Overall Hospital Quality Star Rating on *Hospital Compare*
October 2016 Updates and Specifications Report

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Yale New Haven Health Services Corporation – Center for Outcomes Research and Evaluation (CORE) Project Team

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1. How to Use This Report

Under contract with the Centers for Medicare & Medicaid Services (CMS), Yale New Haven Health Services Corporation – Center for Outcomes Research & Evaluation (CORE) has developed the methodology for the Overall Hospital Quality Star Rating, summarizing the quality information conveyed by many of the measures publicly reported on *Hospital Compare*. The purpose of this report is to provide an overview of the methodology for calculating the Star Rating (v2.0) and provide updated national results for the October 2016 *Hospital Compare* release. A more detailed version of the methodology and process for developing the Star Rating ("Overall Hospital Quality Star Rating v2.0") can be found on *QualityNet* at www.qualitynet.org > Hospitals-Inpatient > Hospital Star Ratings.

This Overall Hospital Quality Star Rating Updates and Specifications Report (October 2016) is organized into the following sections:

- Section 2: Objective of Overall Hospital Quality Star Rating
- Section 3: Overall Hospital Quality Star Rating Methodology
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    - 3.2. Step 1: Selection of Measures for Inclusion in Star Rating
    - 3.3. Step 2: Assignment of Measures to Groups
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2. Objective of Overall Hospital Quality Star Rating

The primary objective of the Overall Hospital Quality Star Rating project is to summarize information from the existing measures on *Hospital Compare* in a way that is useful and easy to interpret for patients and consumers through the development of a statistically sound methodology. Consistent with other CMS Star Rating programs, this methodology assigns each hospital between one and five stars, reflecting the hospital's overall performance on selected quality measures.

The Overall Hospital Quality Star Rating is designed to provide summary information for consumers about existing publicly-reported quality data. In the case of *Hospital Compare*, the Overall Hospital Quality Star Rating will be complimentary to existing efforts, such as the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) star rating (implemented in April 2015), and will not replace the reporting of any individual quality measures. In what follows, "Star Rating(s)" refers to the Overall Hospital Quality Star Rating unless otherwise noted.

3. Overall Hospital Quality Star Rating Methodology

3.1. Overview of Five Steps of the Star Rating Methodology

The methodology to calculate the Overall Star Rating is comprised of a five-step process. These steps are listed below and are described in greater detail in subsequent sections (see Appendix A).

Step 1: Selection and standardization of measures for inclusion in the Overall Star Rating
Step 2: Assignment of measures to groups
Step 3: Calculation of latent variable model group scores
Step 4: Calculation of hospital summary scores as a weighted average of group scores
Step 5: Application of clustering algorithm to translate a summary score into a Star Rating

The measures were first selected based on their relevance and importance as determined through stakeholder and expert feedback. The selected measures were standardized to be consistent in terms of direction and magnitude, with outlying values trimmed (Step 1). In Step 2, the measures were organized into seven groups by measure type. In Step 3, the standardized measures for each group were used to construct a latent variable statistical model that reflected the dimension of quality represented by the measures within the given group. Each of the seven statistical models generated a hospital-specific group score, which is obtained as a prediction of the latent variable. The term prediction is used to represent the realized value of the latent variable. In Step 4, a weight was applied to each group score, and all available groups were averaged to calculate a hospital summary score. Finally, in Step 5, to assign a Star Rating, hospital summary scores were organized into five categories using a clustering algorithm.

Of note, CMS reports hospital performance at the group level, separately categorizing each of a hospital's available group scores into one of three group performance categories (above, same as, and below the national average). These performance categories provide additional detail to patients and consumers for comparing across the seven groups (see Section 4.2).

3.2. Step 1: Selection and Standardization of Measures for Inclusion in the Overall Star Rating

Criteria for Selecting Measures

CMS determined and vetted measure selection criteria with stakeholders through the TEP and opportunities for public input to ensure that the Star Rating captured the diverse aspects of quality represented by the measures on *Hospital Compare*.

