapids, IA | 160079 | Three |
| Meriter Hospital | Madison, WI | 520089 | Three |
| Mission Hospital | Asheville, NC | 340002 | Seven |
| North Colorado Medical Center | Greeley, CO | 060001 | Four |
| **OhioHealth Riverside Methodist Hospital** | Columbus, OH | 360006 | Twelve |
| PIH Health Hospital | Whittier, CA | 050169 | Three |
| Poudre Valley Hospital | Fort Collins, CO | 060010 | Nine |
| Riverside Medical Center | Kankakee, IL | 140186 | Six |
| Rose Medical Center | Denver, CO | 060032 | Eight |
| Saint Thomas West Hospital | Nashville, TN | 440082 | Fourteen |
| Saint Vincent Hospital | Worcester, MA | 220176 | Six |
| Scottsdale Healthcare Osborn Medical Center | Scottsdale, AZ | 030038 | One |
| Scripps Green Hospital | La Jolla, CA | 050424 | Eight |
| St. Cloud Hospital | St. Cloud, MN | 240036 | Nine |
| St. Luke's Hospital | Cedar Rapids, IA | 160045 | Six |
| St. Vincent Indianapolis Hospital | Indianapolis, IN | 150084 | Eight |
| **Sutter Medical Center, Sacramento** | Sacramento, CA | 050108 | Five |
| Virginia Hospital Center | Arlington, VA | 490050 | Three |

*Everest Award winners are bolded.

## Large Community Hospitals*

| Hospital | Location | Medicare ID | Total Year(s) Won |
|---|---|---|---|
| **Advocate Condell Medical Center** | Libertyville, IL | 140202 | Two |
| Advocate Good Samaritan Hospital | Downers Grove, IL | 140288 | Six |
| Asante Rogue Regional Medical Center | Medford, OR | 380018 | Three |
| Beverly Hospital | Beverly, MA | 220033 | Seven |
| Centinela Hospital Medical Center | Inglewood, CA | 050739 | Four |
| Central DuPage Hospital | Winfield, IL | 140242 | Eight |
| **Delray Medical Center** | Delray Beach, FL | 100258 | Six |
| **Hamilton Medical Center** | Dalton, GA | 110001 | Three |
| Houston Methodist Willowbrook Hospital | Houston, TX | 450844 | One |
| **Little Company of Mary Hospital** | Evergreen Park, IL | 140179 | One |
| Mercy Hospital | Coon Rapids, MN | 240115 | Four |
| Mercy Hospital Springfield | Springfield, MO | 260065 | Four |
| **Mosaic Life Care** | Saint Joseph, MO | 260006 | One |
| Paradise Valley Hospital | National City, CA | 050024 | Two |
| Providence Little Company of Mary Medical Center | Torrance, CA | 050353 | Five |
| Roper Hospital | Charleston, SC | 420087 | One |
| St. David's Medical Center | Austin, TX | 450431 | Six |
| St. Francis Downtown | Greenville, SC | 420023 | Two |
| Stormont-Vail HealthCare | Topeka, KS | 170086 | One |
| West Florida Hospital | Pensacola, FL | 100231 | Two |

*Everest Award winners are bolded.

## Medium Community Hospitals*

| Hospital | Location | Medicare ID | Total Year(s) Won |
|---|---|---|---|
| Aurora BayCare Medical Center | Green Bay, WI | 520193 | Two |
| Blanchard Valley Hospital | Findlay, OH | 360095 | Three |
| Chino Valley Medical Center | Chino, CA | 050586 | Four |
| Desert Valley Hospital | Victorville, CA | 050709 | Eight |
| Dupont Hospital | Fort Wayne, IN | 150150 | Two |
| French Hospital Medical Center | San Luis Obispo, CA | 050232 | Two |
| Garden Grove Hospital Medical Center | Garden Grove, CA | 050230 | Four |
| Holland Hospital | Holland, MI | 230072 | Ten |
| **Houston Methodist Sugar Land Hospital** | Sugar Land, TX | 450820 | One |
| Lawrence Memorial Hospital | Lawrence, KS | 170137 | Three |
| Logan Regional Hospital | Logan, UT | 460015 | Five |
| Maple Grove Hospital | Maple Grove, MN | 240214 | Two |
| **Mercy Hospital Anderson** | Cincinnati, OH | 360001 | Eleven |
| Shasta Regional Medical Center | Redding, CA | 050764 | Three |
| St. David's Round Rock Medical Center | Round Rock, TX | 450718 | Two |
| St. John Medical Center | Westlake, OH | 360123 | One |
| St. Vincent Carmel Hospital | Carmel, IN | 150157 | Three |
| Sycamore Medical Center | Miamisburg, OH | 360239 | Six |
| Timpanogos Regional Hospital | Orem, UT | 460052 | One |
| West Valley Medical Center | Caldwell, ID | 130014 | Two |

*Everest Award winners are bolded.

| Small Community Hospitals* | | | |
|---|---|---|---|
| **Hospital** | **Location** | **Medicare ID** | **Total Year(s) Won** |
| Aurora Medical Center Oshkosh | Oshkosh, WI | 520198 | One |
| Barnes-Jewish West County Hospital | Saint Louis, MO | 260162 | One |
| Buffalo Hospital | Buffalo, MN | 240076 | Four |
| **Fort Madison Community Hospital** | Fort Madison, IA | 160122 | Three |
| **Greer Memorial Hospital** | Greer, SC | 420033 | One |
| Hill Country Memorial Hospital | Fredericksburg, TX | 450604 | Five |
| Lakeview Hospital | Bountiful, UT | 460042 | Five |
| Mercy Defiance Hospital | Defiance, OH | 360270 | One |
| OhioHealth Dublin Methodist Hospital | Dublin, OH | 360348 | Four |
| Parkview Huntington Hospital | Huntington, IN | 150091 | Three |
| **Renown South Meadows Medical Center** | Reno, NV | 290049 | One |
| Riverton Hospital | Riverton, UT | 460058 | Two |
| Sacred Heart Hospital on the Emerald Coast | Miramar Beach, FL | 100292 | Five |
| Samaritan Regional Health System | Ashland, OH | 360002 | Two |
| St. Francis Regional Medical Center | Shakopee, MN | 240104 | Two |
| **St. Joseph's Hospital Breese** | Breese, IL | 140145 | Two |
| Sutter Tracy Community Hospital | Tracy, CA | 050313 | One |
| Tanner Medical Center-Villa Rica | Villa Rica, GA | 110015 | Four |
| Valley View Medical Center | Cedar City, UT | 460007 | Six |
| Woodwinds Health Campus | Woodbury, MN | 240213 | Five |

*Everest Award winners are bolded.

# The Everest Award

## The Truven Health 100 Top Hospitals® Everest Award honors hospitals that have both the highest current performance and the fastest long-term improvement.

This award recognizes the boards, executives, and medical staff leaders who developed and executed the transformative strategies that drove the highest rates of improvement, resulting in the highest performance in the U.S. at the end of five years.

The Everest Award winners are a special group of the 100 Top Hospitals award winners that, in addition to achieving benchmark status for one year, have simultaneously set national benchmarks for the fastest long-term improvement on our National Balanced Scorecard. In 2015, only 17 organizations achieved this exceptional level of performance.

### The 2015 Everest Award Winners

Truven Health Analytics™ is proud to present the winners of the Truven Health 100 Top Hospitals Everest Award.

| 2015 Everest Award Winners | | | |
|---|---|---|---|
| **Hospital** | **Location** | **Medicare ID** | **Total Year(s) Won** |
| Advocate Condell Medical Center | Libertyville, IL | 140202 | Two |
| Aspirus Wausau Hospital | Wausau, WI | 520030 | One |
| Christiana Care Health System | Newark, DE | 080001 | One |
| Delray Medical Center | Delray Beach, FL | 100258 | Two |
| Fort Madison Community Hospital | Fort Madison, IA | 160122 | One |
| Greer Memorial Hospital | Greer, SC | 420033 | One |
| Hamilton Medical Center | Dalton, GA | 110001 | One |
| Houston Methodist Sugar Land Hospital | Sugar Land, TX | 450820 | One |
| Little Company of Mary Hospital | Evergreen Park, IL | 140179 | One |
| Mercy Hospital Anderson | Cincinnati, OH | 360001 | One |
| Mosaic Life Care | Saint Joseph, MO | 260006 | One |
| OhioHealth Doctors Hospital | Columbus, OH | 360152 | One |
| OhioHealth Riverside Methodist Hospital | Columbus, OH | 360006 | Three |
| Providence Hospital and Medical Center | Southfield, MI | 230019 | Two |
| Renown South Meadows Medical Center | Reno, NV | 290049 | One |
| St. Joseph's Hospital Breese | Breese, IL | 140145 | Two |
| Sutter Medical Center, Sacramento | Sacramento, CA | 050108 | One |

## Value to the Healthcare Industry

Leaders making critical decisions in an increasingly transparent environment must have more sophisticated intelligence that provides clearer insight into the complexity of changing organizational performance. Being good today is not good enough. Leaders must also balance short- and long-term goals to drive continuous gains in performance and value.

Transparency presents hospital boards and CEOs with a very public challenge to increase the value of core services to their communities. Providing real value is not a one-time event — it is a continuous process of increasing worth over time. We provide unique insights into making smarter decisions that help hospitals achieve these objectives, by comparing individual hospital performance with integrated national benchmarks for highest achievement and fastest improvement.

Integrating national benchmarks for highest achievement with those for fastest long-term improvement radically increases the value of objective business information available for strategy development and decision-making. Comparing hospital or health system performance to these integrated benchmarks allows leaders to review the effectiveness of the long-term strategies that led to current performance. This integrated information enables boards and CEOs to better answer multidimensional questions, such as:

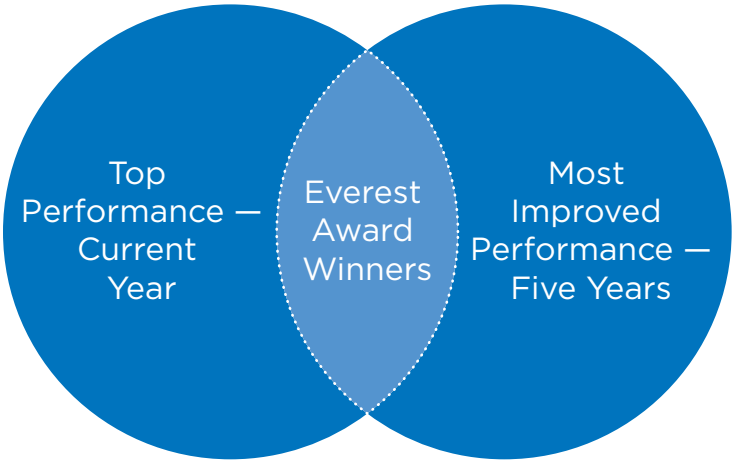
- Did our long-term strategies result in a stronger hospital across all performance areas?
- Did our strategies drive improvement in some areas but inadvertently cause deteriorating performance in others?
- What strategies will help us increase the rate of improvement in the right areas to come closer to national performance levels?
- What incentives do we need to implement for management to achieve the desired improvement more quickly?
- Will the investments we're considering help us achieve improvement goals?
- Can we quantify the long- and short-term increases in value our hospital has provided to our community?

## How We Select the Everest Award Winners

Winners of the 100 Top Hospitals Everest Award are setting national benchmarks for both long-term (three- to five-year) improvement and highest one-year performance on the study's balanced scorecard. Everest Award winners are selected from among the new 100 Top Hospitals award winners. The national award and the Everest Award are based on a set of measures that reflect highly effective performance across the whole organization.

Our methodology for selecting the Everest Award winners can be summarized in three main steps:

1. Selecting the annual 100 Top Hospitals award winners using our objective methodology,* based on publicly available data and a balanced scorecard of performance measures using the most current data available (2013 at the time of this study)
2. Using our five-year (2009-2013) trending methodology to select the 100 hospitals that have shown the fastest, most consistent improvement rates on the same balanced scorecard of performance measures
3. Identifying those hospitals that ranked in the top 100 on both lists. These hospitals are the Everest Award winners




Combining these two methodologies yields a very select group of Everest Award winners; the number of winners will vary every year, based solely on performance in the two dimensions.

## Data Sources

As with all of the 100 Top Hospitals awards, our methodology is objective, and all data come from trusted public sources. We build a database of short-term, acute care, nonfederal U.S. hospitals that treat a broad spectrum of patients. The primary data sources are the Medicare Provider Analysis and Review (MEDPAR) patient claims dataset, the Centers for Medicare & Medicaid Services (CMS) Hospital Compare hospital performance dataset, and the Hospital Cost Report Information System (HCRIS) Medicare cost report file. We use the most recent five years of data available for trending and the most current year for selection of winners.†

*For full details on how the 100 Top Hospitals winners are selected, please see the Methodology section of this document.
†Hospital inpatient mortality, complications, and patient safety are based on two years of data combined for each study year data point. See the Performance Measures section for details.

Residency program information, used in classifying teaching hospitals, is from the American Medical Association (Accreditation Council for Graduate Medical Education (ACGME)-accredited programs) and the American Osteopathic Association (AOA).

After excluding hospitals with data that would skew study results (i.e., specialty hospitals), we have a database study group of nearly 2,800 hospitals.

## Comparison Groups

Because bed size and teaching status have a profound effect on the types of patients a hospital treats and the scope of services it provides, we assigned each hospital in our study database to one of five comparison groups, or classes, according to its size and teaching status (for definitions of each group, see the Methodology section):

- Major Teaching Hospitals
- Teaching Hospitals
- Large Community Hospitals
- Medium Community Hospitals
- Small Community Hospitals

To judge hospitals fairly and compare them to like hospitals, we use these classes for all scoring and ranking to determine winners. For more information on how we build the database, please see the Methodology section of this document.

## Performance Measures

Both the 100 Top Hospitals and the Everest awards are based on a set of measures that assess balanced performance across the whole organization, reflecting the leadership effectiveness of board members, medical staff, management, and nursing. These measures fall into five domains of performance: clinical quality, extended outcomes, operational efficiency, financial health, and patient assessment of care.

