How Can We Lower Hospital Readmission Rates?

Jocelyn Lau

Readmissions: unplanned repeat visits to the hospital

- Costly and avoidable
- Commonly used indicator of a hospital's quality of care
- Tied to Medicare payments

Besides patient characteristics, are there other predictors of readmission rates?

Predicting All-Cause Readmission Rates With Linear Regression

Outcome: # of unplanned all-cause readmissions / 100 admissions for pneumonia

- Pneumonia - common and prevalent
- Medicare (65+ population)
- Already adjusted for age, sex, and specific clinical conditions

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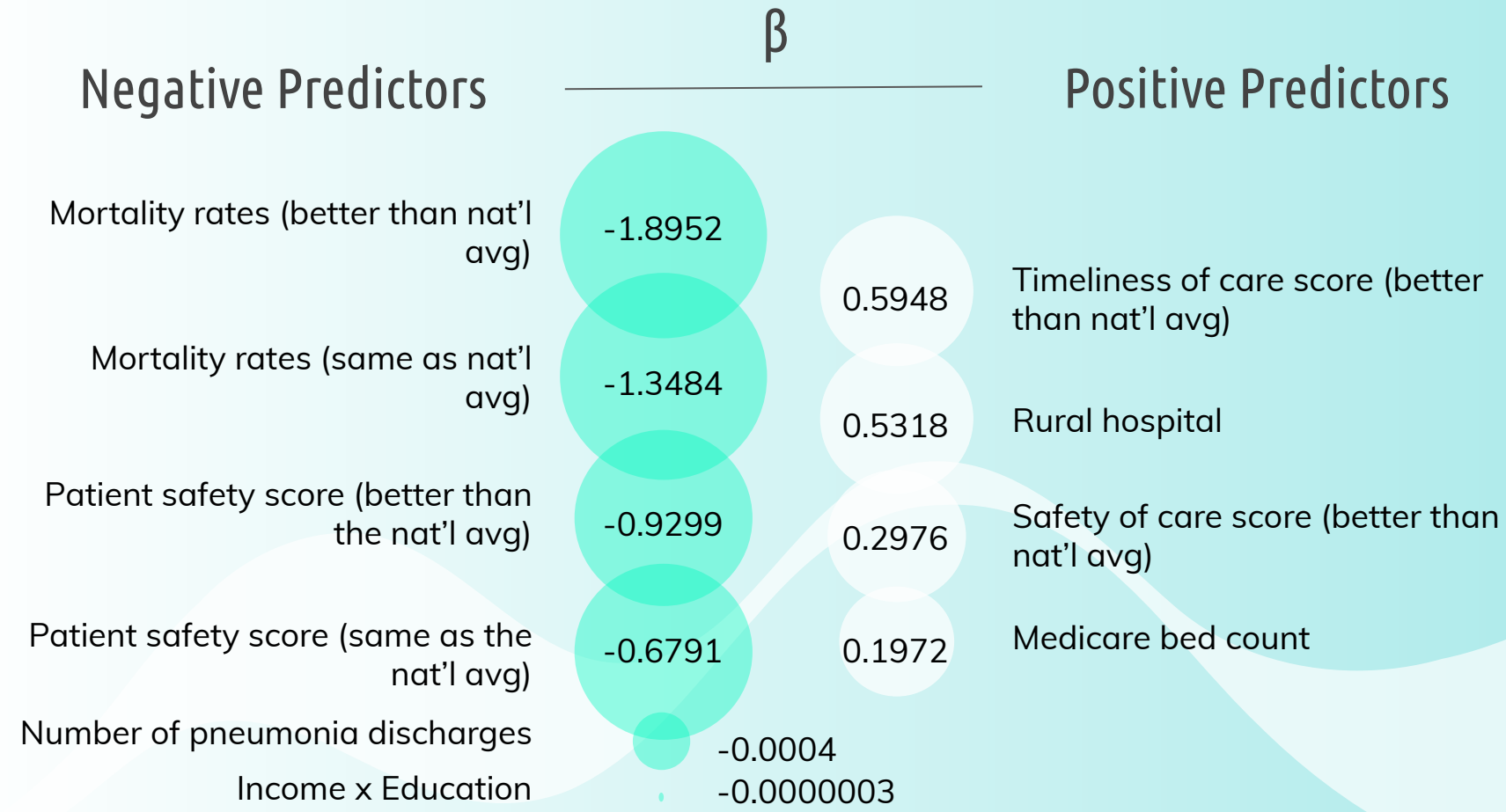
Approach:

