Watson Health®

100 Top Hospitals®

Study
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IBM Watson Health™
75 Binney Street
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Watson Health 100 Top Hospitals Study, 2021; 28th edition

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Contents

Introduction

Welcome to the 28th edition of the Watson Health® 100 Top Hospitals® study from IBM® Watson Health.

For over 26 years, the 100 Top Hospitals program has been producing annual, quantitative studies designed to shine a light on the nation's highest performing hospitals and health systems.

This year's study of US hospitals began with the same goal that has driven each study since the beginning of the 100 Top Hospitals program: To identify top performers and deliver insights that may help all healthcare organizations better focus their improvement initiatives on achieving consistent, balanced, and sustainable high performance.

Illuminating achievement for a value-based world

Our research is based on clinical, operational, and patient perception-of-care measures that form a balanced scorecard. For over 26 years, the hospitals achieving excellence on our scorecard inherently set attainable benchmarks for others in the industry to aspire to over time.

Providing these measures of successful performance may be especially important today as the healthcare landscape continues to evolve from fee-for-service toward value-based care models.

100 Top Hospitals winners consistently set industry benchmarks for measures like 30-day readmissions, mortality rates, and patient experience.

By finding ways to take balanced performance to the next level, the winners of our 100 Top Hospitals award are identifying opportunities to deliver healthcare value to patients, communities, and payers. The performance levels achieved by these hospitals may motivate their peers to use data, analytics, and benchmarks to close performance gaps.

Hospitals do not apply for our 100 Top Hospitals selection process, and award winners do not pay to market their honor.

Delivering a transparent assessment

To maintain the 100 Top Hospitals study's integrity and avoid bias, we use public data sources and explain the methodologies we use to calculate outcome metrics. This supports inclusion of hospitals across the country and facilitates consistency of definitions and data.

Our national balanced scorecard, based on Norton and Kaplan's concept,[1] is the foundation of our research. It is comprised of key measures of hospital performance: inpatient and extended care quality, operational efficiency, financial health, and customer experience. The composite score derived from these measures reflects excellence in hospital care, management, and leadership.

In addition, to support consideration of different types of hospitals, the 100 Top Hospitals study categorizes the nation's hospitals into five groups: major teaching, teaching, large community, medium community, and small community hospitals. This produces benchmarks that are comparable and action-driving across each organizational type. This is important because each kind of hospital has its own set of challenges and opportunities.

Yielding a measure of leadership excellence

Since 1993, the 100 Top Hospitals program has sought to shed light on the efficacy of innovative leaders. The methodology is aimed at identifying leaders who can transform an organization by pinpointing improvement opportunities and adjusting goals for key performance domains. We believe that higher composite scores on the balanced scorecard typically indicate more effective leadership and a consistent delivery of value.

The leadership of today's hospitals, including the board, executive team, and medical staff leadership, is responsible for ensuring all facets of a hospital are performing at similarly high levels in both the short and long term. The 100 Top Hospitals study and analytics provide a view of that enterprise performance alignment.

As the nation continues to focus on improving our health care industry, hospitals are increasingly recognizing the importance of working to promote community health and equity.

For the first time, the 100 Top Hospitals program is incorporating a community health measure into its ranking process this year. Our initial goal was that the community health measure would be weighted equally with other ranking domains assessing inpatient outcomes, extended outcomes, processes of care, operational efficiency, financial health, and patient experience.

Comparing the performance of our 2021 winners to nonwinners

Using the measures presented in our national balanced scorecard, this year's 100 Top Hospitals study revealed significant differences between award winners and their nonwinning peers.

Our study's highest-performing hospitals:

- Had lower inpatient mortality, considering patient severity
- Had fewer patient complications
- Delivered care that resulted in fewer HAIs
- Had lower 30-day mortality and 30-day hospital-wide readmission rates
- Sent patients home sooner
- Provided faster emergency care
- Kept inpatient expenses low while still maintaining a healthy financial environment
- Scored higher on patient ratings of their overall hospital experience

Our study projections also indicate that if the benchmarks of performance established by this year's winners were achieved by all hospitals in the US, the following would be true:

- More than 79,000 additional lives could be saved in-hospital
- Over 44,000 additional patients could be complication-free
- Over $10.1 billion in inpatient costs could be saved
- The typical patient could be released from the hospital almost a half-day sooner and
- ED patients could spend 20 fewer minutes per visit in hospital emergency rooms
- Over 34,000 fewer discharged patients would be readmitted within 30 days

This analysis is based on applying the difference between study winners and nonwinners to Medicare patient counts. If the same standards were applied to all inpatients, the impact would be even greater. For more details about this study's findings and the achievements of the 100 Top Hospitals, please see the Findings section of this document.

Welcoming your input

The 100 Top Hospitals program works to ensure that the measures and methodologies used in our studies are fair, consistent, and meaningful. We continually test the validity of our performance measures and data sources. In addition, as part of our internal performance improvement process, we welcome comments about our study from health system, hospital, and physician executives.

Showcasing the versatility of the 100 Top Hospitals program

The 100 Top Hospitals research is one of three major annual studies of the Watson Health 100 Top Hospitals program. To increase understanding of trends in specific areas of the healthcare industry, the program includes:

100 Top Hospitals and Everest Award studies
Research that annually recognizes the 100 top rated hospitals in the nation based on a proprietary, balanced scorecard of overall organizational performance, and identifies those hospitals that also excel at long- term rates of improvement in addition to performance

50 Top Cardiovascular Hospitals study
An annual study introduced in 1999 that identifies hospitals demonstrating the highest performance in hospital cardiovascular services for four important patient groups: heart attack, heart failure, coronary artery bypass graft and percutaneous coronary intervention

15 Top Health Systems study
An annual study introduced in 2009 that provides an objective measure of health system performance overall and offers insight into the ability of a system's member hospitals to deliver consistent top performance across the communities they serve, all based on our national health system scorecard

In addition to the major studies, customized analyses are also available from the 100 Top Hospitals program, including custom benchmark reports. Our reports are designed to help healthcare executives understand how their organizational performance compares to peers within health systems, states, and markets. 100 Top Hospitals program reports offer a two-dimensional view of both performance improvement over time, applying the most current methodologies across all years of data to produce trends, as well as the most current year performance. You can read more about these studies, order customized reports, and view lists of all winners by visiting 100tophospitals.com.

About IBM Watson Health

Each day, professionals throughout the health ecosystem make powerful progress toward a healthier future. At IBM Watson Health, we help them remove obstacles, optimize efforts, and reveal new insights to support the people they serve.

Working across the landscape, from payers and providers to governments and life sciences, we bring together deep health expertise; proven innovation; and the power of artificial intelligence to enable our customers to uncover, connect, and act as they work to solve health challenges for people everywhere.

For more information, visit ibm.com/watsonhealth.

2021 100 Top Hospitals award winners

The Watson Health 100 Top Hospitals® program is pleased to present the 2021 Watson Health 100 Top Hospitals.

Note that the order of hospitals in the following tables does not reflect performance rating. Hospitals are ordered alphabetically. For full details on these peer groups and the process we used to select the winning benchmark hospitals, see the Methodology section of this document. Everest winners are noted in Bold in the tables below.

Major Teaching Hospitals

Hospitals	Location	Medicare ID	Total Year(s) Won
Ascension Providence Hospital - Southfield Campus	Southfield, MI	230019	12
Baylor Scott & White Medical Center - Temple	Temple, TX	450054	11
Baylor University Medical Center	Dallas, TX	450021	3
Emory University Hospital Midtown	Atlanta, GA	110078	1
Mercy Health Saint Mary's	Grand Rapids, MI	230059	3
Morristown Medical Center	Morristown, NJ	310015	1
NorthShore University HealthSystem	Evanston, IL	140010	22
Riverside Methodist Hospital	Columbus, OH	360006	13
Saint Francis Hospital and Medical Center	Hartford, CT	070002	9
Spectrum Health Hospitals	Grand Rapids, MI	230038	11
St. Joseph Mercy Ann Arbor Hospital	Ann Arbor, MI	230156	12
St. Luke's University Hospital - Bethlehem	Bethlehem, PA	390049	9
University Hospital	Madison, WI	520098	6
University of Utah Hospital	Salt Lake City, UT	460009	4
UPMC Pinnacle Harrisburg	Harrisburg, PA	390067	1

Teaching Hospitals

Hospitals	Location	Medicare ID	Total Year(s) Won
Aspirus Wausau Hospital	Wausau, WI	520030	9
Avera McKennan Hospital & University Health Center	Sioux Falls, SD	430016	7
Banner - University Medical Center South	Tucson, AZ	030111	2
Brandon Regional Hospital	Brandon, FL	100243	9
Grand Strand Medical Center	Myrtle Beach, SC	420085	1

Hospitals	Location	Medicare ID	Total Year(s) Won
HonorHealth Scottsdale Thompson Peak Medical Center	Scottsdale, AZ	030123	2
LDS Hospital	Salt Lake City, UT	460006	5
McKay-Dee Hospital	Ogden, UT	460004	8
Mercy Hospital Northwest Arkansas	Rogers, AR	040010	3
Methodist Hospital	Saint Louis Park, MN	240053	6
Missouri Baptist Medical Center	Saint Louis, MO	260108	4
Morton Plant Hospital	Clearwater, FL	100127	8
Mount Carmel St. Ann's	Westerville, OH	360012	4
Orlando Health Orlando Regional Medical Center	Orlando, FL	100006	4
Redmond Regional Medical Center	Rome, GA	110168	2
Rose Medical Center	Denver, CO	060032	14
Saint Joseph Hospital	Denver, CO	060028	6
Sentara Leigh Hospital	Norfolk, VA	490046	6
Sky Ridge Medical Center	Lone Tree, CO	060112	4
St. Mark's Hospital	Salt Lake City, UT	460047	8
The Medical Center of Aurora	Aurora, CO	060100	3
UCHealth Poudre Valley Hospital	Fort Collins, CO	060010	15
UH Geauga Medical Center	Chardon, OH	360192	4
United Hospital Center	Bridgeport, WV	510006	3
Wesley Medical Center	Wichita, KS	170123	2

Large Community Hospitals

Hospitals	Location	Medicare ID	Total Year(s) Won
AdventHealth Daytona Beach	Daytona Beach, FL	100068	4
AdventHealth Shawnee Mission	Shawnee Mission, KS	170104	5
Asante Rogue Regional Medical Center	Medford, OR	380018	8
Ascension St. Vincent's Southside	Jacksonville, FL	100307	2
Edward Hospital	Naperville, IL	140231	5
El Camino Hospital	Mountain View, CA	050308	4
Elmhurst Hospital	Elmhurst, IL	140200	2
FirstHealth Moore Regional Hospital	Pinehurst, NC	340115	6
Houston Methodist Sugar Land Hospital	Sugar Land, TX	450820	3
Houston Methodist Willowbrook Hospital	Houston, TX	450844	3
Mercy Hospital Oklahoma City	Oklahoma City, OK	370013	6
Mission Regional Medical Center	Mission, TX	450176	2
Olathe Medical Center	Olathe, KS	170049	1
Parkridge Medical Center	Chattanooga, TN	440156	3
Piedmont Fayette Hospital	Fayetteville, GA	110215	6
Silver Cross Hospital	New Lenox, IL	140213	9

Hospitals	Location	Medicare ID	Total Year(s) Won
St. Clair Hospital	Pittsburgh, PA	390228	7
St. David's Medical Center	Austin, TX	450431	12
St. Joseph's Hospital	Tampa, FL	100075	5
TriStar Centennial Medical Center	Nashville, TN	440161	5

Medium Community Hospitals

Hospitals	Location	Medicare ID	Total Year(s) Won
AdventHealth Wesley Chapel	Wesley Chapel, FL	100319	4
Ascension St. Vincent's Clay County	Middleburg, FL	100321	3
Baptist Medical Center Beaches	Jacksonville Beach, FL	100117	2
Baptist Memorial Hospital-North Mississippi	Oxford, MS	250034	1
CHI Health Lakeside	Omaha, NE	280130	1
Dublin Methodist Hospital	Dublin, OH	360348	8
East Liverpool City Hospital	East Liverpool, OH	360096	4
Englewood Community Hospital	Englewood, FL	100267	2
Fairview Park Hospital	Dublin, GA	110125	5
Maple Grove Hospital	Maple Grove, MN	240214	3
McLaren Northern Michigan	Petoskey, MI	230105	2
Mercy Iowa City	Iowa City, IA	160029	3
MercyOne Dubuque Medical Center	Dubuque, IA	160069	3
Orlando Health South Lake Hospital	Clermont, FL	100051	1
Reston Hospital Center	Reston, VA	490107	1
Saint Mary's Regional Medical Center	Reno, NV	290009	2
Sentara RMH Medical Center	Harrisonburg, VA	490004	1
St. Luke's Anderson Campus	Easton, PA	390326	3
TriStar Hendersonville Medical Center	Hendersonville, TN	440194	5
Wooster Community Hospital	Wooster, OH	360036	7

Small Community Hospitals

Hospitals	Location	Medicare ID	Total Year(s) Won
American Fork Hospital	American Fork, UT	460023	9
Ashley Regional Medical Center	Vernal, UT	460030	2
Banner Ironwood Medical Center	San Tan Valley, AZ	030130	1
Baptist Health - Hot Spring County	Malvern, AR	040076	2
Barnes-Jewish West County Hospital	Saint Louis, MO	260162	2

Hospitals	Location	Medicare ID	Total Year(s) Won
Bartow Regional Medical Center	Bartow, FL	100121	1
Buffalo Hospital	Buffalo, MN	240076	7
Cedar City Hospital	Cedar City, UT	460007	10
Coshocton Regional Medical Center	Coshocton, OH	360109	1
Fort Memorial Hospital	Fort Atkinson, WI	520071	1
Hill Country Memorial Hospital	Fredericksburg, TX	450604	9
Lehigh Regional Medical Center	Lehigh Acres, FL	100107	1
Lone Peak Hospital	Draper, UT	460060	3
Mercy Health - Tiffin Hospital	Tiffin, OH	360089	1
Parkview Whitley Hospital	Columbia City, IN	150101	2
Saint Alphonsus Medical Center - Ontario	Ontario, OR	380052	1
Spectrum Health Zeeland Community Hospital	Zeeland, MI	230003	7
SSM Health St. Mary's Hospital - Centralia	Centralia, IL	140034	2
St. Joseph Mercy Chelsea Hospital	Chelsea, MI	230259	3
St. Luke's Miners Campus	Coaldale, PA	390183	1

2021 Everest Award winners

The Watson Health 100 Top Hospitals® Everest Award honors hospitals that have both the highest current performance and the fastest long-term improvement in the years of data analyzed.

Jean Chenoweth, the founder of the 100 Top Hospitals program, regarded the Everest Award as the highest achievement for any hospital. She devoted her professional life to improving healthcare in the United States. Leader of the 100 Top Program for nearly three decades, her legacy is her commitment to high quality standards and performance improvement.

This award recognizes the boards, executives, and medical staff leaders who developed and executed the strategies that drove the highest rates of improvement, resulting in the highest performance in the US 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 2021, only 20 organizations achieved this level of performance.

