

# CMS Hospital Rating

## Executive Summary

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# Introduction

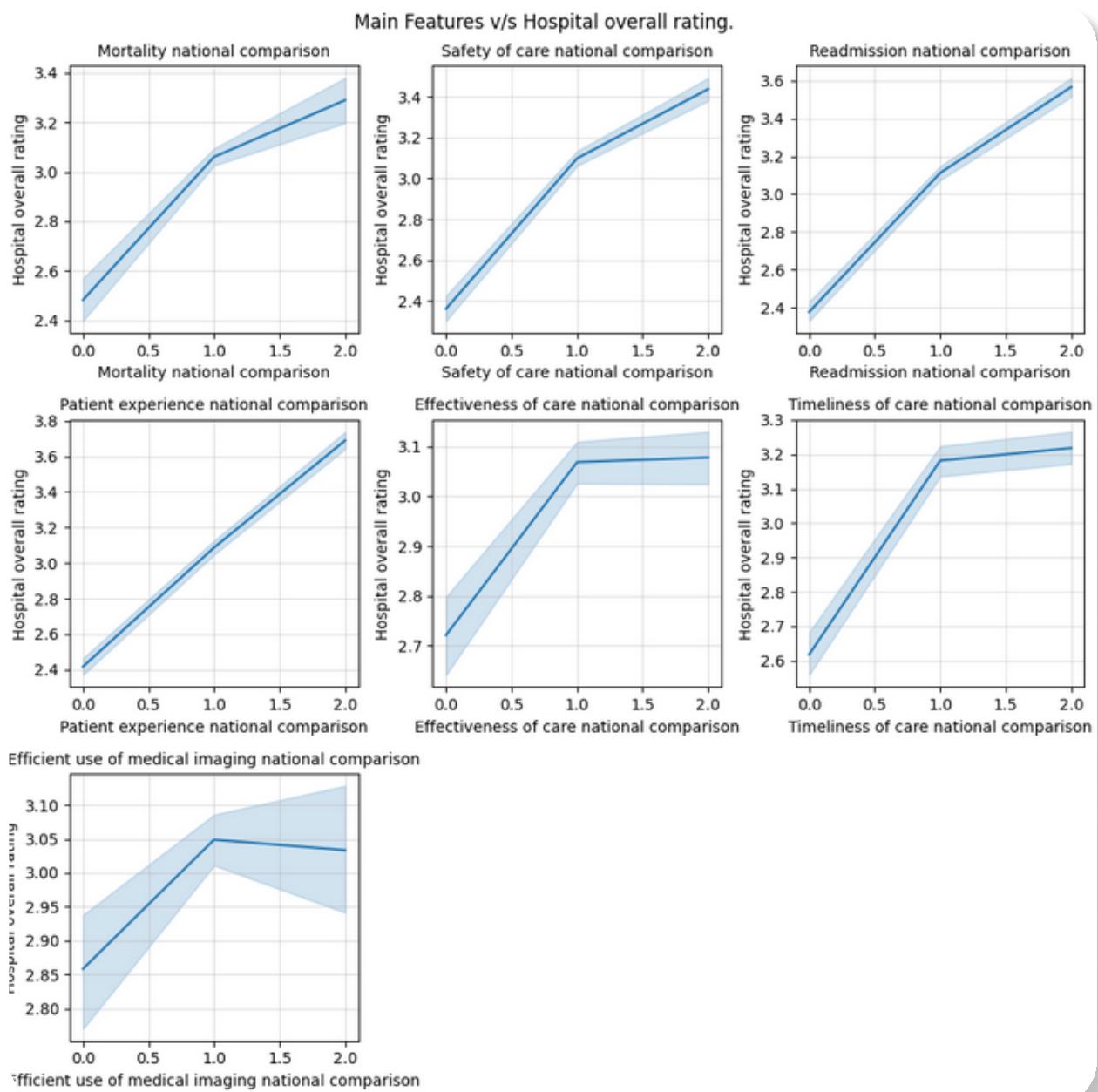
The Centers for Medicare & Medicaid Services ([CMS](#)) is an agency of the U.S. Department of Health and Human Services (HHS) which administers the major government health programs in the U.S. This includes insurance programs such as Medicare, Medicaid, and the Children's Health Insurance Program (CHIP). CMS also plays an important role in collecting and analyzing data with the goal of improving efficiency and equity in the healthcare system. In the current project, you will be analyzing CMS data on hospital quality.