The 11 measures used to select the 2015 winners are:

1. Risk-adjusted mortality index (in-hospital)
2. Risk-adjusted complications index
3. Risk-adjusted patient safety index
4. Core measures mean percent
5. 30-day risk-adjusted mortality rate for acute myocardial infarction (AMI), heart failure (HF), and pneumonia (PNEU)
6. 30-day risk-adjusted readmission rate for AMI, heart failure, pneumonia, and hip/knee arthroplasty
7. Severity-adjusted average length of stay
8. Case mix- and wage-adjusted inpatient expense per discharge
9. Medicare spend per beneficiary index
10. Adjusted operating profit margin
11. HCAHPS score (patient rating of overall hospital performance)

For full details, including calculation and scoring methods, please see the Methodology section.

We use present-on-admission (POA) data in our proprietary risk models. Because POA coding did not become available until the 2009 MEDPAR dataset, in-hospital mortality, complications, patient safety, and length of stay are based on only four years of data (2009–2013). All other measures are based on five years of data.

For the in-hospital mortality, complications, and patient safety — clinical measures with low frequency of occurrence — we combine two years of data for each study year to stabilize results. This year, we combined as follows:

- Study year 2013 = 2013 and 2012 MEDPAR datasets
- Study year 2012 = 2012 and 2011 MEDPAR datasets
- Study year 2011 = 2011 and 2010 MEDPAR datasets
- Study year 2010 = 2010 and 2009 MEDPAR datasets

For specific data years used for each measure, please see page 41 of the Methodology section.

## Ranking and Five-Year Trending Summary

To select the 100 Top Hospitals award winners, we rank hospitals on the basis of current-year performance on each of the study measures relative to other hospitals in their comparison group. We then sum each hospital's performance-measure rankings and re-rank them, overall, to arrive at a final rank for the hospital. The hospitals with the best final ranks in each comparison group are selected as the 100 Top Hospitals award winners. See the Methodology section for details on the ranking methodology, including measures, weighting, and selection of 100 Top Hospitals winners.

Separately, for every hospital in the study, we calculate a t-statistic that measures five-year performance improvement for each of the included performance measures. This statistic measures both the direction and magnitude of change in performance, and the statistical significance of that change. We rank hospitals on the basis of their performance improvement t-statistic on each of the study measures relative to other hospitals in their comparison group. We then sum each hospital's performance-measure rankings and re-rank them overall, to arrive at a final rank for the hospital. The hospitals with the best final rank in each comparison group are selected as the performance improvement benchmark hospitals. See the Methodology section for details on trending, including measure weighting.

As our final step, we find those hospitals that are identified as benchmarks on both lists. These hospitals are the Everest Award winners.

# Findings

The Truven Health 100 Top Hospitals® sheds an important light on how the best hospitals in the country operate. These healthcare industry leaders have successfully balanced the fine line between running lean operations every day, and being innovative and forward-thinking in ways that grow their organizations over the short and long term. The study is more than a list of accomplishments — it's a method for all U.S. hospital and health system leaders to guide their own performance improvement initiatives. By highlighting what the highest-performing leaders around the country are doing well, we are creating aspirational benchmarks for the rest of the industry.

Through the years, the body of published research proving the validity and stability of the 100 Top Hospitals program has continued to grow.[1–27] There's no better way to see how the nation's health and the industry's bottom lines could be improved than by aggregating the winner-versus-nonwinner data from this study.

Based on comparisons between the 100 Top Hospitals study winners and a peer group of similar high-volume hospitals that were not winners, we found that if all hospitals performed at the level of this year's winners:

- Nearly 126,500 additional lives could be saved
- Nearly 109,000 additional patients could be complication-free
- $1.8 billion inpatient costs could be saved
- The typical patient could be released from the hospital a half a day sooner and would have 2-percent fewer expenses related to the complete episode of care than the median patient in the U.S.

We based this analysis on the Medicare patients included in this study. If the same standards were applied to all inpatients, the impact would be even greater.

## How the Winning Hospitals Compare to Their Peers

In this section, we show how the 100 Top Hospitals performed within their comparison groups, or classes (major teaching and teaching hospitals; and large, medium, and small community hospitals), compared with nonwinning peers. For performance measure details and definitions of each comparison group, please see the Methodology section.

Please note: in Tables 1-6, data for the 100 Top Hospitals award winners are labeled Benchmark, and data for all hospitals, excluding award winners, are labeled Peer Group. In columns labeled Benchmark Compared With Peer Group, we calculate the actual and percentage difference between the benchmark hospital scores and the peer group scores.

### 100 Top Hospitals Have Better Survival Rates*

- Overall, the winners have 6 percent fewer deaths than expected, considering patient severity, while their nonwinning peers have as many deaths as would be expected (Table 1).
- Small community hospitals have the most dramatic difference between winners and nonwinners. The winning small hospital median mortality rate is 8.4 percent lower than nonwinning peers. (Table 6).
- Medium-sized community hospitals also have a significantly lower median mortality index than nonwinning peer hospitals, with a 7.7-percent lower index (Table 5).

### 100 Top Hospitals Have Fewer Patient Complications*

- Patients at the winning hospitals have 6 percent fewer complications than expected, considering patient severity, while their nonwinning peers have only 2 percent fewer complications than expected (Table 1).
- Medium-sized community hospitals have the most dramatic difference between winners and nonwinners. Winning hospitals have a median complications index that is 19.4 percent lower than nonwinning hospitals (Table 5).

### 100 Top Hospitals Are Successfully Avoiding Adverse Patient Safety Events*

- A patient safety index (PSI) of 0.84 tells us that the winning hospitals have
- 16 percent fewer adverse patient safety events than expected. Their peers have 6 percent fewer adverse events than expected (Table 1).
- Small- and medium-sized community hospitals have the most dramatic differences between winners and nonwinners. Medium-sized winning hospitals have a median PSI that is 31.2 percent lower than nonwinning hospitals, and small-sized winning hospitals have a median index 20.2 percent lower (Tables 5 and 6).

*Risk-adjusted measures are normalized by comparison group, so results cannot be compared across comparison groups.

## 100 Top Hospitals Follow Accepted Care Protocols

- The winning hospitals' higher core measures mean percent of 99.1 tells us that they have better adherence to recommended core measures of care than their peers, who have a median of 97.8 percent (Table 1).

Over time, the variation in the core measures we have analyzed has decreased dramatically, as hospitals have worked to improve on the delivery of these basic standards of care. This is demonstrated by very high median scores across all comparison groups and the relatively small differences between winners and nonwinners. Now that reporting of many of these core measures is voluntary, and they are losing their differentiating power, we will be evaluating their continued use in this study. However, there are new core measures that have been developed, for which reporting is required. We have included these for information-only purposes this year, and we welcome feedback from the healthcare community on their value.

## 100 Top Hospitals Have Lower 30-Day Mortality and Readmission Rates

- Overall, median 30-day mortality and readmission rates are lower at the winning hospitals than nonwinning hospitals, for all patient groups evaluated.
- 30-day AMI mortality and 30-day HF readmissions median rates show the greatest favorable differences between winners and nonwinners: 0.6 and 0.7 percentage points, respectively (Table 1).
- Major teaching hospitals demonstrate the best performance of any group across all 30-day mortality measures (AMI, HF, and pneumonia). This is true for both winning and nonwinning hospitals, which is a level of consistency in performance we rarely see (Table 2).
- For 30-day readmission measures, teaching hospital winners outperform non-winners and all other groups on AMI and HF readmissions, with rates of 17.1 and 21.2, respectively. They also tie with small community hospitals with the best readmission rate for the new hip/knee arthroplasty measure at 4.7 percent (Tables 3 and 6).

## Patients Treated at 100 Top Hospitals Return Home Sooner*

- Winning hospitals have a median average length of stay (ALOS) that is half a day shorter than their peers' median, which is an 11.2-percent shorter stay (Table 1).
- The winning medium-sized and small community hospitals have the greatest difference in ALOS relative to nonwinning peers, of all the groups, with nearly a full-day shorter median ALOS (Tables 5 and 6).

*Risk-adjusted measures are normalized by comparison group, so results cannot be compared across comparison groups.

## 100 Top Hospitals Have Lower Inpatient Expenses and "Episode" Costs*

- Although the findings show that the winning hospital median for inpatient expense per adjusted discharge is lower than the median for nonwinner peers (3 percent), overall this difference is small and does not appear in all comparison groups (Table 1).
- For MSPB episode expense, overall winning hospitals have a lower MSPB index than nonwinning hospitals by 2 percent (Table 1).
- Major teaching and large community hospitals both have median inpatient expense that is higher than the nonwinning hospitals (Tables 2 and 4).
- Inpatient expense for major teaching hospital winners is 11.5 percent higher than for nonwinners, which is the largest unfavorable difference found. However, winners have a favorable difference in the MSPB episode expense, where the median index is 2 percent better than for nonwinners (Table 2).
- Inpatient expense for teaching hospital winners is the same as for nonwinners. However, winners have the greatest favorable difference in the MSPB episode expense, where the median index is 5 percent better than for nonwinners (Table 3).
- Medium-sized community hospital winners have the best performance compared to nonwinners on inpatient expense per discharge (11 percent better than peers) and the second-best performance on the MSPB index (3 percent better than peers). Medium community hospital winners also have the lowest median inpatient expense per discharge ($5,616) of any group (Table 5).
- The best MSPB episode cost performance is in the small community hospital group, where both winners and nonwinners outperformed all other groups with MSPB indexes of 0.94 and 0.95, respectively.

Further investigation of the interrelationship between inpatient care and episode care is needed. Given that some winners have higher inpatient expense but lower Medicare spend, one possibility is that winning organizations are moving patients to lower-cost settings more quickly. Another possibility is that the inpatient expense factor in our overall scorecard now has less impact on the selection of winners. To fully explain this finding, research on the impact of each measure on overall performance scores is necessary.

In addition, the relationship between the use of acute and non-acute care in achieving best patient outcomes — and the cost-benefit tradeoffs of each — should be explored. It would be important to know whether or not hospitals that manage the inpatient stay and the selection of appropriate sites of care cost more on the acute side but achieve more economical care overall, with equal or better outcomes.

*This year we added a new measure of cost efficiency — the Medicare spending per beneficiary (MSPB) index, as a proxy for episode-of-care cost related to an index-hospitalized patient. This measure, along with our traditional inpatient expense per adjusted discharge measure, now has a weight of one-half in overall hospital scoring.

## 100 Top Hospitals Are More Profitable

- Overall, winning hospitals have a median operating profit margin that is nearly 11 percentage points higher than nonwinning hospitals (14.4 percent versus 3.6 percent) (Table 1).
- Profitability difference is the most dramatic in the small and medium community hospital groups, where winners have profitability that is 15.4 and 13.5 percentage points higher than nonwinners, respectively.
- Medium-sized winning hospitals also have the largest median operating profit margin of any winning group at 17.7 percent.
- Major teaching hospital winners have the lowest median operating profit margin of any winning group at 6.4 percent.

## Patients Rate 100 Top Hospitals Higher Than Peer Hospitals

- The winners' 3.8-percent higher median Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) score tells us that patients treated at the 100 Top Hospitals are reporting a better overall hospital experience than those treated in peer hospitals (Table 1).
- The winning small community hospitals had the highest HCAHPS scores at 273.5 versus 262 of the peer group (Table 6).

**Table 1: National Performance Comparisons (All Classes)**

| Performance Measure | Medians | | Benchmark Compared With Peer Group | | |
|---|---|---|---|---|---|
| | Current Benchmark | Peer Group of U.S. Hospitals | Actual | % | Comments |
| Mortality Index[1] | 0.94 | 1.00 | -0.06 | -5.9% | lower mortality |
| Complications Index[1] | 0.94 | 0.98 | -0.04 | -4.0% | lower complications |
| Patient Safety Index (PSI)[2] | 0.84 | 0.94 | -0.09 | -9.8% | fewer patient safety incidents |
| Core Measures Mean Percent (%)[3] | 99.1 | 97.8 | 1.3 | n/a[6] | higher compliance |
| 30-Day AMI Mortality Rate (%)[4] | 14.2 | 14.8 | -0.6 | n/a[6] | lower 30-day mortality |
| 30-Day HF Mortality Rate (%)[4] | 11.6 | 11.8 | -0.2 | n/a[6] | lower 30-day mortality |
| 30-Day PNEU Mortality Rate (%)[4] | 11.1 | 11.7 | -0.6 | n/a[6] | lower 30-day mortality |
| 30-Day AMI Readmission Rate (%)[4] | 17.4 | 17.8 | -0.4 | n/a[6] | fewer 30-day readmissions |
| 30-Day HF Readmission Rate (%)[4] | 22.0 | 22.7 | -0.7 | n/a[6] | fewer 30-day readmissions |
| 30-Day PNEU Readmission Rate (%)[4] | 16.9 | 17.3 | -0.4 | n/a[6] | fewer 30-day readmissions |
| 30-Day HIP/KNEE Readmission Rate (%)[4] | 4.9 | 5.2 | -0.3 | n/a[6] | fewer 30-day readmissions |
| Average Length of Stay (days)[1] | 4.3 | 4.9 | -0.5 | -11.2% | shorter stays |
| Inpatient Expense per Discharge ($) | 6,341 | 6,540 | -199 | -3.0% | lower inpatient cost |
| Medicare Spend per Beneficiary Index[5] | 0.97 | 0.99 | -0.02 | -2.0% | lower episode cost |
| Operating Profit Margin (%) | 14.4 | 3.6 | 10.8 | n/a[6] | higher profitability |
| HCAHPS Score[5] | 271.0 | 261.0 | 10.0 | 3.8% | greater patient satisfaction |

1. Mortality, complications, and average length of stay (LOS) based on present-on-admission (POA)-enabled risk models applied to MEDPAR 2012 and 2013 data (LOS 2013 only).
2. PSI based on AHRQ POA-enabled risk models applied to MEDPAR 2012 and 2013 data. Ten PSIs included; see Appendix C for list.
3. Core measures data from CMS Hospital Compare Oct 1, 2012-Sep 30, 2013, dataset. See Appendix C for included core measures.
4. 30-day rates from CMS Hospital Compare July 1, 2010-June 30, 2013, dataset.
5. HCAHPS and MSPB data from CMS Hospital Compare Jan 1, 2013-Dec 31, 2013, dataset.
6. We do not calculate percent difference for this measure because it is already a percent value.