The 2021 Everest Award winners

IBM® Watson Health® is pleased to present the winners of the 2021 100 Top Hospitals Everest Award, on the next page.

2021 Everest Award winners

2021 Everest Award winners			
Hospitals	**Location**	**Medicare ID**	**Total year(s) won**
AdventHealth Daytona Beach	Daytona Beach, FL	100068	2
Banner - University Medical Center South	Tucson, AZ	030111	2
Baptist Health - Hot Spring County	Malvern, AR	040076	1
Baylor University Medical Center	Dallas, TX	450021	1
El Camino Hospital	Mountain View, CA	050308	2
Elmhurst Hospital	Elmhurst, IL	140200	2
Houston Methodist Sugar Land Hospital	Sugar Land, TX	450820	2
Houston Methodist Willowbrook Hospital	Houston, TX	450844	1
Lehigh Regional Medical Center	Lehigh Acres, FL	100107	1
Lone Peak Hospital	Draper, UT	460060	1
Mercy Health - Tiffin Hospital	Tiffin, OH	360089	1
Mission Regional Medical Center	Mission, TX	450176	2
Missouri Baptist Medical Center	Saint Louis, MO	260108	1
Orlando Health South Lake Hospital	Clermont, FL	100051	1
Parkridge Medical Center	Chattanooga, TN	440156	1
Saint Mary's Regional Medical Center	Reno, NV	290009	2
St. David's Medical Center	Austin, TX	450431	2
St. Mark's Hospital	Salt Lake City, UT	460047	3
TriStar Centennial Medical Center	Nashville, TN	440161	1
UPMC Pinnacle Harrisburg	Harrisburg, PA	390067	1

The value of the Everest Award measures to the healthcare industry

Leaders facing the challenges of a rapidly changing healthcare environment may benefit from unbiased intelligence that provides objective insights into complex organizational performance. Those insights may also help leaders balance short- and long-term goals to drive continuous gains in performance and value.

Transparency may present hospital boards and CEOs with a public challenge to increase the value of core services to their communities. Providing value is characteristically not a one-time event; it is a continuous process of increasing worth over time. The goal of the 100 Top Hospitals program is to provide information that can help inform the leadership decisions that guide hospitals to achieve those objectives.

We believe the greatest value can be achieved when leaders integrate knowledge of their organization’s performance compared to national benchmarks with information on rates of improvement compared to peers. In this way, leaders can determine the effectiveness of

long- term strategies that led to current performance and understand where to act to course correct.

Our research is designed to help boards and CEOs better answer 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 are considering help us achieve improvement goals?
- Can we quantify the long- and short-term increases in value our hospital has provided to our community?

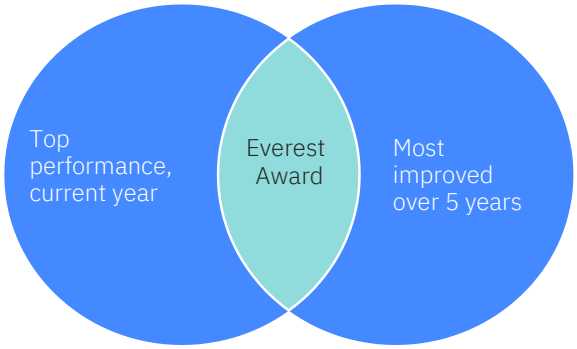
How we select the Everest Award winners

Winners of the 100 Top Hospitals Everest Award set national benchmarks for both fastest rate of improvement and highest current 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 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 (2019 at the time of this study)
2. Using our five-year (2015 -2019) 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 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 100 Top Hospitals studies, our methodology is designed to be objective, and all data comes from public sources. We build a database of short-term, acute care, nonfederal US hospitals that treat a broad spectrum of patients. The primary data sources are the Medicare Provider Analysis and Review (MEDPAR) patient claims data set, the Centers for Medicare & Medicaid Services Hospital Compare hospital performance data set, and the Hospital Cost Report Information System 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. Residency program information, used in classifying teaching hospitals, is from the Accreditation Council for Graduate Medical Education (AMA- and AOA-accredited programs).

For this year's study, after excluding hospitals with insufficient, missing, or invalid data, along with hospitals that would skew study results (for example, specialty hospitals), we had a database study group of 2675 hospitals.

Comparison groups

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

- Major teaching hospitals
- Teaching hospitals
- Large community hospitals
- Medium community hospitals
- Small community hospitals

To support evaluating hospitals fairly and comparing them to like hospitals, we use these comparison groups for all scoring and ranking to uncover winners. For more information on how we build the database, see the Methodology section.

Performance measures

Both the 100 Top Hospitals and the Everest Awards are based on a set of measures that, taken together, are designed to assess balanced performance across the organization, reflecting the leadership effectiveness of board members, management, and medical and nursing staff. These measures fall into five domains of performance: inpatient outcomes, extended outcomes, operational efficiency, financial health, and patient experience.

The 11 measures used to select the 2021 winners are:

1. Risk-adjusted inpatient mortality index
2. Risk-adjusted complications index
3. Mean healthcare-associated infection index
4. Mean 30-day risk-adjusted mortality rate (includes acute myocardial infarction [AMI], heart failure [HF], pneumonia, chronic obstructive pulmonary disease [COPD], and stroke)
5. 30-day risk-adjusted hospital-wide readmission rate
6. Severity-adjusted average length of stay
7. Mean emergency department throughput (in minutes)
8. Case mix- and wage-adjusted inpatient expense per discharge
9. Medicare spend per beneficiary
10. Adjusted operating profit margin
11. Hospital Consumer Assessment of Healthcare Providers and Systems score (overall hospital performance)

For full details, including calculation and scoring methods, see the Methodology section. We use present-on-admission (POA) data in our proprietary risk models. POA coding became available in the 2009 MEDPAR data set. For the inpatient mortality and complications (clinical measures with low frequency of occurrence), we combine two years of data for each study year to stabilize results. Due to the unavailability of ICD-10-CM codes in 2015 MEDPAR data, we reduced the trend years for the inpatient mortality and complications measures to four years with duplication of 2016 MEDPAR data for study year 2016. The average length of stay measure has four trend years as well, but only one MEDPAR data year for each study year, 2016-2019. The combined data sets as follows:

For study year	MEDPAR data sets
2019	2018 and 2019
2018	2018 and 2017
2017	2017 and 2016
2016	2016 and 2016

For specific data periods used for each measure, see the Methodology section.

Ranking and five-year trend summary

To select the 100 Top Hospitals award winners, we rank hospitals on current study 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.

This year, we have introduced an additional element in the ranking of the top hospitals. Although it did not affect the list of 100 Top winners, it did modify the final rankings in the comparison groups.

The methodology used to incorporate the Community Health Measure was to take the final ranking within the five hospital comparison groups, and independently rank the performance of the Community Health Measures relative to other hospitals in their comparison group. We added the rank of the Community Health measure to the final sum (based on the eleven outcome measures) and re-ranked the hospitals within each comparison group. The final rankings are published on the *Fortune* website.

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 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 Watson Health 100 Top Hospitals® study shines a light on the top-performing hospitals in the country. According to publicly available data and our transparent methodologies, these industry leaders appear to have successfully negotiated the fine line between running highly effective operations and being innovative and forward-thinking in ways that grow their organizations over the short and long term.

Year after year, the public data we have gathered for the 100 Top Hospitals studies has provided numerous examples of benchmark hospitals' clinical, financial and operational excellence and affirmed the validity and stability of this approach to performance measurement.[2–28]

The study is more than a list of accomplishments: It is a method US hospital and health system leaders can use to help guide their own performance improvement initiatives. By highlighting what the highest-performing leaders around the country are doing well, we create aspirational benchmarks for the rest of the industry.

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

- Over 79,000 additional lives could be saved in-hospital
- Over 44,000 additional patients could be complication-free
- Over $10.1 billion in inpatient costs could be saved
- The typical patient could be released from the hospital almost a half day sooner
- Over 34,000 fewer discharged patients would be readmitted within 30 days
- Patients would spend 20 fewer minutes per visit in hospital emergency rooms

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.

Note: All currency amounts listed in this 100 Top Hospitals study are in US dollars.

How the winning hospitals compared to their peers

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

Note: In Tables 1 through 6, data for the 100 Top Hospitals award winners is labeled "Benchmark," and data for all hospitals, excluding award winners, is labeled "Peer group." In columns labeled "Benchmark compared with peer group," we calculated the actual and percentage difference between the benchmark hospital scores and the peer group scores.

100 Top Hospitals had better survival rates

- Overall, the winners had 23% fewer deaths than expected (0.77 index), considering patient severity, while their nonwinning peers had only 1% less deaths than would be expected (0.99 index) (Table 1)
- Small community hospitals had the most dramatic difference between winners and nonwinners; the winning small hospital median mortality rate was 49% lower than nonwinning peers (Table 6)
- Medium-sized community hospitals also had a significantly lower median mortality index values than nonwinning peer hospitals, with a 24% lower mortality index (Table 5)

100 Top Hospitals had fewer patient complications

- Overall, patients at the winning hospitals had 27% fewer complications than expected (0.73 index), considering patient severity, while their nonwinning peers had only 8% fewer complications than expected (0.92 index) (Table 1)
- For complications, as with inpatient mortality, small community hospitals had the most dramatic difference between winners and nonwinners; the winning small hospital median observed-to- expected ratio of complications was 35.1% lower than nonwinning peers' index value (0.58 versus 0.90) (Table 6)

100 Top Hospitals had fewer healthcare-associated infections

The healthcare-associated infections (HAIs) measure captures information about the quality of inpatient care. Based on nation-wide data availability, we built a composite measure of HAI performance at the hospital level, considering up to six HAIs, depending on assigned comparison group. (The HAI measure is not ranked for small community hospitals.) The six reported HAIs are: methicillin- resistant staphylococcus aureus (MRSA- bloodstream), central line-associated blood stream infections, catheter-associated urinary tract infections, clostridium difficile (C.diff), surgical site infections (SSIs) following colon surgery, and SSIs following an abdominal hysterectomy.

- Overall, nationally, there were 40% fewer infections than expected at winning hospitals (0.60 standardized infection ratio [SIR] median), compared to 31% fewer infections at peer nonwinning hospitals (0.69 SIR median) (Table 1)
- On the HAI composite index, major teaching hospitals showed the widest difference between winning benchmark hospital performance and nonwinners, with the winning median HAI composite index 22.9% lower than the median value of nonwinners (0.64 and 0.82 median SIR values, respectively) (Table2)
- The winners among large community hospitals had 43% fewer infections than expected (0.57 SIR median), while their nonwinning teaching peers had 32% fewer infections than expected (0.68 SIR median) (Table4)

100 Top Hospitals had lower 30-day mortality and 30-day hospital-wide readmission rates

Several patient groups are included in the 30-day mortality extended care composite metrics. The mean 30-day mortality rate includes heart attack (AMI), heart failure (HF), pneumonia, chronic obstructive pulmonary disease (COPD), and stroke patient groups. The 30-day hospital-wide readmission rate is an outcome measure for unplanned, all-cause readmissions to an acute care facility within 30 days of discharge.

- Mean 30-day mortality rates were lower at the winning hospitals than nonwinning hospitals, across all comparison groups (by 0.7 percentage points) (Table 1)
- Medium community hospital winners demonstrated the best 30-day mortality performance among all hospital comparison groups this year, with a median rate at 11.4% (Table 5)
- As with the 30-day mortality rates, benchmark hospitals had lower 30-day hospital-wide readmission rates than the peer hospitals, across all comparison groups by 0.6 percentage points (Table 1)
- Major teaching hospital winners outperformed nonwinners on 30-day hospital-wide readmissions by the greatest margin (1.1 percentage points) (Table 2)

Patients treated at 100 Top Hospitals returned home sooner

- Overall, winning hospitals had a median severity- adjusted average length of stay (LOS) that was 0.4 day shorter than peers (Table 1)
- Winning major teaching and small community hospitals had the largest difference from the non-winners in average LOS, with a median average LOS of 0.6 days shorter (Tables 2 and 6)
- Among teaching hospitals, there was also a large difference between winners and nonwinners on median average LOS, at 4.4 days versus 4.9 days (a 10.5% difference) (Table 3)

Patients spent less time in 100 Top Hospitals emergency departments

- Overall, winning hospitals had shorter median wait times for emergency services than their peers, by 15.1% (Table 1)
- The most dramatic difference in emergency department (ED) service delivery times between winning hospitals and their peers occurred in the major teaching category where there was 44minutes less time-to-service; winning teaching hospitals followed right behind with 35.5 minutes less time-to-service (Tables 2 and 3)
- However, major teaching hospitals had the longest average ED throughput times of all comparison groups, at 161 minutes for winners and 205 minutes for nonwinners (Tables 2 through 6)

- Small community hospitals had the shortest average ED throughput times of all comparison groups for both winning and nonwinning hospitals (93.8and 100.5 minutes, respectively) (Table 6)

100 Top Hospitals had lower inpatient expenses and Medicare spend per beneficiary episode costs

- The findings show that overall, and in all comparison groups, the winning hospital median for case mix- and wage-adjusted inpatient expense per discharge was lower than the median for nonwinner peers this year (Tables 1 through 6)
- For Medicare spend per beneficiary (MSPB), a measure of the total Medicare-paid claim amounts associated with an inpatient episode, including three days prior through 30 days post discharge, winning hospitals had a lower median index than nonwinning hospitals by 3.4%, overall (Table 1)
- Medium community hospital winners had the lowest case mix- and wage- adjusted inpatient expense per discharge than any other comparison group with expenses at $5,896. Nonwinning hospitals in the large community hospital group had the lowest expense than any other comparison group at $6,786 (Tables 4 and 5)
- The largest difference in expenses between and winning and nonwinning hospitals was found in the major teaching hospital comparison group with a difference of $2,036 (Table 2)
- The best MSPB 30-day risk-adjusted episode spending performance was observed in the small community hospital group, where both winners and nonwinners outperformed all other groups by having MSPB index values of 0.90 and 0.96, respectively (Table 6)

100 Top Hospitals were more profitable

- Overall, winning hospitals had a median operating profit margin that was 11.8 percentage points higher than nonwinning hospitals (15.8% versus 4.0%) (Table 1)
- Profitability difference was the most dramatic in the small community hospital group, where winners had operating profit margins that were 15.5 percentage points higher than nonwinners (Table 6)
- Teaching and small community hospital winners had the largest median operating profit margin of the other winning groups at 17.2% (Tables 3 and 6)
- In contrast, major teaching hospital winners had the lowest median operating profit margin of any winning group at 11.7% (Table 2)

Patients rated 100 Top Hospitals higher than peer hospitals

- Patients treated at the 100 Top Hospitals reported a better overall hospital experience than those treated in peer hospitals, with a Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) overall top-box percent

median value that was 6.0% percentage points higher, as reported on CMS Hospital Compare (Table 1)