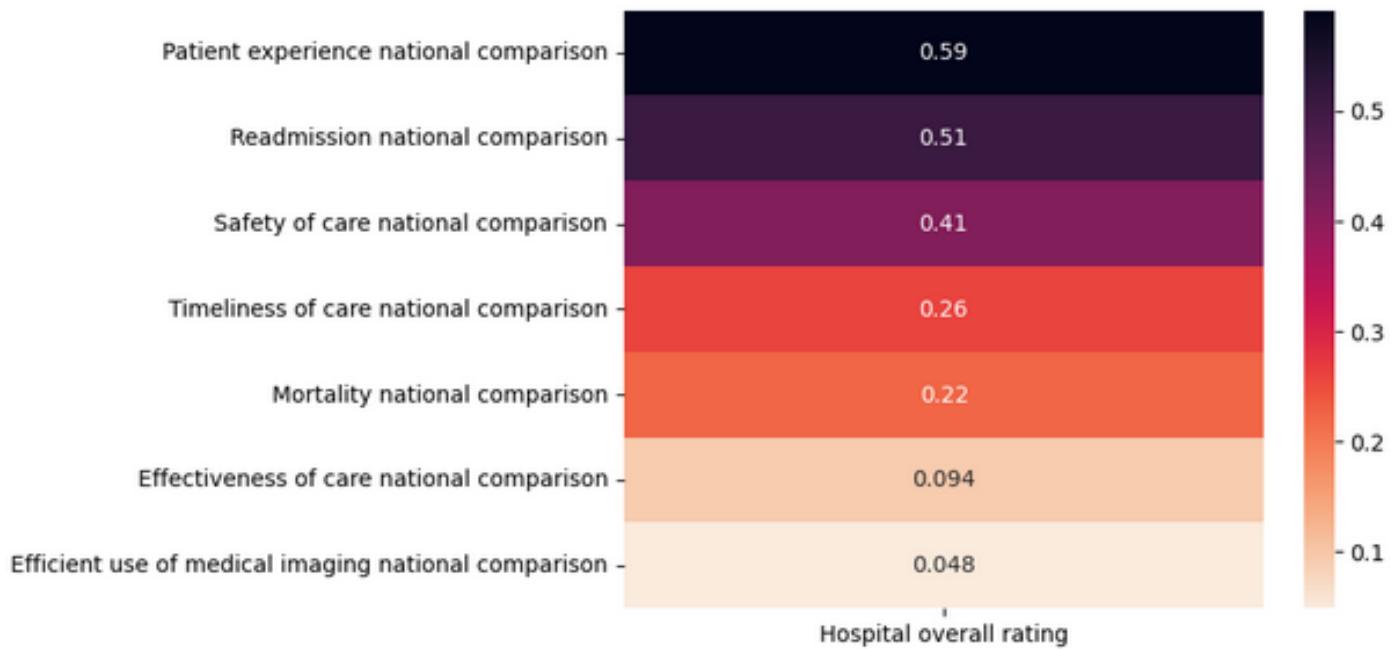
CMS rates hospitals in the U.S. on a scale of 1-5, with the objective of making it easier for patients and consumers to compare the quality of services offered by hospitals. CMS conducts surveys each year and keeps on updating the ratings to reflect the current services being delivered by each of the hospitals.

The ratings directly influence the choice of hospitals made by consumers and may significantly impact hospitals' revenues. This project is focused on developing an approach to calculate hospital ratings and using it to identify areas of improvement for hospitals.

