Rating & Provider Analysis by P A V Prasad

Background – CMS Star Rating Methodology and Provider Analysis

CMS rates providers on a scale of 1 to 5. The objectives of the analysis are to:

- Understand the star rating methodology and identify the important variables affecting star ratings
- Recommending ways for Evanston Hospital to improve their current star rating of 3 to 4 at-least

The analysis is divided into four parts:

1. Data Understanding – Groups and Measures
2. Identifying important measures affecting star ratings
3. Predictive modelling of star ratings
4. Provider analysis: Recommending ways for Evanston Hospital to improve their rating

1. Data Understanding – Groups and Measures

- Identifying important measures affecting star ratings
- Predictive modelling of star ratings
- Provider analysis

- 7 Groups, 62 Measures

CMS included 62 measures (or variables) classified under 7 groups having a certain weightage as follows:

1. Groups
   - Mortality, Readmission, Safety of Care, Patient Experience (22% weightage groups)
   - Timeliness of care, Effectiveness of care, Medical Imaging Efficiency (4% weightage groups)

2. Measures (some examples)
   - Positive measures: Patients given appropriate vaccines, Patients given timely treatment etc.
   - Negative measures: All mortality measures, readmission measures, timeliness measures (avg. time taken to provide emergency care etc.)

- Quality Issues: Format, Standardization and Missing Values

The three main data quality issues in the raw data provided by hospital compare are:

1. Data format

The original data is in 'wide-format' in approx. 55 files which was converted into one 'long' master file such that each row represents a provider and each column a measure, each cell is a numeric score of a measure

2. Standardization of Measures

Measures need to be standardized such that 'higher value indicates better performance'

3. Missing values

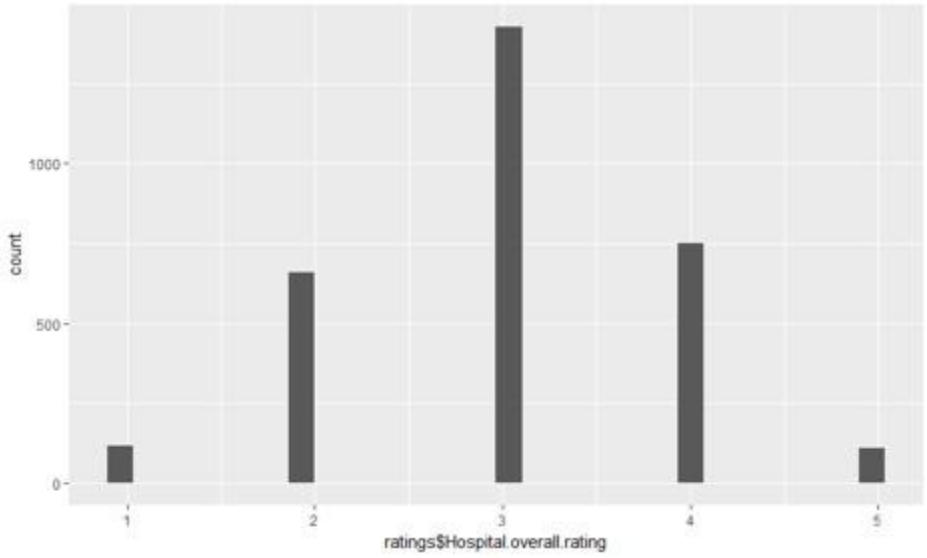
About 50% measures have a large number of missing values – they have been imputed as per the guidelines provided by CMS

- Distribution of Star Ratings

Table – Provider Rating Distribution

Rating	Number of providers
1	117 (3.4%)
2	659 (19.5%)
3	1426 (42.2%)
4	749 (22.1%)
5	110 (3.3%)
NA	321 (9.5%)