- The winning large community hospitals had the highest median HCAHPS top-box percent among all comparison groups, at 79% versus 70% for nonwinners (Table 4)
- Large community hospital winners also had the biggest performance difference over peers (9.0 percentage points higher HCAHPS rates) among all comparison groups (Table 4)

Table 1: National Performance Comparisons (All Hospitals in Study)

Table 1: National Performance Comparisons (All Hospitals in Study)						
Domain	Performance Measures	Medians		Benchmark Compared With Peer Group		
		Benchmark Hospitals (Winners)	Peer Hospitals (Nonwinners)	Difference	Percent Difference	Comments
Clinical Outcomes	Inpatient Mortality Index[1]	0.77	0.99	-0.22	-22.3%	Lower mortality
	Complications Index[1]	0.73	0.92	-0.18	-20.1%	Fewer complications
	HAI Index[2]	0.60	0.69	-0.09	-13.1%	Fewer infections
Extended Outcomes	30-Day Mortality Rate[3]	11.6	12.3	-0.7	n/a[7]	Lower 30-day mortality
	30-Day Hosp-Wide Readmission Rate[4]	15.0	15.6	-0.6	n/a[7]	Fewer 30-day readmissions
Operational Efficiency	Average Length of Stay[1]	4.4	4.7	-0.4	-7.7%	Shorter stays
	ED Throughput Measure[5]	111.3	131.0	-19.8	-15.1%	Less time to service
	Inpatient Expense per Discharge[6]	$6,186	$7,190	-$1,004	-14.0%	Lower inpatient cost
	Medicare Spend per Beneficiary[5]	0.96	0.99	-0.03	-3.4%	Lower Episode Cost
Financial Health	Operating Profit Margin[6]	15.8	4.0	11.8	n/a[7]	Higher profitability
Patient Experience	HCAHPS Top Box (%)[5]	77.0	71.0	6.0	n/a[7]	Better patient experience

1. Mortality, complications and average length of stay based on Present on Admission (POA)-enabled risk models applied to MEDPAR 2018 and 2019 data (ALOS 2019 only)
2. Healthcare-Associated Infections (HAI) data from CMS Hospital Compare Jan 1, 2019 - Dec 31, 2019 data set (excluding Small Community Hospitals)
3. 30-day rates from CMS Hospital Compare July 1, 2016-June 30, 2019 data set
4. 30-day rates from CMS Hospital Compare July1, 2018-June 30, 2019 data set
5. ED measure, MSPB and HCAHPS data from CMS Hospital Compare Jan 1, 2019-Dec 31, 2019 data set
6. Inpatient expense and operating profit margin data from CMS Hospital Cost Report Information System (HCRIS) data file, 2019
7. We do not calculate percent difference for this measure because it is already a percent value

Table 2: Major Teaching Hospital Performance Comparisons

Table 2: Major Teaching Hospital Performance Comparisons						
Domain	Performance Measures	Medians		Benchmark Compared With Peer Group		
		Benchmark Hospitals (Winners)	Peer Hospitals (Nonwinners)	Difference	Percent Difference	Comments
Clinical Outcomes	Inpatient Mortality Index[1]	0.91	1.00	-0.09	-9.2%	Lower mortality
	Complications Index[1]	0.94	0.97	-0.03	-2.9%	Fewer complications
	HAI Index[2]	0.64	0.82	-0.19	-22.9%	Fewer infections
Extended Outcomes	30-Day Mortality Rate[3]	11.5	12.0	-0.5	n/a[7]	Lower 30-day mortality
	30-Day Hosp-Wide Readmission Rate[4]	15.1	16.2	-1.1	n/a[7]	Fewer 30-day readmissions
Operational Efficiency	Average Length of Stay[1]	4.4	5.0	-0.6	-11.5%	Shorter stays
	ED Throughput Measure[5]	161.0	205.0	-44.0	-21.5%	Less time to service
	Inpatient Expense per Discharge[6]	$6,420	$8,456	-$2,036	-24.1%	Lower inpatient cost
	Medicare Spend per Beneficiary[5]	0.97	1.01	-0.04	-3.5%	Lower Episode Cost
Financial Health	Operating Profit Margin[6]	11.7	3.8	7.9	n/a[7]	Higher profitability
Patient Experience	HCAHPS Top Box (%)[5]	77.0	71.0	6.0	n/a[7]	Better patient experience

1. Mortality, complications and average length of stay based on Present on Admission (POA)-enabled risk models applied to MEDPAR 2018 and 2019 data (ALOS 2019 only)
2. Healthcare-Associated Infections (HAI) data from CMS Hospital Compare Jan 1, 2019 - Dec 31, 2019 data set (excluding Small Community Hospitals)
3. 30-day rates from CMS Hospital Compare July 1, 2016-June 30, 2019 data set
4. 30-day rates from CMS Hospital Compare July1, 2018-June 30, 2019 data set
5. ED measure, MSPB and HCAHPS data from CMS Hospital Compare Jan 1, 2019-Dec 31, 2019 data set
6. Inpatient expense and operating profit margin data from CMS Hospital Cost Report Information System (HCRIS) data file, 2019
7. We do not calculate percent difference for this measure because it is already a percent value

Table 3: Teaching Hospital Performance Comparisons

Table 3: Teaching Hospital Performance Comparisons						
Domain	Performance Measures	Medians		Benchmark Compared With Peer Group		
		Benchmark Hospitals (Winners)	Peer Hospitals (Nonwinners)	Difference	Percent Difference	Comments
Clinical Outcomes	Inpatient Mortality Index[1]	0.79	0.98	-0.19	-19.2%	Lower mortality
	Complications Index[1]	0.72	0.99	-0.27	-27.3%	Fewer complications
	HAI Index[2]	0.56	0.71	-0.15	-21.3%	Fewer infections
Extended Outcomes	30-Day Mortality Rate[3]	11.8	12.3	-0.5	n/a[7]	Lower 30-day mortality
	30-Day Hosp-Wide Readmission Rate[4]	15.3	15.7	-0.4	n/a[7]	Fewer 30-day readmissions
Operational Efficiency	Average Length of Stay[1]	4.4	4.9	-0.5	-10.5%	Shorter stays
	ED Throughput Measure[5]	111.5	147.0	-35.5	-24.1%	Less time to service
	Inpatient Expense per Discharge[6]	$5,925	$6,964	-$1,039	-14.9%	Lower inpatient cost
	Medicare Spend per Beneficiary[5]	0.97	1.01	-0.03	-3.4%	Lower Episode Cost
Financial Health	Operating Profit Margin[6]	17.2	4.6	12.5	n/a[7]	Higher profitability
Patient Experience	HCAHPS Top Box (%)[5]	76.0	70.0	6.0	n/a[7]	Better patient experience

1. Mortality, complications and average length of stay based on Present on Admission (POA)-enabled risk models applied to MEDPAR 2018 and 2019 data (ALOS 2019 only)
2. Healthcare-Associated Infections (HAI) data from CMS Hospital Compare Jan 1, 2019 - Dec 31, 2019 data set (excluding Small Community Hospitals)
3. 30-day rates from CMS Hospital Compare July 1, 2016-June 30, 2019 data set
4. 30-day rates from CMS Hospital Compare July1, 2018-June 30, 2019 data set
5. ED measure, MSPB and HCAHPS data from CMS Hospital Compare Jan 1, 2019-Dec 31, 2019 data set
6. Inpatient expense and operating profit margin data from CMS Hospital Cost Report Information System (HCRIS) data file, 2019
7. We do not calculate percent difference for this measure because it is already a percent value

Table 4: Large Community Hospital Performance Comparisons

Table 4: Large Community Hospital Performance Comparisons						
Domain	Performance Measures	Medians		Benchmark Compared With Peer Group		
		Benchmark Hospitals (Winners)	Peer Hospitals (Nonwinners)	Difference	Percent Difference	Comments
Clinical Outcomes	Inpatient Mortality Index[1]	0.79	1.02	-0.23	-22.1%	Lower mortality
	Complications Index[1]	0.86	0.99	-0.13	-13.0%	Fewer complications
	HAI Index[2]	0.57	0.68	-0.10	-15.2%	Fewer infections
Extended Outcomes	30-Day Mortality Rate[3]	11.6	12.4	-0.8	n/a[7]	Lower 30-day mortality
	30-Day Hosp-Wide Readmission Rate[4]	15.2	15.5	-0.3	n/a[7]	Fewer 30-day readmissions
Operational Efficiency	Average Length of Stay[1]	4.7	5.0	-0.3	-6.0%	Shorter stays
	ED Throughput Measure[5]	122.5	148.3	-25.8	-17.4%	Less time to service
	Inpatient Expense per Discharge[6]	$6,373	$6,786	-$412	-6.1%	Lower inpatient cost
	Medicare Spend per Beneficiary[5]	1.00	1.01	-0.01	-1.1%	Lower Episode Cost
Financial Health	Operating Profit Margin[6]	15.0	6.6	8.4	n/a[7]	Higher profitability
Patient Experience	HCAHPS Top Box (%)[5]	79.0	70.0	9.0	n/a[7]	Better patient experience

1. Mortality, complications and average length of stay based on Present on Admission (POA)-enabled risk models applied to MEDPAR 2018 and 2019 data (ALOS 2019 only)
2. Healthcare-Associated Infections (HAI) data from CMS Hospital Compare Jan 1, 2019 - Dec 31, 2019 data set (excluding Small Community Hospitals)
3. 30-day rates from CMS Hospital Compare July 1, 2016-June 30, 2019 data set
4. 30-day rates from CMS Hospital Compare July1, 2018-June 30, 2019 data set
5. ED measure, MSPB and HCAHPS data from CMS Hospital Compare Jan 1, 2019-Dec 31, 2019 data set
6. Inpatient expense and operating profit margin data from CMS Hospital Cost Report Information System (HCRIS) data file, 2019
7. We do not calculate percent difference for this measure because it is already a percent value

Table 5: Medium Community Hospital Performance Comparisons

Table 5: Medium Community Hospital Performance Comparisons						
Domain	Performance Measures	Medians		Benchmark Compared With Peer Group		
		Benchmark Hospitals (Winners)	Peer Hospitals (Nonwinners)	Difference	Percent Difference	Comments
Clinical Outcomes	Inpatient Mortality Index[1]	0.74	0.98	-0.23	-23.8%	Lower mortality
	Complications Index[1]	0.77	0.98	-0.21	-21.5%	Fewer complications
	HAI Index[2]	0.54	0.61	-0.07	-11.5%	Fewer infections
Extended Outcomes	30-Day Mortality Rate[3]	11.4	12.3	-0.8	n/a[7]	Lower 30-day mortality
	30-Day Hosp-Wide Readmission Rate[4]	14.8	15.6	-0.8	n/a[7]	Fewer 30-day readmissions
Operational Efficiency	Average Length of Stay[1]	4.4	4.9	-0.5	-9.9%	Shorter stays
	ED Throughput Measure[5]	103.8	131.3	-27.5	-21.0%	Less time to service
	Inpatient Expense per Discharge[6]	$5,896	$6,869	-$973	-14.2%	Lower inpatient cost
	Medicare Spend per Beneficiary[5]	0.95	0.99	-0.05	-4.6%	Lower Episode Cost
Financial Health	Operating Profit Margin[6]	14.8	4.7	10.1	n/a[7]	Higher profitability
Patient Experience	HCAHPS Top Box (%)[5]	76.5	70.0	6.5	n/a[7]	Better patient experience

1. Mortality, complications and average length of stay based on Present on Admission (POA)-enabled risk models applied to MEDPAR 2018 and 2019 data (ALOS 2019 only)
2. Healthcare-Associated Infections (HAI) data from CMS Hospital Compare Jan 1, 2019 - Dec 31, 2019 data set (excluding Small Community Hospitals)
3. 30-day rates from CMS Hospital Compare July 1, 2016-June 30, 2019 data set
4. 30-day rates from CMS Hospital Compare July1, 2018-June 30, 2019 data set
5. ED measure, MSPB and HCAHPS data from CMS Hospital Compare Jan 1, 2019-Dec 31, 2019 data set
6. Inpatient expense and operating profit margin data from CMS Hospital Cost Report Information System (HCRIS) data file, 2019
7. We do not calculate percent difference for this measure because it is already a percent value

Table 6: Small Community Hospital Comparisons

Table 6: Small Community Hospital Comparisons						
Domain	Performance Measures	Medians		Benchmark Compared With Peer Group		
		Benchmark Hospitals (Winners)	Peer Hospitals (Nonwinners)	Difference	Percent Difference	Comments
Clinical Outcomes	Inpatient Mortality Index[1]	0.51	1.00	-0.49	-49.2%	Lower mortality
	Complications Index[1]	0.58	0.90	-0.32	-35.1%	Fewer complications
	HAI Index[2]	n/a	n/a	n/a	n/a	n/a
Extended Outcomes	30-Day Mortality Rate[3]	11.6	12.4	-0.8	n/a[7]	Lower 30-day mortality
	30-Day Hosp-Wide Readmission Rate[4]	14.7	15.4	-0.7	n/a[7]	Fewer 30-day readmissions
Operational Efficiency	Average Length of Stay[1]	4.3	4.9	-0.6	-13.0%	Shorter stays
	ED Throughput Measure[5]	93.8	100.5	-6.8	-6.7%	Less time to service
	Inpatient Expense per Discharge[6]	$6,344	$7,577	-$1,233	-16.3%	Lower inpatient cost
	Medicare Spend per Beneficiary[5]	0.90	0.96	-0.06	-6.1%	Lower Episode Cost
Financial Health	Operating Profit Margin[6]	17.2	1.7	15.5	n/a[7]	Higher profitability
Patient Experience	HCAHPS Top Box (%)[5]	76.5	73.0	3.5	n/a[7]	Better patient experience

1. Mortality, complications and average length of stay based on Present on Admission (POA)-enabled risk models applied to MEDPAR 2018 and 2019 data (ALOS 2019 only)
2. Healthcare-Associated Infections (HAI) data from CMS Hospital Compare Jan 1, 2019 - Dec 31, 2019 data set (excluding Small Community Hospitals)
3. 30-day rates from CMS Hospital Compare July 1, 2016-June 30, 2019 data set
4. 30-day rates from CMS Hospital Compare July1, 2018-June 30, 2019 data set
5. ED measure, MSPB and HCAHPS data from CMS Hospital Compare Jan 1, 2019-Dec 31, 2019 data set
6. Inpatient expense and operating profit margin data from CMS Hospital Cost Report Information System (HCRIS) data file, 2019
7. We do not calculate percent difference for this measure because it is already a percent value

US map and states by region

The US maps featured in Figures 1 and 2 provide a visual representation of the variability in performance across the country for the current and previous year studies. Additionally, Table 7 shows each state's rank quintile performance, grouped by geographic region, for the current and previous year studies.

To produce this data, we calculated the 100 Top Hospitals measures at the state level, ranked each measure, then weighted and summed the ranks to produce an overall state performance score. States were ranked from best to worst on the overall score, and the results are reported as rank quintiles.