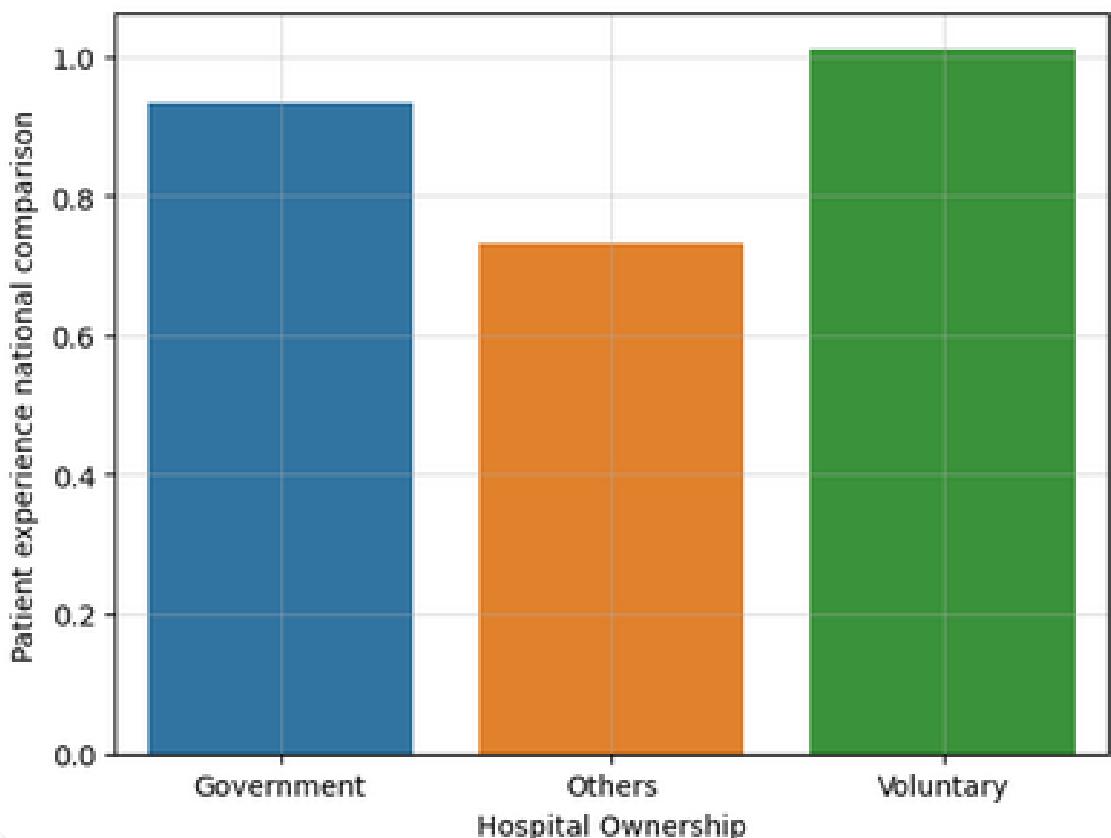
# Insights

- The Dataset has groups of main features
  - Mortality
  - Readmission
  - Safety of care
  - Patient Experience
  - Effectiveness of care
  - Timeliness of care
  - Efficient use of medical imaging.
- Patient experience has high correlation to overall ratings out of the other groups





- Ownership also has an positive effect on the ratings of hospital
- Voluntary hospital have maximum ownership.

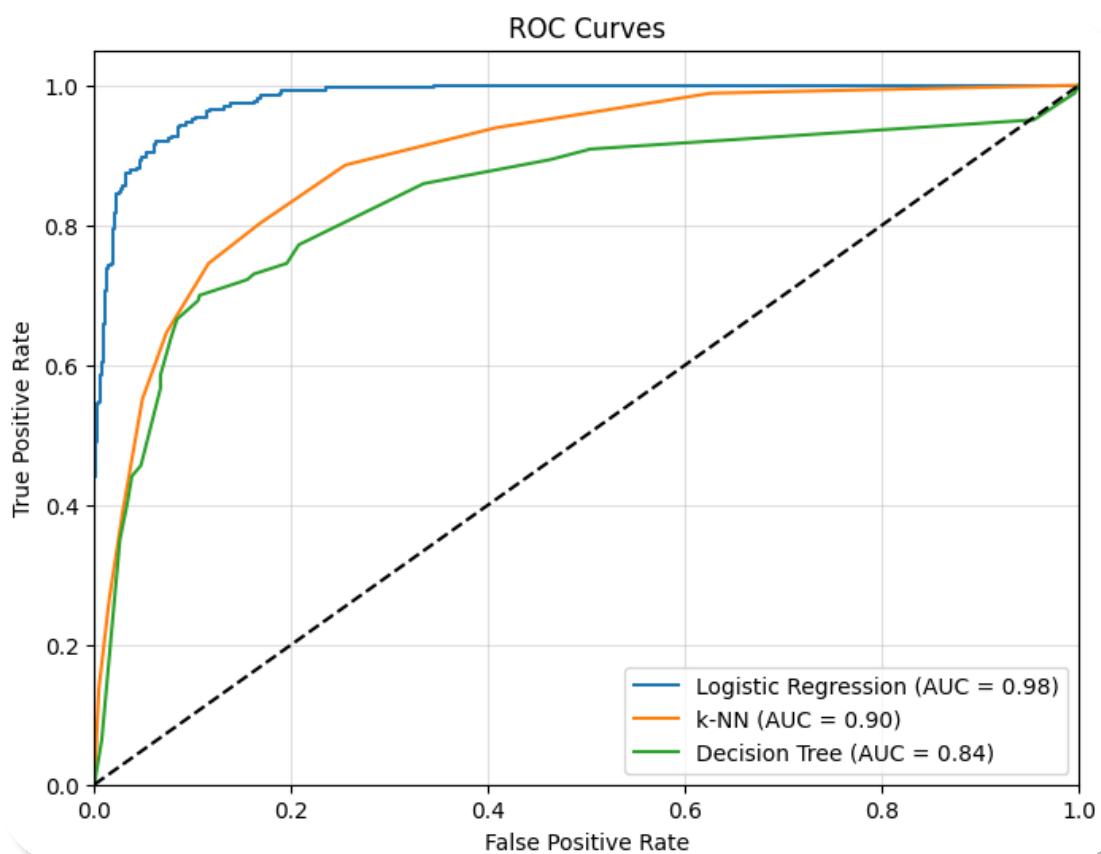


# Classification Models

- Trained 3 classification models:
  - Logistic Regression
  - Decision Trees
  - K-Nearest Neighbors

