



**2018**

# Hospital Strength INDEX<sup>®</sup> Methodology

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## **Research and Analytic Team**

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Ken Gross joined The Chartis Group as Chief Data Scientist in February 2017. He has over 15 years of experience as a thought leader for advanced analytic techniques and solution development across the healthcare provider industry. At Chartis, he serves as a senior advisor and industry expert to healthcare providers, aiming to advance their analytic capabilities and methods, and leading the development of new analytic methodologies and algorithms that support Chartis' consulting practices.

Prior to joining Chartis, Dr. Gross was founder and Principal of Quantitative Innovations, a data strategy consulting practice, where he advised hospital systems and ACOs on implementation of population health data analytic strategies. He also served as the Director of Research and Evaluation for the Camden Coalition of Healthcare Providers, where he developed innovative quantitative and spatial analytic methods for understanding and addressing the needs of high utilization patients. Prior to his work with the Camden Coalition, Dr. Gross held positions as a Senior Associate at The Reinvestment Fund, and an Epidemiologist for the City of Philadelphia, Division of Maternal and Child Health.

Dr. Gross holds a PhD in Policy Research, Evaluation and Measurement from the University of Pennsylvania, where he also served as an Institute for Educational Sciences Pre-Doctoral Fellow. He earned a Master of Public Health from Drexel University and a Bachelor of Arts degree from Washington University in St. Louis.

## The Hospital Strength INDEX® Overview

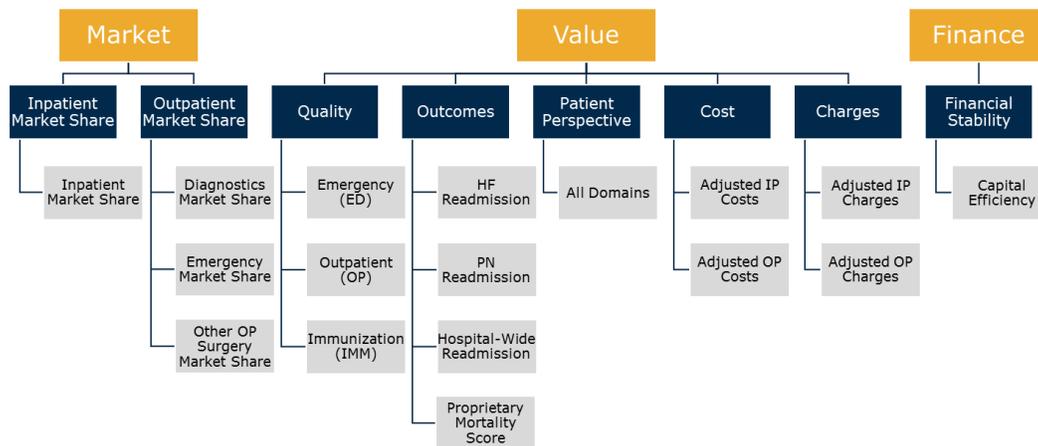
The Hospital Strength INDEX is the industry’s most comprehensive and objective assessment of rural hospital performance.

By assessing performance across approximately sixty Indicators and eight Pillars of performance, INDEX brings a rural-relevant perspective to healthcare leaders making strategic and operational decisions. The INDEX is the foundation for many of rural healthcare’s most prominent awards (e.g. Top 100 Critical Access Hospitals and Top 100 Rural & Community Hospitals) and is used by organizations such as the National Rural Health Association (NRHA) in support of its advocacy and legislative initiatives.

Since its inception, the INDEX has helped more than 750 rural and Critical Access Hospitals integrate sophisticated analytics for benchmarking performance and has been used by more than 25 state agencies, state hospital associations, federal grant programs and both the NRHA and the National Organization of State Offices of Rural Health (NOSORH). INDEX analytics continually inform healthcare industry policy, research and thought leadership.

### Methodology Summary

The INDEX is a holistic assessment of rural provider performance relative to all Critical Access Hospitals (CAHs) and Rural & Community Hospitals nationally (see *Hospitals in the Study Group* for details). Each hospital’s INDEX score is a percentile rank of aggregate performance across eight Pillars spanning Market, Value and Finance. Each Pillar score reflects a percentile rank of aggregate performance across each underlying Indicator. In total, thirty Indicators serve as the basis for these Pillars (Figure 1).<sup>1</sup>



**Figure 1.** The INDEX is comprised of eight Pillars of performance spanning Market, Value and Finance. Thirty Indicators serve as the basis of these Pillars.