The 2020 state findings were based on the 100 Top Hospitals measure methodologies, using 2017 and 2018 MEDPAR data (combined) for inpatient mortality and complications; July 1, 2015-June 30, 2018 for 30-day mortality rates, July 1, 2017-June 30, 2018 for 30-day hospital-wide rates, Oct 1, 2017-March 31, 2018 for influenza immunization rates and 2018 data for all other measures.

This analysis allows us to observe geographic patterns in performance. Among our observations:

- The Midwest continues to be the frontrunner in percentage of states in the top two performance quintiles versus other regions, with an increase in lead this year (83.3% of states in 2021 versus 75% of states in 2020)
- The Northeast continues to show the poorest performance overall, by a large margin in both years, with 88.9% of its states in the bottom two quintiles in 2021 and 2020.
- The South's performance worsened further in 2021 with two more states falling into the bottom two quintiles for a total of 9 in 2021 versus 7 states in 2020. This equates to 52.9% of the Southern states in the bottom two quintiles.

Figure 1 State-level Performance Comparisons, 2021 Study

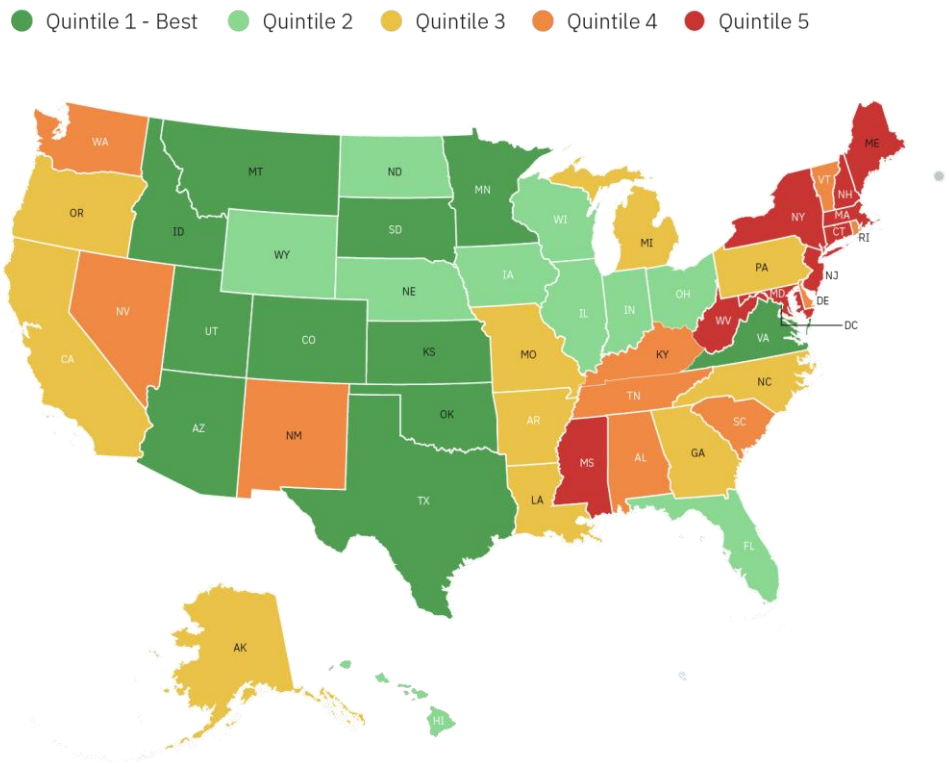


Figure 2 State-level Performance Comparisons, 2020 Study

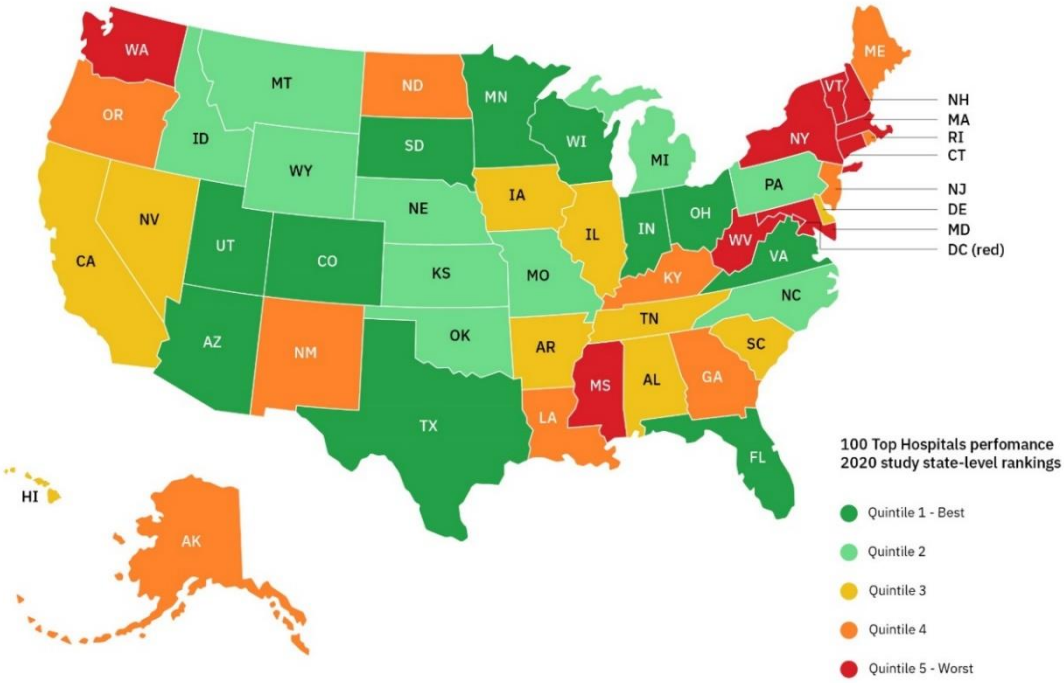


Table 7. 100 Top Hospitals Two-year State-level Performance Comparisons

Northeast		Midwest		South		West	
Current Study	Previous Study	Current Study	Previous Study	Current Study	Previous Study	Current Study	Previous Study
CT	CT	IL	IL	AL	AL	AK	AK
ME	ME	IN	IN	AR	AR	AZ	AZ
MA	MA	IA	IA	DE	DE	CA	CA
NH	NH	KS	KS	DC	DC	CO	CO
NJ	NJ	MI	MI	FL	FL	HI	HI
NY	NY	MN	MN	GA	GA	ID	ID
PA	PA	MO	MO	KY	KY	MT	MT
RI	RI	NE	NE	LA	LA	NV	NV
VT	VT	ND	ND	MD	MD	NM	NM
		OH	OH	MS	MS	OR	OR
		SD	SD	NC	NC	UT	UT
		WI	WI	OK	OK	WA	WA
				SC	SC	WY	WY
				TN	TN		
				TX	TX		
				VA	VA		
				WV	WV		

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 US hospitals have not been able to improve much across the entire balanced scorecard of performance measures (Table 8).

Notably, only two metrics, mean 30-day mortality rate and ED throughput, had fewer than 80% of in-study hospitals in the category of "no statistically significant change in performance."

Table 8. Direction of Performance Change for All Hospitals in Study, 2015-2019

Table 8: Direction of Performance Change for All Hospitals in Study, 2015 - 2019

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 Inpatient Mortality Index	151	5.9%	2,367	92.2%	48	1.9%
Risk-Adjusted Complication Index	111	4.3%	2,409	93.9%	46	1.8%
Mean Healthcare-Associated Infection Index[3]	124	6.9%	1,612	90.3%	50	2.8%
Mean 30-Day Mortality Rate	848	33.0%	1,633	63.6%	85	3.3%
30-Day Hospital-Wide Readmission Rate	102	4.0%	2,370	92.4%	94	3.7%
Severity-Adjusted Average Length of Stay	218	8.5%	2,132	83.1%	216	8.4%
Emergency Department Throughput (minutes)	173	6.7%	2,010	78.3%	383	14.9%
Adjusted Inpatient Expense per Discharge	87	3.4%	2,080	81.5%	386	15.1%
Medicare Spend Per Beneficiary	187	7.3%	2,184	85.1%	195	7.6%
Adjusted Operating Profit Margin	182	7.1%	2,190	85.7%	184	7.2%
HCAHPS Top Box Percent	193	7.5%	2,225	86.7%	148	5.8%

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 IQR outlier data points. 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.

However, over the five years of trend we studied, many hospitals have been able to raise the performance bar on many clinical and operational measures (see green column in Table 8).

- Most notably, 33% of hospitals improved their 30-day mortality rate over the 5 trend years studied
- Only 5.9% of hospitals improved their inpatient mortality (92.2% had no change), while the great majority of hospitals (over 93%) also had no change in their complications performance
- While 15.1% of the hospitals studied exhibited an increase in inpatient expense per discharge during the trend years studied (declining performance), it is worth noting that 81.5% of hospitals held inpatient operating expenses steady (important in the volatile landscape for healthcare, as 100 Top Hospitals financial data is not adjusted for inflation)
- HCAHPS patient experience showed the third- highest proportion of hospitals improving, with 7.5% of hospitals nationwide seeing an increase in how patients rate their care experience overall

Test metrics: Reported for information only

Every year, we evaluate the 100 Top Hospitals study and explore whether new measures would enhance the value of the analysis we provide.

For this study, we continue to test several performance measures that update basic standards of inpatient care and expand the balanced scorecard across the continuum of care. We have also added, new this year, eleven patient safety indicator (PSI) measures from the CMS Hospital Compare data set, as well as an outpatient surgical unplanned revisit measure.

Patient safety indicators

Patient safety is an important measure of hospital quality. Patient safety measures are reflective of both clinical quality and the effectiveness of systems within the hospital setting. CMS publishes in the Hospital Compare data set 10 individual PSI measures and one overall score that represents serious complications that were potentially avoidable.

Unplanned hospital revisits

This metric measures unplanned visits to the hospital after outpatient surgery. It is an outcome measure that CMS defines as ‘unplanned hospital visits within 7 days of a same-day surgery at a hospital outpatient department ‘. Unplanned visits can include inpatient admission directly after surgery, or emergency department, observation stay or inpatient admission within 7 days of the surgical procedure. The population included in this measure is Medicare-fee-for-service patients aged 65 years and older.

30-day episode-of-care payment measures

We are continuing to publish risk-standardized payments associated with 30-day episode-of-care measures for three patient groups that are now being published by CMS in the Hospital Compare data set. These measures capture differences in services and supplies provided to patients who have been diagnosed with AMI, HF, or pneumonia. According to the CMS definition of these measures, they are the sum of payments made for care and supplies starting the day the patient enters the hospital and for the next 30 days.

Excess days in acute care measures

One of the more recent set of measures available from CMS in the Hospital Compare data set are the EDAC measures for AMI, HF and pneumonia. CMS defines "excess days" as the difference between a hospital's average days in acute care and expected days, based on an average hospital nationally. Days in acute care include days spent in an ED, a hospital observation unit, or a hospital inpatient unit for 30 days following a hospitalization.

90-day episode-of-care payment measure

Another measure] available in the Hospital Compare data set is the 90-day episode- of- care payment metric for primary, elective THA/TKA. Like the other 30-day episode-of-care payment measures, CMS calculates risk- standardized payments associated with a 90-day episode of care, compared to an "average" hospital nationally. The measure summarizes payments for patients across multiple care settings, services, and supplies during the 90-day period, which starts on the day of admission.

90-day complication measure

Along with the THA/TKA 90-day payment, CMS is publishing a THA/TKA 90-day complication measure. This measure calculates a risk- standardized complication rate for elective, primary THA/TKA procedures using the occurrence of one or more of the below complications within the specified timeframes:

- AMI, pneumonia, or sepsis / septicemia / shock during or within seven days of index admission
- Surgical site bleeding, pulmonary embolism, or death during or within 30 days of index admission
- Mechanical complication or periprosthetic joint infection/wound infection during or within 90 days of index admission

See the CMS website for measure methodology.[29]

In Table 9 you will find the PSI median values for benchmark and peer hospitals across all comparison groups. Notable findings are:

– Benchmark (winning) hospitals outperformed peer hospitals on all individual PSI measures as well as the composite measure for serious complications

– The greatest difference between benchmark and peer hospitals was found with postoperative respiratory failure rates (PSI-11) where there was nearly one percentage point difference (0.89), with a benchmark median of 5.06 compared to the peer hospitals' median rate of 5.95

Table 10 shows the national performance of benchmark and peer hospitals on the additional test metrics. Key findings include:

– Winners performed better on all three of the EDAC measures, AMI, HF and pneumonia, with median values that were 8.2, 12.15 and 4 days less than the peer medians, respectively
– On two measures, AMI and pneumonia 30-day payment, benchmark hospitals had lower total episode amounts than peers (a 0.5% lower AMI amount and a 0.1% lower pneumonia median total Medicare payment amount)

Table 9: National Performance Comparisons (All Classes)

Table 9: National Performance Comparisons (All Classes)					
Performance Measure	Medians		Benchmark Compared With Peer Group		
	Winning Benchmark Hospitals	Nonwinning Peer Group of U.S. Hospitals	Difference	Percent Difference	Comments
PSI-3 Pressure Sores[1,2]	0.32	0.43	-0.11	n/a[4]	fewer patient safety incidents
PSI-6 Collapsed Lung due to Medical Treatment[1,2]	0.24	0.25	-0.01	n/a[4]	fewer patient safety incidents
PSI-8 Broken Hip from a Fall after Surgery[1,2]	0.10	0.11	-0.01	n/a[4]	fewer patient safety incidents
PSI-9 Perioperative Hemorrhage or Hematoma Rate[1,2]	2.39	2.44	-0.05	n/a[4]	fewer patient safety incidents
PSI-10 Postoperative Acute Kidney Injury Requiring Dialysis Rate[1,2]	1.25	1.32	-0.07	n/a[4]	fewer patient safety incidents
PSI-11 Postoperative Respiratory Failure Rate[1,2]	5.06	5.95	-0.89	n/a[4]	fewer patient safety incidents
PSI-12 Serious Blood Clots after Surgery[1,2]	3.20	3.59	-0.39	n/a[4]	fewer patient safety incidents
PSI-13 Blood Stream Infection after Surgery	4.52	4.66	-0.14	n/a[4]	fewer patient safety incidents
PSI-14 A Wound that Splits Open after Surgery on the Abdomen or Pelvis[1,2]	0.89	0.90	-0.01	n/a[4]	fewer patient safety incidents
PSI-15 Accidental Cuts and Tears from Medical Treatment[1,2]	1.15	1.21	-0.06	n/a[4]	fewer patient safety incidents
PSI-90 Serious Complications[1,3]	0.86	0.96	-0.10	-10.4%	fewer patient safety incidents

1. PSI measures from CMS Hospital Compare July 1, 2017 - June 30, 2019 data set
2. PSI measures are rate values per 1000 discharges
3. PSI measure is an index value
4. We do not calculate percent difference for this measure because it is already a percent value

Table 10. National Performance Comparisons (All Classes)

Table 10: National Performance Comparisons (All Classes)					
Performance Measure	Medians		Benchmark Compared With Peer Group		
	Winning Benchmark Hospitals	Nonwinning Peer Group of U.S. Hospitals	Difference	Percent Difference	Comments
AMI 30-Day Episode Payment[1]	$25,458	$25,583	-$126	-0.5%	lower episode cost
Heart Failure 30-Day Episode Payment[1]	$17,657	$17,614	$43	0.2%	higher episode cost
Pneumonia 30-Day Episode Payment[1]	$18,332	$18,358	-$27	-0.1%	lower episode cost
AMI 30-Day Excess Days in Acute Care[2]	-4.30	3.90	-8.2	-210.3%	fewer days in acute care
Heart Failure 30-Day Excess Days in Acute Care[2]	-6.20	5.95	-12.15	-204.2%	fewer days in acute care
Pneumonia 30-Day Excess Days in Acute Care[2]	4.00	8.00	-4.00	-50.0%	fewer days in acute care
THA/TKA 90-Day Episode Payment[3]	$19,655	$20,675	-$1,020	-4.9%	lower episode cost
THA/TKA 90-Day Complications Rate[3]	2.3	2.4	-0.1	n/a[4]	fewer complications
Ratio of Unplanned Hospital Visits after Outpatient Surgery[3]	1.0	1.0	0	0.0%	same visits

1. 30-day measures from CMS Hospital Compare July 1, 2016 - June 30, 2019 data set
2. 90-day measures from CMS Hospital Compare April 1, 2016 - March 31, 2019 data set
3. OP-36 measure from CMS Hospital Compare Jan 1, 2019 - Dec 31, 2019
4. We do not calculate percent difference for this measure because it is already a percent value

Critical access hospitals

For the fourth year in a row in the 15 Top Health Systems study, we have included results for critical access hospitals (CAHs) that were affiliated with a profiled health system on the performance and rate of improvement matrix graphs in the health system report. Health systems have expressed interest in the inclusion of their CAHs to gain a more complete picture of their entire system's performance.