**Table 2: Major Teaching Hospital Performance Comparisons**

| Performance Measure | Medians | | Benchmark Compared With Peer Group | | |
|---|---|---|---|---|---|
| | Current Benchmark | Peer Group of U.S. Hospitals | Actual | % | Comments |
| Mortality Index[1] | 0.96 | 1.00 | -0.04 | -3.9% | lower mortality |
| Complications Index[1] | 0.97 | 0.99 | -0.03 | -2.8% | lower complications |
| Patient Safety Index (PSI)[2] | 0.92 | 1.00 | -0.08 | -8.3% | fewer patient safety incidents |
| Core Measures Mean Percent (%)[3] | 98.8 | 98.0 | 0.8 | n/a[6] | higher compliance |
| 30-Day AMI Mortality Rate (%)[4] | 13.4 | 14.4 | -1.0 | n/a[6] | lower 30-day mortality |
| 30-Day HF Mortality Rate (%)[4] | 10.6 | 10.8 | -0.2 | n/a[6] | lower 30-day mortality |
| 30-Day PNEU Mortality Rate (%)[4] | 10.5 | 11.2 | -0.7 | n/a[6] | lower 30-day mortality |
| 30-Day AMI Readmission Rate (%)[4] | 17.7 | 18.4 | -0.7 | n/a[6] | fewer 30-day readmissions |
| 30-Day HF Readmission Rate (%)[4] | 23.3 | 23.6 | -0.3 | n/a[6] | fewer 30-day readmissions |
| 30-Day PNEU Readmission Rate (%)[4] | 18.9 | 18.1 | 0.8 | n/a[6] | more 30-day readmissions |
| 30-Day HIP/KNEE Readmission Rate (%)[4] | 5.5 | 5.3 | 0.2 | n/a[6] | fewer 30-day readmissions |
| Average Length of Stay (days)[1] | 4.5 | 5.0 | -0.4 | -8.2% | shorter stays |
| Inpatient Expense per Discharge ($) | 8,278 | 7,425 | 853 | 11.5% | higher inpatient cost |
| Medicare Spend per Beneficiary Index[5] | 0.98 | 1.00 | -0.02 | -2.0% | lower episode cost |
| Operating Profit Margin (%) | 9.5 | 3.1 | 6.4 | n/a[6] | higher profitability |
| HCAHPS Score[5] | 272.0 | 261.0 | 11.0 | 4.2% | greater patient satisfaction |

1. Mortality, complications, and average length of stay (LOS) based on present-on-admission (POA)-enabled risk models applied to MEDPAR 2012 and 2013 data (LOS 2013 only).
2. PSI based on AHRQ POA-enabled risk models applied to MEDPAR 2012 and 2013 data. Ten PSIs included; see Appendix C for list.
3. Core measures data from CMS Hospital Compare Oct 1, 2012-Sep 30, 2013, dataset. See Appendix C for included core measures.
4. 30-day rates from CMS Hospital Compare July 1, 2010-June 30, 2013, dataset.
5. HCAHPS and MSPB data from CMS Hospital Compare Jan 1, 2013-Dec 31, 2013, dataset.
6. We do not calculate percent difference for this measure because it is already a percent value.

**Table 3: Teaching Hospital Performance Comparisons**

| Performance Measure | Medians | | Benchmark Compared With Peer Group | | |
|---|---|---|---|---|---|
| | Current Benchmark | Peer Group of U.S. Hospitals | Actual | % | Comments |
| Mortality Index[1] | 0.96 | 1.00 | -0.04 | -4.2% | lower mortality |
| Complications Index[1] | 0.95 | 1.00 | -0.05 | -4.8% | lower complications |
| Patient Safety Index (PSI)[2] | 0.90 | 0.98 | -0.08 | -7.9% | fewer patient safety incidents |
| Core Measures Mean Percent (%)[3] | 98.6 | 98.2 | 0.4 | n/a[6] | higher compliance |
| 30-Day AMI Mortality Rate (%)[4] | 14.3 | 14.5 | -0.3 | n/a[6] | lower 30-day mortality |
| 30-Day HF Mortality Rate (%)[4] | 11.6 | 11.6 | 0.0 | n/a[6] | no difference |
| 30-Day PNEU Mortality Rate (%)[4] | 11.0 | 11.5 | -0.5 | n/a[6] | lower 30-day mortality |
| 30-Day AMI Readmission Rate (%)[4] | 17.2 | 17.9 | -0.6 | n/a[6] | fewer 30-day readmissions |
| 30-Day HF Readmission Rate (%)[4] | 21.1 | 22.5 | -1.4 | n/a[6] | fewer 30-day readmissions |
| 30-Day PNEU Readmission Rate (%)[4] | 16.9 | 17.4 | -0.5 | n/a[6] | fewer 30-day readmissions |
| 30-Day HIP/KNEE Readmission Rate (%)[4] | 4.7 | 5.2 | -0.5 | n/a[6] | fewer 30-day readmissions |
| Average Length of Stay (days)[1] | 4.3 | 5.0 | -0.7 | -13.8% | shorter stays |
| Inpatient Expense per Discharge ($) | 6,337 | 6,334 | 3 | 0.0% | higher inpatient cost |
| Medicare Spend per Beneficiary Index[5] | 0.96 | 1.01 | -0.05 | -5.0% | lower episode cost |
| Operating Profit Margin (%) | 13.3 | 4.7 | 8.7 | n/a[6] | higher profitability |
| HCAHPS Score[5] | 272.0 | 262.0 | 10.0 | 3.8% | greater patient satisfaction |

1. Mortality, complications, and average length of stay (LOS) based on present-on-admission (POA)-enabled risk models applied to MEDPAR 2012 and 2013 data (LOS 2013 only).
2. PSI based on AHRQ POA-enabled risk models applied to MEDPAR 2012 and 2013 data. Ten PSIs included; see Appendix C for list.
3. Core measures data from CMS Hospital Compare Oct 1, 2012-Sep 30, 2013, dataset. See Appendix C for included core measures.
4. 30-day rates from CMS Hospital Compare July 1, 2010-June 30, 2013, dataset.
5. HCAHPS and MSPB data from CMS Hospital Compare Jan 1, 2013-Dec 31, 2013, dataset.
6. We do not calculate percent difference for this measure because it is already a percent value.

**Table 4: Large Community Hospital Performance Comparisons**

| Performance Measure | Medians | | Benchmark Compared With Peer Group | | |
|---|---|---|---|---|---|
| | Current Benchmark | Peer Group of U.S. Hospitals | Actual | % | Comments |
| Mortality Index[1] | 0.97 | 1.00 | -0.03 | -2.9% | lower mortality |
| Complications Index[1] | 0.92 | 1.00 | -0.08 | -8.2% | lower complications |
| Patient Safety Index (PSI)[2] | 0.80 | 0.99 | -0.19 | -19.0% | fewer patient safety incidents |
| Core Measures Mean Percent (%)[3] | 99.2 | 98.3 | 0.9 | n/a[6] | higher compliance |
| 30-Day AMI Mortality Rate (%)[4] | 14.3 | 14.7 | -0.4 | n/a[6] | lower 30-day mortality |
| 30-Day HF Mortality Rate (%)[4] | 12.3 | 11.6 | 0.7 | n/a[6] | higher 30-day mortality |
| 30-Day PNEU Mortality Rate (%)[4] | 11.2 | 11.4 | -0.2 | n/a[6] | lower 30-day mortality |
| 30-Day AMI Readmission Rate (%)[4] | 17.7 | 17.9 | -0.2 | n/a[6] | fewer 30-day readmissions |
| 30-Day HF Readmission Rate (%)[4] | 22.1 | 22.6 | -0.5 | n/a[6] | fewer 30-day readmissions |
| 30-Day PNEU Readmission Rate (%)[4] | 16.8 | 17.4 | -0.6 | n/a[6] | fewer 30-day readmissions |
| 30-Day HIP/KNEE Readmission Rate (%)[4] | 5.0 | 5.1 | -0.1 | n/a[6] | fewer 30-day readmissions |
| Average Length of Stay (days)[1] | 4.6 | 5.0 | -0.5 | -9.5% | shorter stays |
| Inpatient Expense per Discharge ($) | 6,524 | 6,259 | 264 | 4.2% | higher inpatient cost |
| Medicare Spend per Beneficiary Index[5] | 1.02 | 1.02 | 0.00 | 0.0% | no difference |
| Operating Profit Margin (%) | 13.4 | 5.5 | 7.9 | n/a[6] | higher profitability |
| HCAHPS Score[5] | 267.5 | 262.0 | 5.5 | 2.1% | greater patient satisfaction |

1. Mortality, complications, and average length of stay (LOS) based on present-on-admission (POA)-enabled risk models applied to MEDPAR 2012 and 2013 data (LOS 2013 only).
2. PSI based on AHRQ POA-enabled risk models applied to MEDPAR 2012 and 2013 data. Ten PSIs included; see Appendix C for list.
3. Core measures data from CMS Hospital Compare Oct 1, 2012-Sep 30, 2013, dataset. See Appendix C for included core measures.
4. 30-day rates from CMS Hospital Compare July 1, 2010-June 30, 2013, dataset.
5. HCAHPS and MSPB data from CMS Hospital Compare Jan 1, 2013-Dec 31, 2013, dataset.
6. We do not calculate percent difference for this measure because it is already a percent value.

**Table 5: Medium-Sized Community Hospital Performance Comparisons**

| Performance Measure | Medians | | Benchmark Compared With Peer Group | | |
|---|---|---|---|---|---|
| | Current Benchmark | Peer Group of U.S. Hospitals | Actual | % | Comments |
| Mortality Index[1] | 0.92 | 1.00 | -0.08 | -7.7% | lower mortality |
| Complications Index[1] | 0.80 | 0.99 | -0.19 | -19.4% | lower complications |
| Patient Safety Index (PSI)[2] | 0.67 | 0.97 | -0.30 | -31.2% | fewer patient safety incidents |
| Core Measures Mean Percent (%)[3] | 99.2 | 98.0 | 1.2 | n/a[6] | higher compliance |
| 30-Day AMI Mortality Rate (%)[4] | 14.0 | 14.9 | -0.9 | n/a[6] | lower 30-day mortality |
| 30-Day HF Mortality Rate (%)[4] | 11.8 | 11.9 | -0.2 | n/a[6] | lower 30-day mortality |
| 30-Day PNEU Mortality Rate (%)[4] | 11.3 | 11.7 | -0.4 | n/a[6] | lower 30-day mortality |
| 30-Day AMI Readmission Rate (%)[4] | 17.5 | 17.8 | -0.3 | n/a[6] | fewer 30-day readmissions |
| 30-Day HF Readmission Rate (%)[4] | 22.7 | 22.7 | 0.0 | n/a[6] | no difference |
| 30-Day PNEU Readmission Rate (%)[4] | 16.8 | 17.4 | -0.6 | n/a[6] | fewer 30-day readmissions |
| 30-Day HIP/KNEE Readmission Rate (%)[4] | 5.0 | 5.2 | -0.2 | n/a[6] | fewer 30-day readmissions |
| Average Length of Stay (days)[1] | 4.1 | 5.0 | -0.9 | -17.7% | shorter stays |
| Inpatient Expense per Discharge ($) | 5,616 | 6,310 | -694 | -11.0% | lower inpatient cost |
| Medicare Spend per Beneficiary Index[5] | 0.97 | 1.00 | -0.03 | -3.0% | lower episode cost |
| Operating Profit Margin (%) | 17.7 | 4.2 | 13.5 | n/a[6] | higher profitability |
| HCAHPS Score[5] | 270.5 | 261.0 | 9.5 | 3.6% | greater patient satisfaction |

1. Mortality, complications, and average length of stay (LOS) based on present-on-admission (POA)-enabled risk models applied to MEDPAR 2012 and 2013 data (LOS 2013 only).
2. PSI based on AHRQ POA-enabled risk models applied to MEDPAR 2012 and 2013 data. Ten PSIs included; see Appendix C for list.
3. Core measures data from CMS Hospital Compare Oct 1, 2012-Sep 30, 2013, dataset. See Appendix C for included core measures.
4. 30-day rates from CMS Hospital Compare July 1, 2010-June 30, 2013, dataset.
5. HCAHPS and MSPB data from CMS Hospital Compare Jan 1, 2013-Dec 31, 2013, dataset.
6. We do not calculate percent difference for this measure because it is already a percent value.

**Table 6: Small Community Hospital Performance Comparisons**

| Performance Measure | Medians | | Benchmark Compared With Peer Group | | |
|---|---|---|---|---|---|
| | Current Benchmark | Peer Group of U.S. Hospitals | Actual | % | Comments |
| Mortality Index[1] | 0.91 | 0.99 | -0.09 | -8.6% | lower mortality |
| Complications Index[1] | 0.90 | 0.96 | -0.06 | -6.6% | lower complications |
| Patient Safety Index (PSI)[2] | 0.78 | 0.98 | -0.20 | -20.2% | fewer patient safety incidents |
| Core Measures Mean Percent (%)[3] | 99.3 | 96.9 | 2.3 | n/a[6] | higher compliance |
| 30-Day AMI Mortality Rate (%)[4] | 15.2 | 15.0 | 0.2 | n/a[6] | higher 30-day mortality |
| 30-Day HF Mortality Rate (%)[4] | 11.6 | 12.1 | -0.5 | n/a[6] | lower 30-day mortality |
| 30-Day PNEU Mortality Rate (%)[4] | 11.5 | 12.1 | -0.6 | n/a[6] | lower 30-day mortality |
| 30-Day AMI Readmission Rate (%)[4] | 17.1 | 17.6 | -0.5 | n/a[6] | fewer 30-day readmissions |
| 30-Day HF Readmission Rate (%)[4] | 21.6 | 22.6 | -1.0 | n/a[6] | fewer 30-day readmissions |
| 30-Day PNEU Readmission Rate (%)[4] | 16.9 | 17.1 | -0.2 | n/a[6] | fewer 30-day readmissions |
| 30-Day HIP/KNEE Readmission Rate (%)[4] | 4.7 | 5.1 | -0.4 | n/a[6] | fewer 30-day readmissions |
| Average Length of Stay (days)[1] | 4.1 | 5.0 | -0.9 | -17.7% | shorter stays |
| Inpatient Expense per Discharge ($) | 6,402 | 6,909 | -507 | -7.3% | lower inpatient cost |
| Medicare Spend per Beneficiary Index[5] | 0.94 | 0.95 | -0.01 | -1.1% | lower episode cost |
| Operating Profit Margin (%) | 17.1 | 1.7 | 15.4 | n/a[6] | higher profitability |
| HCAHPS Score[5] | 273.5 | 262.0 | 11.5 | 4.4% | greater patient satisfaction |

1. Mortality, complications, and average length of stay (LOS) based on present-on-admission (POA)-enabled risk models applied to MEDPAR 2012 and 2013 data (LOS 2013 only).
2. PSI based on AHRQ POA-enabled risk models applied to MEDPAR 2012 and 2013 data. Ten PSIs included; see Appendix C for list.
3. Core measures data from CMS Hospital Compare Oct 1, 2012-Sep 30, 2013, dataset. See Appendix C for included core measures.
4. 30-day rates from CMS Hospital Compare July 1, 2010-June 30, 2013, dataset.
5. HCAHPS and MSPB data from CMS Hospital Compare Jan 1, 2013-Dec 31, 2013, dataset.
6. We do not calculate percent difference for this measure because it is already a percent value.