<sup>1</sup> Nearly thirty additional Indicators are included in detailed INDEX analytic reports for further benchmarking, although these measures are not included in the INDEX rankings.

All data leveraged in the INDEX are the most recent publicly available from CMS. All information in this release (February 2018) represents the most recently available data as of December 2017 (Table 1).

**Table 1.** Data Summary

Pillar	Source	Dataset	Time Period
Inpatient Market Share	CMS	Service Area File 2016	January 2016-December 2016
Outpatient Market Share	CMS	Standard Analytical File - OP 2016	January 2016-December 2016
Quality	CMS	Hospital Compare - Core Measures	January 2016-December 2016
Outcomes	CMS	MedPAR 2016 Final Rule	October 2015-September 2016
	CMS	Hospital Compare - Mortality / Readmissions	July 2013-June 2016
Patient Perspectives	CMS	Hospital Compare - HCAHPS	January 2016-December 2016
Cost	CMS	Standard Analytical File - OP 2016	January 2016-December 2016
	CMS	MedPAR 2016 Final Rule	October 2015-September 2016
	CMS	Healthcare Cost Report Information System (HCRIS) Q3 2017	Most recent Cost Report provided as of 9/30/17
Charge	CMS	MedPAR 2016 Final Rule	October 2015-September 2016
	CMS	Standard Analytical File - OP 2016	January 2016-December 2016
Financial Stability	CMS	Healthcare Cost Report Information System (HCRIS) Q3 2017	Most recent Cost Report provided as of 9/30/17

All available data are included in the INDEX. Statistical sampling and data projection methodologies are employed only when necessary. Missing data are estimated using a Fully Conditional Specification (FCS) regression-based multiple imputation method. Raw values are converted to normalized z-scores for standardization. Outliers are reduced using a truncation technique through which outliers over three standard deviations from the mean are truncated. Indicators unable to be ranked after imputation due to missing or excluded data are removed from Pillar and composite INDEX rankings.

Each Pillar score reflects a percentile rank of the hospital's aggregate performance across underlying metrics relative to all hospitals in the analysis. In some instances, weighting and/or standardization across Indicators within each Pillar are performed. See Appendix A: Detailed Methodology for additional information specific to each Pillar.

The composite INDEX score reflects a percentile rank of the hospital's aggregate performance across all eight Pillars. For each hospital, a composite score is computed as the sum of the z-scores for all eight Pillars. All Pillars are equally-weighted. This sum is percentile ranked against the study group to derive the overall INDEX score. Providers missing three or more Pillars are excluded from the overall INDEX ranking and the INDEX score is denoted as "N/A."

## ***Hospitals in the Study Group***

The INDEX strives to include all active Critical Access Hospitals (CAHs) and Rural & Community Hospitals. CCRH defines Rural & Community Hospitals as all active U.S. short-term acute care, non-specialty and non-federal hospitals located in zip codes designated as “rural” by the Federal Office of Rural Health Policy (FORHP) with no more than 200 beds. This INDEX release (February 2018) includes 2,123 rural providers: 1,312 CAHs and 811 Rural & Community Hospitals.

The most recently available CMS Provider of Services (POS) file is used to determine the initial population of eligible hospitals. This file contains individual records for each Medicare-approved provider and is updated quarterly. This dataset is cross-checked against other sources including the AHA Hospital Directory and the American Hospital Directory to confirm hospital identity, status, and appropriateness for inclusion. Exclusions are based on the following criteria:

- **Specialty Hospital Designation:**
  - Providers designated as specialty hospitals in the CMS Hospital Provider of Services file are excluded. These include psychiatric, rehab, long-term care, surgical specialty and other specialty facilities.
  - Hospitals designated as cancer centers and children’s or pediatric hospitals are excluded.
  - Governmental facilities including Veterans Administration, Indian Health Service hospitals and related federal facilities are excluded.
  - Hospitals with 80 percent of their MS-DRG inpatient case mix concentrated in three or fewer Major Diagnostic Categories (MDCs) are excluded.
- **Geography:**
  - Hospitals in outlying U.S. Territories (i.e. Samoa, Virgin Islands, Puerto Rico, etc.) are excluded.
- **Data Availability:**
  - Hospitals missing more than 60 percent of the Indicators in each Pillar are excluded from that Pillar analysis.
  - Hospitals missing three or more Pillar scores due to lack of supporting data are excluded from the composite INDEX analysis.