Three years ago, we expanded the publication of CAH results by including our findings for CAH national benchmark and peer group performance in the 2018 100 Top Hospitals national study. Again this year in the national study, we are publishing the findings for the CAH comparison group. Since this information is presented for information only, CAH winners are not being selected, as we are still evaluating the usefulness of the publicly available data. We welcome feedback from healthcare leaders on the new CAH profile and reports that are now available. CAHs with valid data for all six measures listed below were included in the analysis. A total of 619 of 1354 CAHs available in MEDPAR meet this criterion. Standard 100 Top Hospitals methodologies were applied in developing the metrics and in analyzing CAH performance. See Appendix C for details on methodologies.

- Risk-adjusted inpatient mortality

- Risk-adjusted complications
- 30-day hospital-wide readmission
- Severity-adjusted average LOS
- Adjusted operating profit margin
- HCAHPS top box

We selected the 20 top-ranked CAHs to be our benchmark group. This group outperformed national peers on each included measure.

The most notable difference between benchmark CAHs compared to the peer group was in operating profit margin (10.6 percentage points higher)

- Benchmark CAHs were also strong in risk- adjusted inpatient mortality, with 53% fewer deaths than expected, compared to peer hospitals with nearly as many deaths as expected (median index values of 0.47 and 0.92, respectively)
- For risk-adjusted complications, benchmark CAHs had an index value 27.2% lower than peers, while both had median values well below 1.00, reflecting fewer complications than expected (0.54 and 0.75, respectively)
- Average LOS was also 14.6% shorter at benchmark CAHs, where patients left the hospital a half a day sooner than in peer hospitals (2.9 days versus 3.4 days, respectively)
- 30-day hospital-wide readmission rates were better at benchmark facilities, 15.1% versus 15.4%, respectively

Table 11. National Performance Comparisons – Critical Access Hospitals

Table 11. National performance comparisons - critical access hospitals					
Performance measure	Medians		Benchmark compared with peer group		
	Benchmark hospitals	Peer group of US CAHs	Difference	Percent difference	Comments
Risk-adjusted inpatient mortality index[1]	0.47	0.92	-0.5	-49.4%	lower mortality
Risk-adjusted complications index[1]	0.54	0.75	-0.2	-27.2%	fewer complications
30-day hospital-wide readmission rate[2]	15.1	15.4	-0.3	n/a[5]	lower 30-day mortality
Severity-adjusted average length of stay[1]	2.9	3.4	-0.5	-14.6%	fewer 30-day readmissions
Adjusted operating profit margin[3]	11.8	1.2	10.6	n/a[5]	shorter stays
HCAHPS Top Box (%)[4]	82.5	79.0	3.5	n/a[5]	higher profitability

1. Mortality, complications and average length of stay based on Present on Admission (POA)-enabled risk models applied to MEDPAR 2018 and 2019 data (ALOS 2019 only).
2. 30-day rate from CMS Hospital Compare July 1, 2018-June 30, 2019 data set.
3. Adjusted operating profit margin data from CMS Hospital Cost Report Information System (HCRIS) data file, 2019.
4. HCAHPS measure data from CMS Hospital Compare Jan 1, 2019-Dec 31, 2019 data set.
5. We do not calculate percent difference for these measures because they are already a percent value.

Methodology

Watson Health 100 Top Hospitals® is a quantitative study that annually identifies 100 US hospitals with the highest achievement on a balanced scorecard.

The 100 Top Hospitals scorecard, based on Norton and Kaplan's concept,[1] consists of 11 measures distributed across five domains (inpatient outcomes, extended outcomes, operational efficiency, financial health, and patient experience) 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 in the study.

This 100 Top Hospitals study includes only short-term, nonfederal, acute care US 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 groups

The following section is intended to be an overview of these steps. More detailed information can be requested from the 100 Top program.

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, 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) data set
- Medicare Hospital Cost Reports (all-payer)
- Centers for Medicare & Medicaid Services (CMS) Hospital Compare data sets

We use MEDPAR patient-level demographic, diagnosis, and procedure information to calculate inpatient mortality, complications, and length of stay (LOS). The MEDPAR data set contains information on the approximately 15 million Medicare patients discharged annually from US acute care hospitals. In this study, we used the most recent two federal fiscal years of MEDPAR data available, which include Medicare Advantage (HMO) encounters, to identify current performance and to select the winning hospitals. To be included in the study, a hospital must have the two most current years of data available, with valid present-on-admission (POA) coding. Hospitals that file Medicare claims jointly with other hospitals under one provider number were analyzed as one organization. Four years of MEDPAR data were used to develop the study trend database this year. Typically six years of data are used to

populate 5 trend data points, however, the unavailability of ICD-10-CM data in MEDPAR restricted the number of historical years to MEDPAR 2016 – 2019.

The 100 Top Hospitals program has 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.

Note: To identify the Everest Award winners, we also reviewed the most recent five years of data, to study the rate of change in performance through the years. the special Everest Award section of this document to read more about the methodology.

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 US 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 the hospital's current data year cost reports published in the federal Healthcare Cost Report Information System (HCRIS) 2020 fourth-quarter data set for this study. If we did not have a complete 2019 cost report for a hospital, we excluded the hospital from the study.

In this study, we used CMS Hospital Compare data sets published in the third and fourth quarters of 2020 for healthcare-associated infection (HAI) measures, 30-day mortality rates, 30-day hospital-wide readmission rates, emergency department (ED) throughput measures, Medicare spend per beneficiary (MSPB), and Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) patient experience-of-care data. We used the current data year data point to identify current performance and to select the winning hospitals. Five data points, 2015 through 2019, were used to develop the study trend database. We also used residency program information to classify hospitals. This comes from the Accreditation Council for Graduate Medical Education (ACGME).

*We obtain AMA and AOA graduate medical education program data directly from the ACGME. This year's study is based on the ACGME files for 2018/2019 hospital residency programs In addition, we consult online information about graduate medical education programs from the Fellowship and Residency Electronic Interactive Database Access (FREIDA) and hospital websites to confirm program participation.

Table 12. Time Periods

Table 12. Time Periods	
References in text	Time Periods
Federal fiscal years (FFY)	Oct - Sept
Study Year	2021
Current data year (MEDPAR)	FFY 2019
Current data year (Medicare Cost Reports)	Year ending in 2019
Two most current/recent years of data (MEDPAR / Medicare Cost Reports)	2018 and 2019
Trend data years (MEDPAR)	FFY 2016 - 2019
Trend data years (Medicare Cost Reports)	Years ending in 2015 - 2019
PIDB data used in risk model development	FFY 2017

Risk- and severity-adjustment models

The IBM Watson Health® proprietary risk- and severity-adjustment models for inpatient mortality, complications, and LOS have been recalibrated for this study release using FFY 2017 data available in the all-payer Watson Health's Projected Inpatient Database (PIDB). The PIDB is one of the largest US inpatient, all-payer databases of its kind, containing approximately 22 million inpatient discharges annually, obtained from approximately 5,300 hospitals which comprise more than 60% of the nonfederal US market. Watson Health risk- and severity-adjustment models take advantage of available 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 models were used in producing the risk-adjusted inpatient mortality and complications indexes, based on two most current years of MEDPAR data. The severity-adjusted LOS was produced based on the current MEDPAR data year.

Present-on-admission coding adjustments

Since 2010, we have observed a rise in the number of principal diagnosis and secondary diagnosis codes that do not have a valid POA indicator code in the MEDPAR data files. Since 2011, an invalid code of "0" has been appearing. This phenomenon has led to an artificial rise in the number of complications that appear to be occurring during the hospital stay. See Appendix C for details.

To correct for this bias, we adjusted MEDPAR record processing through our mortality and complications risk models, and LOS severity-adjustment model, as follows:

- Original, valid (Y, N, U, W, or 1) POA codes assigned to diagnoses were retained
- Where a POA code of "0" appeared, we took the next four steps:

- We treated all diagnosis codes on the CMS exempt list as "exempt," regardless of POA coding
- We treated all principal diagnoses as "present on admission"
- We treated secondary diagnoses where the POA code "Y" or "W" appeared more than 50% of the time in Watson Health's all- payer database, as "present on admission"
- All others were treated as "not present"

Hospital exclusions

After building the database, a total of 3,092 short-term, general, acute care US hospitals were available in the current MEDPAR data file. This was our starting population (after removing specialty and federally owned hospitals), prior to applying additional hospital exclusions to avoid skewing study results. Excluded from the study were:

- Specialty hospitals (that is, critical access,* children's, women's, psychiatric, substance abuse, rehabilitation, cardiac, orthopedic, heart, cancer, and long-term acute care)
- Federally owned hospitals
- Non-US hospitals (such as those in Puerto Rico, Guam, and the US Virgin Islands)
- Hospitals with fewer than 25 acute care beds
- Hospitals with fewer than 100 Medicare patient discharges in the current data year
- Hospitals with Medicare average LOS longer than 25 days in the current data year
- Hospitals with no reported Medicare patient deaths in the current data year
- Hospitals for which a current year Medicare Cost Report was not available
- Hospitals with a current year Medicare Cost Report that was not for a 12-month. reporting period
- Hospitals that had fewer than 60% of patient records with valid POA codes
- 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, 2,675 hospitals were included in the study.

Classifying hospitals into comparison groups

Bed size, teaching status, and extent of residency/ fellowship program involvement can affect 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, according to its size and teaching status.

Our classification methodology draws a 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 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 (GME) programs accredited by either the ACGME or the AOA. The definition includes both the number of programs and type (sponsorship or participation) of 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
    i. Sponsorship of at least 10 GME programs, or
    ii. Involvement in at least 15 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 0.55 (regardless of number of GME program involvement) and bed size of 250 or greater.

Teaching hospitals

Meet two of the three:

1. 200 or more acute care beds in service
2. Resident*-per-bed ratio of at least 0.03 and total GME programs not null or 0
3. Total GME programs are 3 or greater and a resident-to-bed ratio not null or 0

If criteria two and three are met, bed size must be between 99 and 199.

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 we believe to be most useful for boards, CEOs, and other leaders in the current hospital operating environment. In addition, we continually review trends in the health care market, to identify the need for and availability of new performance measurement approaches. We welcome feedback from hospital and system executives on the usefulness of our measures and our approach.

As the healthcare industry has changed, our methods have evolved. Our current measures are centered on five main components of hospital performance: inpatient outcomes, extended outcomes, operational efficiency, financial health, and patient experience.

The 11 measures included in this study, by performance domain, are:

Inpatient outcomes

1. Risk-adjusted inpatient mortality index
2. Risk-adjusted complications index
3. Mean HAI index

Extended outcomes

1. Mean 30-day risk-adjusted mortality rate (includes acute myocardial infarction [AMI], heart failure [HF], pneumonia, chronic obstructive pulmonary disease [COPD], and stroke)
2. 30-day risk-adjusted hospital-wide readmission rate

Operational efficiency

1. Severity-adjusted average LOS

2. Mean ED throughput measure
3. Case mix- and wage-adjusted inpatient expense per discharge
4. MSPB index

Financial health

1. Adjusted operating profit margin

Patient experience

1. HCAHPS top-box rate (overall hospital performance)

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

Inpatient outcomes

Our measures of inpatient outcomes include four measures: risk-adjusted mortality index, risk-adjusted complications index and mean healthcare-associated infection index. These measures show us how the hospital is performing on what we consider to be the most basic and essential care standards (survival, error-free care avoidance of infections) while treating patients in the hospital.

Extended outcomes

The extended outcomes measures (30-day mortality rates for AMI, HF, pneumonia, COPD, and stroke patients; and 30-day hospital-wide readmission rates) help us understand how the hospital's patients are faring over a longer period[29]. These measures are part of the CMS Hospital Value-Based Purchasing Program and are reported upon widely in the industry. Hospitals with lower values appear to be providing or coordinating the care continuum with better medium-term results for these conditions.

As hospitals become more interested in contracting for population health management, we believe that 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.

Operational efficiency

The operational efficiency domain includes severity- adjusted average LOS, ED throughput, MSPB, and inpatient expense per discharge. Average LOS serves as a proxy for clinical efficiency in an inpatient setting, while the ED throughput measures focus on process efficiency in one of the most important access points to hospital care.

Average LOS is adjusted to increase the validity of comparisons across the hospital industry. We use a Watson 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.

For ED throughput, we use the mean of the reported median minutes for two critical processes: median time from admit decision to ED departure for admitted patients, and median time from ED arrival to ED departure for non-admitted patients.

We adjust inpatient expense, as reported on the hospital cost report, for patient severity (Medicare case mix index) and area wage levels (CMS 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.

The MSPB index is used as a proxy for continuum-of-care performance. This measure, as defined by CMS, is the ratio of MSPB treated in a specific hospital and the median MSPB nationally. It includes Medicare Part A and Part B payments three days prior to the hospital admission, the hospital stay, and 30 days post-discharge. We believe this indicator can be a beginning point for understanding hospital and local-are 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 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 hospital 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 part of a health systems. Health system accounting practices often recognize hospitals as units of the system, with no cash or investment assets of their own. Moreover, hospitals in health systems are 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 experience

We believe that a measure of patient perception of care (the patient "experience") is crucial to the balanced scorecard concept. Understanding how patients perceive the care a hospital provides, and how that perception compares with perceptions of patients in peer hospitals, is an important step a hospital can take in pursuing performance excellence. For this reason, we use the top-box answer in CMS Hospital Compare data set as the measure's value. The top-box is defined as the percent of patients who gave their hospital a rating of 9 or 10 on a scale of 0 to 10, where 10 is the highest rating. We use the overall rating question only, as the ranked metric.