## U.S. Map and States by Region

A U.S. map based on the 2015 study (Figure 1) provides a visual representation of the variability in performance across the country. Additionally, Table 7 shows each state's rank quintile performance, grouped by geographic region. To produce these data, we calculate the 100 Top Hospitals measures at the state level,[1] rank each measure, then weight and sum the ranks to produce an overall state performance score. States are ranked from best to worst on the overall score, and the results are reported as rank quintiles.

We made a number of changes to methodology and measures this year, in line with our commitment to continually improve the value of our study to healthcare leaders. We added new metrics that reflect the shift to continuum of care, and the organizations with effective leadership and cultures supporting change are those that will perform best. Due to these changes, we are not comparing this year's state performance to last year's. We made the following changes that could impact results:

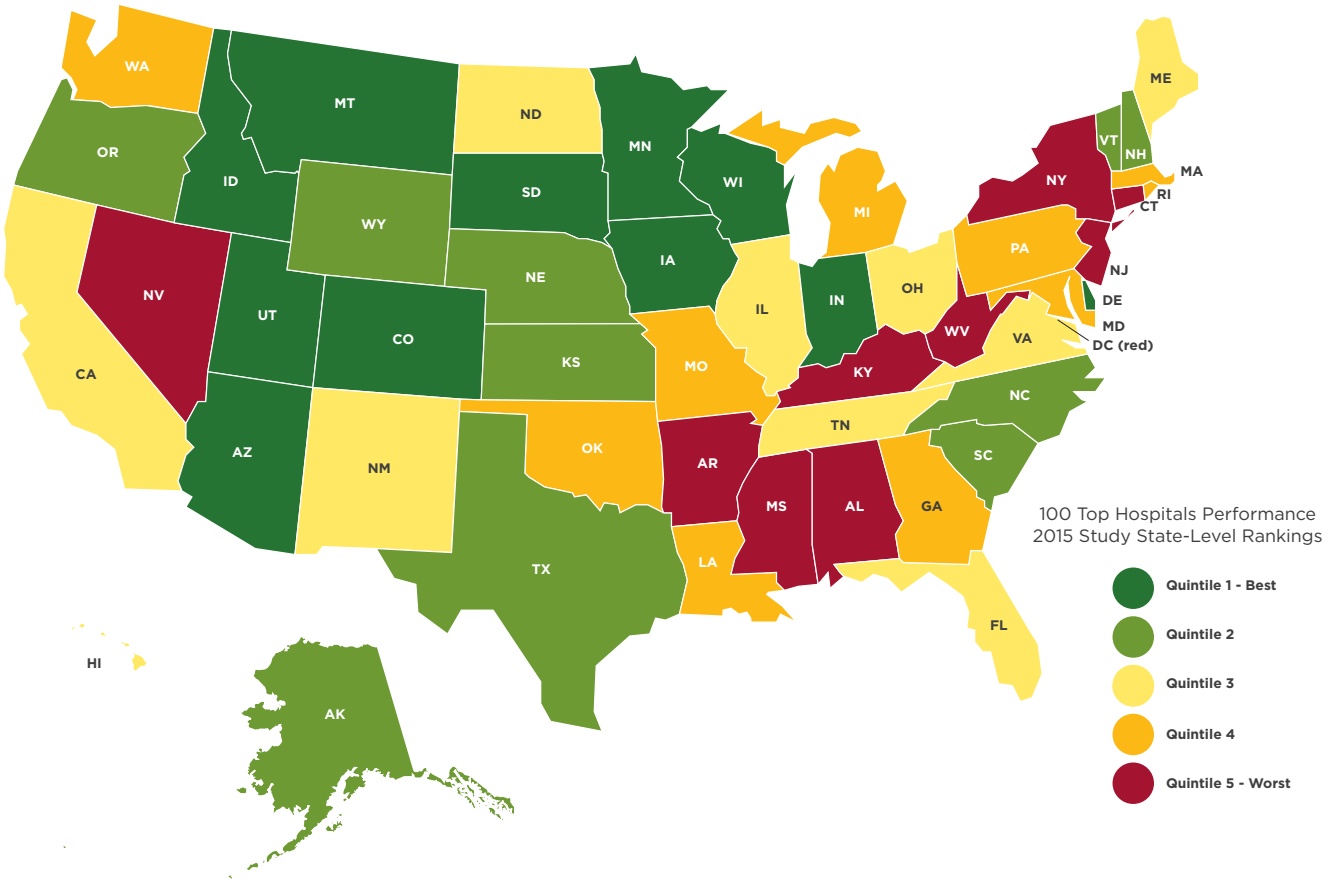
- Added hip/knee to readmission rate group (now one of four rates included, along with AMI, heart failure, and pneumonia)
- Added the Medicare spend per beneficiary index as a ranked measure with a weight of one-half
- Reduced the weight of the inpatient expense metric to one-half from one
- Aggregated the HCAHPS score to state-level weighting, by hospital MEDPAR discharges rather than sample size

Our observations regarding state performance include:

- The West is the front-runner in percentage of hospitals in the top two performance quintiles (61.5 percent), with the Midwest, second (58.3 percent).
- In addition, the Midwest is the only region with no hospitals in the bottom performance quintile.
- The Northeast shows the poorest performance overall, by a large margin, with 66.7 percent of its states in the bottom two quintiles.
- In addition, the Northeast is the only region with no hospitals in the top quintile.

[1] Each state measure is calculated from the acute care hospital data for that state. Mortality, complications, patient safety, and average length of stay are aggregated from MEDPAR patient record data. Core measures, 30-day mortality, and 30-day readmissions are aggregated from the numerator and denominator data for each hospital. Inpatient expense per discharge, operating profit margin, Medicare spend per beneficiary index, and HCAHPS scores are hospital values weighted by the number of acute discharges at each hospital. A mean weighted value is calculated for each state. Individual measure ranks are weighted using the same measure weights as in the 100 Top Hospitals study.

## Figure 1: State-Level Performance Comparisons, 2015 Study




State Data Note: The 2015 state findings are based on the 100 Top Hospitals measure methodologies, using 2012 and 2013 MEDPAR data (combined) for clinical measures and 2013 data for all other measures.

## Table 7: 100 Top Hospitals Two-Year State-Level Performance Comparisons

| Northeast | Midwest | South | West |
|---|---|---|---|
| Connecticut | Illinois | Alabama | Alaska |
| Maine | Indiana | Arkansas | Arizona |
| Massachusetts | Iowa | Delaware | California |
| New Hampshire | Kansas | District of Columbia | Colorado |
| New Jersey | Michigan | Florida | Hawaii |
| New York | Minnesota | Georgia | Idaho |
| Pennsylvania | Missouri | Kentucky | Montana |
| Rhode Island | Nebraska | Louisiana | Nevada |
| Vermont | North Dakota | Maryland | New Mexico |
| | Ohio | Mississippi | Oregon |
| | South Dakota | North Carolina | Utah |
| | Wisconsin | Oklahoma | Washington |
| | | South Carolina | Wyoming |
| | | Tennessee | |
| | | Texas | |
| | | Virginia | |
| | | West Virginia | |

Quintile 1 - Best
Quintile 2
Quintile 3
Quintile 4
Quintile 5 - Worst

## Performance Improvement Over Time: All Hospitals

By studying the direction of performance change of all hospitals in our study (winners and nonwinners), we can see that in recent years, U.S. hospitals have not been able to significantly improve performance across the entire balanced scorecard (Table 8). However, over the years we studied (2009 through 2013), there were a few noteworthy performance improvements for specific measures (see green column in Table 8):

- Nearly 10 percent of hospitals significantly improved their inpatient mortality rates.
- Mean core measures scores showed 58.7 percent of hospitals improving, indicating continued focus on adherence to these minimum standards of care.
- Almost 33 percent of hospitals significantly improved their 30-day readmission rates, likely a result of the attention these measures are getting in payment systems.
- Over 22 percent of hospitals are also improving HCAHPS scores at a significant rate.

For the first time, we have trended 30-day mortality and 30-day readmission rates in this study. It is of note that more than 20 percent of hospitals had statistically significant worsening of their 30-day mortality rates. The opposite trend is seen for inpatient mortality, as mentioned above. Research into the relationship between inpatient and extended care mortality rates is needed at the hospital level. There may be factors, such as inappropriately early discharge, failure to manage the hand-offs to other care settings, high-risk patient populations, or lack of community and family support systems, that are leading to this phenomenon.

On the operating efficiency front, nearly 21 percent of the hospitals studied had a significant increase in expense per discharge (significantly declining performance).

For the remainder of the measures, the majority of hospitals in the study had no statistically significant change in performance (yellow column in Table 8).

**Table 8: Direction of Performance Change for All Hospitals in Study, 2009–2013**

| Performance Measure | Significantly Improving Performance | | No Statistically Significant Change in Performance | | Significantly Declining Performance | |
|---|---|---|---|---|---|---|
| | Count of Hospitals[1] | Percent of Hospitals[2] | Count of Hospitals[1] | Percent of Hospitals[2] | Count of Hospitals[1] | Percent of Hospitals[2] |
| Risk-Adjusted Mortality Index | 255 | 9.5% | 2,433 | 90.2% | 8 | 0.3% |
| Risk-Adjusted Complication Index | 57 | 2.1% | 2,578 | 95.6% | 61 | 2.3% |
| Risk-Adjusted Patient Safety Index (PSI) | 8 | 0.3% | 2,541 | 97.0% | 71 | 2.7% |
| Core Measures Mean Percent | 1582 | 58.7% | 1,106 | 41.0% | 8 | 0.3% |
| 30-Day Mortality Rate | 378 | 14.0% | 2,012 | 74.6% | 306 | 11.4% |
| 30-Day Readmission Rate | 1183 | 43.9% | 1,507 | 55.9% | 6 | 0.2% |
| Severity-Adjusted Average Length of Stay | 270 | 10.0% | 2,407 | 89.3% | 19 | 0.7% |
| Adjusted Inpatient Expense per Discharge | 71 | 2.6% | 2,058 | 76.7% | 554 | 20.6% |
| Operating Profit Margin | 210 | 7.8% | 2,300 | 85.7% | 173 | 6.4% |
| HCAHPS Score | 598 | 22.2% | 2,042 | 75.7% | 56 | 2.1% |

1. Count refers to the number of in-study hospitals whose performance fell into the highlighted category on the measure.
Note: Total number of hospitals included in the analysis will vary by measure due to exclusion of interquartile range outlier data points. PSI, inpatient expense, and profit are affected. Some in-study hospitals had too few data points remaining to calculate trend.
2. Percent is of total in-study hospitals across all peer groups.

## Potential New Metrics for 2016: Expanded Core Measures and 30-Day Extended Outcomes Measures

Every year, we evaluate the 100 Top Hospitals study and explore whether new measures would enhance the value of the analysis we provide. In the 2015 study, we are publishing new performance measures that update basic standards of inpatient care and expand the balanced scorecard across the continuum of care. If you would like to provide feedback on these proposed measures, please email **100tophospitals@truvenhealth.com**.

- New Core Measures — Core measures have been included in the study for many years as widely accepted and nationally endorsed minimum standards for process of care. At this time, our core measures score is based on heart attack, heart failure, pneumonia, and surgical care core measures. In the 2015 study, we are publishing the new stroke care and blood clot treatment measures from the expanded CMS core measures set. We are also publishing the emergency department efficiency measures again this year.
- New 30-Day Mortality and Readmission Measures — We are publishing the new condition-specific outcome measures that CMS publicly reported in their most recent Hospital Compare dataset. These chronic obstructive pulmonary disease and stroke 30-day mortality and readmission measures are displayed in this study for the first time. The data period for these measures is the same as for the other 30-day metrics: July 1, 2010–June 30, 2013.

# Methodology

Truven Health 100 Top Hospitals® is a quantitative study that annually identifies 100 U.S. hospitals with the highest achievement on a balanced scorecard. The 100 Top Hospitals Balanced Scorecard, based on Norton and Kaplan's[28] concept, consists of 11 measures distributed across five domains — clinical quality, extended outcomes, efficiency, financial health, and patient assessment of care — and uses only publicly available data. The hospitals with the highest ranking on a composite score of the 11 measures are the highest-achieving hospitals. This study includes only short-term, nonfederal, acute care U.S. hospitals that treat a broad spectrum of patients.

The main steps we take in selecting the 100 Top Hospitals are:

- Building the database of hospitals, including special selection and exclusion criteria
- Classifying hospitals into comparison groups by size and teaching status
- Scoring hospitals on a balanced scorecard of 11 performance measures across five domains
- Determining 100 Top Hospitals by ranking hospitals relative to their comparison group

The following section is intended to be an overview of these steps. To request more detailed information on any of the study methodologies outlined here, please email **100tophospitals@truvenhealth.com** or call +1.800.366.7526.

Note: This section details the methods used to determine the 100 Top Hospitals award winners. For details on the methods used to select the Everest Award winners, please see the Everest Awards section of this document.

## Building the Database of Hospitals

The publicly available data used for this study primarily come from:

- Medicare Provider Analysis and Review (MEDPAR) dataset
- Medicare Cost Report
- Centers for Medicare & Medicaid Services (CMS) Hospital Compare dataset

We use MEDPAR patient-level demographic, diagnosis, and procedure information to calculate mortality, complications, patient safety, and length of stay (LOS). The MEDPAR dataset contains information on the approximately 15 million Medicare patients discharged annually from U.S. acute care hospitals. In this study, we used the most recent two federal fiscal years of MEDPAR data available — 2012 and 2013 — which include Medicare HMO (health maintenance organization) encounters.[29] Hospitals that file Medicare claims jointly with other hospitals under one provider number are analyzed as one organization.