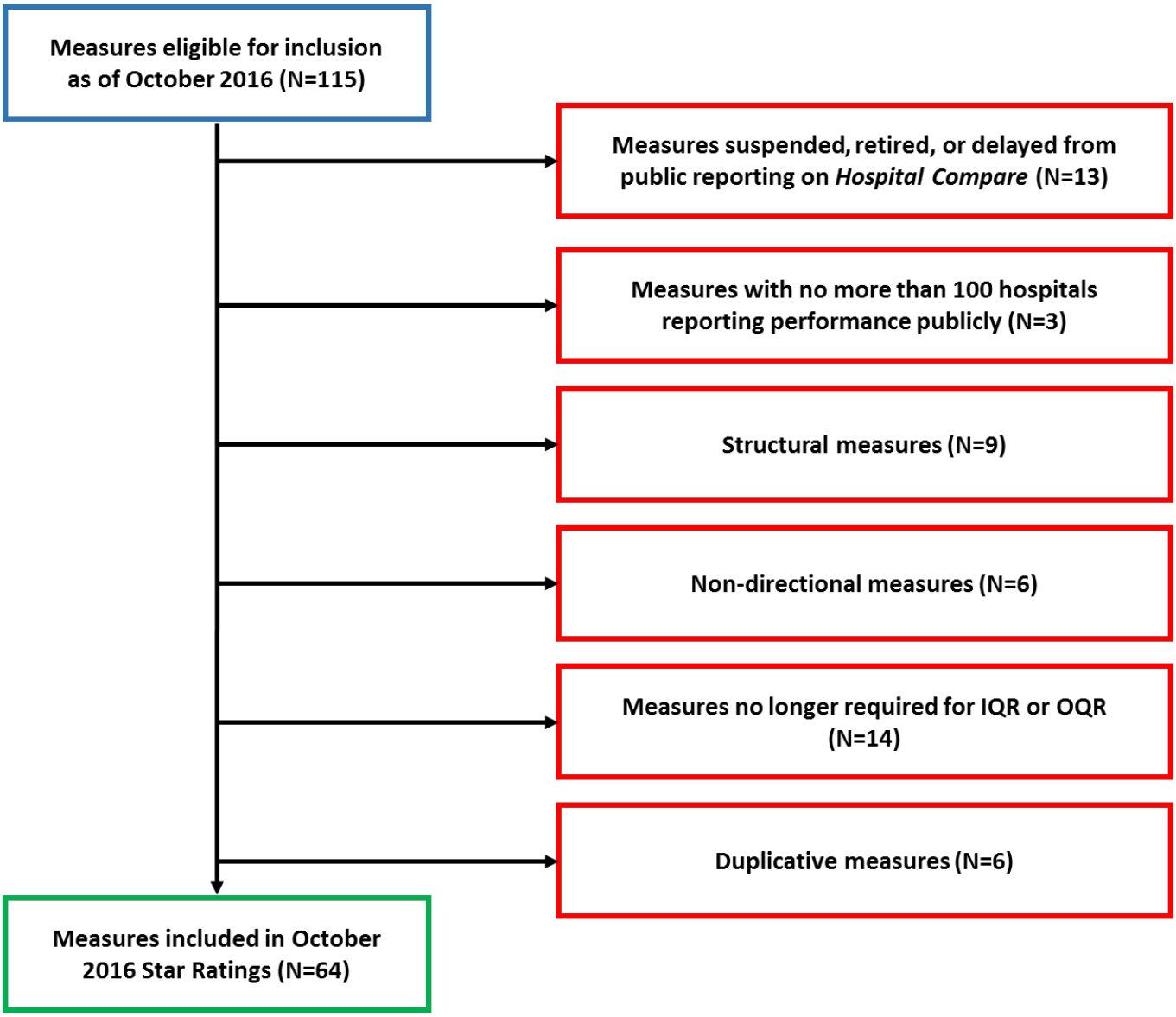
Because the Star Rating is intended for acute care hospitals, CMS first omitted all measures on *Hospital Compare* that were specific to specialty hospitals (such as cancer hospitals or inpatient psychiatric facilities), or ambulatory surgical centers prior to applying any measure selection criteria. With these measures omitted, the total number of measures eligible for inclusion in the Star Rating for October 2016 is 115 measures. The Star Rating methodology further limited the number of measures for inclusion in order to maintain a sound methodology through measure selection criteria, which are presented in the subsequent text and in Figure 1.

Measure Selection Criteria

CMS uses the following criteria to exclude measures from the Star Rating calculation:

1. Measures suspended, retired, or delayed from public reporting on *Hospital Compare*;
2. Measures with no more than 100 hospitals reporting performance publicly;
3. Structural measures;
4. Measures for which it is unclear whether a higher or lower score is better (non-directional);
5. Measures no longer required for Inpatient Quality Reporting (IQR) Program or Outpatient Quality Reporting (OQR) Program; and
6. Duplicative measures (e.g., individual measures that make up a composite measure that is also reported; or measures that are identical to another measure).

Figure 1. Measure Selection Flowchart (October 2016 Data)



Standardization of Measure Scores

For all selected measures, CMS transforms the measures into a single, common scale to account for differences in measure score format, differences in score direction, and the occurrence of extreme outliers. A measure is standardized by subtracting the national mean of measure scores from a hospital's measure score and dividing it by the standard deviation across hospitals. Measure direction is standardized by reversing the direction of the standardized scores for all measures for which "lower score is better," and converting them into "higher score is better" measures. Finally, CMS utilizes Winsorization to limit the influence of measures with extreme outlier values at the

0.125th percentile (Z=-3) and the 99.875th percentile (Z=3). Winsorization is a common strategy used to set extreme outliers to a specified percentile of the data. All standardized measure scores above 3 are set to be 3, and all standardized below -3 are set to be -3.

3.3. Step 2: Assignment of Measures to Groups

Approach to Grouping Measures

CMS organizes measures into groups by measure type (Table 1). Group names were finalized with input from a patient and patient advocate working group, convened in collaboration with the NPWF, and previous CMS consumer testing.

Table 1. Overall Hospital Quality Star Rating Groups

Groups
Mortality
Safety of Care
Readmission
Patient Experience
Effectiveness of Care
Timeliness of Care
Efficient Use of Medical Imaging

Measures by Group for October 2016

We assigned each measure included in the Star Rating to one of seven mutually exclusive groups: Mortality (N=7), Safety of Care (N=8), Readmission (N=8), Patient Experience (N=11), Effectiveness of Care (N=18), Timeliness of Care (N=7), and Efficient Use of Medical Imaging (N=5). For a complete list of the measures in each group, please refer to Table B.1 in Appendix B.