Model	Accuracy	F1 Score	Confusion Matrix (TN, FP, FN, TP)
Logistic Regression	0.935730	0.883629	(635, 20, 39, 224)
k-NN	0.846405	0.706861	(607, 48, 93, 170)
Decision Tree	0.840959	0.709163	(594, 61, 85, 178)

- Logistic regression has the best metrics out of other models.
- Regression models were tuned with GridSearchCV.



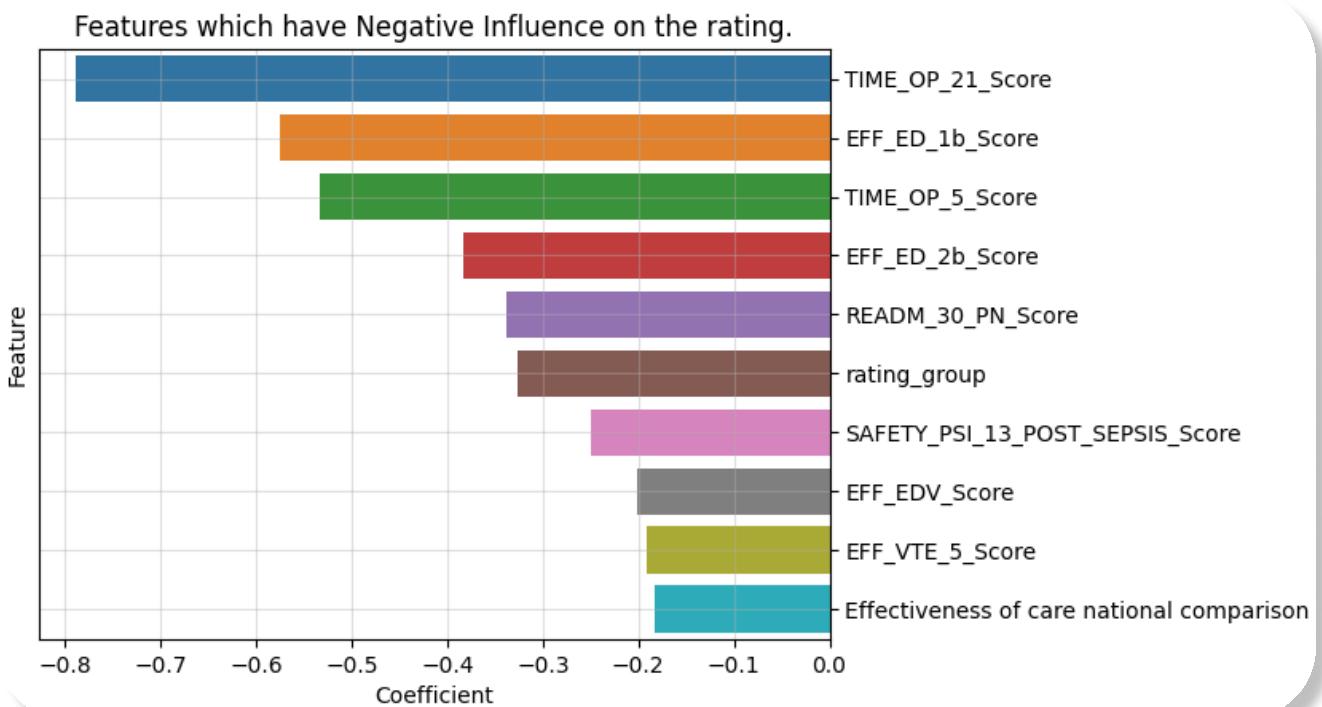
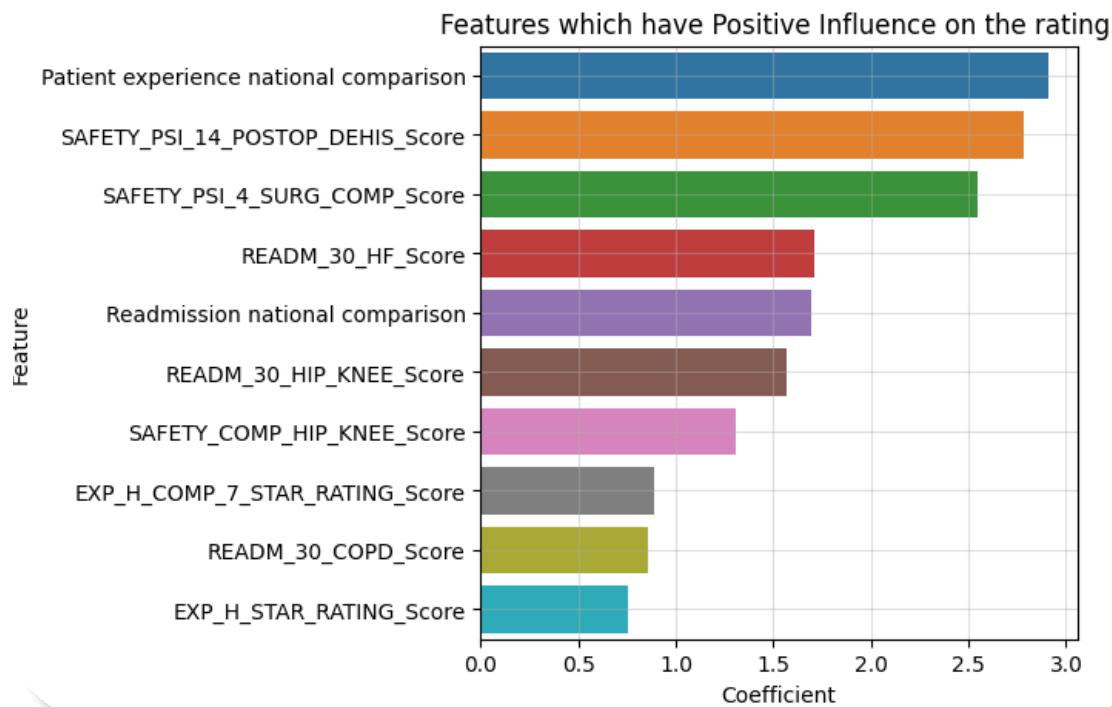
# Predictions