Plot - Provider Rating Distribution

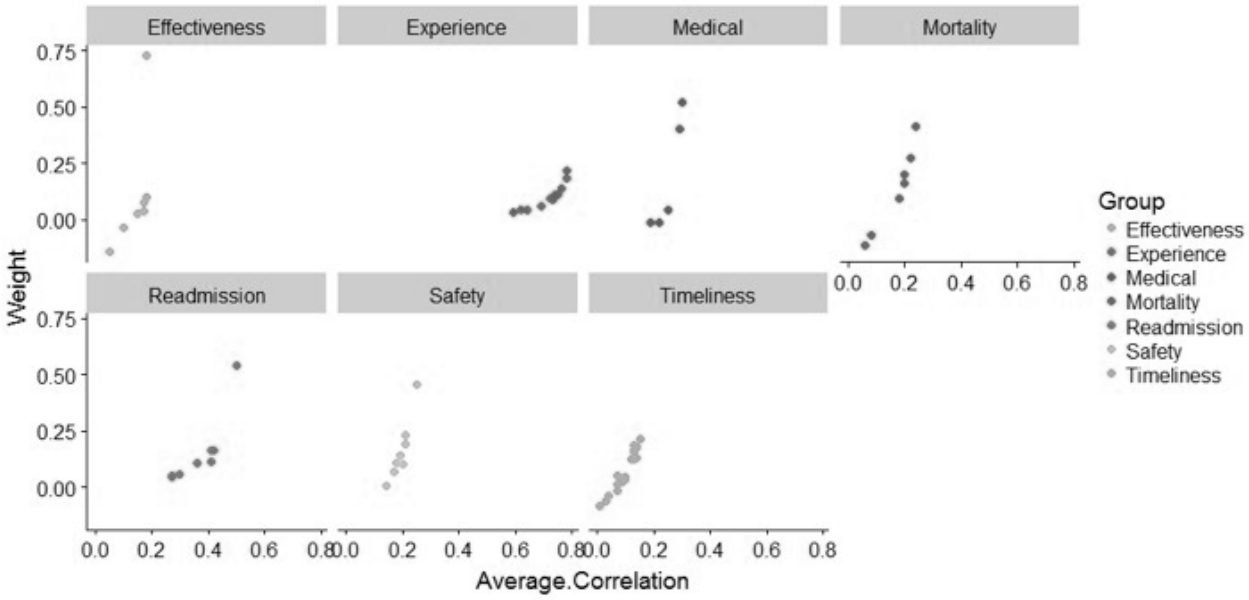


- Approx. 42% providers have 3 star rating
- Approx. 20% have 2 and 4 each; 3.5% have 1 and 5 each

2. Identifying important measures affecting star ratings

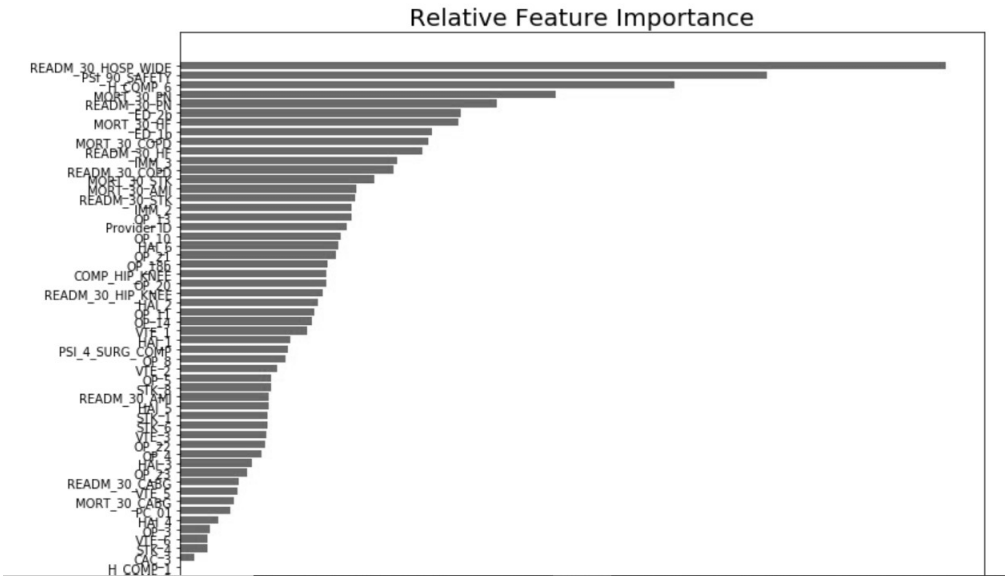
- Correlated measures carry higher weightage

Within each group, measure **weights are proportional to the correlation** of the measure within the group.



