

The Effect of Perceived Quality and Satisfaction on Hospital Rating

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Hospital Quality?



Data Preparation

| Attributes | Type | Attributes | Type |
|-------------------------|--------------|--------------------------|---------|
| Hospital Overall Rating | Nominal | Emergency Services | Nominal |
| Provider ID | Quantitative | Meets EHR criteria | Nominal |
| Hospital Name | Nominal | Mortality | Nominal |
| Address | Nominal | Safety of care | Nominal |
| City | Nominal | Readmission | Nominal |
| State | Nominal | Patient experience | Nominal |
| ZIP Code | Nominal | Effectiveness of care | Nominal |
| County Name | Nominal | Timeliness of care | Nominal |
| Phone Number | Quantitative | Efficient use of imaging | Nominal |
| Hospital Type | Nominal | | |
| Hospital Ownership | Nominal | | |

- Eliminate attributes

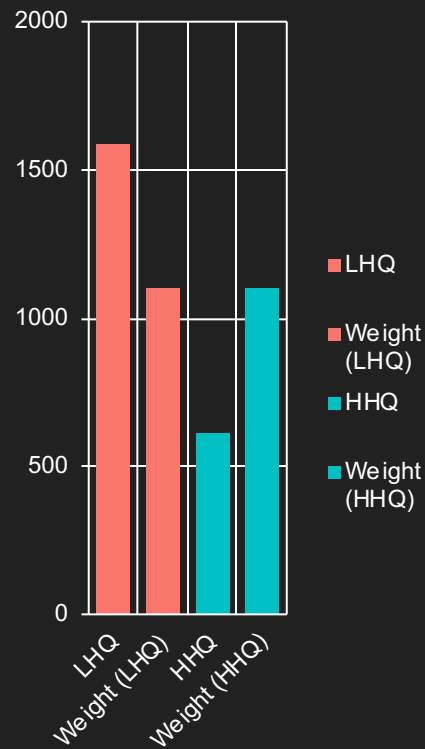
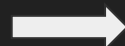
- Provider ID
- Hospital Name
- ...
- Footnote attributes

- Chi-squared Test

- Emergency Services

| Attributes | Kruskal-Wallis chi-squared | df | P-value |
|-------------|----------------------------|----|-----------|
| h_mortality | 136.15 | 2 | < 2.2e-16 |
| h_soc | 453.12 | 2 | < 2.2e-16 |
| h_ra | 673.62 | 2 | < 2.2e-16 |
| h_pex | 719.14 | 2 | < 2.2e-16 |
| h_eoc | 79.619 | 2 | < 2.2e-16 |
| h_toc | 173.25 | 2 | < 2.2e-16 |
| h_imaging | 11.624 | 2 | 0.002992 |
| h_ownership | 69.485 | 8 | 6.222e-12 |
| h_es | 0.053771 | 1 | 0.8166 |