We, like a multitude of highly respected academic researchers, have used the MEDPAR database for many years. We believe it to be an accurate and reliable source for the types of high-level analyses performed in this study. Performance based on Medicare data has been found to be highly representative of both the inpatient all-payer and the inpatient medical-surgical populations.

Note: To choose the Everest Award winners, we also reviewed the most recent five years of data, 2009 through 2013, to study the rate of change in performance through the years. To read more about the Everest Award methodology, see the special Everest Award section of this document. For specific data sources for each performance measure, see the table on page 41.

We use Medicare Cost Reports to create our 100 Top Hospitals database, which contains hospital-specific demographic information and hospital-specific, all-payer revenue and expense data. The Medicare Cost Report is filed annually by every U.S. hospital that participates in the Medicare program. Hospitals are required to submit cost reports to receive reimbursement from Medicare. It should be noted that the Medicare Cost Report includes all hospital costs, not just costs associated with Medicare beneficiaries.

The Medicare Cost Report promotes comparability of costs and efficiency among hospitals in reporting. We used hospital 2013 cost reports published in the federal Healthcare Cost Report Information System (HCRIS) third quarter 2014 dataset for this study. If we did not have a complete 2013 cost report for a hospital, we excluded the hospital from the study.

In this study, we used CMS Hospital Compare datasets published in the third and fourth quarters of 2014 for core measures, 30-day mortality rate, 30-day readmission rate, Medicare spend per beneficiary index, and Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) patient perception of care data.

We used residency program information to classify hospitals. This comes from the American Medical Association (Accreditation Council for Graduate Medical Education (ACGME)-accredited programs)[30] and the American Osteopathic Association (AOA).[31]

## Severity-Adjustment Models and Present-on-Admission Data

The Truven Health proprietary risk- and severity-adjustment models for mortality, complications, and LOS have been recalibrated this release using federal fiscal year (FFY) 2012 data available in the Truven Health all-payer Projected Inpatient Data Base (PIDB). The PIDB is a normative database containing approximately 27 million patient discharge records from 3,700 hospitals, representing over half of the nonfederal, acute care discharges in the U.S. Truven Health risk- and severity-adjustment models take advantage of available present-on-admission (POA) coding that is reported in all-payer data. Only patient conditions that are present on admission are used to determine the probability of death, complications, or the expected LOS.

The recalibrated severity-adjustment models were used in producing the risk-adjusted mortality and complications indexes, based on two years of MEDPAR data (2012 and 2013). The severity-adjusted LOS was based on MEDPAR 2013.

We leverage the Agency for Healthcare Research and Quality (AHRQ) Patient Safety Indicator (PSI) risk models for the composite patient safety index used in the study. These models also take into account POA coding available in the data. Under the Deficit Reduction Act of 2005, as of FFY 2008, hospitals receive reduced payment for cases with certain conditions — such as falls, surgical site infections, and pressure ulcers — that were not present at the time of patient admission but occur during hospitalization. As a result, CMS now requires all inpatient prospective payment system hospitals to document whether a patient has these conditions when admitted.

## Hospital Exclusions

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

- Specialty hospitals (i.e., critical access, children's, women's, psychiatric, substance abuse, rehabilitation, cardiac, orthopedic, heart, cancer, and long-term acute care)
- Federally owned hospitals
- Non-U.S. hospitals (such as those in Puerto Rico, Guam, and the U.S. Virgin Islands)
- Hospitals with fewer than 25 acute care beds
- Hospitals with fewer than 100 Medicare patient discharges in FFY 2013
- Hospitals with Medicare average LOS longer than 25 days in FFY 2013
- Hospitals with no reported Medicare patient deaths in FFY 2013
- Hospitals for which a 2013 Medicare Cost Report was not available
- Hospitals with a 2013 Medicare Cost Report that was not for a 12-month reporting period
- Hospitals that did not report POA information
- Hospitals missing data required to calculate performance measures

In addition, specific patient records were also excluded:

- 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, psychiatric, and substance-abuse patients
- Patients with stays shorter than one day

After all exclusions were applied, 2,787 hospitals were included in the study.

## Classifying Hospitals Into Comparison Groups

Bed size, teaching status, and extent of residency/fellowship program involvement have a profound effect on the types of patients a hospital treats and the scope of services it provides. When analyzing the performance of an individual hospital, it is important to evaluate it against other similar hospitals. To address this, we assigned each hospital to one of five comparison groups, or classes, according to its size and teaching status.

Our classification methodology draws a significant distinction between major teaching hospitals and teaching hospitals by reviewing the number and type of teaching programs, and by accounting for level of involvement in physician education and research through evidence of program sponsorship versus simple participation. This methodology de-emphasizes the role of bed size and focuses more on teaching program involvement. Using this approach, we seek to measure both the depth and breadth of teaching involvement and recognize teaching hospitals' tendencies 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-acute-care beds ratio, and involvement in graduate medical education programs accredited by either the ACGME[32] or the AOA.[33] The definition includes both the number of programs and type (sponsorship or participation) of graduate medical education (GME) program involvement. In this study, AOA residency program involvement is treated as being equivalent to ACGME program sponsorship.

The five comparison groups 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 a resident[†]-per-bed ratio of at least 0.25, plus
   - 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 resident[†]-per-bed ratio)
3. A resident[†]-per-bed ratio of at least 0.60 (regardless of bed size or GME program involvement)

[†]We include interns, residents, and fellows reported in full-time equivalents (FTEs) on the hospital cost report.

### Teaching Hospitals

- 200 or more acute care beds in service, and
- Either a resident†-per-bed ratio of at least 0.03 or involvement in at least three 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 to 249 acute care beds in service, and
- Not classified as a teaching hospital per definitions above

### Small Community Hospitals

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

## Scoring Hospitals on Weighted Performance Measures

### Evolution of Performance Measures

We use a balanced scorecard approach, based on public data, to select the measures most useful for boards and CEOs in the current hospital operating environment. Throughout the life of the study, we have worked diligently to meet this vision. We gather feedback from industry leaders, hospital executives, academic leaders, and internal experts; review trends in the healthcare market; and survey hospitals in demanding marketplaces to learn what measures are valid and reflective of top performance.

As the market has changed, our methods have evolved. Our current measures are centered on five main components of hospital performance: clinical quality, extended outcomes, efficiency, financial health, and patient assessment of care.

The measures for the 2015 study are:

**Clinical Quality**

1. Risk-adjusted mortality index (in-hospital)
2. Risk-adjusted complications index
3. Risk-adjusted patient safety index
4. Core measures mean percent

**Extended Outcomes**

5. 30-day risk-adjusted mortality rates for acute myocardial infarction (AMI), heart failure, and pneumonia
6. 30-day risk-adjusted readmission rates for AMI, heart failure, pneumonia, and hip/knee arthroplasty

**Efficiency**

7. Severity-adjusted average LOS
8. Case mix- and wage-adjusted inpatient expense per discharge
9. Medicare spend per beneficiary index

**Financial Health**

10. Adjusted operating profit margin

**Patient Assessment of Care**

11. HCAHPS score (patient rating of overall hospital performance)

Following is the rationale for the selection of our balanced scorecard domains and the measures used for each.

## Clinical Quality

Our measures of clinical quality include three outcome measures — risk-adjusted mortality index, risk-adjusted complications index, and risk-adjusted mean patient safety index — and one process-of-care measure, core measures mean percent.

The mortality and complications measures show us how the hospital is performing on the most basic and essential care standards — survival and error-free care — while treating patients in the hospital.

Patient safety is another important measure of hospital quality tracked closely in the industry. The risk-adjusted mean patient safety index is based on a subset of the AHRQ PSIs applicable to the Medicare population.[32]

Patient safety measures reflect 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 the AHRQ 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 10 PSIs, which allows us to gauge the results of hospital-wide patient safety performance.

Core measures were developed by The Joint Commission and CMS, and endorsed by the National Quality Forum, as minimum basic process-of-care standards. They have been 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 care. Our core measures score is based on the heart attack, heart failure, pneumonia, and surgical care areas of this program, using Hospital Compare data reported on the CMS website.[33] In this study, we included core measures that CMS mandated for use in reporting in 2013. See Appendix C for a list.

## Extended Outcomes

The extended outcomes measures — 30-day mortality rates for AMI, heart failure, and pneumonia, and 30-day readmission rates for AMI, heart failure, pneumonia, and hip/knee arthroplasty patients — help us understand how the hospital's patients are faring over a longer period. These measures are part of the CMS value-based purchasing program and are watched closely in the industry. Hospitals with lower values appear to be providing or coordinating a continuum of care with better medium-term results for these conditions.

As hospitals become more interested in contracting for population health management, understanding outcomes beyond the walls of the acute care setting is imperative. We are committed to adding new metrics that assess performance along the continuum of care as they become publicly available.

## Efficiency

The efficiency domain includes severity-adjusted average LOS, adjusted inpatient expense per discharge, and Medicare spend per beneficiary. Severity-adjusted average LOS serves as a proxy for clinical efficiency, while adjusted inpatient expense per discharge serves as a measure of operating efficiency. We limit our analysis to inpatient expense per discharge because our research has shown that measures that weight outpatient services to aggregate them with inpatient discharges are inherently biased, which tends to skew results favorably toward hospitals with higher outpatient volume.

Both average LOS and inpatient expense per discharge require adjustment to increase the validity of comparisons across the hospital industry. We use a Truven Health proprietary severity-adjustment model to determine expected LOS at the patient level. Patient-level observed and expected LOS values are used to calculate the hospital-level, severity-adjusted, average LOS. We adjust inpatient expenses, as reported on the hospital cost report, for patient severity (Medicare case mix index) and area wage levels (area wage index applied to labor cost). These adjustments allow us to more accurately compare hospitals with different levels of patient severity operating in varying cost-of-living environments. See Appendix C for details on the calculation of this measure.

As another proxy for continuum of care performance, we have added the Medicare spend per beneficiary index this year. This measure, as defined and calculated by CMS, is the ratio of Medicare spending per beneficiary treated in a specific hospital and the median Medicare spending per patient nationally. It includes Medicare Part A and Part B payments three days prior to the hospital stay, during the stay, and 30 days post-discharge.

We believe this indicator can be a beginning point for understanding hospital and local area cost performance relative to hospital peer markets.

## Financial Health

Currently, we have one measure of hospital financial health: adjusted operating profit margin. The operating profit margin is a measure of management's ability to operate within its current financial constraints and provides an indicator of the hospital's financial health. We adjust operating profit margin for net related organization expense, as reported on the Medicare cost report, to provide a more accurate measure of a hospital's profitability. See Appendix C for details on the calculation of this measure.

Previous studies included measures of hospital liquidity and asset management. We retired these measures as more and more hospitals became a part of health systems. Health system accounting practices often recognize hospitals as units of the system, with no cash or investment assets of their own; a typical practice is to transfer revenue up to the health system accounts daily. Moreover, hospitals in health systems are now often reported as having no debt in their own name. Using public data, there is no effective way to accurately measure liquidity or other balance sheet-related measures of financial health.

## Patient Assessment of Care

We believe that a measure of patient perception of care is crucial to the balanced scorecard concept. Understanding how patients perceive the care a hospital provides, and how that perception compares and contrasts with perceptions of patients in peer hospitals, is an important step a hospital must take in pursuing performance improvement. As such, this study includes the HCAHPS score, based on patient perception of care data from the HCAHPS patient survey. In this study, the HCAHPS score is based on the HCAHPS overall hospital rating question only.

Through the combined measures described above, we hope to provide a balanced picture of overall hospital performance, which is really a reflection of leadership's ability to consistently improve performance over time and sustain high performance, once achieved. Full details about each of these performance measures are included on the following pages.

## Performance Measures

| Risk-Adjusted Mortality Index (In-Hospital) | | | |
|---|---|---|---|
| **Why We Include This Element** | **Calculation** | **Comment** | **Favorable Values Are** |
| 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, or the reverse, given the patient's condition. | We calculate an index value based on the number of actual in-hospital deaths in 2012 and 2013, divided by the number expected, given the risk of death for each patient. We normalize the index based on the observed and expected deaths for each comparison group. 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).<br><br>Palliative care patients are included in the risk model. POA coding is considered as part of the risk model. Post-discharge deaths are not included. For more details, see Appendix C. 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 rank hospitals on the difference between observed and expected deaths, expressed in normalized standard deviation units (z-score).[34, 35] Hospitals with the fewest deaths, relative to the number expected, after accounting for standard binomial variability, receive the most favorable scores. We use two years of MEDPAR data (2012 and 2013) to reduce the influence of chance fluctuation. Normalization was done by comparison group.<br><br>Hospitals with observed values statistically worse than expected (95-percent confidence) are not eligible to be named benchmark hospitals. | Lower |

| Risk-Adjusted Complications Index | | | |
|---|---|---|---|
| **Why We Include This Element** | **Calculation** | **Comment** | **Favorable Values Are** |
| Keeping patients free from potentially avoidable complications is an important goal for all healthcare providers.<br>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, or the reverse, given the patient's condition. | We calculate an index value based on the number of cases with complications in 2012 and 2013, divided by the number expected, given the risk of complications for each patient. We normalize the index based on the observed and expected complications for each comparison group. 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). Complications rates are calculated from normative data for two patient risk groups: medical and surgical. POA coding is considered as part of the risk model. For more details, see Appendix C.<br><br>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 rank hospitals on the difference between the observed and expected number of patients with complications, expressed in normalized standard deviation units (z-score).[34, 35] We use two years of MEDPAR data (2012 and 2013) to reduce the influence of chance fluctuation. Normalization was done by comparison group. Hospitals with the fewest observed complications, relative to the number expected, after accounting for standard binomial variability, receive the most favorable scores.<br><br>Hospitals with observed values statistically worse than expected (95-percent confidence) are not eligible to be named benchmark hospitals. | Lower |