3.4. Step 3: Calculation of Latent Variable Model Group Scores

Overview of Latent Variable Model (LVM)

CMS employs latent variable modeling (LVM) to estimate a group score for the dimension of quality represented by the measures in each group. LVM is a statistical modeling approach that has been used to summarize information in a variety of settings ranging from education to healthcare. For the Star Rating, LVM assumes each measure reflects information about an underlying, unobserved dimension of quality. A separate LVM is constructed for each group so that a total of seven latent variable models are used to calculate the Star Ratings. The LVM accounts for the relationship, or correlation, between measures for a single hospital. Measures that are more consistent with each other, as well as measures with larger denominators, have a greater influence on the derived latent

variable. Each model estimates, for each hospital, the value of a single latent variable representing the underlying, unobserved dimension of quality; this estimate is the hospital's group score.

Loadings of Measures within Each Group

As noted above, measures that are more consistent, or more correlated, with other measures within the group have a greater influence on the hospital's group score. The influence of an individual measure on the group score is represented by the measure's "loading."

A loading is empirically derived for each measure in a group when applying the LVM; these statistically estimated measure loadings are regression coefficients based on maximum likelihood methods using observed data and are not subjectively assigned. A loading reflects the degree of the measure's influence on the group score relative to the other measures included in the same group. A measure's loading is the same across all hospitals. Measures with higher loadings are more strongly associated with the group score and the other measures within that group. All measures included in the Star Rating have an effect on the group score; however, measures with higher loadings have a greater association (or impact) on the group score than measures with substantially lower loadings. The loadings for the October 2016 Star Rating are reported in Appendix C.

Please note, the loadings for an individual measure are re-estimated each time the Star Rating is updated and can dynamically change as the distribution of hospitals' performance on the measure and its correlation with other measures evolve over time.

Accounting for Measure Sampling Variation

Hospitals' reported measure scores may include different numbers of patients, depending on the measure. For each measure, some hospitals may report a score based on data from fewer cases while other hospitals report scores based on more cases, resulting in differing precision for each hospital's individual measure score. This variability in precision is usually known as "sampling variation."

CMS gives more weight to measure scores that are more precise by using a weighted likelihood method. This method uses the hospital's measure denominator (hospital case count or sample size) to weight the observed value. A weighted likelihood ensures that a hospital with a larger denominator, or a more precise measure score, contributes more in calculating the loadings used to estimate the group score.

3.5. Step 4: Calculation of the Hospital Summary Score as a Weighted Average of Group Scores

Weighting Scheme

The seven group scores are combined to create a hospital summary score. To calculate this hospital summary scores, CMS takes a weighted average of that hospital's available group scores, assigning each group a policy-based weight (Table 2). This weighting scheme was modified from that used for the Hospital Value-based Purchasing (VBP) program. Additionally, these weights were thoroughly vetted through the TEP, opportunities for public input, hospital dry run, and the patient and patient advocate working group.

Table 2. Measure Group Weight for the Overall Star Rating

Measure Group	Star Ratings Weight
Mortality (N=7)	22%
Safety of Care (N=8)	22%
Readmission (N=8)	22%
Patient Experience (N=11)	22%
Effectiveness of Care (N=18)	4%
Timeliness of Care (N=7)	4%
Efficient Use of Medical Imaging (N=5)	4%

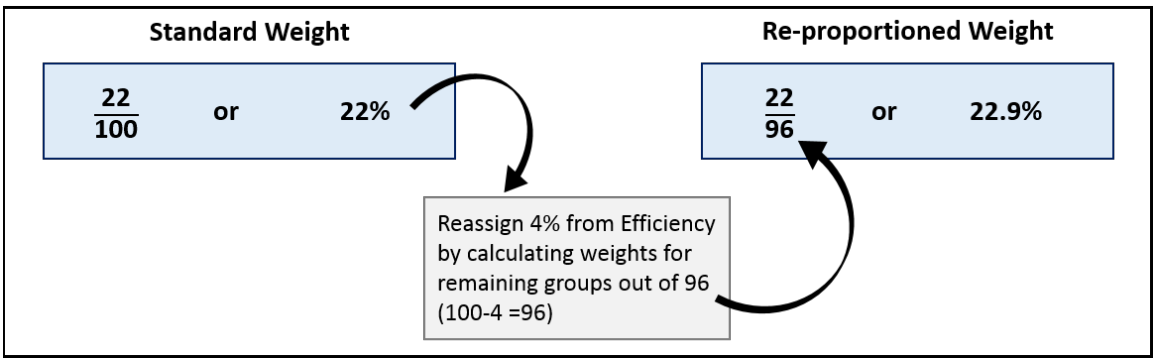
Method for Re-Weighting When Missing Group(s)

If a hospital reports no measures for a given measure group, that group is considered to be "missing." When a hospital is missing one or more groups, CMS applies the same approach as the Hospital VBP program, re-proportioning the weight of the missing group(s) across the groups for which the hospital does report measures. Table 3 & Figure 2 provide examples of how CMS adjusts the weighting scheme for a hospital that is missing the Efficient Use of Medical Imaging group.