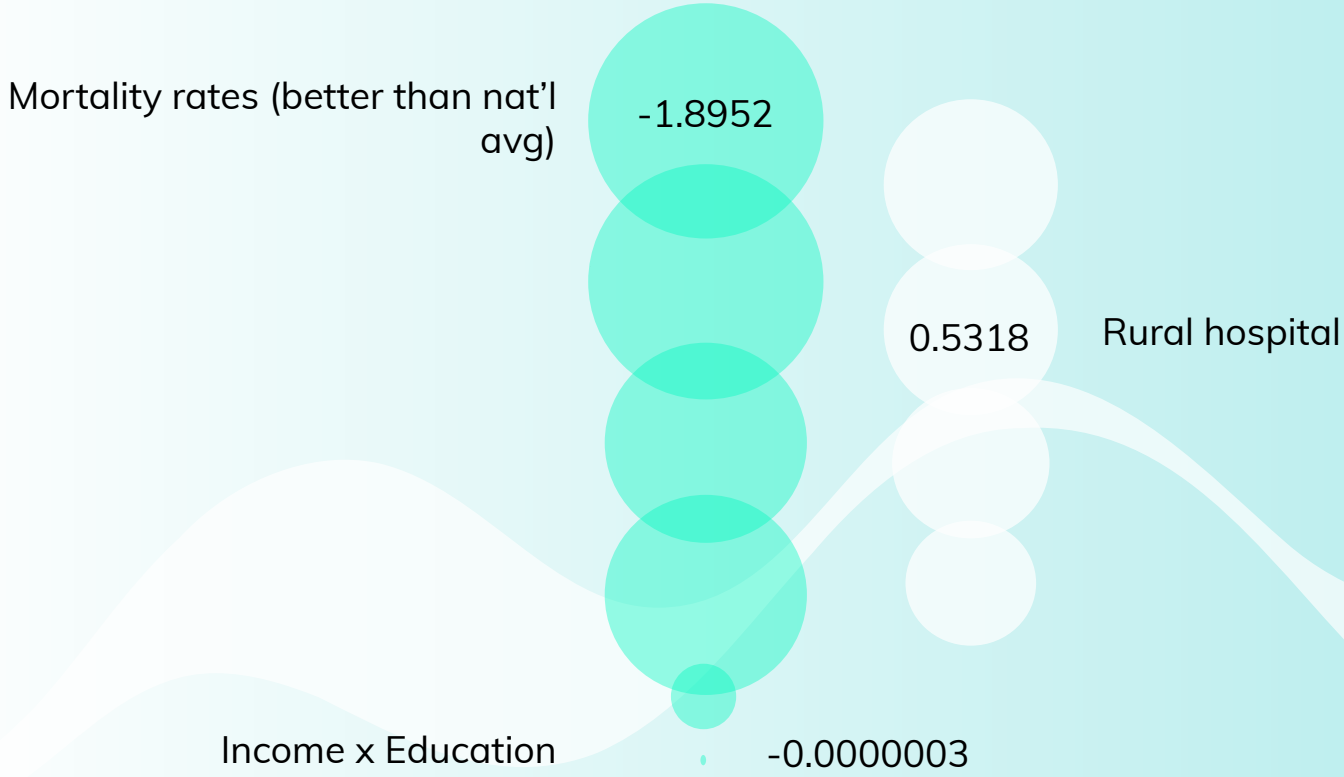
- Linear regression: Statsmodel OLS
- Cross-validation: GridSearchCV w/ Ridge and LASSO


β
Negative Predictors
Positive Predictors
Mortality rates (better than nat'l avg)
-1.8952
Mortality rates (same as nat'l avg)
-1.3484
Patient safety score (better than the nat'l avg)
-0.9299
Patient safety score (same as the nat'l avg)
-0.6791
Number of pneumonia discharges
-0.0004
Income x Education
-0.0000003
0.5948
Timeliness of care score (better than nat'l avg)
0.5318
Rural hospital
0.2976
Safety of care score (better than nat'l avg)
0.1972
Medicare bed count