A comprehensive, balanced view

Through the combined measures described above, we hope to provide a balanced picture of overall hospital performance, which can reflect 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 inpatient mortality index			
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 the two most current years of data, divided by the number expected, given the risk of death for each patient. We use our proprietary risk-adjusted mortality index model to determine expected deaths. This model is designed to predict the likelihood of a patient's death based on patient- level characteristics (age, sex, presence of complicating diagnoses, and other characteristics). We normalize the expected value based on the observed and expected deaths for each comparison group. We calculate a normalized index based on the observed and normalized expected deaths, and patient count. Palliative care patients (Z515) are included in the risk model. POA coding is used in the risk model to identify pre-existing conditions for accurate assessment of patient severity. Do not resuscitate (DNR) patients (Z66) are excluded. Post- discharge deaths are excluded. For more information, see Appendix C. The reference value for this index is 1.00; a value of 1.15 indicates 15% more deaths occurred than were predicted, and a value of 0.85 indicates 15% fewer deaths than predicted.	We rank hospitals on the difference between observed and expected deaths, expressed in normalized standard deviation units (z-score)[30,31]. 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 the most current MEDPAR data to reduce the influence of chance fluctuation. The MEDPAR data set includes both Medicare fee-for-service claims and Medicare Advantage (HMO) encounter records. Hospitals with observed values statistically worse than expected (99% confidence), and whose values are above the high trim point (75th percentile of statistical outliers), are not eligible to be named benchmark hospitals. For more details, see Appendix C.	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. 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 the two most current years of data, divided by the number expected, given the risk of complications for each patient. We use our proprietary expected complications risk index models to determine expected complications. These models account for patient-level characteristics (age, sex, principal diagnosis, comorbid conditions, and other characteristics). Complication rates are calculated from normative data for two patient risk groups: medical and surgical. We normalize the expected value based on the observed and expected complications for each comparison group. POA coding is used in the risk model to identify pre-existing conditions for accurate assessment of patient severity and to distinguish them from complications occurring during hospitalization. For more details, see Appendix C. The reference value for this index is 1.00; a value of 1.15 indicates 15% more complications occurred than were predicted, and a value of 0.85 indicates 15% 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). We use two years of the most current MEDPAR data to reduce the influence of chance fluctuation. The MEDPAR data set includes both Medicare fee-for-service claims and Medicare Advantage (HMO) encounter records. Hospitals with observed values statistically worse than expected (99% confidence), and whose values are above the high trim point (75th percentile of statistical outliers), are not eligible to be named benchmark hospitals.	Lower

Mean healthcare-associated infection index			
Why we include this element	Calculation	Comment	Favorable values are
There is a deep public interest in tracking and preventing hospital acquired infections, so we are now using the healthcare associated infection (HAI) data reported by CMS to analyze hospital performance and provide national benchmarks in this area.	For this study, CMS Hospital Compare data for the current calendar year (CY) are included. Hospitals complete the required surveillance and report HAI occurrences, and the count of patient days associated with each HAI metric, through the Centers for Disease Control and Prevention's National Healthcare Safety Network (NHSN), which in turn reports data to CMS. To calculate a Standardized Infection Ratio (SIR) for reporting HAI incidence, expected values are developed by the NHSN using probability models constructed from NHSN baseline data which represents a standard population. We normalize each expected value based on the observed and expected HAIs for each comparison group. We use the observed, normalized expected values and associated days to calculate a normalized z-score for each HAI metric. For each comparison group, the composite HAI measure is the mean of the individual HAI normalized z-scores included for that group. See Appendix C for methodology details.	We rank hospitals on the mean normalized HAI z-score, by comparison group. For reporting, we calculate the mean of the CMS-reported standardized infection rates (SIR) for the included HAI metrics. The CMS Hospital Compare HAI data set includes hospital-reported HAIs for all inpatients.	Lower

Mean 30-day risk-adjusted mortality rate (AMI, HF, pneumonia, COPD, and stroke 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 conditions may have contributed to their longer-term survival. Because these measures are part of the CMS Hospital Value-Based Purchasing Program, they are 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 aftercare processes. Hospitals that score well may be better prepared for a pay-for- performance structure.	Data is from the CMS Hospital Compare data set. CMS calculates a 30-day mortality rate (all-cause deaths within 30 days of admission, per 100 patients) 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. For more information about this data, see Appendix C. We calculate the arithmetic mean of the included 30-day mortality rates (AMI, HF, pneumonia, COPD, and stroke).	We rank hospitals by comparison group, based on the mean rate for included 30-day mortality measures (AMI, HF, pneumonia, COPD, and stroke). The CMS Hospital Compare data for 30-day mortality is based on Medicare fee-for-service claims only. For more information, see Appendix C.	Lower

30-day risk-adjusted hospital-wide readmission rate			
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 may have contributed to issues with their post-discharge medical stability and recovery. These measures are 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 aftercare processes. Hospitals that score well may be better prepared for a pay-for- performance structure.	Data is from the CMS Hospital Compare data set. CMS calculates a 30-day hospital-wide readmission rate (all-cause readmissions within 30 days of discharge, per 100 patients) using one year of MEDPAR data.	We rank hospitals by comparison group, based on the rate published by CMS in the Hospital Compare data set. The CMS Hospital Compare data for 30-day hospital-wide readmission is based on Medicare fee-for-service claims only. For more information, see Appendix C.	Lower

Severity-adjusted average length of stay			
Why we include this element	Calculation	Comment	Favorable values are
A lower severity-adjusted average length of stay (LOS) generally indicates more efficient consumption of hospital resources and reduced risk to patients.	For this study, we used the most current year of MEDPAR data for this measure. We calculate a 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 each 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. POA coding is used in the risk model to identify pre-existing conditions for accurate assessment of patient severity. For more details, see Appendix C.	We rank hospitals on their severity- adjusted ALOS. We severity-adjust ALOS to factor out differences attributable to the varying severity of illness of patients at each hospital.	Lower

Mean emergency department throughput measure			
Why we include this element	Calculation	Comment	Favorable values are
The hospital emergency department (ED) is an important access point to healthcare for many people. A key factor in evaluating ED performance is process "throughput"-- measurement of the timeliness with which patients receive treatment and either are admitted or discharged. Timely ED processes impact both care quality and the quality of the patient experience.	Data is from the CMS Hospital Compare data set. CMS publishes the median minutes for each throughput measure, by calendar year. We include two of the published measures in our composite: median time from admit decision time to transfer to the floor and median time to discharge for non-admitted patients. We calculate the unweighted mean of the two metrics. For more details, see Appendix C.	The mean ED throughput metric is the ranked measure. CMS requires hospitals submit a sample of ED visit wait times.	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.	This measure uses hospital Medicare Cost Report data from the current cost report year. 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. 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% 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. See Appendix C for detailed calculations and the Medicare Cost Report locations (worksheet, line, and column) for each calculation element.	Adjusted inpatient expense per discharge measures the hospital's average cost of delivering inpatient care on a per-unit basis. 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. We rank hospitals on their adjusted inpatient expense per discharge. Hospitals with extreme outlier values for this measure are not eligible to be named benchmark hospitals.	Lower

Medicare spend per beneficiary index			
Why we include this element	Calculation	Comments	Favorable values are
Medicare spend per beneficiary (MSPB) helps to determine how efficiently a hospital coordinates the care for its patients across continuum-of-care sties. Lower values indicate lower costs relative to national medians and thus greater efficiency.	We report the hospital index published in the CMS Hospital Compare public data set. CMS aggregates costs associated with the index admission from three days pre-admission, 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 below1.0 means lower-than-national median cost per beneficiary.	We rank hospitals on the MSPB index. CMS calculates the cost of care for each admitted patient, including both Medicare Part A and Part B costs.	Lower

Adjusted operating profit margin			
Why we include this element	Calculation	Comment	Favorable values are
Operating profit margin is one of the most straightforward measures of a hospital's financial health. It is a measure of the amount of income a hospital is taking in versus its expenses.	This measure uses hospital Medicare Cost Report data from the current cost report year. 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. Total operating expense is the sum of operating expense and net related organization expense. See Appendix C for detailed calculations and the Medicare Cost Report locations (worksheet, line, and column) for each calculation element.	We adjust hospital operating expense for net related organization expense to obtain a true picture of the operating costs. Net related organization expense includes the net of costs covered by the hospital on behalf of another organization and costs covered by another organization on behalf of the hospital. We rank hospitals on their adjusted operating profit margin. Hospitals with extreme outlier values for this measure are not eligible to be named benchmark hospitals.	Higher

Hospital Consumer Assessment of Healthcare Providers and Systems score (overall hospital rating)			
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.	Data is from the CMS Hospital Compare data set. For this study, we included the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) results for the current calendar year. We use the HCAHPS survey instrument question, "How do patients rate the hospital, overall?" as the ranked metric, using the 'top box' response percent as the measured value.	We rank hospitals based on the "top-box" answer percent value in the CMS Hospital Compare data set in the current CY. See Appendix C for full details. HCAHPS data is survey data, based on either a sample of hospital inpatients or all inpatients.	Higher

Table 13. Data Sources and Time Periods

Performance Measure	Current Performance (100 Top Award Selection)	5-Year Trend Performance
Risk-Adjusted Inpatient Mortality Index	MEDPAR Federal Fiscal Year (FFY) 2018 and 2019*	MEDPAR Federal Fiscal Year (FFY) 2016-2019*,**
Risk-Adjusted Complications Index	MEDPAR FFY 2018 and 2019*	MEDPAR FFY 2016-2019*,**
Mean Healthcare-Associated Infection Index***	CMS Hospital Compare Calendar Year (CY) 2019	CMS Hospital Compare CY 2015-2019
Mean 30-Day Mortality Rate (AMI, Heart Failure, Pneumonia COPD, Stroke)	CMS Hospital Compare Jul 1, 2016-Jun 30, 2019	CMS Hospital Compare: Three-year datasets ending Jun 30 in 2015, 2016, 2017, 2018, 2019
30-Day Hospital-Wide Readmission Rate	CMS Hospital Compare Jul 1, 2018-Jun 30, 2019	CMS Hospital Compare: One-year data sets ending Jun 30 in 2015, 2016, 2017, 2018, 2019
Severity-Adjusted Average Length of Stay	MEDPAR FFY 2019	MEDPAR FFY 2016-2019**
Mean Emergency Department Throughput Measure	CMS Hospital Compare CY 2019	CMS Hospital Compare CY 2015-2019
Inpatient Expense per Discharge (Case Mix- and Wage-Adjusted)	HCRIS Medicare Cost reports ending in 2019	HCRIS Medicare Cost reports ending in 2015-2019
MSPB Index	CMS Hospital Compare Calendar Year (CY) 2019	CMS Hospital Compare CY 2015-2019
Adjusted Operating Profit Margin	HCRIS Medicare Cost reports ending in 2019	HCRIS Medicare Cost reports ending in 2015-2019
HCAHPS Top Box Percent (Overall Hospital Rating)	CMS Hospital Compare CY 2019	CMS Hospital Compare CY 2015-2019

*Two years of data are combined for each study year data point
**Trend years reduced to four data points due to unavailability of ICD-10-CM data
*** The HAI measure is not included in the small community hospital group ranked metrics

Determining the 100 Top Hospitals

Eliminating outliers

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

Interquartile range methodology

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

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

This is done to avoid the possibility of hospitals with a high probability of having erroneous cost report data being declared winners.

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

Mortality and complications outliers

For mortality and complications, which have observed and expected values, we identify hospitals with performance that is statistically worse than expected. Hospitals that are worse than expected are excluded from consideration when we select the study winners. This is done because we do not want hospitals that have poor clinical outcomes to be declared winners.

A hospital is winner-excluded if both of the following conditions apply:

Observed value is higher than expected and the difference is statistically significant with 99% confidence. 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 with 99% confidence.

We calculate the 75th percentile index value for mortality and complications, including data only for hospitals that meet condition 1. These values are used as the high trim points for those hospitals. Hospitals with mortality or complications index values above the respective trim points are winner-excluded.

Hospitals with a negative operating profit margin

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

Ranking

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

Community health adjustment in ranking

New this year, we have introduced an additional measure that affected the ranking of the 100 Top hospitals. The Community Health Survey developed in partnership with the Bloomberg American Health Initiative and the Center for Health Equity at the Johns Hopkins Bloomberg School of Public Health was sent to the 200 top ranking hospitals. Although no changes in the final 100 Top hospital selection occurred with the implementation of this new metric, there were changes in the final ranking of the 100 Top hospitals. For complete details of this new measure, see Appendix c.

Table 14. Measures and Weights

Measure	Weight	Small community hospital weight
Risk-Adjusted Inpatient Mortality Index	1	1.25
Risk-Adjusted Complications Index	1	1.25
Mean Healthcare-Associated Infection Index*	1	NA
Mean30-DayMortalityRate(AMI,HeartFailure,PneumoniaCOPD,Stroke)	1	1.25
30-Day Hospital-Wide Readmission Rate	1	1.25
Severity-Adjusted Average Length of Stay	1	1
Mean Emergency Department Throughput Measure	1	1
Inpatient Expense per Discharge (Case Mix- and Wage-Adjusted)	1	1
MSPB Index	1	1
Adjusted Operating Profit Margin	1	1
HCAHPS Top Box Percent (Overall Hospital Rating)	1	1

*HAI metrics are not ranked for small community hospitals. For this comparison group only, weights for inpatient mortality, complications, 30-day mortality, and 30-day readmission weights were increased to 1.25 to balance quality and operational groups for ranking purposes.