Table 3. Example Re-Weighting Scheme when Missing Efficient Use of Medical Imaging Group

Measure Group	Standard Weight	Re proportioned Weight
Mortality	22%	22.9%
Safety of Care	22%	22.9%
Readmission	22%	22.9%
Patient Experience	22%	22.9%
Effectiveness of Care	4%	4.2%
Timeliness of Care	4%	4.2%
Efficient Use of Medical Imaging **(N=0)**	4%	---

Figure 2. Example Calculation for Re-Proportioning Group Weights



Winsorization of Summary Scores

CMS analyzes the distribution of hospital summary scores and performs a second Winsorization. Winsorization is a common strategy used to set extreme outliers to a specified percentile of the data; in this case, any extreme outlier values lower than the 0.5th percentile and higher than the 99.5th percentile is reset to have the 0.5th percentile or 99.5th percentile value, respectively. For the October 2016 update, Winsorization only resulted in modification of 46 individual hospital summary scores out of a total 4,603 hospital summary scores in the dataset.

3.6. Step 5: Application of Clustering Algorithm to Obtain a Star Rating

Approach for Translating a Summary Score to a Star Rating

To translate each hospital's summary score to a rating between one and five stars, CMS applies *k*-means clustering.

Overview of k-Means Clustering

The *k*-means clustering analysis is a standard method for creating categories (or clusters) so that observations in each category are closer to their category mean than to any other category mean. The number of categories is pre-specified; CMS specifies five categories, so that *k*-means clustering analysis generates five categories (clusters) based on hospital summary scores in a way that minimizes the distance between summary scores (observations) and the middle value of their assigned cluster (category mean). It organizes hospitals into one of five categories such that a hospital's summary score is "more like" that of the other hospitals in the same category and "less like" the summary scores of hospitals in the other categories. The Star Rating categories are structured such that the lowest group is one star and the highest group is five stars.

4. Reporting Thresholds and Results for October 2016 Implementation

4.1. Minimum Thresholds for Receiving a Star Rating

CMS evaluated and developed standards regarding the minimum number of measures and groups a hospital must report in order to receive a publicly reported Star Rating on *Hospital Compare*. CMS set these thresholds to allow for as many hospitals as possible to receive a Star Rating without sacrificing the validity and reliability of the Star Rating methodology.

On average, hospitals reported five groups and 39 measures for October 2016. A total of 3,693 (80.23%) hospitals on *Hospital Compare* met the public reporting threshold for receiving a Star Rating for October 2016.

Please note results included in this report may differ from the results posted on *Hospital Compare* due to data suppressed by CMS for one or more quarters. CMS may suppress data for various reasons, like data inaccuracies.

Minimum Threshold of Measures per Group

The minimum measure threshold for October 2016 is three measures per group.

Minimum Threshold of Groups in Summary Score

The minimum group threshold for October 2016 is three groups with at least one outcome group (that is, Mortality, Safety of Care, or Readmission).

If a hospital met the minimum threshold of having three groups (one of which must be an Outcome group) with at least three measures, any other measures reported by the hospital were also included in the hospital's Star Rating. That is, any additional measures were included even if the hospital did not meet the minimum three measure threshold for a given group. This decision ensured that the Star Rating was inclusive of publicly reported measures and was vetted with the public through the second Star Rating opportunity for public input.

4.2. Group Performance Category

In addition to a hospital's Star Rating, CMS reports a group performance category for each of a hospital's available (i.e., meeting the minimum threshold) measure groups. To calculate a performance category, a hospital's group score is compared to the national average group score. The LVM for each group produces a point estimate and standard error that can be used to construct a 95% confidence interval for each hospital's group score for comparison to the national mean group score. The group performance categories are:

- "Above the national average," defined as a group score with a confidence interval that falls entirely *above* the national average;

- "Same as the national average," defined as a group score with a confidence interval that includes the national average; and
- "Below the national average," defined as a group score with a confidence interval that falls entirely *below* the national average.

4.3. Distribution of the Overall Star Rating and Group Performance Categories

The Star Rating for October 2016 public reporting is calculated using October 2016 *Hospital Compare* data. The frequency of hospitals by each Star Rating category is shown in Table 4. Of note, the minimum and maximum score for each category will change with each reporting period based on the underlying distribution of hospital summary scores. Table 5 displays the frequency of hospitals in each performance category by group.

Table 4. Frequency of Hospitals by Star Category using *k*-Means

Rating	Frequency (Number of Hospitals)	Summary Score Range in Cluster	Mean (sd)
1 Star	121	-1.98, -1.05	-1.33 (0.23)
2 Star	701	-1.05, -0.38	-.063 (0.17)
3 Star	1,789	-0.38, 0.21	-0.05 (0.16)
4 Star	970	0.21, 0.81	0.42 (0.15)
5 Star	112	0.82, 2.02	1.11 (0.28)

Note: The total number of hospitals in the *Hospital Compare* dataset as of October 2016 is 4,603 hospitals. Results shown are for all hospitals meeting the reporting criteria (N=3,693).
Please note results included in this report may differ from the results posted on *Hospital Compare* due to data suppressed by CMS for one or more quarters. CMS may suppress data for various reasons, like data inaccuracies.