- Top 10 measures carry approx. 80% weight

Measures	Group
READM_30_HOSP_WIDE	Readmission
READM_30_PN	
READM_30_HF	
PSI_90_SAFETY	Safety
H_COMP_6	Patient Experience
MORT_30_PN	Mortality
MORT_30_HF	
MORT_30_COPD	
ED_2b	Timeliness of Care
ED_1b	



3. Predictive modelling of star ratings

- Overall Accuracy of approx. 65% with Random Forest
- Overall Accuracy of 54% using Factor Analysis and Clustering Model

- Process

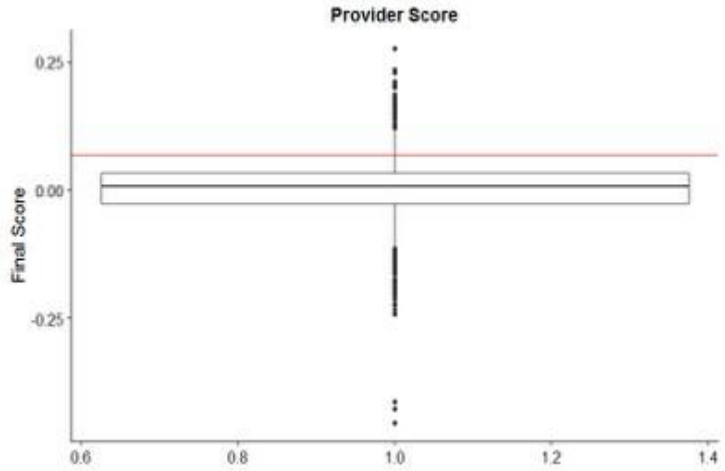
- Using the measure weights calculated using factor analysis, each group's score is calculated
- The group scores are multiplied by the weight of group (22% or 4%) to calculate the final score
- Based on the final score, 5 clusters are created

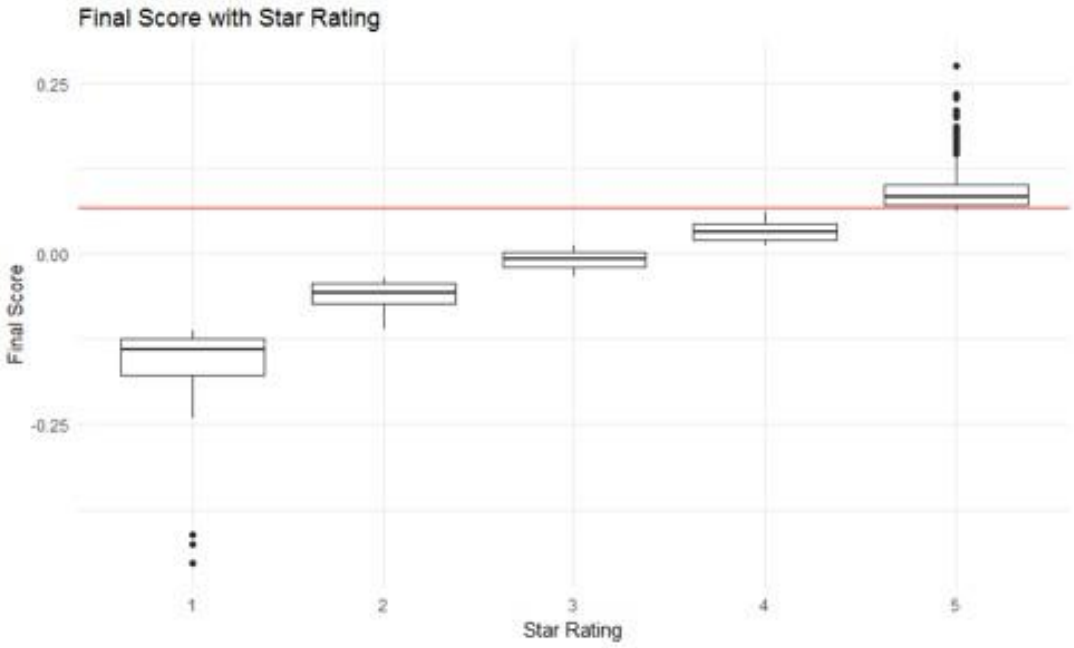
- Results

- Logistic regression predicts star ratings with an overall accuracy of **approx. 67%.**
- Linear regression with OLS is 38%
- K Means clustering as n=3