Table 15. Study Population by Comparison Group

Comparison Group	Number of Winners	Number of Nonwinners	Total Hospitals in Study
Major Teaching Hospitals	15	193	208
Teaching Hospitals	25	580	605
Large Community Hospitals	20	234	254
Medium Community Hospitals	20	754	774
Small Community Hospitals	20	814	834
All Hospitals	**100**	**2,575**	**2,675**

Appendices

Appendix A – Distribution of winners by state and region

Winners by state

State	Number of Winners	
	Current Study	Previous Study
Alabama	0	1
Alaska	0	0
Arizona	3	2
Arkansas	2	2
California	1	6
Colorado	5	7
Connecticut	1	0
Delaware	0	0
District of Columbia	0	0
Florida	13	8
Georgia	4	1
Hawaii	0	0
Idaho	0	1
Illinois	5	7
Indiana	1	3
Iowa	2	3
Kansas	3	3
Kentucky	0	1
Louisiana	0	0
Maine	0	0
Maryland	0	0
Massachusetts	0	0
Michigan	7	3
Minnesota	3	2
Mississippi	1	0
Missouri	2	3

State	Number of Winners	
	Current Study	Previous Study
Montana	0	1
Nebraska	1	0
Nevada	1	2
New Hampshire	0	0
New Jersey	1	0
New Mexico	0	0
New York	0	0
North Carolina	1	0
North Dakota	0	0
Ohio	8	9
Oklahoma	1	4
Oregon	2	1
Pennsylvania	5	4
Rhode Island	0	0
South Carolina	1	0
South Dakota	1	0
Tennessee	3	0
Texas	7	8
Utah	8	12
Vermont	0	0
Virginia	3	1
Washington	0	0
West Virginia	1	1
Wisconsin	3	4
Wyoming	0	0

Winners by region

Region	Number of Winners	
	Current Study	Previous Study
Northeast	7	4
Midwest	36	37
South	37	27
West	20	32

Appendix B – States included in each US Census region

US census regions

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

IBM Watson Health® makes normative comparisons of mortality and complications rates by using patient-level data to control for case mix and severity differences. We do this by evaluating ICD-10-CM diagnosis and procedure codes to adjust for severity within clinical case mix groupings. Conceptually, we group patients with similar characteristics (that is, age, sex, principal diagnosis, procedures performed, admission type, and comorbid conditions) to produce expected, or normative, comparisons. Through testing, we have found that this methodology produces normative comparisons using readily available administrative data, eliminating the need for additional data collection[32–36].

To support the transition from ICD-9-CM to ICD-10-CM, our risk- and severity-adjustment models have been modified to use the Agency for Healthcare Research and Quality (AHRQ) Clinical Classifications Software (CCS)[37] categories for risk assignment. CCS categories are defined in both coding languages with the intent of being able to accurately compare ICD-9 categories with ICD-10 categories. Calibrating our models using CCS categories provides the flexibility to accept and process patient record data in either ICD-9 or ICD-10 coding formats and produces consistent results in risk and severity adjustment.

The CCS-based approach applies to all 100 Top Hospitals program proprietary models that use code- based rate tables, which include the Risk-Adjustment Mortality Index, Expected Complication Risk Index, and Expected Resource Demand (PFD/ERD) Length of Stay (LOS) models used in this study.

Normative database development

Watson Health constructed a normative database of case-level data from its Projected Inpatient Database (PIDB), a national all-payer database containing more than 22 million all-payer discharges annually. This data is obtained from approximately 5,300 hospitals, representing over 60% of all discharges from short-term, general, nonfederal hospitals in the US. PIDB discharges are statistically weighted to represent the universe of short-term, general, nonfederal hospitals in the US. Demographic and clinical data are also included: age, sex, and LOS; clinical groupings (Medicare Severity Diagnosis Related Groups, or MS-DRGs), ICD-9-CM and ICD-10-CM principal and secondary diagnoses and procedures; present-on-admission (POA) coding; admission source and type; and discharge status. For this study, risk models were recalibrated using federal fiscal year (FFY) 2017 all-payer data.

Use of 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, which were not present at the time of the patient's admission but occurred during hospitalization. The Centers for Medicare & Medicaid Services (CMS) now requires all Inpatient Prospective Payment System (IPPS) hospitals to document whether a patient has these and other conditions when admitted. The Watson Health proprietary risk- and severity-adjustment models for inpatient mortality, complications, and LOS use POA data reported in

the all-payer data to identify conditions that were present on admission and distinguish them from complications that occurred while the patient was in the hospital. Our models develop expected values based only on conditions that were present on admission.

In addition to considering the POA indicator codes in calibration of our risk- and severity-adjustment models, we have adjusted for missing/invalid POA coding found in the Medicare Provider Analysis and Review (MEDPAR) data files. After 2010, we have observed a significantly higher percentage of principal diagnosis and secondary diagnosis codes that do not have a valid POA indicator code in the MEDPAR data files. Since 2011, an invalid code of "0" has been appearing. This phenomenon has led to an artificial rise in the number of conditions that appear to be occurring during the hospital stay, as invalid POA codes are treated as "not present" by POA- enabled risk models.

To correct for this bias, we adjusted MEDPAR record processing through our mortality, complications, and LOS models as follows:

- Original, valid (Y, N, U, W, or 1) POA codes assigned to diagnoses were retained
- Where a POA code of "0" appeared, we took the next four steps :
    - We treated all diagnosis codes on the CMS exempt list as "exempt," regardless of POA coding
    - We treated all principal diagnoses as "present on admission"
    - We treated secondary diagnoses where the POA code "Y" or "W" appeared more than 50% of the time in Watson Health's all- payer database, as "present on admission"
    - All others were treated as "not present"

Percentage of diagnosis codes with POA indicator code of "0" by MEDPAR year										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Principal diagnosis	0.00%	4.26%	4.68%	4.37%	3.40%	4.99%	2.45%	3.96%	3.94%	3.90%
Secondary diagnosis	0.00%	15.05%	19.74%	22.10%	21.58%	23.36%	21.64%	24.11%	24.53%	24.87%

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 normative comparisons of hospital outcomes, we must adjust raw data to accommodate differences that result from the variety and severity of admitted cases.

Risk-adjusted inpatient mortality index models

Watson Health has developed an inpatient mortality risk model that can be applied to coded patient claims data to estimate the expected probability of death occurring, given various patient-related factors. The mortality risk model used in this study is calibrated for patients age 65 and older. Additionally, in response to the transition to ICD-10-CM, diagnosis and procedure codes (and the interactions among them) have been mapped to the AHRQ CCS for assignment of risk instead of using the individual diagnosis, procedure, and interaction effects.

We exclude long-term care, psychiatric, substance abuse, rehabilitation, and federally owned or controlled facilities. In addition, we exclude certain patient records from the data set: psychiatric; substance abuse; 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 (Z515) are included in the mortality risk model, which is calibrated to estimate probability of death for these patients. The Watson Health mortality risk model excludes records with "do not resuscitate" (DNR) (Z66) orders that are coded as present on admission.

Hospice versus palliative care patients

Separately licensed hospice unit patient records are not included in MEDPAR data. They have a separate billing type and separate provider numbers. In addition, patients receiving hospice treatment in acute care beds are billed under hospice, not the hospital, and would not be in the MEDPAR data file.

Inpatients coded as palliative care (Z515) are included in the study. Over the past few years, the number of patients coded as palliative care has increased significantly, and our risk models have been calibrated in order to produce expected values for these patients.

Excluding records that are DNR status at admission is supported by the literature. A recent peer-reviewed publication stated: "Inclusion of DNR patients within mortality studies likely skews those analyses, falsely indicating failed resuscitative efforts rather than humane decisions to limit care after injury"[38]. Our rationale is straightforward: If a patient is admitted DNR (POA), then typically no heroic efforts would be made to save that patient if they began to fail.

Without the POA DNR exclusion, if a given hospital has a higher proportion of POA DNR patients that it is not attempting to save from death compared to an otherwise similar hospital that is not admitting as high a proportion of such patients, the first hospital would look lower- performing compared to the second through no fault of its own. The difference would be driven by the proportion of POA DNR patients.

Note: We are no longer able to exclude all rehabilitation patients as we have done in the past. This is because the ICD-10-CM coding system does not identify rehabilitation patients. We can only exclude those patients coded as being in a Prospective Payment System (PPS)-exempt hospital rehabilitation unit (provtype = R or T).

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 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 (for example, age, clinical grouping, and severity of illness)[32–36].

This model accounts for only patient conditions that are present on admission when calculating risk. Additionally, in response to the transition to ICD-10- CM, diagnosis and

procedure codes, and the interactions among them, have been mapped to AHRQ CCS categories for assignment of risk instead of using the individual diagnosis, procedure, and interaction effects. See discussion under the methods for identifying patient severity above.

Staff physicians at Watson Health suggested clinical patient characteristics that were 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

Watson Health has developed a complications risk model that can be applied to coded patient claims data to estimate the expected probability of a complication occurring, given various patient-related factors. We exclude long-term care, psychiatric, substance abuse, rehabilitation, and federally owned or controlled facilities. In addition, we exclude certain patient records from the data set: psychiatric; substance abuse; 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 (Z515) are included in the complications risk model, which is calibrated to estimate probability of complications for these patients.

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 Watson Health complications model uses clinical qualifiers to identify complications that have occurred in the inpatient setting. The complications used in the model are listed on the following page.

Complication	Patient Group
Intraoperative or Postprocedural Complications Relating to Urinary Tract	Surgical only
Intraoperative or Postprocedural Complications Relating to Respiratory System Except Pneumonia	Surgical only
GI Complications Following Procedure	Surgical only
Infection Following Injection / Infusion	All patients
Decubitus Ulcer	All patients
Post-operative Septicemia, Abscess, and Wound Infection	Surgical, including cardiac
Aspiration Pneumonia	Surgical only
Tracheostomy Complications	All patients
Complications of Cardiac, Vascular and Hemodialysis Devices	Surgical, including cardiac
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 Complication	Surgical, including cardiac
Miscellaneous Complications	All patients
Cardio-respiratory Arrest, Shock, or Failure	Surgical only
Intraoperative or Postprocedure Complications Relating to Nervous System	Surgical only
Intraoperative or Postprocedural Acute Myocardial Infarction	Surgical only
Post-operative Cardiac Abnormalities Except AMI	Surgical only
Procedure-related Perforation or Laceration	All patients
Post-operative Physiologic and Metabolic Derangements	Surgical, including cardiac
Intraoperative or Postprocedural Coma or Stupor	Surgical, including cardiac
Post-operative Pneumonia	Surgical, including cardiac
Pulmonary Embolism	All patients
Venous Thrombosis	All patients
Hemorrhage, Hematoma or Seroma Complicating a Procedure	All patients
Post-procedure 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 CNS Depressants	Surgical, including cardiac
Complication Relating to Antibiotics	All patients
Complications Relating to Other Anti-infective Drugs	All patients
Complications Relating to Anti-neoplastic and Immunosuppressive Drugs	All patients
Complications Relating to Anticoagulants and Drugs Affecting Clotting Factors	All patients
Complications Relating to Narcotics and Related Analgesics	All patients
Complications Relating to Non-narcotic Analgesics	All patients
Complications Relating to Antiepileptic, Sedative-hypnotic and Anti-Parkinsonism Drugs	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

Complication	Patient Group
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 Anti-asthmatic Drugs	All patients
Complications Relating to Other Medications (Includes Hormones, Insulin, Iron, 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 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,[39–42] including health system, hospital, service line, or MS-DRG classification. This model accounts for only patient conditions that are present on admission when calculating risk. Additionally, in response to the transition to ICD-10-CM, diagnosis and procedure codes, and the interactions among them, have been mapped to AHRQ CCS categories for assignment of risk instead of using the individual diagnosis, procedure, and interaction effects.

Index interpretation

An outcome index is a ratio of an observed number of outcomes to an expected number of outcomes in a 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 the number of observed events divided by the number of expected events and can be calculated for outcomes that involve counts of occurrences (for example, 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% 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% more outcomes, and an index of 0.90 indicates 10% fewer outcomes than expected based on the experience of the norm. The index can be calculated across a variety of groupings (for example, hospital or service line).

Healthcare-associated infections

Healthcare-associated infections (HAIs), as developed by the National Healthcare Safety Network* (NHSN) and reported by CMS in the public Hospital Compare data set, capture new information about the quality of inpatient care. Tracking and intervening to reduce infection rates for methicillin- resistant staphylococcus aureus (MRSA), central line- associated blood stream infections (CLABSI), catheter-associated urinary tract infection (CAUTI), clostridium difficile colitis (C.diff), and other problematic infections must be reported to CMS. New public data will allow the development of national benchmarks for use by hospital leadership to affect change.

Healthcare-Associated Infection Measures	
HAI-1	Central line-associated bloodstream infections (CLABSI) in ICUs and select wards
HAI-2	Catheter-associated urinary tract infections (CAUTI) in ICUs and select wards
HAI-3	Surgical Site Infection from colon surgery (SSI: Colon)
HAI-4	Surgical Site Infection from abdominal hysterectomy (SSI: Hysterectomy)
HAI-5	Methicillin-resistant Staphylococcus Aureus (MRSA) Blood Laboratory-identified Events (Bloodstream infections)
HAI-6	Clostridium difficile (C.diff.) Laboratory-identified Events (Intestinal infections)

The HAI measures are reported as risk- adjusted standardized infection ratios (SIRs) using probability models and normative data sets maintained by a branch of the Centers for Disease Control and Prevention (CDC), the NHSN. Along with reporting SIR data to CMS, NHSN is responsible for administering HAI surveillance procedures and reporting specifications, along with producing software and training programs for all participating hospitals. Its underlying methodology details for building the SIR are documented and updated annually in a reference guide posted at the CDC website[43].

To enable reporting of a hospital's general performance level on the HAI measures overall, we calculate a composite HAI measure for each hospital. Each facility's composite HAI measure considers only the HAIs included for its designated 100 Top Hospitals® comparison group, as indicated in the table below. Since not all hospitals report data for all six HAIs, we vary the number of included HAI measures based on data availability in each comparison group.

Compare Group	Included HAIs	Minimum Required
Major Teaching	HAI-1, HAI-2, HAI-3, HAI-4, HAI-5, HAI-6	4
Teaching	HAI-1, HAI-2, HAI-3, HAI-5, HAI-6	4
Large Community	HAI-1, HAI-2, HAI-3, HAI-5, HAI-6	4
Medium Community	HAI-1, HAI-2, HAI-6	1
Small Community	NOT RANKED	NA

In addition to the SIR values for each HAI, CMS publishes the observed and expected values, as well as a population count (days or procedures), which varies by measure.

We normalize the individual hospital expected values for each HAI by multiplying them by the ratio of the observed to expected values for their comparison group for that HAI.
We calculate a normalized z-score for each HAI, for each hospital, using the observed, normalized expected and count. We did not calculate a z-score for an individual HAI if CMS did not report a SIR value for that measure in the Hospital Compare data set.

To develop a composite HAI measure, we believe it is not appropriate to simply "roll up" observed and expected values across the different HAIs because the overall observed to expected ratio would be weighted by the rates for each HAI, which could be quite different, and the HAIs are also likely to be distributed differently from hospital to hospital. For these reasons, we calculate an unweighted mean of the normalized z-scores as the composite HAI measure used for ranking hospitals.

For reporting, we calculate an unweighted mean of the CMS SIRs for each hospital. If no value was available for a measure, the composite measure represents the mean of available measures, as long as the hospital had the minimum required number of HAIs for its comparison group. For each HAI, the SIR can be viewed as a unitless measure that is essentially a percent difference; that is, observed to expected ratio minus 1 x 100 = percent difference, which is unbiased by differences in the rates by HAI or distributions of HAIs by hospital. It is methodologically appropriate to ask: What is the average (mean) percent difference between my observed rates of HAIs and the expected rates of those HAIs?

30-day risk-adjusted mortality rates and 30-day risk-adjusted hospital-wide readmission rates

This study currently includes two extended outcome measures (30-day mortality and 30-day hospital-wide readmissions), as developed by CMS and published in the Hospital Compare data set.