- The prediction were made with Logistic Regression model.
- The predictions were mapped as
  - 1, 2, 3 as 0
  - 4, 5 as 1

Provider ID	Hospital Ownership	hospital_overall_rating_pred
520139	Voluntary	1
520189	Government	1
370029	Government	0
370032	Others	0
370036	Government	0
370037	Voluntary	0

# Effects of the Features

- The following Features have positive effects in the overall rating of the features.



# Summary

- Patient experience, Safety and Readmission has most effect on the overall rating of the hospital.
- Timelinesss, Effectiveness has most negative effect on overall rating of the hospital.
- Logistic Regression has best ratings out of all the models with roc rating of 0.98.
- Knn was the second best with roc rating of 0.90.
- South Dakota best overall best rated hospitals.

# Recommendations

- Hospitals should improve their Timeliness, and Effectiveness of care to have less negative influence on the hospital ratings.
- Hospitals should be better at the Patient Experience, Safety, and Readmission to get better ratings.
- Find out reason why other hospitals are in very less frequency.
- Top 10 features which have the most negative influence on the hospital ratings.
  - a. 'TIME\_OP\_21\_Score'
  - b. 'EFF\_ED\_1b\_Score'
  - c. 'TIME\_OP\_5\_Score'
  - d. 'EFF\_ED\_2b\_Score'
  - e. 'READM\_30\_PN\_Score'
  - f. 'rating\_group'
  - g. 'SAFETY\_PSI\_13\_POST\_SEPSIS\_Score'
  - h. 'EFF\_EDV\_Score'
  - i. 'EFF\_VTE\_5\_Score'
  - j. 'Effectiveness of care national comparison'
- 1. Top 10 features which have Positive influence on the overall hospital rating.
  - a. 'Patient experience national comparison'
  - b. 'SAFETY\_PSI\_14\_POSTOP\_DEHIS\_Score'
  - c. 'SAFETY\_PSI\_4\_SURG\_COMP\_Score'
  - d. 'READM\_30\_HF\_Score'
  - e. 'Readmission national comparison'
  - f. 'READM\_30\_HIP\_KNEE\_Score'
  - g. 'SAFETY\_COMP\_HIP\_KNEE\_Score'
  - h. 'EXP\_H\_COMP\_7\_STAR\_RATING\_Score'
  - i. 'READM\_30\_COPD\_Score'
  - j. 'EXP\_H\_STAR\_RATING\_Score'