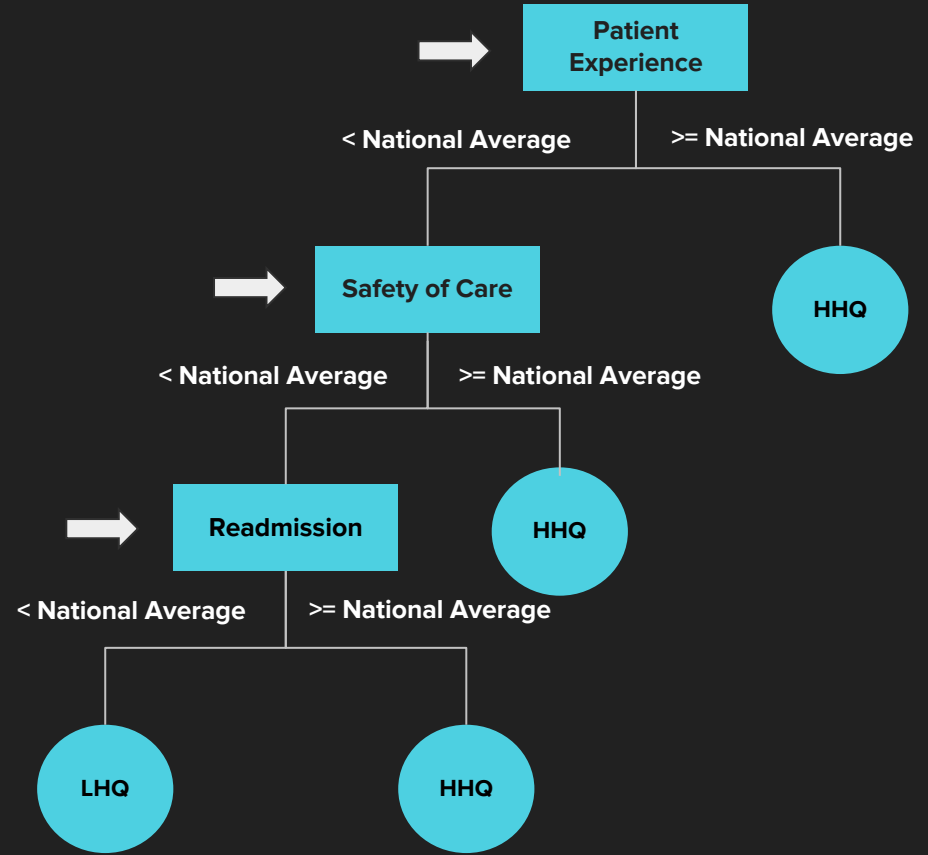
- Imbalanced Class
 - Class balancing



- No missing values
- Remove outliers

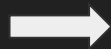
Predictive Modeling/Classification

- Decision Tree



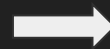
- Naive Bayes

- **Not suitable**
- Limitations



Treatment

1. Discretize numeric variables
2. Probability Density Function



Loss of Information

● Logistic Regression

- Mortality
 - ↑ probability of HHQ
- More Satisfaction, Readmission, and Patient Experience
 - ↑ probability of HHQ

Final Model Summary

Odds Ratios...

| Variable | Class | HHQ |
|--|-------|---------|
| ===== | | |
| h_mortality=Same as the national average | | 0.7994 |
| h_mortality=Above the national average | | 12.4041 |
| h_mortality=Below the national average | | 0.0362 |
| h_soc=Above the national average | | 7.7909 |
| h_soc=Same as the national average | | 0.7639 |
| h_soc=Below the national average | | 0.08 |
| h_ra=Above the national average | | 9.052 |
| h_ra=Below the national average | | 0.0626 |
| h_ra=Same as the national average | | 0.9357 |
| h_pex=Above the national average | | 7.7946 |
| h_pex=Same as the national average | | 0.6781 |
| h_pex=Below the national average | | 0.1414 |
| h_toc=Below the national average | | 0.7872 |
| h_toc=Same as the national average | | 0.9767 |
| h_toc=Above the national average | | 1.3474 |

Post-Prediction Analysis

Within Cluster Sum of Squared Errors

● K-Means Clustering

○ K = 3



- Hospitals with Tertiary Care Capacity
 - ↑ Mortality
- Hospitals with Patient Relations
 - ↑ Satisfaction of Care
- Hospitals with Patient Management
 - ↑ Readmission

Conclusions and Recommendations

| | Accuracy | Precision (True) | Recall (True) | ROC Area |
|--|----------|------------------|---------------|----------|
| Decision Tree | 87.49% | 84.4% | 91.8% | 0.911 |
| Logistic Regression (on full dataset with classification threshold = 0.5) | 86.89% | 85.6% | 88.5% | 0.943 |
| Logistic Regression (on further eliminated dataset) | 87.85% | 85.3% | 91.5% | 0.944 |

| Tertiary Care Capacity | Patient Relations | Patient Management |
|---|---|---|
| <ul style="list-style-type: none">● Problems on pooling <ul style="list-style-type: none">→ Technical Analysis→ Surveys | <ul style="list-style-type: none">● Satisfaction <ul style="list-style-type: none">→ Loyalty Plans | <ul style="list-style-type: none">● Communication <ul style="list-style-type: none">→ Audit current patient plan |

Importance of Hospital Overall Quality Prediction Model

Harvard
Business
Review

DATA

Why Hospitals Need Better Data Science

by Sanjeev Agrawal

OCTOBER 19, 2017



SUMMARY



SAVE

SHARE



COMMENT



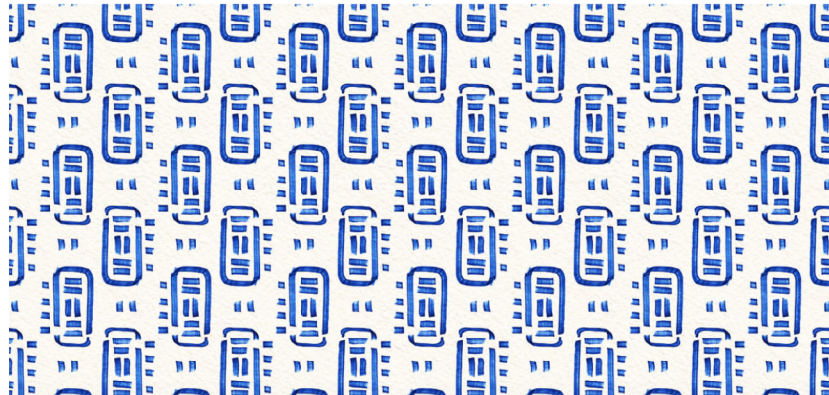
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Questions?