For the 30-day mortality measure, CMS is reporting three-year rolling data periods with each year ending in June 30. The 30-day hospital-wide readmission measure is reported in one-year increments, ending on June 30. The Hospital Compare website and database were

created by CMS, the US Department of Health and Human Services, and other members of the Hospital Quality Alliance. The data on the website comes from hospitals that have agreed to submit quality information that will be made public. Both measures used in this study have been endorsed by the National Quality Forum (NQF).

CMS calculates the 30-day mortality and 30-day readmission rates from Medicare enrollment and claims records using statistical modeling techniques that adjust for patient-level risk factors and account for the clustering of patients within hospitals. Only Medicare fee-for-service records are included. We are including 30-day mortality rates for acute myocardial infarction (AMI), heart failure (HF), pneumonia, chronic obstructive pulmonary disease (COPD), and stroke patients. 30-day hospital-wide readmission rates are based on unplanned, all-cause readmission after admission for any eligible condition within 30- days of acute care hospital discharge.

The individual CMS mortality models estimate hospital-specific, risk-standardized, all-cause 30-day mortality rates for patients hospitalized with a principal diagnosis of AMI, HF, pneumonia, COPD, or stroke. 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 CMS hospital-wide readmission model estimates hospital-specific, risk-standardized, unplanned, all-cause 30-day readmission rates for patients discharged alive to a non-acute care setting. Patients may have been readmitted back to the same hospital, to a different hospital, or to another acute care facility. They may have been readmitted for the same condition as their recent hospital stay or for a different reason (CMS has indicated this is to discourage hospitals from coding similar readmissions as different readmissions)[30]. 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.

Data note relating to the July 2016 Hospital Compare performance period (July 1, 2012 - June 30, 2015): The pneumonia measure cohort was expanded to include principal discharge codes for sepsis and aspiration pneumonia. This resulted in a significant increase in pneumonia 30-day mortality rates nationally, beginning with the 2015 data year.

Length-of-stay methodologies

Watson Health has developed a severity-adjusted resource demand model that can be applied to coded patient claims data to estimate the expected LOS, given various patient-related factors[44]. We exclude long-term care, psychiatric, substance abuse, rehabilitation, and federally owned or controlled facilities. In addition, we exclude certain patient records from the data set: psychiatric; substance abuse; unclassified cases (MS-DRGs 945, 946, and 999); cases in which patient age was less than 65 years; and cases in which a patient was transferred to another short-term, acute care hospital.

Palliative care patients (Z515) are included in the LOS model, which is calibrated to predict expected LOS for these patients.

Note: We are no longer able to exclude all rehabilitation patients, as we have done in the past, because the ICD-10-CM coding system does not identify rehabilitation patients. We can only exclude those patients coded as being in a PPS- exempt hospital rehabilitation unit (provtype = R or T).

Our severity-adjusted resource demand model allows us to produce risk-adjusted performance comparisons on LOS between or across subgroups of inpatients. These patient groupings can be based on factors such as clinical groupings, hospitals, product lines, geographic regions, and physicians. This regression model adjusts for differences in diagnosis type and illness severity, based on ICD-10-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.

In response to the transition to ICD-10-CM, diagnosis, procedure, and interaction codes have been mapped to AHRQ CCS categories for severity assignment instead of using the individual diagnosis, procedure, and interaction effects.

POA coding allows us to estimate appropriate adjustments to LOS weights based on pre-existing conditions. Complications that occurred during the hospital stay are not considered in the model. We calculate expected values from model coefficients that are normalized to the clinical group and transformed from log scale.

Emergency department throughput measure

We have included two emergency department (ED) throughput measures from the CMS Hospital Compare data set. The hospital ED is an access point to healthcare for many people. A key factor in evaluating ED performance is process "throughput," measures of timeliness with which patients are seen by a provider, receive treatment, and either are admitted or discharged. Timely ED processes may impact both care quality and the quality of the patient experience. We chose to include measures that define two ED processes: median time from admit decision to ED departure for admitted patients, and median time from ED arrival to ED departure for non-admitted patients.

For this study's measure, we used the current year data from CMS Hospital Compare. Hospitals are required to have reported both ED measures or they are excluded from the study. Our ranked metric is the calculated mean of the two included measures.

Hospitals participating in the CMS Inpatient Quality Reporting and Outpatient Quality Reporting Programs report data for any eligible adult ED patients, including Medicare patients, Medicare managed care patients, and non-Medicare patients. Submitted data can be for all eligible patients or a sample of patients, following CMS sampling rules.

Emergency Department Throughput Measures	
ED-2b	Admit Decision Time to ED Departure Time for Admitted Patients
OP-18b	Median Time from ED Arrival to ED Departure for Discharged ED Patients

Inpatient expense per discharge and operating profit margin measure calculations

For this study, we used hospital-reported data from the current data year of Medicare cost reports available in the Hospital Cost Report Information System 2019 third- and fourth-quarter data files to calculate the inpatient expense per discharge and operating profit margin measures. Below you will find our calculations and the cost report locations (worksheet, line, and column) of data elements for these measures. The line and column references are the standard based on CMS Form 2552-10.

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 (for example, organ procurement, outpatient therapy, and other capital-related costs)

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 2018 Final Rule table 2 (cost report end dates in 2018 Q1, Q2, Q3) or IPPS FFY2019, table 2 (cost report end dates in 2017 Q4)
- CMS wage index — CMS Federal Register: CMS IPPS FFY 2018 (cost report end dates in 2019 Q1, Q2, Q3) or IPPS FFY2020, table 2 (cost report end dates in 2019 Q4)

Medicare spend per beneficiary

The Medicare spend per beneficiary (MSPB) index is included 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 data sets, and in FFY 2015, began to include it in the Hospital 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".[46]

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 MSPB 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 (that is, allowed charges) are counted in the MSPB episode as long as the start of the claim falls within the episode window. 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. This measure excludes patients who died during the episode.

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 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 various risk factors including case mix, age, and hierarchical condition category (HCC) indicators.

Adjusted operating profit margin

[(net patient revenue + other operating revenue – (total operating expense + net related organization expense)) ÷ (net patient revenue + other operating revenue)] × 100

> other operating revenue = [total other income – other income: (for example, contributions and donations) – 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

Note: When a hospital has already reported the net related organization expense in its total operating expense, we subtract it back out to avoid double- counting. This issue is identified on worksheet G-2 expense additions, lines 30 through 35 (including sublines) where titles contain references to “home office,” “related organization,” “shared services,” “system assessment,” “corporate allocation,” or “internal allocation.”

When the reported value is less than 80% of the reported related organization expense, we subtract the G-2 expense additions from total operating expense. When the G-2 expense additions is any other value, we back-out related organization expense from total operating expense. In this study, 2.7% of in-study hospitals received this correction.

Hospital Consumer Assessment of Healthcare Providers and Systems 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 may be 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 medicare.gov/hospitalcompare. A downloadable version of HCAHPS results is available.

Although we report 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)

Hospitals' performance is measured by using the highest rating, or top box, value. CMS Hospital Compare provides the percent of patients that rated the hospital in all three categories, our performance metric is based solely on the top box percent for the overall hospital rating question.

This is a change in our methodology. Previous studies used a weighted score based on the sum of all three categories. For the purpose of clarity and simplicity, we have moved to using the 'top box' percent.

Performance measure normalization

The inpatient mortality, complications, HAI, and LOS measures are normalized based on the in- study population, 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 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 expected values by multiplying them by the ratio of the observed to expected values for their comparison group. We then calculate the normalized z-score based on the observed and normalized expected values and the patient count.

For the HAI measures, we base our ranking on the unweighted mean of the normalized z-scores for the included HAIs. Included HAIs vary by comparison group. We normalize the individual hospital expected values for each HAI by multiplying them by the ratio of the observed to expected values for their comparison group for that HAI. We calculated a normalized z-score for each HAI, for each hospital, using the observed, normalized expected and count.

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 its 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).

Community Health Survey measure

The 100 Top Hospitals program incorporated a community health measure into its ranking process this year. Our initial goal was that the community health measure would be weighted equally with other ranking domains assessing inpatient outcomes, extended outcomes, processes of care, operational efficiency, financial health, and patient experience. This would be dependent on the surveys completed and returned to us.

For this year's study, we utilized the final recommendations from Measuring Hospital Contributions to Community Health with a Focus on Equity created by the Bloomberg American Health Initiative and the Center for Health Equity at the Johns Hopkins Bloomberg School of Public Health.

Key principles of this measure include:

1. Components of the measure should be based on evidence, existing standards, and best practices.
2. The underlying data should be publicly available or easily and transparently collected from hospitals and health systems.
3. Hospitals and health systems, community organizations, and the general public should have the opportunity to suggest and comment on all elements of the proposed measures.

The proposal recommended a four-component approach to measuring hospital contributions to community health. Data for the first proposed component are publicly available through websites that track health outcomes by county. Data for the other three proposed components would be derived from a straightforward survey to be filled out by hospitals.

For the 2021 100 Top Hospitals Study, we focused on the three components that would be derived from a hospital survey. The survey focuses on the role that a hospital can play including: (1) acting as a healthcare provider to provide services critical for community health and offering critical preventive services; (2) acting as a partner and teaming up with local organizations to implement critical programs; and (3) acting as an anchor institution and supporting local economic and social progress.

We processed the hospital level data by peer group for the eleven outcome measures and identified the top 200 performing hospitals. We then reached out to all of the top performing hospitals via email to share and ask for the hospital to submit a Community Health survey. Due to the nature of this data collection process and time period, we received responses from about 60% of the hospitals. Since all hospitals did not return a survey, we had to modify our initial thinking.

The community health measure is measured as a percentage. 100% is the highest score possible. Submitting a survey and sharing your data is 25% (data transparency). Each of the other components of the survey – hospital as a provider, hospital as a partner, and hospital as an anchor institution is worth an additional 25%. In order to receive the full 25% for each component, hospitals needed to attest to at least half of the best practice standards. (See Appendix D).

The final methodology used to incorporate the Community Health Measure was to take the Final Ranking within the five hospital comparison groups, and independently rank the performance of the Community Health Measures relative to other hospitals in their comparison group. We added the rank of the Community Health measure to the final sum (based on the eleven outcome measures) and re-ranked the hospitals within each comparison group. The final rankings are published on the Fortune website.

Differences between current and trend profiles

Normalization

The current year values on the current and trend graphs will not match for inpatient mortality, complications, or average LOS. This is because we use different norm factors to normalize the expected values.

- Current profile: We combine in-study hospitals' data for only the most current study year to calculate each comparison group norm factor (observed/expected). Note: The current study year was comprised of the two most current years MEDPAR data for inpatient morality and complications, and the current year data only for average LOS.
- Trend profile: We combine in-study hospitals' data for all five study years to calculate each comparison group norm factor.

In-study hospital counts

There are fewer in-study hospitals in the trend profile than the current profile because some hospitals do not have enough data points for one or more measures to calculate trend, so they are excluded.

- Additional impact on average LOS calculation: The observed/normalized expected LOS index for each hospital is converted into an average LOS in days by multiplying it by the mean average LOS for all in-study hospitals (sum observed LOS/in- study hospital count). The grand mean average LOS will be different in current and trend profiles when there are different numbers of in-study hospitals.

Both the current and trend profiles are internally consistent. They each provide relevant comparisons of a profiled hospital's performance versus peers and national benchmarks.

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- 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 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. Dividing such a value by a number that may be zero or negative does not convey any meaningful information because the amount of change is not proportional to its previous value.

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

We do not report any individual hospital data that is based on 11 or fewer patients, as required by CMS. This affects the following measures:

- Risk-adjusted inpatient mortality index
- Risk-adjusted complications index
- 30-day mortality rates for AMI, HF, pneumonia, COPD, and stroke (CMS does not report a rate when count is less than 25)
- 30-day hospital-wide readmission rates (CMS does not report a rate when count is less than 25)
- Average LOS

Appendix D – Community Health Survey

Community Health with a Focus on Equity

A full description of best practice standards is available at https://americanhealth.jhu.edu/news/measuring-hospital-contributions-community-health-focus-equity.

Best Practice Standard	Attestation	Add Link for More Details (optional)
Hospital as Provider		
1. Our hospital is a comprehensive tobacco-free campus. Details	[ ] We attest to this standard	
2. Our hospital has an inpatient tobacco use cessation program. Details	[ ] We attest to this standard	
3. Our hospital provides buprenorphine treatment for opioid use disorder in the ED. Details	[ ] We attest to this standard	
4. Our Hospital provides screening, brief intervention, and referral to treatment for alcohol use in the ED and hospital. Details	[ ] We attest to this standard	
5. Our hospital runs a hospital-based violence prevention program. Details	[ ] We attest to this standard	
6. Our hospital screens for intimate partner violence and refers to services and supports as needed. Details	[ ] We attest to this standard	
7. Our hospital offers healthy food options. Details	[ ] We attest to this standard	
8. Our hospital has a social needs screening and referral program. Details	[ ] We attest to this standard	
9. Our hospital offers an infant safe sleep education program. Details	[ ] We attest to this standard	
10. Our hospital adopts 10 practices to support breastfeeding. Details	[ ] We attest to this standard	
11. Our hospital offers contraception treatment and counselling to patients immediately postpartum. Details	[ ] We attest to this standard	
12. Our hospital implements practices to reduce falls and optimize mobility for elderly patients per the Age Friendly Hospital Program. Details	[ ] We attest to this standard	
Hospital as Community Partner		

Best Practice Standard	Attestation	Add Link for More Details (optional)
1.Our hospital does a community needs assessment with the department of health. Details	[ ] We attest to this standard	
2. Our hospital provides meaningful support for a community based hypertension control program. Details	[ ] We attest to this standard	
3. Our hospital provides meaningful support for a community based hypertension control program. Details	[ ] We attest to this standard	
4. Our hospital provides meaningful support for an evidence-based home visiting program. Details	[ ] We attest to this standard	
5. Our hospital provides meaningful support for training and work of community health workers. Details	[ ] We attest to this standard	
6. Our hospital makes meaningful contributions to supporting school success. Details	[ ] We attest to this standard	
7. Our hospital meaningfully supports expanding access to fresh, healthy foods in the community. Details	[ ] We attest to this standard	
8. Our hospital invests in expanding or improving healthy, affordable housing in the community. Details	[ ] We attest to this standard	
Hospital as Anchor Institution		
1. Our hospital has a five-year plan for achieving diversity in board and top management. Details	[ ] We attest to this standard	
2. Our hospital pays all employees a minimum hourly rate based on the local living wage. Details	[ ] We attest to this standard	
3. Our hospital has a minority owned business purchasing and procurement goal and measures progress towards this goal. Details	[ ] We attest to this standard	
4. Our hospital supports access to affordable high-quality child care for children of all full and part-time employees. Details	[ ] We attest to this standard	
5. Our hospital provides paid sick leave to all employees. Details	[ ] We attest to this standard	
6. Our hospital adopts a “do no harm” collections policy. Details	[ ] We attest to this standard	
7. Our hospital has a returning citizen work program. Details	[ ] We attest to this standard	
8. Our hospital supports community sustainability. Details	[ ] We attest to this standard	

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