## Appendix A: Detailed Methodology

**Table 2.** Inpatient Market Share Pillar Methodology

Component	Inpatient Market Share
Data Source(s)	CMS Service Area File
Indicator(s)	Medicare Inpatient Market Share
Methodology	<p>Each hospital’s inpatient service area is defined as the fewest number of zip codes comprising 65 percent of the hospital’s total inpatient Medicare case count over the most recent three years of available data. The home zip code is included. Zip codes with fewer than an average of one (1) case per year are removed. Zip codes with a center point more than 35 miles from the hospital are removed.</p> <p>Inpatient market share is computed as the total inpatient Medicare hospital cases from the defined service area divided by the total inpatient Medicare market cases from the defined service area for the most recent year of available data.</p>
Scoring	Inpatient market share values are normalized across all hospitals in the analysis. For each hospital, the inpatient market share z-score is percentile ranked against all analyzed providers to derive the Pillar score. To reward facilities with strong inpatient market positions, higher market shares receive higher percentile rankings.

**Table 3.** Outpatient Market Share Pillar Methodology

Component	Outpatient Market Share
Data Source(s)	Outpatient Standard Analytical File (OPSAF)
Indicator(s)	<p>Medicare Outpatient Market Share – Non-Cardiac Surgery</p> <p>Medicare Outpatient Market Share – Emergency</p> <p>Medicare Outpatient Market Share – Diagnostic and Therapeutic Services</p>
Methodology	<p>Each hospital’s outpatient service area is defined as the fewest number of Federal Information Processing Standard (FIPS) codes comprising 75 percent of the hospital’s total outpatient Medicare procedures over the most recent three years. The home FIPS code is included. FIPS codes with fewer than an average of one (1) procedure per year are removed. FIPS codes with a center point more than 100 miles from the hospital are removed. No distance-based exclusions are applied to FIPS codes missing latitude/longitude data. Service areas are defined for each Indicator individually.</p> <p>Outpatient market share is computed as the total outpatient hospital Medicare payments from the defined service area divided by the total outpatient market Medicare payments from the defined service area for the most recent year of available data. Outpatient market share is defined for each Indicator individually.</p>
Scoring	For each Indicator, outpatient market share values are normalized across all hospitals in the analysis. For each hospital, z-scores for all Indicators are averaged. All Indicators are equally-weighted. This average z-score is percentile ranked against all analyzed providers to derive the Pillar score. To reward facilities with strong outpatient market positions, higher market shares receive higher percentile rankings.
Notes	Outpatient procedures are categorized under the highest-ranking service line according to the following hierarchy: Non-Cardiac Surgery, Emergency, and Diagnostic and Therapeutic Services. Cases that do not fall into these service lines are excluded from the analysis.

**Table 4.** Quality Pillar Methodology

Component	Quality
Data Source(s)	Hospital Compare – Process of Care
Indicator(s)	ED-1b Median Time from ED Arrival to ED Departure for Admitted ED Patients OP-4 Aspirin at Arrival OP-18b Median Time from ED Arrival to ED Departure for Discharged ED Patients OP-20 Median Time from ED Arrival to Provider Contact for ED Patients OP-21 Median Time to Pain Management for Long Bone Fracture OP-22 Percent of Patients Leaving without Being Seen IMM-2 Immunization Rate for Influenza
Methodology	<p>Process of Care data are compiled as reported on Hospital Compare. No further data manipulation is performed.</p> <p>Data that are suppressed by CMS due to insufficient volume are treated as missing and multiple imputation is used to estimate suppressed values. Hospitals not reporting these measures citing the footnote of, "Data are shown only for hospitals that participate in the Inpatient Quality Reporting (IQR) and Outpatient Quality Reporting (OQR) programs" are excluded from the Pillar analysis. Pillar score is denoted as "*N/A."</p> <p>Principal components factor analysis is employed to determine the appropriate weighting for each Indicator.</p>
Scoring	<p>For each Indicator, scores are normalized across all hospitals in the analysis. To reward facilities delivering top quality, higher values receive higher z-scores for OP-4 and IMM-2. Lower values receive higher z-scores for ED-1b, OP-18b, OP-20, OP-21 and OP-22. Across all Indicators, the weighted average z-score (as determined by factor analysis) is percentile ranked against all analyzed providers to derive the Pillar score.</p>
Notes	<p>Hospitals missing data for four or more Indicators are excluded from the Pillar analysis. Pillar score is denoted as "N/A." The analyzed Indicators represent the most widely-accepted, rural-relevant measures with data for at least 40 percent of hospitals in the study. New metrics and measures that are not representative of rural hospital performance are purposefully omitted. The incorporation of additional measures in the future will be considered based on industry acceptance and data availability.</p>