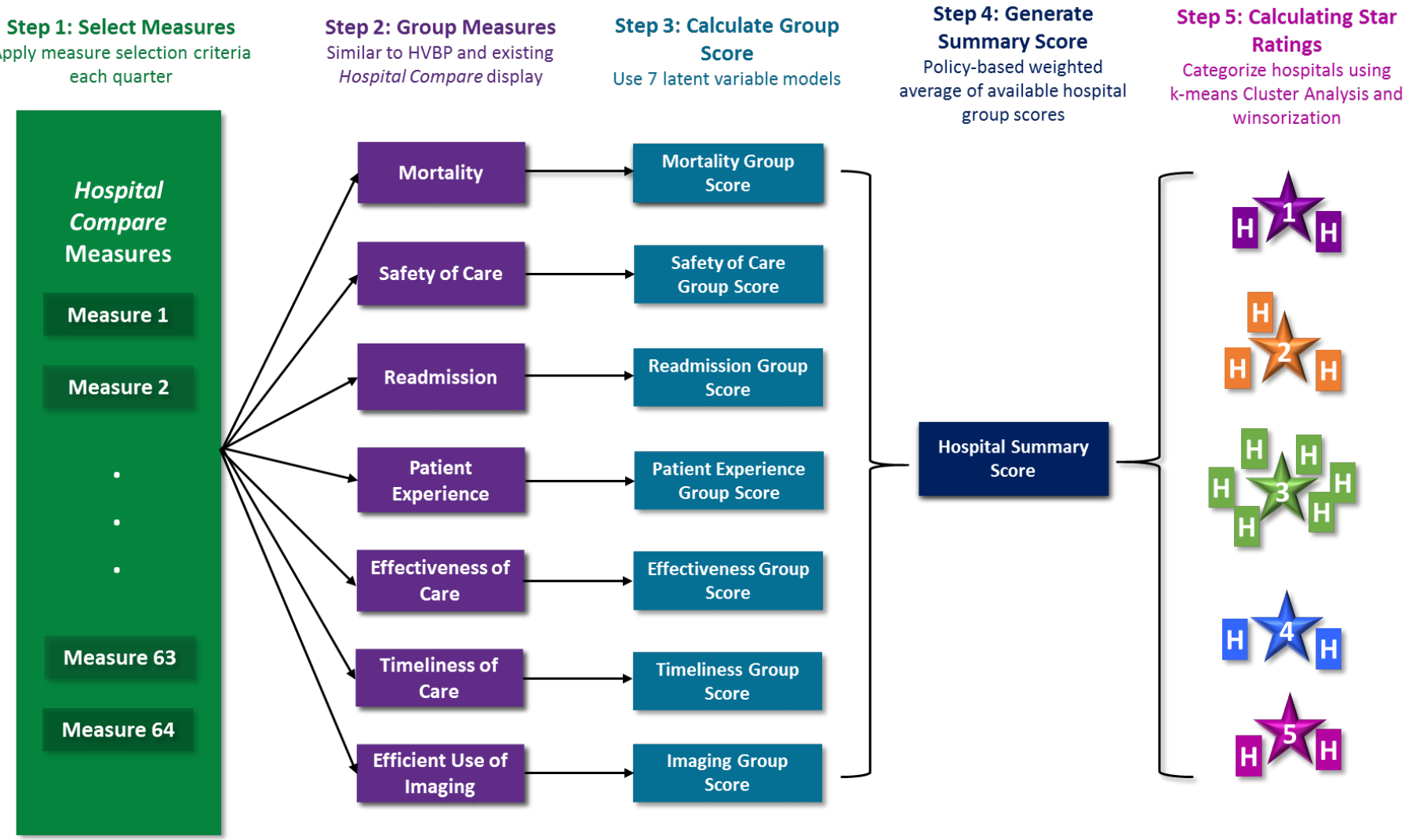
Table 5. Frequency of Hospitals by Group Performance Category

	Frequency (Number of Hospitals) by Group Performance Category		
Group	**Above the National Average**	**Same as the National Average**	**Below the National Average**
Mortality (N=3,525)	413	2,762	350
Safety of Care (N=2,969)	821	1,457	691
Readmission (N=3,861)	827	2,147	887
Patient Experience (N=3,507)	1,205	1,175	1,127
Effectiveness of Care (N=3,746)	1,022	2,210	514
Timeliness of Care (N=3,531)	1,105	1,483	943
Efficient Use of Medical Imaging (N=2,836)	377	2,084	375

Note: The total number of hospitals in the *Hospital Compare* dataset as of October 2016 is 4,603 hospitals. Results shown are for all hospitals with ≥ 3 measures by group.
Please note results included in this report may differ from the results posted on *Hospital Compare* due to data suppressed by CMS for one or more quarters. CMS may suppress data for various reasons, like data inaccuracies.

Appendix A: Flowchart of the Five-Step Overall Star Rating Methodology

Figure A.1. The Five Steps of the Overall Star Rating Methodology



Appendix B: Measures Selection Details

Table B.1. Measures Included in October 2016 Star Rating (N=64)