## Risk-Adjusted Mean Patient Safety Index

| Why We Include This Element | Calculation | Comment | Favorable Values Are |
|---|---|---|---|
| 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. The AHRQ, a public health service agency within the federal government's Department of Health and Human Services, has developed a set of 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 the AHRQ 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 10 included PSIs (see Appendix C for a list), we calculate an index value based on the number of actual PSI occurrences for 2012 and 2013, combined, divided by the number of normalized expected occurrences, given the risk of the PSI event for each patient. Values are normalized by comparison group. We apply the hospital-level PSI methodology from AHRQ to the 2012 and 2013 MEDPAR acute care data, using the publicly available AHRQ models to adjust for risk.[40] POA coding is considered as part of the PSI model. For more information, see Appendix C.<br><br>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.<br><br>We rank hospitals on the difference between the observed and expected number of patients with PSI events, for each of the 10 selected PSIs, expressed in standard deviation units (z-score).[34, 35] | We use two years of MEDPAR data (2012 and 2013) to reduce the influence of chance fluctuation. The AHRQ PSI risk models used POA coding in the MEDPAR data. We normalize z-scores by hospital comparison group and develop a mean normalized z-score as an aggregate PSI score. Hospitals with the fewest observed PSIs, relative to the number expected, accounting for binomial variability, receive the most favorable scores.<br><br>Hospitals with extreme outlier values for this measure are not eligible to be named benchmark hospitals (see "Eliminating Outliers" on page 42). | Lower |

## Core Measures Mean Percent

| Why We Include This Element | Calculation | Comment | Favorable Values Are |
|---|---|---|---|
| To be truly balanced, a scorecard must include various measures of quality. Core measures were developed by The Joint Commission and endorsed by the National Quality Forum as minimum basic standards. They are a widely accepted method for measuring patient care quality that includes specific guidelines for heart attack, heart failure, pneumonia, and surgical care. | For each hospital, we calculate the arithmetic mean of the included core measure percent values. The reported core measure percent values reflect the percentage of eligible patients who received the expected standard of patient care. We consider reported core measure percents with patient counts less than or equal to 25, or with relative standard error values greater than or equal to 0.30, statistically unreliable. In these cases, we substitute the comparison group-specific median percent value for the affected core measure. | Core measure values are from CMS Hospital Compare. We include data for Oct. 1, 2012, through Sept. 30, 2013. Because of low reporting, we exclude a number of core measures for small community hospitals.<br><br>We rank hospitals by comparison group, based on the mean core measure percent value for included core measures.<br><br>For a list of the measures used and those excluded, please see Appendix C. | Higher |

## 30-Day Risk-Adjusted Mortality Rates for AMI, Heart Failure, and Pneumonia Patients

| Why We Include This Element | Calculation | Comment | Favorable Values Are |
|---|---|---|---|
| 30-day mortality rates are a widely accepted measure of the effectiveness of hospital care. They allow us to look beyond immediate inpatient outcomes and understand how the care the hospital provided to inpatients with these particular conditions may have contributed to their longer-term survival. Because these measures are part of the CMS value-based purchasing program, they are now being watched closely in the industry. In addition, tracking these measures may help hospitals identify patients at risk for post-discharge problems, and target improvements in discharge planning and after-care processes. Hospitals that score well may be better prepared for a pay-for-performance structure. | CMS calculates a 30-day mortality rate for each patient condition using three years of MEDPAR data, combined. CMS does not calculate rates for hospitals where the number of cases is too small (less than 25). In these cases, we substitute the comparison group-specific median rate for the affected 30-day mortality measure. | Data are from the CMS Hospital Compare. We include data for July 1, 2010, through June 30, 2013. For more information about this data, see Appendix C.<br><br>We rank hospitals independently on each of the three 30-day mortality rates (AMI, heart failure, and pneumonia), by hospital comparison group. Each patient condition receives one-sixth weight in overall hospital ranking, for a total 30-day mortality rate weight of one-half. | Lower |

## 30-Day Risk-Adjusted Readmission Rates for AMI, Heart Failure, and Pneumonia Patients

| Why We Include This Element | Calculation | Comment | Favorable Values Are |
|---|---|---|---|
| 30-day readmission rates are a widely accepted measure of the effectiveness of hospital care. They allow us to understand how the care the hospital provided to inpatients with these particular conditions may have contributed to issues with their post-discharge medical stability and recovery.<br><br>These measures are now being watched closely in the industry. Tracking these measures may help hospitals identify patients at risk for post-discharge problems if discharged too soon, as well as target improvements in discharge planning and after-care processes. Hospitals that score well may be better prepared for a pay-for-performance structure. | CMS calculates a 30-day readmission rate for each patient condition using three years of MEDPAR data, combined. CMS does not calculate rates for hospitals where the number of cases is too small (less than 25). In these cases, we substitute the comparison group-specific median rate for the affected 30-day readmission rate measure. | Data are from the CMS Hospital Compare. We included data for July 1, 2010, through June 30, 2013. For more information about this data, see Appendix C.<br><br>We rank hospitals independently on each of four available 30-day readmission rates (AMI, heart failure, pneumonia, and hip/knee arthroplasty), by hospital comparison group. Each patient condition receives one-eighth weight in overall hospital ranking, for a total 30-day readmission rate weight of one-half. | Lower |

## Severity-Adjusted Average Length-of-Stay

| Why We Include This Element | Calculation | Comment | Favorable Values Are |
|---|---|---|---|
| A lower severity-adjusted average LOS generally indicates more efficient consumption of hospital resources and reduced risk to patients. | We calculate an LOS index value by dividing the actual LOS by the normalized expected LOS. Expected LOS adjusts for difference in severity of illness using a linear regression model. We normalize the expected values based on the observed and expected LOS of the hospitals in the comparison group. Each hospital LOS index is converted to an average LOS in days by multiplying by the in-study population grand mean LOS. See Appendix C for more information. | This measure uses MEDPAR data for 2013. We adjust average LOS to factor out differences attributable to the varying severity of illness of patients at each hospital using POA-enabled severity-adjustment models. For more information on this model, see Appendix C.<br><br>We rank hospitals on their severity-adjusted average LOS. | Lower |

## Case Mix- and Wage-Adjusted Inpatient Expense per Discharge

| Why We Include This Element | Calculation | Comment | Favorable Values Are |
|---|---|---|---|
| This measure helps to determine how efficiently a hospital cares for its patients. Low values indicate lower costs and thus better efficiency. | We calculate the inpatient expense per discharge measure by aggregating the cost center-level inpatient expense from the hospital cost report and dividing by the total acute inpatient discharges, adjusted for case mix and area wage indexes. See Appendix C for detailed calculations and the Medicare Cost Report locations (worksheet, line, and column) for each calculation element. | This measure uses Medicare Cost Report data for hospital cost reports ending in calendar year 2013. Adjusted inpatient expense per discharge measures the hospital's average cost of delivering inpatient care on a per-unit basis. Inpatient expense for each department is calculated from fully allocated cost using the ratio of inpatient charges to total charges. For inpatient nursing units, this will always be 100 percent of the fully allocated cost. For departments with inpatient and outpatient services, the ratio will vary. Non-reimbursable and special purpose cost centers are omitted as these have no charges for patient care.<br><br>The hospital's CMS-assigned case mix index adjusts inpatient expense to account for differences in patient complexity. The CMS area wage index is applied to labor cost only and accounts for geographic differences in cost of living.<br><br>We rank hospitals on their adjusted inpatient expense per discharge.<br><br>Hospitals with extreme outlier values for this measure are not eligible to be named benchmark hospitals (see "Eliminating Outliers" on page 42). | Lower |

## Medicare Spend per Beneficiary Index

| Why We Include This Element | Calculation | Comment | Favorable Values Are |
|---|---|---|---|
| This measure helps to determine how efficiently a hospital coordinates the care for its patients across a continuum of care sites. Lower values indicate lower costs relative to national medians and thus better efficiency. | CMS calculates the cost of care for each admitted patient, including Medicare Part A and Part B costs. CMS aggregates costs associated with the index admission from three days preadmission, through inpatient stay, and 30 days post-discharge. This cost is divided by the median national cost. CMS applies both numerator and denominator adjustments. An index value above 1.0 means higher-than-national median cost per beneficiary. An index value below 1.0 means lower-than-national median cost per beneficiary. | We report the hospital index published in the CMS Hospital Compare public dataset for calendar year 2013. We rank hospitals on the Medicare spend per beneficiary index. | Lower |

## Adjusted Operating Profit Margin

| Why We Include This Element | Calculation | Comment | Favorable Values Are |
|---|---|---|---|
| Operating profit margin is one of the purest measures of a hospital's financial health. It is a measure of the amount of income a hospital is taking in versus its expenses. | We calculate the adjusted operating profit margin by determining the difference between a hospital's total operating revenue and total operating expense, expressed as a percentage of its total operating revenue, adjusted for net related organization expense. Total operating revenue is the sum of net patient revenue plus other operating revenue. Operating expense is adjusted for net related organization expense. See Appendix C for detailed calculations and the Medicare Cost Report locations (worksheet, line, and column) for each calculation element. | This measure uses Medicare Cost Report data for hospital cost reports ending in calendar year 2013.<br><br>We rank hospitals on their adjusted operating profit margin.<br><br>Hospitals with extreme outlier values for this measure were not eligible to be named benchmark hospitals (see "Eliminating Outliers" on page 42). | Higher |

| HCAHPS Score (Patient Rating of Overall Hospital Performance) | | | |
|---|---|---|---|
| **Why We Include This Element** | **Calculation** | **Comment** | **Favorable Values Are** |
| We believe that including a measure of patient assessment/perception of care is crucial to the balanced scorecard concept. How patients perceive the care a hospital provides has a direct effect on its ability to remain competitive in the marketplace. | We use the HCAHPS survey instrument question, "How do patients rate the hospital, overall?" to score hospitals. Patient responses could fall into three categories, and the number of patients in each category is reported as a percent:<br>▪ Patients who gave a rating of 6 or lower (low)<br>▪ Patients who gave a rating of 7 or 8 (medium)<br>▪ Patients who gave a rating of 9 or 10 (high)<br><br>For each answer category, we assign a weight as follows: 3 equals high or good performance, 2 equals medium or average performance, and 1 equals low or poor performance. We then calculate a weighted score for each hospital by multiplying the HCAHPS answer percent by the category weight. For each hospital, we sum the weighted percent values for the three answer categories. The result is the HCAHPS score. See Appendix C for full details. | Data are from CMS Hospital Compare. We include the HCAHPS results for calendar year 2013.<br><br>We rank hospitals based on the weighted percent sum or HCAHPS score. The highest possible HCAHPS score is 300 (100 percent of patients rate the hospital high). The lowest HCAHPS score is 100 (100 percent of patients rate the hospital low). | Higher |

| Data Sources and Periods | | |
|---|---|---|
| **Performance Measure** | **Current Performance** | **Multi-Year Trend Performance (Everest Award Winner Selection)** |
| Risk-Adjusted Mortality Index | MEDPAR FFY 2012 and 2013 | MEDPAR FFY 2009–2013* |
| Risk-Adjusted Complications Index | MEDPAR FFY 2012 and 2013 | MEDPAR FFY 2009–2013* |
| Risk-Adjusted Patient Safety Index | MEDPAR FFY 2012 and 2013 | MEDPAR FFY 2009–2013* |
| Core Measures Mean Percent | CMS Hospital Compare Oct. 1, 2012–Sept. 30, 2013 (FFY 2013) | CMS Hospital Compare (FFY 2009–FFY 2013) |
| 30-Day Mortality Rate (AMI, Heart Failure, Pneumonia) | CMS Hospital Compare July 1, 2010–June 30, 2013 | CMS Hospital Compare (Three-year datasets ending June 30 in 2009, 2010, 2011, 2012, and 2013) |
| 30-Day Readmission Rate (AMI, Heart Failure, Pneumonia, Hip/Knee Arthroplasty) | CMS Hospital Compare July 1, 2010–June 30, 2013 | CMS Hospital Compare (Three-year datasets ending June 30 in 2009, 2010, 2011, 2012, and 2013) |
| Severity-Adjusted Average LOS | MEDPAR FFY 2013 | MEDPAR FFY 2009–2013* |
| Adjusted Inpatient Expense per Discharge | HCRIS 2013 Medicare Cost Reports | HCRIS 2009–2013 Medicare Cost Reports |
| Medicare Spend per Beneficiary Index | CMS Hospital Compare Calendar Year (CY) 2013 | No Trend Available |
| Adjusted Operating Profit Margin | 2013 Medicare Cost Reports | HCRIS 2009–2013 Medicare Cost Reports |
| HCAHPS | CMS Hospital Compare CY 2013 | CMS Hospital Compare CY 2009–2013 |

*Two years of data are combined for each study year. See the Everest Award section for more details.

## Determining the 100 Top Hospitals

### Eliminating Outliers

Within each of the five hospital comparison groups, we ranked hospitals based on their performance on each of the measures relative to other hospitals in their group. Prior to ranking, we used three methods of identifying hospitals that were performance outliers. These hospitals were not eligible to be named winners.

### Interquartile Range Methodology

We used the interquartile range methodology to identify hospitals with extreme outlier values for the following measures:

- Risk-adjusted patient safety index (high outliers only)
- Case mix- and wage-adjusted inpatient expense per discharge (high or low outliers)
- Adjusted operating profit margin (high and low outliers)

This was done to avoid the possibility of hospitals with poor patient safety performance or a high probability of having erroneous cost report data being declared winners.

For more information on the interquartile range methodology, please see Appendix C.

### Mortality and Complications Outliers

For mortality and complications, which have observed and expected values, we identified hospitals with performance that was statistically worse than expected. This was done because we do not want hospitals that have poor clinical outcomes to be declared winners.

Hospital mortality is considered worse than expected if the observed value is higher than expected and the difference is statistically significant with 95-percent confidence. Confidence interval high and low index values (95-percent confidence) are calculated. When a hospital's observed value is 30 or greater, we use the approximate binomial confidence interval methodology. When a hospital's observed value is less than 30, we use the exact mid-P binomial confidence interval methodology. If the hospital's low confidence interval index value is greater than or equal to 1.0, the hospital is statistically worse than expected and is excluded from the list of possible winners.

### Operating Profit Margin Outliers

We identified hospitals with a negative adjusted operating profit margin as outliers. This was done because we do not want hospitals that fail to meet this very basic financial responsibility to be declared winners.