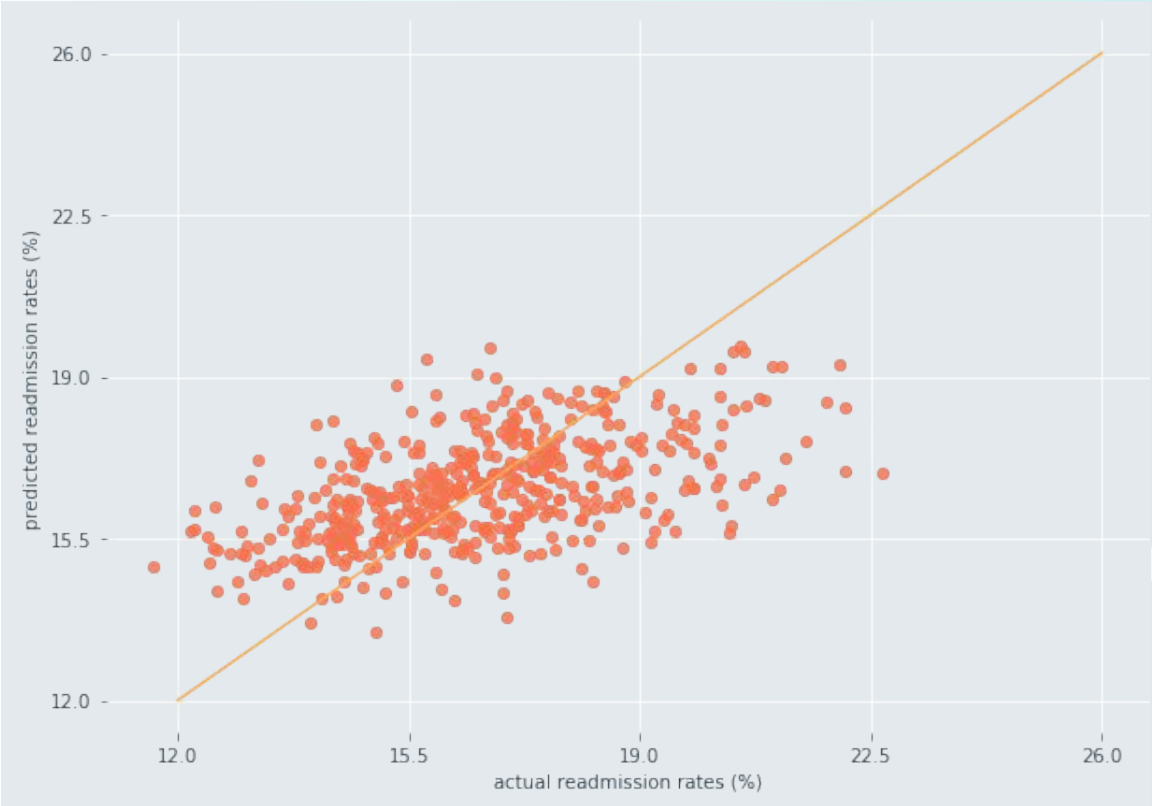
β

Negative Predictors

Positive Predictors



Readmission rates are hard to predict with geographic and hospital-level features



Actual vs. Predicted Hospital Readmission Rates

Mean Absolute Error: 1.366

Ridge MAE: 1.365
LASSO MAE: 1.363

Readmission rates are weakly predicted by a small subset of variables

- Regardless of model regularization
- Not explored: skill/quality of doctors/nurses

To improve readmission rates, focus on:

- Encouraging hospitals to invest in improving mortality scores
- Investing in hospitals in rural areas
- Patient level, not hospital-level factors

Thank You

Appendix

Who Cares?