Measure Name	Group
MORT-30-AMI Acute Myocardial Infarction (AMI) 30-Day Mortality Rate	Mortality (N=7)
MORT-30-CABG Coronary Artery Bypass Graft (CABG) 30-Day Mortality Rate	
MORT-30-COPD Chronic Obstructive Pulmonary Disease (COPD) 30-Day Mortality Rate	
MORT-30-HF Heart Failure (HF) 30-Day Mortality Rate	
MORT-30-PN Pneumonia (PN) 30-Day Mortality Rate	
MORT-30-STK Acute Ischemic Stroke (STK) 30-Day Mortality Rate	
PSI-4-SURG-COMP Death Among Surgical Patients with Serious Treatable Complications	
HAI-1 Central-Line Associated Bloodstream Infection (CLABSI)	Safety of Care (N=8)
HAI-2 Catheter-Associated Urinary Tract Infection (CAUTI)	
HAI-3 Surgical Site Infection from colon surgery (SSI-colon)	
HAI-4 Surgical Site Infection from abdominal hysterectomy (SSI-abdominal hysterectomy)	
HAI-5 MRSA Bacteremia	
HAI-6 Clostridium Difficile (C. difficile)	
COMP-HIP-KNEE Hospital-Level Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and Total Knee Arthroplasty (TKA)	
PSI-90-Safety Complication/Patient Safety for Selected Indicators (PSI)	
READM-30-AMI Acute Myocardial Infarction (AMI) 30-Day Readmission Rate	Readmission (N=8)
READM-30-CABG Coronary Artery Bypass Graft (CABG) 30-Day Readmission Rate	
READM-30-COPD Chronic Obstructive Pulmonary Disease (COPD) 30-Day Readmission Rate	
READM-30-HF Heart Failure (HF) 30-Day Readmission Rate	
READM-30-Hip-Knee Hospital-Level 30-Day All-Cause Risk-Standardized Readmission Rate (RSRR) Following Elective Total Hip Arthroplasty (THA)/Total Knee Arthroplasty (TKA)	
READM-30-PN Pneumonia (PN) 30-Day Readmission Rate	
READM-30-STK Stroke (STK) 30-Day Readmission Rate	
READM-30-HOSP-WIDE HWR Hospital-Wide All-Cause Unplanned Readmission	
H-CLEAN-HSP Cleanliness of Hospital Environment (Q8)	Patient Experience (N=11)
H-COMP-1 Nurse Communication (Q1, Q2, Q3)	
H-COMP-2 Doctor Communication (Q5, Q6, Q7)	
H-COMP-3 Responsiveness of Hospital Staff (Q4, Q11)	
H-COMP-4 Pain management (Q13, Q14)	

Measure Name	Group
H-COMP-5 Communication About Medicines (Q16, Q17)	
H-COMP-6 Discharge Information (Q19, Q20)	
H-HSP-RATING Overall Rating of Hospital (Q21)	
H-QUIET-HSP Quietness of Hospital Environment (Q9)	
H-RECMND Willingness to Recommend Hospital (Q22)	
H-COMP-7 HCAHPS 3 Item Care Transition Measure (CTM-3)	
CAC-3 Home Management Plan of Care (HMPC) Document Given to Patient/Caregiver	Effectiveness of Care (N=18)
IMM-2 Influenza Immunization	
IMM-3/OP-27 Healthcare Personnel Influenza Vaccination	
OP-4 Aspirin at Arrival	
OP-22 ED-Patient Left Without Being Seen	
OP-23 ED-Head CT or MRI Scan Results for Acute Ischemic Stroke or Hemorrhagic Stroke who Received Head CT or MRI Scan Interpretation Within 45 Minutes of Arrival	
PC-01 Elective Delivery Prior to 39 Completed Weeks Gestation: Percentage of Babies Electively Delivered Prior to 39 Completed Weeks Gestation	
STK-1 Venous Thromboembolism (VTE) Prophylaxis	
STK-4 Thrombolytic Therapy	
STK-6 Discharged on Statin Medication	
STK-8 Stroke Education	
VTE-1 Venous Thromboembolism Prophylaxis	
VTE-2 Intensive Care Unit Venous Thromboembolism Prophylaxis	
VTE-3 Venous Thromboembolism Patients with Anticoagulation Overlap Therapy	
VTE-5 Venous Thromboembolism Warfarin Therapy Discharge Instructions	
VTE-6 Hospital Acquired Potentially-Preventable Venous Thromboembolism	
OP-29 Endoscopy/Poly Surveillance- Appropriate Follow-up Interval for Normal Colonoscopy in Average Risk Patients	
OP-30 Endoscopy/Poly Surveillance- OP-30: Endoscopy/Poly Surveillance – Colonoscopy Interval for Patients with a History of Adenomatous Polyps – Avoidance of Inappropriate Use	
ED-1b Median Time from ED Arrival to ED Departure for Admitted ED Patients	Timeliness of Care (N=7)
ED-2b Admit Decision Time to ED Departure Time for Admitted Patients	
OP-3b Median Time to Transfer to Another Facility for Acute Coronary Intervention	
OP-5 Median Time to ECG	
OP-18b Median Time from ED Arrival to ED Departure for Discharged ED Patients	
OP-20 Door to Diagnostic Evaluation by a Qualified Medical Professional	
OP-21 ED-Median Time to Pain Management for Long Bone Fracture	

Measure Name	Group
OP-8 MRI Lumbar Spine for Low Back Pain	Efficient Use of Medical Imaging (N=5)
OP-10 Abdomen CT Use of Contrast Material	
OP-11 Thorax CT Use of Contrast Material	
OP-13 Cardiac Imaging for Preoperative Risk Assessment for Non-Cardiac Low-Risk Surgery	
OP-14 Simultaneous Use of Brain Computed Tomography (CT) and Sinus CT	

Table B.2. Measures Excluded from October 2016 Star Rating (N=51)