## Ranking

Within the five hospital comparison groups, we ranked hospitals on the basis of their performance on each of the performance measures independently, relative to other hospitals in their group. Each performance measure is assigned a weight for use in overall ranking (see table below). Each hospital's performance measure ranks were summed to arrive at a total score for the hospitals. The hospitals were then ranked based on their total scores, and the hospitals with the best overall rankings in each comparison group were selected as the winners.

| Measure | Weight |
|---|---|
| Risk-Adjusted Mortality Index | 1 |
| Risk-Adjusted Complications Index | 1 |
| Risk-Adjusted Patient Safety Index | 1 |
| Core Measures Mean Percent | 1 |
| 30-Day Mortality Rates (Heart Attack, Heart Failure, Pneumonia) | 1/6th ea |
| 30-Day Readmission Rates (Heart Attack, Heart Failure, Pneumonia, Hip/Knee Arthroplasty) | 1/8th ea |
| Severity-Adjusted Average LOS | 1 |
| Inpatient Expense per Discharge | 1/2 |
| Medicare Spend per Beneficiary | 1/2 |
| Adjusted Operating Profit Margin | 1 |
| HCAHPS Score (Consumers Overall Hospital Rating) | 1 |

This study hospital population includes:

| Comparison Group | Number of Winners | Number of Nonwinners | Total Hospitals in Study |
|---|---|---|---|
| Major Teaching Hospitals | 15 | 186 | 201 |
| Teaching Hospitals | 25 | 404 | 429 |
| Large Community Hospitals | 20 | 294 | 314 |
| Medium Community Hospitals | 20 | 939 | 959 |
| Small Community Hospitals | 20 | 864 | 884 |
| **All Hospitals** | **100** | **2,687** | **2,787** |

# Appendix A

## Distribution of Winners by State and Region*

| State | Number of Winners | |
|---|---|---|
| | Current Study | Previous Study |
| Alabama | 0 | 0 |
| Alaska | 0 | 0 |
| Arizona | 2 | 1 |
| Arkansas | 0 | 0 |
| California | 14 | 13 |
| Colorado | 3 | 4 |
| Connecticut | 0 | 0 |
| Delaware | 1 | 0 |
| District of Columbia | 0 | 0 |
| Florida | 3 | 6 |
| Georgia | 3 | 2 |
| Hawaii | 0 | 0 |
| Idaho | 1 | 1 |
| Illinois | 10 | 9 |
| Indiana | 4 | 2 |
| Iowa | 3 | 3 |
| Kansas | 2 | 1 |
| Kentucky | 0 | 0 |
| Louisiana | 0 | 1 |
| Maine | 0 | 0 |
| Maryland | 0 | 0 |
| Massachusetts | 2 | 5 |
| Michigan | 4 | 3 |
| Minnesota | 7 | 3 |
| Mississippi | 0 | 0 |
| Missouri | 3 | 1 |
| Montana | 1 | 2 |
| Nebraska | 0 | 0 |
| Nevada | 1 | 0 |
| New Hampshire | 0 | 0 |
| New Jersey | 0 | 0 |

| State | Number of Winners | |
|---|---|---|
| | Current Study | Previous Study |
| New Mexico | 0 | 0 |
| New York | 0 | 0 |
| North Carolina | 2 | 3 |
| North Dakota | 0 | 0 |
| Ohio | 10 | 9 |
| Oklahoma | 0 | 0 |
| Oregon | 1 | 1 |
| Pennsylvania | 1 | 4 |
| Rhode Island | 0 | 0 |
| South Carolina | 3 | 1 |
| South Dakota | 0 | 1 |
| Tennessee | 1 | 2 |
| Texas | 5 | 11 |
| Utah | 7 | 4 |
| Vermont | 0 | 0 |
| Virginia | 1 | 2 |
| Washington | 0 | 0 |
| West Virginia | 0 | 0 |
| Wisconsin | 5 | 5 |
| Wyoming | 0 | 0 |

| Census Region | Number of Winners | |
|---|---|---|
| | Current Study | Previous Study |
| Northeast | 3 | 9 |
| Midwest | 48 | 37 |
| South | 19 | 28 |
| West | 30 | 26 |

*For a listing of states within each census region, see Appendix B.

# Appendix B States Included in Each Census Region

| Northeast | Midwest | South | West |
|---|---|---|---|
| Connecticut | Illinois | Alabama | Alaska |
| Maine | Indiana | Arkansas | Arizona |
| Massachusetts | Iowa | Delaware | California |
| New Hampshire | Kansas | District of Columbia | Colorado |
| New Jersey | Michigan | Florida | Hawaii |
| New York | Minnesota | Georgia | Idaho |
| Pennsylvania | Missouri | Kentucky | Montana |
| Rhode Island | Nebraska | Louisiana | Nevada |
| Vermont | North Dakota | Maryland | New Mexico |
| | Ohio | Mississippi | Oregon |
| | South Dakota | North Carolina | Utah |
| | Wisconsin | Oklahoma | Washington |
| | | South Carolina | Wyoming |
| | | Tennessee | |
| | | Texas | |
| | | Virginia | |
| | | West Virginia | |

# Appendix C: Methodology Details

## Methods for Identifying Patient Severity

Without adjusting for differences in patient severity, comparing outcomes among hospitals does not present an accurate picture of performance. To make valid normative comparisons of hospital outcomes, we must adjust raw data to accommodate differences that result from the variety and severity of admitted cases.

Truven Health Analytics™ is 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. 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.[36]

### Normative Database Development

Truven Health constructed a normative database of case-level data from its Projected Inpatient Data Base (PIDB), a national all-payer database containing more than 27 million all-payer discharges annually. These data are obtained from approximately 3,700 hospitals, representing more than half of all discharges from short-term, general, nonfederal hospitals in the U.S. PIDB discharges are statistically weighted to represent the universe of all short-term, general, nonfederal hospitals in the U.S. Demographic, and clinical data are also included: age, sex, and LOS; clinical groupings (Medicare Severity Diagnosis Related Groups, or MS-DRGs), ICD-9-CM principal and secondary diagnoses, and ICD-9-CM principal and secondary procedures; present-on-admission coding; admission source and type; and discharge status. For this study, risk models were recalibrated using FFY 2012 all-payer data.

### Present-on-Admission Data

Under the Deficit Reduction Act of 2005, as of FFY 2008, hospitals receive reduced payments for cases with certain conditions — such as falls, surgical site infections, and pressure ulcers — that were not present at the time of the patient's admission but occurred during hospitalization. As a result, CMS now requires all inpatient prospective payment system hospitals to document whether a patient has these conditions when admitted. The Truven Health proprietary risk-adjustment models for mortality, complications, and LOS take into account POA data reported in the all-payer data. Our risk models develop expected values based only on conditions that were present on admission.

## Risk-Adjusted Mortality Index Models

Truven Health has developed an overall mortality risk model. We exclude long-term care, psychiatric, substance abuse, rehabilitation, and federally owned or controlled facilities. In addition, we exclude certain patient records from the dataset: psychiatric, substance abuse, rehabilitation, and unclassified cases (MS-DRGs 945, 946, and 999); cases in which patient age was less than 65 years; and cases in which a patient transferred to another short-term, acute care hospital. Palliative care patients (v66.7) are included in the mortality risk model, which is calibrated to determine probability of death for these patients.

A standard logistic regression model is used to estimate the risk of mortality 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, etc.)[37–41] This model takes into account only patient conditions that are present on admission when calculating risk.

Staff physicians at Truven Health have suggested important clinical patient characteristics that were also incorporated into the proprietary 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 health system, hospital, service line, or MS-DRG classification.

## 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 Truven Health complications model uses clinical qualifiers to identify complications that have occurred in the inpatient setting.
The complications used in the model are:

| Complication | Patient Group |
|---|---|
| Postoperative complications relating to urinary tract | Surgical only |
| Postoperative complications relating to respiratory system except pneumonia | Surgical only |
| Gastrointestinal (GI) complications following procedure | Surgical only |
| Infection following injection/infusion | All patients |
| Decubitus ulcer | All patients |
| Postoperative septicemia, abscess, and wound infection | Surgical, including cardiac |
| Aspiration pneumonia | Surgical only |
| Tracheostomy complications | All patients |
| Complications of cardiac devices | Surgical, including cardiac |
| Complications of vascular and hemodialysis devices | Surgical only |
| Nervous system complications from devices/complications of nervous system devices | Surgical only |
| Complications of genitourinary devices | Surgical only |
| Complications of orthopedic devices | Surgical only |
| Complications of other and unspecified devices, implants, and grafts | Surgical only |
| Other surgical complications | Surgical, including cardiac |
| Miscellaneous complications | All patients |

| Complication | Patient Group |
|---|---|
| Cardio-respiratory arrest, shock, or failure | Surgical only |
| Postoperative complications relating to nervous system | Surgical only |
| Postoperative acute myocardial infarction (AMI) | Surgical only |
| Postoperative cardiac abnormalities except AMI | Surgical only |
| Procedure-related perforation or laceration | All patients |
| Postoperative physiologic and metabolic derangements | Surgical, including cardiac |
| Postoperative coma or stupor | Surgical, including cardiac |
| Postoperative pneumonia | Surgical, including cardiac |
| Pulmonary embolism | All patients |
| Venous thrombosis | All patients |
| Hemorrhage, hematoma, or seroma complicating a procedure | All patients |
| Postprocedure complications of other body systems | All patients |
| Complications of transplanted organ (excludes skin and cornea) | Surgical only |
| Disruption of operative wound | Surgical only |
| Complications relating to anesthetic agents and central nervous system (CNS) depressants | Surgical, including cardiac |
| Complications relating to antibiotics | All patients |
| Complications relating to other anti-infective drugs | All patients |
| Complications relating to antineoplastic and immunosuppressive drugs | All patients |
| Complications relating to anticoagulants and drugs affecting clotting factors | All patients |
| Complications relating to blood products | All patients |
| Complications relating to narcotics and related analgesics | All patients |
| Complications relating to non-narcotic analgesics | All patients |
| Complications relating to anticonvulsants and antiparkinsonism drugs | All patients |
| Complications relating to sedatives and hypnotics | All patients |
| Complications relating to psychotropic agents | All patients |
| Complications relating to CNS stimulants and drugs affecting the autonomic nervous system | All patients |
| Complications relating to drugs affecting cardiac rhythm regulation | All patients |
| Complications relating to cardiotonic glycosides (digoxin) and drugs of similar action | All patients |
| Complications relating to other drugs affecting the cardiovascular system | All patients |
| Complications relating to antiasthmatic drugs | All patients |
| Complications relating to other medications (includes hormones, insulin, iron, and oxytocic agents) | All patients |

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. 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,[42–45] including health system, hospital, service line, or MS-DRG classification. This model takes into account only patient conditions that are present on admission when calculating risk.

## Patient Safety Indicators

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

> The Patient Safety Indicators (PSIs) 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 PSIs can be used to help hospitals identify potential adverse events that might need further study, provide the opportunity to assess the incidence of adverse events and in-hospital complications using administrative data found in the typical discharge record, and include indicators for complications occurring in-hospital that may represent patient safety events. And indicators also have area-level analogs designed to detect patient safety events on a regional level.[46]

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 the 20 PSIs included in the original AHRQ methodology, 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 in our study. 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, death in low-mortality DRGs (PSI 2) no longer has risk values in the model.

Since the POA coding has become available with the MEDPAR 2009 dataset, pressure ulcer (PSI 3) and postoperative pulmonary embolism or deep vein thrombosis (PSI 12), which are highly impacted by POA coding, are included. The AHRQ model version used in this study was Version 4.5, published in May 2013. The model used POA coding in MEDPAR data.

The final set of 10 PSIs included in this study are:

- PSI 3: Pressure ulcer
- PSI 4: Death among surgical inpatients with serious treatable complications
- PSI 6: Iatrogenic pneumothorax
- PSI 7: Central venous catheter-related bloodstream infections
- PSI 9: Perioperative hemorrhage or hematoma
- PSI 10: Postoperative physiologic and metabolic derangements
- PSI 11: Postoperative respiratory failure

- PSI 12: Perioperative pulmonary embolism or deep vein thrombosis
- PSI 13: Postoperative sepsis
- PSI 14: Postoperative wound dehiscence

### 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 to calculate two separate outcome measures. Both PSI and ECRI are methodologies for identifying complications of care. Although the definitions have some similarities, there are enough differences that the two are useful complements to each other. ECRI is an overall complication methodology in which the outcome is the occurrence of one or more of 47 complications of care. The AHRQ PSIs used in our study are based on 10 separate models that evaluate the occurrence of 10 distinct complications of care, one of which is mortality-related — an adverse outcome that is not included in the 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 (i.e., 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 of 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, 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 line).

## Core Measures

Core measures were developed by The Joint Commission and endorsed by the National Quality Forum (NQF), the nonprofit public-private partnership organization that endorses national healthcare performance measures, as minimum basic care standards. They have been a widely accepted method for measuring quality of patient care that includes specific guidelines for heart attack (acute myocardial infarction, or AMI), heart failure (HF), pneumonia, pregnancy and related conditions, and surgical care. Although CMS has made reporting of a number of core measures voluntary, as of January 2014, we are continuing the use of these measures in this study, which profiles hospital performance using 2013 datasets.

Our composite core measures mean percent is based on the AMI, HF, pneumonia, and surgical care areas of this program, using Hospital Compare data reported on the CMS website. The data in this study are for Oct. 1, 2012, through Sept. 30, 2013.