**Table 5.** Outcomes Pillar Methodology

Component	Outcomes
Data Source(s)	Hospital Compare – Mortality and Readmission Medicare Provider and Analysis Review (MedPAR)
Indicator(s)	30-Day Heart Failure (HF) Readmission Rate 30-Day Pneumonia (PN) Readmission Rate 30-Day Hospital-Wide Readmission Rate Proprietary Risk-Adjusted In-Hospital All-Condition Mortality Score
Methodology	<p>Readmission rates are compiled as reported on Hospital Compare. No further data manipulation is performed.</p> <p>To compute the Proprietary Risk-Adjusted In-Hospital All-Condition Mortality Score, data are first stratified by DRG cluster. In clusters with lower mortality rates, contingency tables are used to stratify according to age and number of comorbidities. National per-stratum mortality rates are used to calculate expected mortality rates for each hospital. In clusters with higher mortality rates, logistic regression models are fit, adjusting for age, gender, cluster-specific comorbidities, and admission source. Expected rates from the contingency table and logistic models are risk-adjusted for each hospital based upon patient mix. For each hospital, the number of standard deviations between the observed and expected mortality rates is computed. This value is normalized and ranked as described below. Note inpatients age 65 or older are excluded if the patient stayed less than two days (unless died), left against medical advice, was transferred, or was assigned DRGs 981-999.</p> <p>Data that are suppressed by CMS due to insufficient volume are treated as missing and multiple imputation is used to estimate suppressed values. Hospitals not reporting these measures citing the footnote of, "Data are shown only for hospitals that participate in the Inpatient Quality Reporting (IQR) and Outpatient Quality Reporting (OQR) programs" are excluded from the Pillar analysis. Pillar score is denoted as "N/A."</p> <p>Principal components factor analysis is employed to determine the appropriate weighting for each Indicator.</p>
Scoring	For each Indicator, scores are normalized across all hospitals in the analysis. To reward facilities with strong outcomes, lower readmission rates receive higher z-scores. Higher Mortality Scores receive higher z-scores. Across all evaluated Indicators, the weighted average z-score (as determined by factor analysis) is percentile ranked against all analyzed providers to derive the Pillar score.
Notes	Hospitals missing data for two or more Indicators are excluded from the Pillar analysis. Pillar score is denoted as "N/A." The analyzed Indicators represent the most widely-accepted, rural-relevant measures with data for at least 40 percent of hospitals in the study. New metrics and measures that are not representative of rural hospital performance are purposefully omitted. The incorporation of additional measures in the future will be considered based on industry acceptance and data availability.