Measure Name	Exclusion Criterion
AMI-2 Aspirin Prescribed at Discharge	Suspended, retired, or delayed from public reporting (N=13)
AMI-10 Statin Prescribed at Discharge	
CAC-1 Relievers for Inpatient Asthma	
CAC-2 Systemic Corticosteroids for Inpatient Asthma	
HF- 1 Discharge Instructions	
HF-3 ACEI or ARB for LVSD	
OP-6 Timing of Antibiotic Prophylaxis	
OP-7 Prophylactic Antibiotic Selection for Surgical Patients	
PN-3b Blood Cultures Performed in the ED prior to Initial Antibiotic Received in Hospital	
SCIP-Inf-4 Cardiac Surgery Patients with Controlled Postoperative Blood Glucose	
SCIP-Inf-10 Surgery Patients with Perioperative Temperature Management	
SM-PART-STROKE Participation in a Systematic Clinical Database Registry for Stroke Care	
MV Number of Medicare Patient Discharges for Selected MS-DRGs	
AMI-8a Timing of Receipt of Primary Percutaneous Coronary Intervention (PCI)	Measures no longer required for IQR or OQR (N=14)
HF-2 Evaluation of LVS Function	
PN-6 Initial Antibiotic Selection for Community-Acquired Pneumonia (CAP) in Immunocompetent Patient	
SCIP-Card-2 Surgery Patients on Beta-Blocker Therapy Prior to Arrival Who received a Beta-Blocker During the Perioperative Period	
SCIP-Inf-1 Prophylactic Antibiotic Received Within One Hour Prior to Surgical Incision	
SCIP-Inf-2 Prophylactic Antibiotic Selection for Surgical Patients	
SCIP-Inf-3 Prophylactic Antibiotics Discontinued Within 24 Hours After Surgery End Time	
SCIP-Inf-9 Urinary Catheter Removed on Postoperative Day 1 (POD 1) or Postoperative Day 2 (POD 2) with day of surgery being day zero	
SCIP-VTE-2 Surgery Patients Who Received Appropriate Venous Thromboembolism Prophylaxis Within 24 Hours Prior to Surgery to 24 Hours After Surgery	
STK-2 Discharged on Antithrombotic Therapy	
STK-3 Anticoagulation Therapy for Atrial Fibrillation/Flutter	
STK-5 Antithrombotic Therapy By End of Hospital Day 2	
STK-10 Assessed for Rehabilitation	
VTE-4 Venous Thromboembolism Patients Receiving Unfractionated Heparin with Dosages/Platelet Count Monitoring by Protocol or Nomogram	

Measure Name	Exclusion Criterion
PSI-6 Iatrogenic Pneumothorax	Duplicative measures already captured in a composite measure (N=6)
PSI-12 Postoperative Pulmonary Embolism or Deep Vein Thrombosis	
PSI-14 Postoperative Wound Dehiscence	
PSI-15 Accidental Puncture or Laceration	
HAI-1a Central Line-Associated Bloodstream Infection (CLABSI) – ICU Only	
HAI-2a Catheter-Associated Urinary Tract Infection (CAUTI) – ICU Only	
AMI-7a Fibrinolytic Therapy Received Within 30 Minutes of Hospital Arrival	Measures with less than or equal to 100 hospitals reporting (N=3)
OP-1 Median Time to Fibrinolysis	
OP-2 Fibrinolytic Therapy Received Within 30 Minutes of Emergency Department Arrival	
ACS-REGISTRY Participation in a Multispecialty Surgical Registry	Structural measures without evidence of an association with changes in clinical practice or improved outcomes (N=9)
SM-PART-CARD Participation in a Systematic Clinical Database Registry for Cardiac Surgery	
SM-PART-GEN-SURG Participation in a Systematic Clinical Database Registry for General Surgery	
SM-PART-NURSE Participation in a Systematic Clinical Database Registry for Nursing Sensitive Care	
OP-12 The Ability for Providers with HIT to Receive Laboratory Data Electronically Directly into their ONC-Certified EHR System as Discrete Searchable Data	
OP-17 Tracking Clinical Results between Visits	
OP-25 Safe Surgery Checklist Use	
OP-26 Hospital Outpatient Volume Data on Selected Outpatient Surgical Procedures	
EDV-1 Emergency Department (ED) Volume	
MSPB-1/SPP-1 Medicare Spending per Beneficiary (MSPB)	Non-directional measures (N=6)
OP-9 Mammography Follow-up Rates	
PAYM-30-AMI Acute Myocardial Infarction (AMI) Payment per Episode of Care	
PAYM-30-HF Heart Failure (HF) Payment per Episode of Care	
PAYM-30-PN Pneumonia (PN) Payment per Episode of Care	
Medicare Hospital Spending by Claim Spending Breakdowns by Claim Type	

Appendix C: Measure Loadings by Group

Table C.1. Measure loadings by each group for October 2016

Group	Measure Name	Loading Coefficient
Mortality (N=7)	**MORT-30-AMI** Acute Myocardial Infarction (AMI) 30-Day Mortality Rate	0.48
	MORT-30-CABG Coronary Artery Bypass Graft (CABG) 30-Day Mortality Rate	0.35
	MORT-30-COPD Chronic Obstructive Pulmonary Disease (COPD) 30-Day Mortality Rate	0.62
	MORT-30-HF Heart Failure (HF) 30-Day Mortality Rate	0.74
	MORT-30-PN Pneumonia (PN) 30-Day Mortality Rate	0.66
	MORT-30-STK Acute Ischemic Stroke (STK) 30-Day Mortality Rate	0.52
	PSI-4-SURG-COMP Death Among Surgical Patients with Serious Treatable Complications	0.29
Safety of Care (N=8)	**COMP-HIP-KNEE** Hospital-Level Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and Total Knee Arthroplasty (TKA)	0.17
	HAI-1 Central-Line Associated Bloodstream Infection (CLABSI)	0.06
	HAI-2 Catheter-Associated Urinary Tract Infection (CAUTI)	0.11
	HAI-3 Surgical Site Infection from colon surgery (SSI-colon)	0.09
	HAI-4 Surgical Site Infection from abdominal hysterectomy (SSI-abdominal hysterectomy)	0.06
	HAI-5 MRSA Bacteremia	0.01
	HAI-6 Clostridium Difficile (C. difficile)	0.001
	PSI-90-Safety Complication/Patient Safety for Selected Indicators (PSI)	0.93
Readmission (N=8)	**READM-30-AMI** Acute Myocardial Infarction (AMI) 30-Day Readmission Rate	0.54
	READM-30-CABG Coronary Artery Bypass Graft (CABG) 30-Day Readmission Rate	0.27
	READM-30-COPD Chronic Obstructive Pulmonary Disease (COPD) 30-Day Readmission Rate	0.57
	READM-30-HF Heart Failure (HF) 30-Day Readmission Rate	0.63