In calculating each hospital's core measures mean percent, the comparison group median core measure value was substituted for a missing core measure. In addition, the comparison group median core measure value was substituted when the hospital reported core measures with patient counts less than or equal to 25 or with relative standard error greater than or equal to 0.30. This was done because the original reported values were considered statistically unreliable.

| Heart Attack Core Measures | |
|---|---|
| AMI-2* | Heart attack patients given aspirin at discharge |
| AMI-8a* | Heart attack patients given PCI (percutaneous coronary intervention) within 90 minutes of arrival |
| AMI-10* | Heart attack patients given a prescription for a statin at discharge |

| Heart Failure Core Measures | |
|---|---|
| HF-1 | Heart failure patients given discharge instructions |
| HF-2 | Heart failure patients given an evaluation of left ventricular systolic (LVS) function |
| HF-3 | Heart failure patients given ACE (angiotensin-converting enzyme) inhibitor or ARB (angiotensin receptor blocker) for left ventricular systolic dysfunction (LVSD) |

| Pneumonia Core Measures | |
|---|---|
| PN-3b | Pneumonia patients whose initial emergency room blood culture was performed prior to the administration of the first hospital dose of antibiotics |
| PN-6 | Pneumonia patients given the most appropriate initial antibiotic(s) |

| Surgical Care Improvement Project Core Measures | |
|---|---|
| SCIP-INF-1 | Surgery patients who were given an antibiotic at the right time (within one hour before surgery) to help prevent infection |
| SCIP-INF-2 | Surgery patients who were given the right kind of antibiotic to help prevent infection |
| SCIP-INF-3 | Surgery patients whose preventive antibiotics were stopped at the right time (within 24 hours after surgery) |

*We did not include this measure for small community hospitals due to very low reporting.

| | |
|---|---|
| SCIP-INF-4* | Heart surgery patients whose blood sugar (blood glucose) is kept under good control in the days right after surgery |
| SCIP-VTE-2 | Patients who got treatment at the right time (within 24 hours before or after surgery) to help prevent blood clots after certain types of surgery |
| SCIP-CARD-2 | Surgery patients who were taking heart drugs called beta blockers before coming to the hospital, who were kept on the beta blockers during the periods just before and after surgery |
| SCIP-INF-9 | Surgery patients whose urinary catheters were removed on the first or second day after surgery |
| SCIP-INF-10 | Patients having surgery who were actively warmed in the operating room or whose body temperature was near normal by the end of surgery |

## 30-Day Risk-Adjusted Mortality Rates and 30-Day Risk-Adjusted Readmission Rates

This study currently includes two extended outcome measures — 30-day mortality and 30-day readmission rates, as developed by the CMS and published in the Hospital Compare dataset (third quarter 2014). The longitudinal data period contained in this analysis is July 1, 2010, through June 30, 2013. The Hospital Compare website and database were created by CMS, the Department of Health and Human Services, and other members of the Hospital Quality Alliance. The data on the website come from hospitals that have agreed to submit quality information that will be made public. Both of the measures used in this study have been endorsed by the NQF.

CMS calculates the 30-day mortality and 30-day readmission rates from Medicare enrollment and claims records using sophisticated statistical modeling techniques that adjust for patient-level risk factors and account for the clustering of patients within hospitals. The rates for 30-day mortality are published for heart attack, heart failure, and pneumonia patients; 30-day readmission rates are published for heart attack, heart failure, pneumonia, and elective total hip or knee arthroplasty.

The three CMS mortality models (heart attack, heart failure, and pneumonia) estimate hospital-specific, risk-standardized, all-cause 30-day mortality rates for patients hospitalized with a principal diagnosis of heart attack, heart failure, or pneumonia. All-cause mortality is defined as death from any cause within 30 days after the admission date, regardless of whether the patient dies while still in the hospital or after discharge.

The four CMS readmission models estimate hospital-specific, risk-standardized, all-cause 30-day readmission rates for patients discharged alive to a non-acute care setting with a principal diagnosis of heart attack, heart failure, pneumonia, or elective total hip or knee arthroplasty. Patients may have been readmitted back to the same hospital, to a different hospital, or to an acute care facility. They may have been readmitted for the same condition as their recent hospital stay or for a different reason (this is to discourage hospitals from coding similar readmissions as different readmissions).[33] All readmissions that occur 30 days after discharge to a non-acute care setting are included, with a few exceptions. CMS does not count planned admissions (obstetrical delivery, transplant surgery, maintenance chemotherapy, rehabilitation, and non-acute admissions for a procedure) as readmissions.

*We did not include this measure for small community hospitals due to very low reporting.

## Length-of-Stay Methodologies

We use the Truven Health proprietary severity-adjusted resource demand methodology for the length of stay (LOS) performance measure. The LOS severity-adjustment model is calibrated using our normative Projected Inpatient Data Base (PIDB), a national all-payer database containing more than 27 million all-payer discharges annually, described in more detail at the beginning of this appendix.

Our severity-adjusted resource demand model allows us to produce risk-adjusted performance comparisons on LOS between or across virtually any subgroup of inpatients. These patient groupings can be based on clinical groupings, hospitals, product lines, geographic regions, physicians, etc. This regression model adjusts for differences in diagnosis type and illness severity, based on ICD-9-CM coding. It also adjusts for patient age, gender, and admission status. Its associated LOS weights allow group comparisons on a national level and in a specific market area.

POA coding allows us to determine appropriate adjustments to LOS weights based on pre-existing conditions versus complications that occurred during hospital care. We calculate expected values from model coefficients that are normalized to the clinical group and transformed from log scale.

## Medicare Spending per Beneficiary Index

The Medicare spending per beneficiary (MSPB) index is included in the study as a ranked measure for the first time this year. We have added this measure as a proxy for episode-of-care cost efficiency for hospitalized patients. CMS develops and publishes this risk-adjusted index in the public Hospital Compare datasets, and in FFY 2015, it will be included in the Value-Based Purchasing program. The CMS stated reason for including this measure is "...to reward hospitals that can provide efficient care at a lower cost to Medicare." In this study, we are using data for calendar year 2013.

The MSPB index evaluates hospitals' efficiency relative to the efficiency of the median hospital, nationally. Specifically, the MSPB index assesses the cost to Medicare of services performed by hospitals and other healthcare providers during an MSBP episode, which comprises the period three days prior to, during, and 30 days following a patient's hospital stay. Payments made by Medicare and the beneficiary (i.e., allowed charges) are counted in the MSPB episode as long as the start of the claim falls within the episode window. Inpatient Prospective Payment System (IPPS) outlier payments (and outlier payments in other provider settings) are also included in the calculation of the MSPB index. The index is available for Medicare beneficiaries enrolled in Medicare Parts A and B who were discharged from short-term acute care hospitals during the period of performance. Medicare Advantage enrollees are not included.

The MSPB index is calculated by dividing the profiled hospital's risk-adjusted average episode cost by the national hospital median. The profiled hospital's MSPB amount is the sum of standardized, risk-adjusted spending across all of a hospital's eligible episodes divided by the number of episodes for that hospital. This is divided by the median MSPB amount across all episodes nationally. CMS adjusts spending amounts for area price variation and also for various risk factors including case mix, age, and hierarchical condition category (HCC) indicators

## Inpatient Expense per Discharge and Operating Profit Margin Measure Calculations

A number of our calculations include data from the Medicare Cost Report. Below you will find our calculations and the cost report locations (worksheet, line, and column) for all of these items. The following apply to the 100 Top Hospitals study and the hospital Medicare Cost Report for the hospital fiscal year ending in 2013. The line and column references are the standard based on CMS Form 2552-10. Any deviations from this standard are checked by system and manual data analysis to ensure that coding has been done properly.

### Case Mix- and Wage-Adjusted Inpatient Expense per Discharge

[(0.62 × Acute Inpatient Expense ÷ CMS Wage Index) + 0.38 × Acute Inpatient Expense) ÷ Acute Inpatient Discharges] ÷ Medicare Case Mix Index

Acute Inpatient Expense = Inpatient Expense − Subprovider Expense − Nursery Expense − Skilled Nursing Facility Expense − Intermediate-Care Facility Expense − Other Long-Term Care Facility Expense − Cost Centers Without Revenue (e.g., Organ Procurement, Outpatient Therapy, Other Capital-Related Costs, etc.)

Inpatient Expense = Sum Over All Departments [(Inpatient Department Charges ÷ Department Charges) × Department Cost]

*Individual Element Locations in the Medicare Cost Report:*

- Acute Inpatient Discharges — Worksheet S-3, Line 14, Column 15
- Inpatient Department (Cost Center) elements
  - Fully Allocated Cost — Worksheet C, Part 1, Column 1; If Missing, Use Worksheet B, Part 1, Column 26
  - Total Charges — Worksheet C, Part 1, Column 8
  - Inpatient Charges — Worksheet C, Part 1, Column 6
- Medicare Case Mix Index — Federal Register: CMS IPPS FFY 2013 Final Rule Table 2 (Cost Report End Dates in 2013 Q1, Q2, Q3) or IPPS FFY 2014, Table 2 (Cost Report End Dates in 2013 Q4)
- CMS Wage Index — CMS Federal Register: CMS IPPS FFY 2013 (Cost Report End Dates in 2013 Q1, Q2, Q3) or IPPS FFY 2014, Table 2 (Cost Report End Dates in 2013 Q4

### Adjusted Operating Profit Margin

[(Net Patient Revenue + Other Operating Revenue − (Total Operating Expense + Related Organization Expense)) ÷ (Net Patient Revenue + Other Operating Revenue)] × 100

Other Operating Revenue = [Total Other Income − Other Income: Contributions, Donations, etc. − Other Income From Investments]

*Individual Element Locations in the Medicare Cost Report:*

- Net Patient Revenue — Worksheet G-3, Line 3, Column 1
- Total Other Income — Worksheet G-3, Line 25, Column 1
- Other Income: Contributions, Donations, Etc. — Worksheet G-3, Line 6, Column 1
  Other Income From Investments — Worksheet G-3, Line 7, Column 1
- Total Operating Expense — Worksheet G-3, Line 4, Column 1
- Related Organization Expense — Worksheet A-8, Line 12, Column 2

## HCAHPS Overall Hospital Rating

To measure patient perception of care, this study uses the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) patient survey. HCAHPS is a standardized survey instrument and data collection methodology for measuring patients' perspectives on their hospital care. HCAHPS is a core set of questions that can be combined with customized, hospital-specific items to produce information that complements the data hospitals currently collect to support internal customer service and quality-related activities.

HCAHPS was developed through a partnership between CMS and AHRQ that had three broad goals:

- Produce comparable data on patients' perspectives of care that allow objective and meaningful comparisons among hospitals on topics that are important to consumers
- Encourage public reporting of the survey results to create incentives for hospitals to improve quality of care
- Enhance public accountability in healthcare by increasing the transparency of the quality of hospital care provided in return for the public investment

The HCAHPS survey has been endorsed by the NQF and the Hospital Quality Alliance. The federal government's Office of Management and Budget has approved the national implementation of HCAHPS for public reporting purposes.

Voluntary collection of HCAHPS data for public reporting began in October 2006. The first public reporting of HCAHPS results, which encompassed eligible discharges from October 2006 through June 2007, occurred in March 2008. HCAHPS results are posted on the Hospital Compare website, found at **hospitalcompare.hhs.gov** or through a link on **medicare.gov**. A downloadable version of HCAHPS results is available.

For this study, we used Hospital Compare data for calendar year 2013. Although we are reporting hospital performance on all HCAHPS questions, only performance on the overall hospital rating question, "How do patients rate the hospital, overall?" is used to rank hospital performance. Patient responses fall into three categories, and the number of patients in each category is reported as a percent:

- Patients who gave a rating of 6 or lower (low)
- Patients who gave a rating of 7 or 8 (medium)
- Patients who gave a rating of 9 or 10 (high)

For each answer category, we assign a weight as follows: 3 equals high or good performance, 2 equals medium or average performance, and 1 equals low or poor performance. We then calculate a weighted score for each hospital by multiplying the HCAHPS answer percent by the category weight. For each hospital, we sum the weighted percent values for the three answer categories. Hospitals are then ranked by this weighted percent sum. The highest possible HCAHPS score is 300 (100 percent of patients rate the hospital high). The lowest possible HCAHPS score is 100 (100 percent of patients rate the hospital low).

## Performance Measure Normalization

The mortality, complications, patient safety index, and LOS measures are normalized based on the in-study population and by comparison group to provide a more easily interpreted comparison among hospitals. To address the impact of bed size and teaching status, including extent of residency program involvement, and compare hospitals to other like hospitals, we assign each hospital in the study to one of five comparison groups (major teaching, teaching, large community, medium community, and small community hospitals). Detailed descriptions of the patient and hospital comparison groups can be found in the Methodology section of the 100 Top Hospitals study.

For the mortality and complications measures, we base our ranking on the difference between observed and expected events, expressed in standard deviation units (z-scores) that have been normalized. We normalize the individual hospital z-scores by finding the difference between the hospital z-score and the mean z-score for their comparison group. The difference is then divided by the standard deviation of the comparison group's z-scores to produce the normalized z-score for the hospital.

For the patient safety index measure, we base our ranking on the mean of the normalized z-scores for the included PSIs. Normalized z-scores are calculated for each individual PSI as described above for mortality and complications.

For the LOS measure, we base our ranking on the normalized, severity-adjusted LOS index expressed in days. This index is the ratio of the observed and the normalized expected values for each hospital. We normalize the individual hospital's expected values by multiplying them by the ratio of the observed to expected values for the comparison group. The hospital's normalized index is then calculated by dividing the hospital's observed value by its normalized expected value. We convert this normalized index into days by multiplying by the average LOS of all in-study hospitals (grand mean LOS).

## Interquartile Range Methodology

For each measure, we calculate an interquartile range (IQR) based on data for all in-study hospitals. Two outlier points (trim points) are set for each measure: one upper limit and one lower limit.

A value (X) is considered an outlier if either of the following is true:

X > = Upper-Limit Outlier Point
X < = Lower-Limit Outlier Point

The procedure for calculating the IQR and outlier points is as follows:

- Determine the first quartile (Q1). This is the 25th percentile value of all records in the population
- Determine the third quartile (Q3). This is the 75th percentile value of all records in the population
- Calculate the IQR by subtracting Q1 from Q3. (IQR = Q3 – Q1)
- Calculate the upper-limit trim point for the PSI index and the upper- and lower-limit trim points for inpatient expense per discharge:
  - Upper Limit = Q3 + (3.0 × IQR)
  - Lower Limit = Q1 – (3.0 × IQR)
- Calculate the upper- and lower-limit trim points for operating profit margin:
  - Upper Limit = Q3 + (2.0 × IQR)
  - Lower Limit = Q1 – (2.0 × IQR)

Data points that are outside the IQR limits are considered to be extreme outliers and are excluded.

## 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.[47]

We also do not report percent change when the metrics are already percentages. In these cases, we report the simple difference between the two percentage values.

## Protecting Patient Privacy

In accordance with patient privacy laws, we do not report any individual hospital data that are based on 11 or fewer patients. This affects the following measures:

- Risk-adjusted mortality index
- Risk-adjusted complications index
- 30-day mortality rates for AMI, heart failure, and pneumonia (CMS does not report a rate when count is less than 25)
- 30-day readmission rates for AMI, heart failure, pneumonia, and hip/knee replacement (CMS does not report a rate when count is less than 25)
- Average LOS

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