**Table 6.** Patient Perspective Pillar Methodology

Component	Patient Perspective
Data Source(s)	Hospital Compare – HCAHPS
Indicator(s)	<p>Patients Reporting they would “Definitely Recommend” the Hospital</p> <p>Patients Rating the Hospital a 9 or 10 on a Scale from 0 (Lowest) to 10 (Highest)</p> <p>Patients Reporting their Room and Bathroom were “Always” Clean</p> <p>Patients Reporting Nurses “Always” Communicated Well</p> <p>Patients Reporting Doctors “Always” Communicated Well</p> <p>Patients Reporting they “Always” Received Help as Soon as they Wanted</p> <p>Patients Reporting their Pain was “Always” Well-Controlled</p> <p>Patients Reporting Staff “Always” Explained Medications Before Administering</p> <p>Patients Reporting “Yes” they were Given Information About what to Do during their Recovery at Home</p> <p>Patients Reporting the Area Around their Room was “Always” Quiet at Night</p>
Methodology	<p>HCAHPS scores are compiled as reported on Hospital Compare. No further data manipulation is performed.</p> <p>Data that are suppressed by CMS due to insufficient volume are treated as missing and multiple imputation is used to estimate suppressed values. Hospitals not reporting these measures citing the footnote of, “Data are shown only for hospitals that participate in the Inpatient Quality Reporting (IQR) and Outpatient Quality Reporting (OQR) programs” are excluded from the Pillar analysis. Pillar score is denoted as “*N/A.”</p> <p>Principal components factor analysis is employed to determine the appropriate weighting for each Indicator.</p>
Scoring	<p>For each Indicator, scores are normalized across all hospitals in the analysis. Across all evaluated Indicators, the weighted average z-score (as determined by factor analysis) is percentile ranked against all analyzed providers to derive the Pillar score. To reward facilities with strong patient satisfaction, hospitals with higher scores receive higher percentile ranks.</p>
Notes	<p>Hospitals missing data for four or more Indicators are excluded from the Pillar analysis. Pillar score is denoted as “N/A.”</p>

**Table 7.** Cost Pillar Methodology

Component	Cost
Data Source(s)	Medicare Provider and Analysis Review (MedPAR) Outpatient Standard Analytical File (OPSAF) Healthcare Cost Report Information Systems (HCRIS)
Indicator(s)	Medicare Adjusted Average Costs – Inpatient Medicare Adjusted Average Costs – Outpatient
Methodology	Each hospital’s cost-to-charge ratio is applied to average case-mix and wage rate-adjusted inpatient and outpatient charges. See Charge Pillar Methodology (Table 8) for detail regarding charge calculations.
Scoring	Each Indicator is normalized across all hospitals in the analysis. For each hospital, the z-scores for both Indicators are averaged. Both Indicators are equally-weighted. This value is percentile ranked against all analyzed providers to derive the Pillar score. To reward facilities with strong cost efficiency, lower average costs receive higher percentile rankings.

**Table 8.** Charge Pillar Methodology

Component	Charge
Data Source(s)	Medicare Provider and Analysis Review (MedPAR) Outpatient Standard Analytical File (OPSAF)
Indicator(s)	Medicare Adjusted Average Charges – Inpatient Medicare Adjusted Average Charges – Outpatient
Methodology	For each hospital in the analysis, inpatient charges are case-mix adjusted based on the CMS-assigned case weight for each claim’s MS-DRG. Ungroupable cases not assigned a DRG are excluded from the analysis. Each hospital’s case-mix adjusted inpatient charges are aggregated to derive an average inpatient charge per case. Average inpatient charges are wage-rate adjusted according to CMS-defined provider wage indices.  For each hospital in the analysis, outpatient charges are case-mix adjusted based on the CMS-assigned case weight for each claim’s Ambulatory Payment Classification (APC) code. Procedures not assigned an APC code are excluded from the analysis. Each hospital’s case-mix adjusted outpatient charges are aggregated to derive an average charge per unit. Average outpatient charges are wage-rate adjusted according to CMS-defined provider wage indices.
Scoring	Each Indicator is normalized across all hospitals in the analysis. For each hospital, the z-scores for both Indicators are averaged. Both Indicators are equally-weighted. This value is percentile ranked against all analyzed providers to derive the Pillar score. To reward facilities with strong charges, lower average charges receive higher percentile rankings.

**Table 9.** Financial Stability Pillar Methodology

Component	Financial Stability
Data Source(s)	Healthcare Cost Report Information Systems (HCRIS)
Indicator(s)	Net Income/Total Revenue
Methodology	The above ratio is calculated for each hospital based on Cost Report data.
Scoring	For each hospital, Net Income/Total Revenue is computed and normalized against all hospitals in the analysis. Z-scores are percentile ranked against all analyzed providers to derive the Pillar score. To reward facilities with greater financial stability, higher ratios receive higher percentile rankings.
Notes	The selection of the evaluated indicator is based on academic research identifying the financial ratios most highly correlated to long-term fiscal viability (Lynn, M. & Wetheim, P. Key Financial Ratios Can Foretell Hospital Closures. HFMA Journal, 47(11), 66-70. 1993). Additional metrics were not evaluated in the INDEX due to poor data integrity. The incorporation of additional measures in the future will be considered based on industry acceptance and data availability.