Group	Measure Name	Loading Coefficient
	READM-30-Hip-Knee Hospital-Level 30-Day All-Cause Risk-Standardized Readmission Rate (RSRR) Following Elective Total Hip Arthroplasty (THA)/Total Knee Arthroplasty (TKA)	0.42
	READM-30-HOSP-WIDE HWR Hospital-Wide All-Cause Unplanned Readmission	0.94
	READM-30-PN Pneumonia (PN) 30-Day Readmission Rate	0.61
	READM-30-STK Stroke (STK) 30-Day Readmission Rate	0.53
Patient Experience (N=11)	**H-CLEAN-HSP** Cleanliness of Hospital Environment (Q8)	0.65
	H-COMP-1 Nurse Communication (Q1, Q2, Q3)	0.74
	H-COMP-2 Doctor Communication (Q5, Q6, Q7)	0.61
	H-COMP-3 Responsiveness of Hospital Staff (Q4, Q11)	0.70
	H-COMP-4 Pain management (Q13, Q14)	0.67
	H-COMP-5 Communication About Medicines (Q16, Q17)	0.69
	H-COMP-6 Discharge Information (Q19, Q20)	0.58
	H-COMP-7 HCAHPS 3 Item Care Transition Measure (CTM-3)	0.77
	H-HSP-RATING Overall Rating of Hospital (Q21)	0.78
	H-QUIET-HSP Quietness of Hospital Environment (Q9)	0.58
	H-RECMND Willingness to Recommend Hospital (Q22)	0.74
Effectiveness of Care (N=18)	**CAC-3** Home Management Plan of Care (HMPC) Document Given to Patient/Caregiver	0.46
	IMM-2 Influenza Immunization	0.41
	IMM-3/OP-27 Healthcare Personnel Influenza Vaccination	0.17
	OP-4 Aspirin at Arrival	0.38
	OP-22 ED-Patient Left Without Being Seen	0.23
	OP-23 ED-Head CT or MRI Scan Results for Acute Ischemic Stroke or Hemorrhagic Stroke who Received Head CT or MRI Scan Interpretation Within 45 Minutes of Arrival	0.44
	OP-29 Endoscopy/Poly Surveillance- Appropriate Follow-up Interval for Normal Colonoscopy in Average Risk Patients	0.32

Group	Measure Name	Loading Coefficient
	OP-30 Endoscopy/Poly Surveillance- OP-30: Endoscopy/Poly Surveillance – Colonoscopy Interval for Patients with a History of Adenomatous Polyps – Avoidance of Inappropriate Use	0.40
	PC-01 Elective Delivery Prior to 39 Completed Weeks Gestation: Percentage of Babies Electively Delivered Prior to 39 Completed Weeks Gestation	0.26
	STK-1 Venous Thromboembolism (VTE) Prophylaxis	0.54
	STK-4 Thrombolytic Therapy	0.66
	STK-6 Discharged on Statin Medication	0.41
	STK-8 Stroke Education	0.48
	VTE-1 Venous Thromboembolism Prophylaxis	0.57
	VTE-2 Intensive Care Unit Venous Thromboembolism Prophylaxis	0.67
	VTE-3 Venous Thromboembolism Patients with Anticoagulation Overlap Therapy	0.53
	VTE-5 Venous Thromboembolism Warfarin Therapy Discharge Instructions	0.58
	VTE-6 Hospital Acquired Potentially-Preventable Venous Thromboembolism	0.55
Timeliness of Care (N=7)	**ED-1b** Median Time from ED Arrival to ED Departure for Admitted ED Patients	0.84
	ED-2b Admit Decision Time to ED Departure Time for Admitted Patients	0.78
	OP-3b Median Time to Transfer to Another Facility for Acute Coronary Intervention	0.18
	OP-5 Median Time to ECG	0.20
	OP-18b Median Time from ED Arrival to ED Departure for Discharged ED Patients	0.76
	OP-20 Door to Diagnostic Evaluation by a Qualified Medical Professional	0.53
	OP-21 ED-Median Time to Pain Management for Long Bone Fracture	0.43
Efficient Use of Medical Imaging (N=5)	**OP-8** MRI Lumbar Spine for Low Back Pain	0.08
	OP-10 Abdomen CT Use of Contrast Material	0.69
	OP-11 Thorax CT Use of Contrast Material	0.30
	OP-13 Cardiac Imaging for Preoperative Risk Assessment for Non-Cardiac Low-Risk Surgery	-0.01
	OP-14 Simultaneous Use of Brain Computed Tomography (CT) and Sinus CT	-0.02