



## Star Methodology Enhancement for December 2017 Public Release

The Centers for Medicare & Medicaid Services (CMS) contracted with the with Yale New Haven Health Services Corporation – Center for Outcomes Research and Evaluation (CORE) to re-evaluate the Overall Hospital Quality Star Rating on *Hospital Compare*. During the development of the Overall Star Rating, CMS and the development team sought to be transparent and responsive to stakeholder input by convening a multi-stakeholder Technical Expert Panel and a Patient & Patient Advocate Work Group as well as holding two public input periods, two National Provider Calls, and a hospital dry run. For the re-evaluation of the Overall Star Rating methodology, CMS and the development team continued to prioritize transparency. This effort included seeking stakeholder feedback through a new multi-disciplinary Technical Expert Panel, a Provider Leadership Work Group (i.e., hospital associations and hospital executives), and a public input period.

Based on stakeholders’ feedback from the technical expert panel and the public input period, CMS implemented four enhancements to the Overall Star Rating methodology for the December 2017 *Hospital Compare* refresh. These enhancements ([Table 1](#)), detailed below, include utilizing adaptive quadrature to calculate measure group scores, applying the reporting thresholds prior to k-means clustering, using complete convergence for k-means clustering, and removing hospital summary score winsorization. Overall these methodological enhancements yield a broader Star Rating distribution, increase reliability, and improve the stability of hospital estimates.

**Table 1 – Summary of Star Methodology Enhancements for December 2017**

October 2017 Star Rating	New for the December 2017 Star Rating
Latent variable models, including the use of non-adaptive quadrature	Latent variable models, including the use of adaptive quadrature
Hospital summary scores below -3 and above 3 were winsorized to -3 and 3, respectively	Hospital summary scores are not winsorized
All hospitals were clustered into a Star Rating	Only hospitals that fulfill the reporting requirements will be clustered into a Star Rating
A single iteration of k-means clustering	Multiple iterations of k-means clustering to complete convergence

### Updated Approach to Calculating Measure Group Scores

Previously, the methodology estimated a hospital’s measure group scores using latent variable models (LVMs) that included the use of a technique called non-adaptive Gaussian Quadrature. This method was selected for being both robust and reducing computational time, but could lead to marginal differences in hospitals’ star assignments based on the number of computational starting points. To address this issue, the Star Ratings development team evaluated the use of adaptive quadrature, which requires fewer quadrature points to achieve higher accuracy. The

development team previously did not use adaptive quadrature due to the concerns around computation time and identification of similar Star Rating results on initial testing datasets when applying a combination of non-adaptive and adaptive quadrature methods. However, the development team has tested this improvement in several prior reporting periods and believes this change will yield improvements in the stability of hospital measure group scores and ultimately improve the reliability of hospital Star Rating classifications

### **Resequencing the Application of Reporting Thresholds**

Under the current methodology, the Star Ratings are assigned after removal of hospital summary score outliers (i.e., winsorization), but prior to application of the public reporting threshold. Based on stakeholder feedback and planned re-evaluation analyses conducted by the measure development contractor, CMS is planning to reorder these steps to apply the Star Rating threshold prior to clustering. In other words, only those hospitals that meet the public reporting thresholds would be clustered into Star Ratings. Because Star Rating assignment is done through k-means clustering, a comparative analytic procedure, there may be better conceptual basis to apply clustering only to the subset of hospitals for which a Star Rating is ultimately to be reported.

### **Clustering Approach to Include Complete Convergence for Assigning Hospitals to Star Categories**

Previously, a statistical analysis called k-means clustering was used to create the five star categories and assign hospitals to one of those five categories. These five star categories and a hospital's assignment to a category were identified through one iteration of clustering. In the new version of the methodology, k-means clustering is still used, but instead of a single iteration, multiple iterations of clustering are utilized to achieve complete convergence. This approach identifies the optimal solution of Star Ratings assignments. This change was made based on stakeholder input as well as results from planned statistical analyses.

### **Removing Hospital Score Winsorization**

Previously, hospital summary scores identified as statistical outliers were removed from the summary score distribution through a process called winsorization. The use of winsorization generated a broader Star Rating distribution by avoiding the clustering of extreme hospitals into a Star Rating category. Given that use of complete convergence for clustering results in a broader distribution of Star Ratings, this winsorization step no longer appears necessary.