Policy Makers

Inform the design of incentive and payment programs

Healthcare Businesses

Identify opportunities for their related products and services

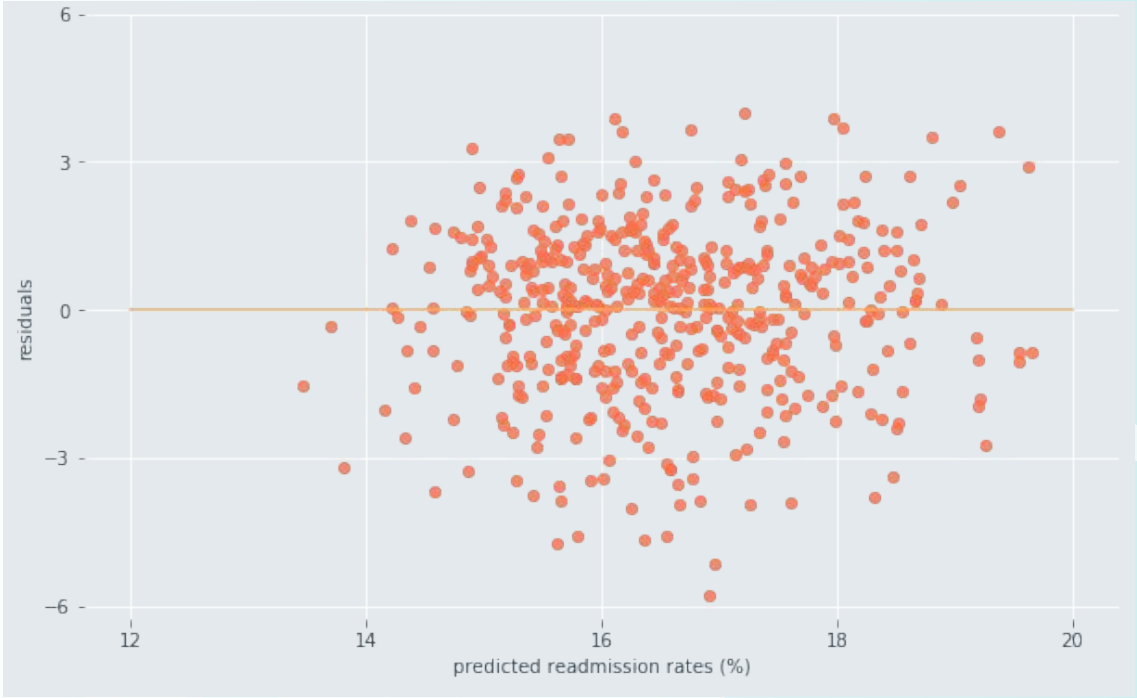
Hospitals

Understand their performance relative to other hospitals

Potential Predictors

Focus	Features	Data Source
Geographical/ demographic	• Median income of county • Education level of county • Urban or Rural	• 2014-2017 Census • 2013-2017 American Community Survey • 2017 Provider of Services file
Performance-related	• Number of pneumonia discharges • Performance on 5 other Medicare measures (Better, same, worse than national average)	• 2014-2017 data.medicare.gov
Hospital-specific	• Bed count (hospital size) • Wage index (labor costs) • Case mix index • Hospital ownership • Emergency services • Medical school affiliation	• 2017 Provider of Services file • 2014-2016 Federal IPPS files • 2014-2017 data.medicare.gov

Linear Assumptions and Other Evaluation Criteria



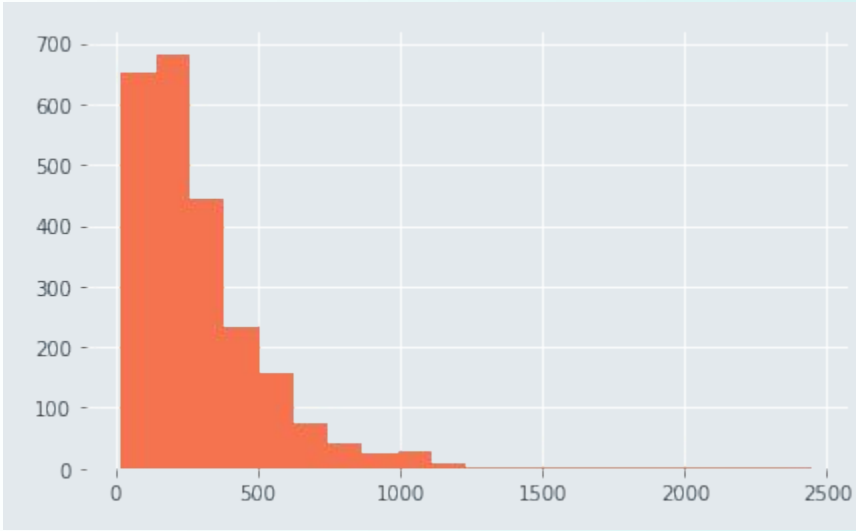
Predicted Hospital Readmission Rates vs Residuals

R-squared:	0.278
Adj. R-squared:	0.274
F-statistic:	72.66
Prob (F-statistic):	6.15e-126
Log-Likelihood:	-3782.3
AIC:	7587.
BIC:	7648.