4. Provider analysis: Recommending ways for Evanston Hospital to improve their rating

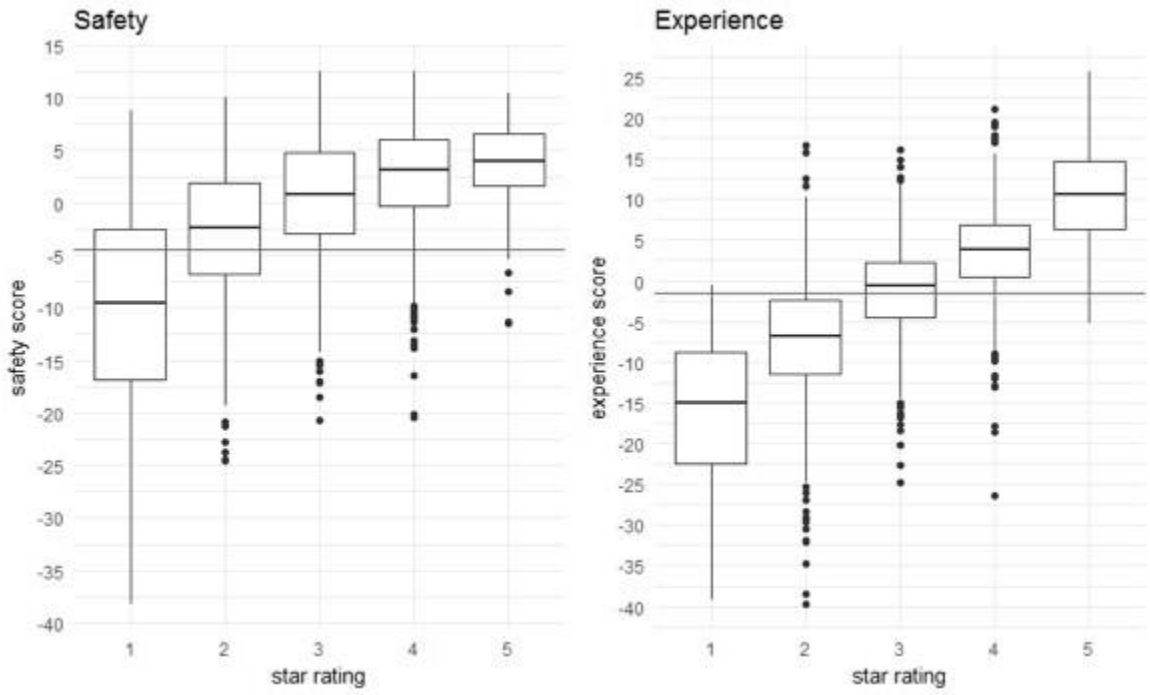
- Final (Predicted) Provider Score is comparable to 4/5 rated hospitals





- Safety and Patient Experience scores are lower than national average

Group	Score Compared to National Average
Mortality (22%)	Above
Safety (22%)	**Below**
Readmission (22%)	Above
Experience (22%)	**Below**
Effectiveness (4%)	Above
Timeliness (4%)	Same
Medical (4%)	Above



- Surgical Site and MRSA Infections and Overall Patient Experience are key areas of improvement in Safety and Experience

In Safety, *HAI_4 and HAI_5* scores are lower than average:

- HAI_4: Surgical Site Infection from abdominal hysterectomy (SSI: Hysterectomy)

- HAI_5: Methicillin-resistant Staphylococcus Aureus (MRSA) Blood Laboratory-identified Events (Bloodstream infections)

In Experience*, H_HSP_RATING_LINEAR_SCORE, H_RECMND_LINEAR_SCORE and H_CLEAN_LINEAR_SCORE* are lower than average:

- H_HSP_RATING_LINEAR_SCORE: Patients who gave their hospital a rating of 9 or 10
- H_RECMND_LINEAR_SCORE: Patients who reported they would recommend the hospital
- H_CLEAN_LINEAR_SCORE: Patients who reported that their room and bathroom were "Always" clean

- 11 low scoring measures in 3 groups carry approx. 30% weight

Low scoring measures:

- Readmission measures comprise about 20% weight
- Experience measures comprise about 6% weight
- Safety measures comprise about 4% weight

Recommendations for Evanston Hospital

The key measures of improvement are:

1. **Readmission:** Hospital-wide readmissions, readmission due to heart failure, pneumonia
2. **Patient Experience:** Discharge Information
3. Safety: PSI
4. **Timeliness of Care:** Median Time from ED arrival to ED departure and Admit decision time to ED departure time for admitted patients
5. **Mortality:** Pneumonia, Heart failure and chronic obstructive pulmonary disease.