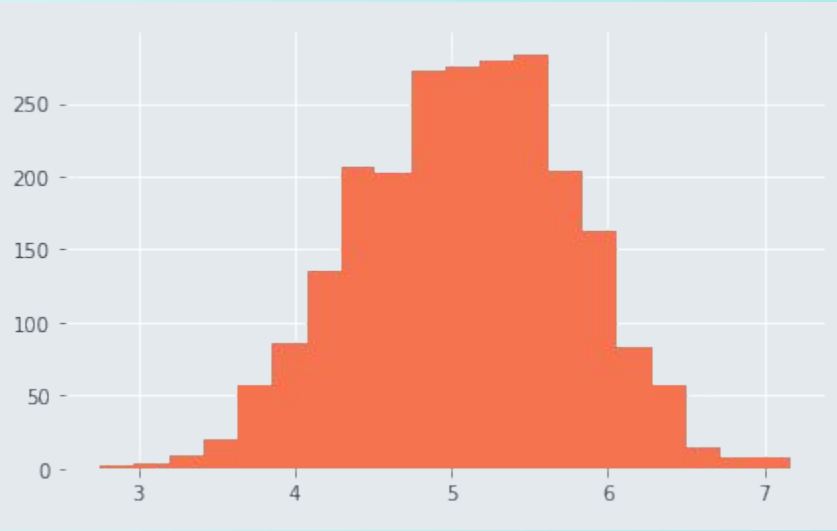
Omnibus:	69.187	**Durbin-Watson:**	1.980
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	77.956
Skew:	0.449	**Prob(JB):**	1.18e-17
Kurtosis:	3.423	**Cond. No.**	2.77

Box-cox transformation of Medicare bed count

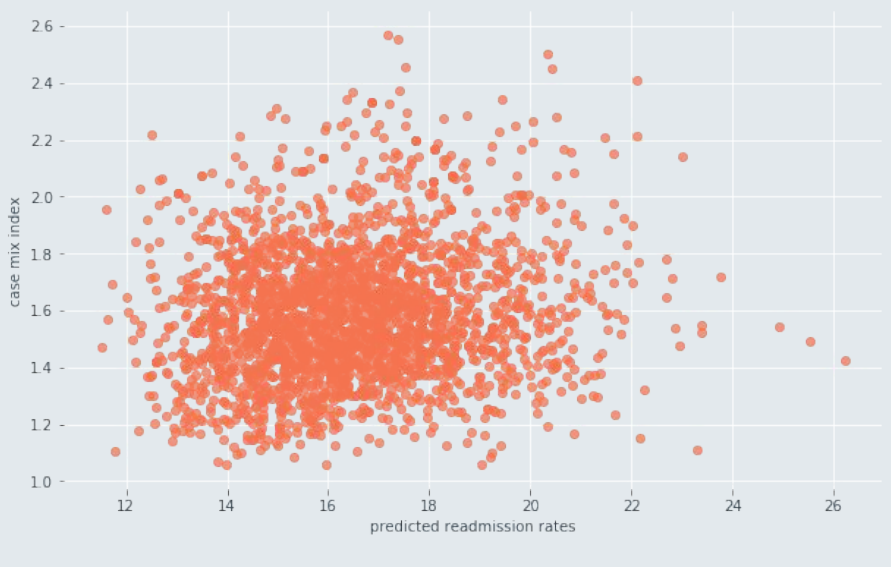
Bed Count



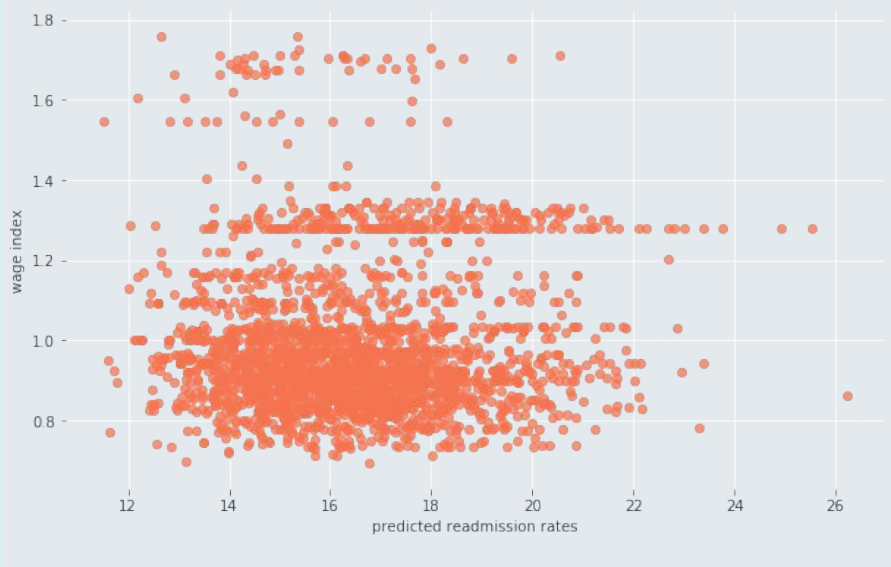
Bed Count Transformed (Lambda: 0.022)



Non-significant Features



Case Mix Index



Wage Index

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