Uncovering value in hospital patient surveys

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Challenges to the healthcare business

Providers can't charge higher rates. Payers can't increase premiums. [...] To uncover value and grow business, stakeholders must start to chip away at the cost of care.

- Mitchell Morris, MD, Optum

Main stakeholders:

- insurance companies
- hospitals

Research proposal

Project outline: We link patient survey data to hospital performance metrics to identify means of reducing costs (by improving the quality of healthcare).

Data source: The Centers for Medicare & Medicaid Services (CMS) Medicare provider data (*https://data.cms.gov/provider-data/*). In particular, the datasets *Patient survey (HCAHPS) - Hospital*, *Unplanned Hospital Visits -Hospital*, and *Hospital-Acquired Condition Reduction Program*.

Response variables

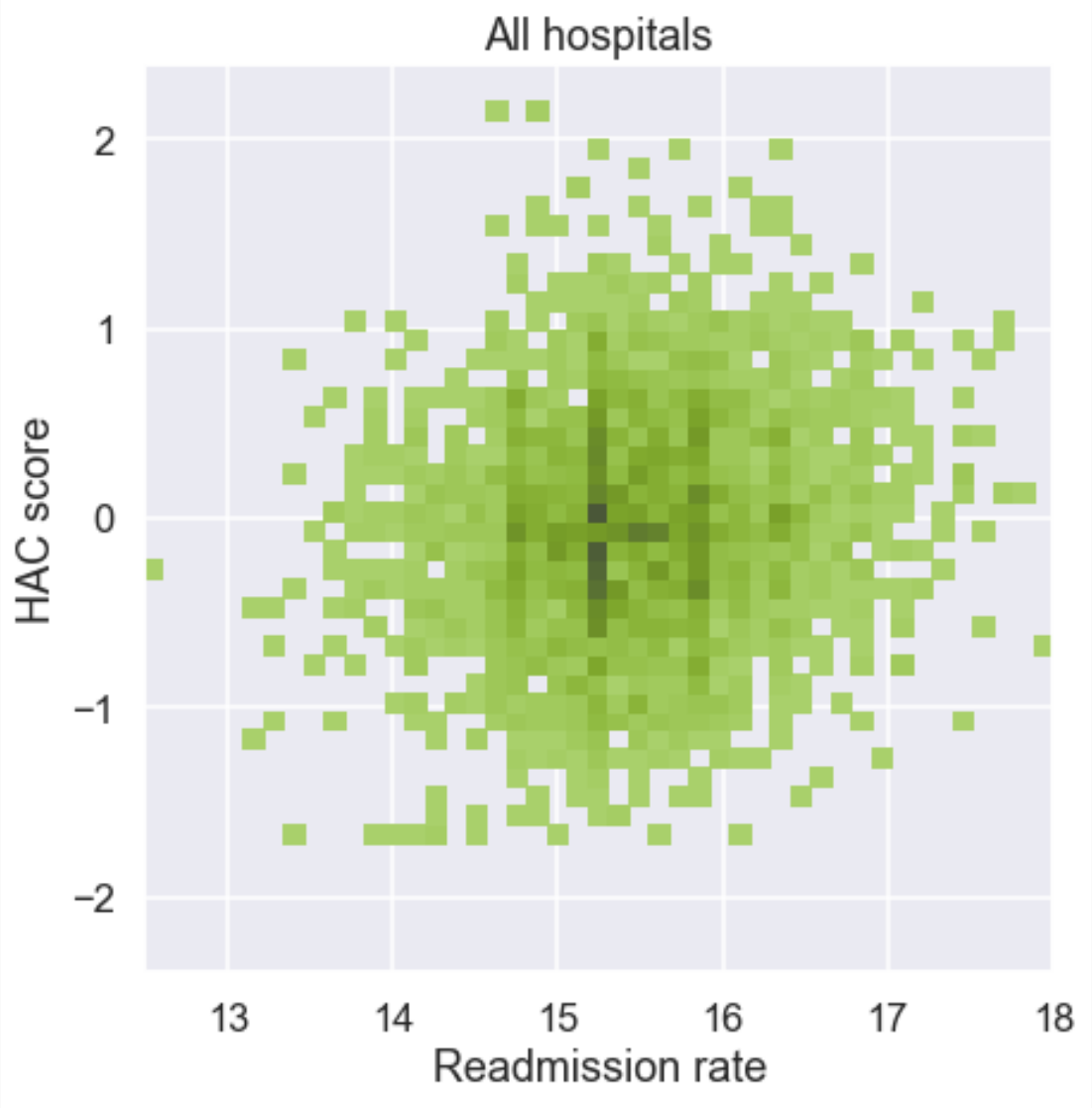
(1) Rate of readmission within 30 days of being discharged from a hospital stay.

(2) Total Hospital-Acquired Condition (HAC) Score (signed standard deviations from mean).

Hazards to stakeholders:

- Increased costs/claims payments.
- Damage to reputation.
- Reduced funding.
- Greater likelihood of malpractice lawsuit.

Little relationship between targets



Predictors

Amalgamated at the hospital level from patient surveys, they are the linear scores attributed to

- Cleanliness
- Nurse communication
- Doctor communication
- Staff responsiveness
- Communication about medicine
- Discharge information
- Care transition
- Overall hospital rating
- Quietness
- Recommend hospital

Readmission rate: best subsets regression

OLS Regression Results

Dep. Variable:	y	R-squared:	0.091
Model:	OLS	Adj. R-squared:	0.088
Method:	Least Squares	F-statistic:	33.81
Date:	Sun, 25 Jul 2021	Prob (F-statistic):	2.58e-63
Time:	13:37:10	Log-Likelihood:	-3610.9
No. Observations:	3384	AIC:	7244.
Df Residuals:	3373	BIC:	7311.
Df Model:	10		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	20.6760	0.617	33.484	0.000	19.465	21.887
x1	-0.0150	0.005	-3.141	0.002	-0.024	-0.006
x2	-0.0090	0.012	-0.734	0.463	-0.033	0.015
x3	-0.0164	0.009	-1.743	0.081	-0.035	0.002
x4	-0.0126	0.006	-2.181	0.029	-0.024	-0.001
x5	0.0206	0.005	3.818	0.000	0.010	0.031
x6	-0.0469	0.005	-8.998	0.000	-0.057	-0.037
x7	0.0407	0.011	3.763	0.000	0.019	0.062
x8	0.0392	0.015	2.539	0.011	0.009	0.069
x9	-0.0079	0.003	-2.309	0.021	-0.015	-0.001
x10	-0.0470	0.009	-5.009	0.000	-0.065	-0.029

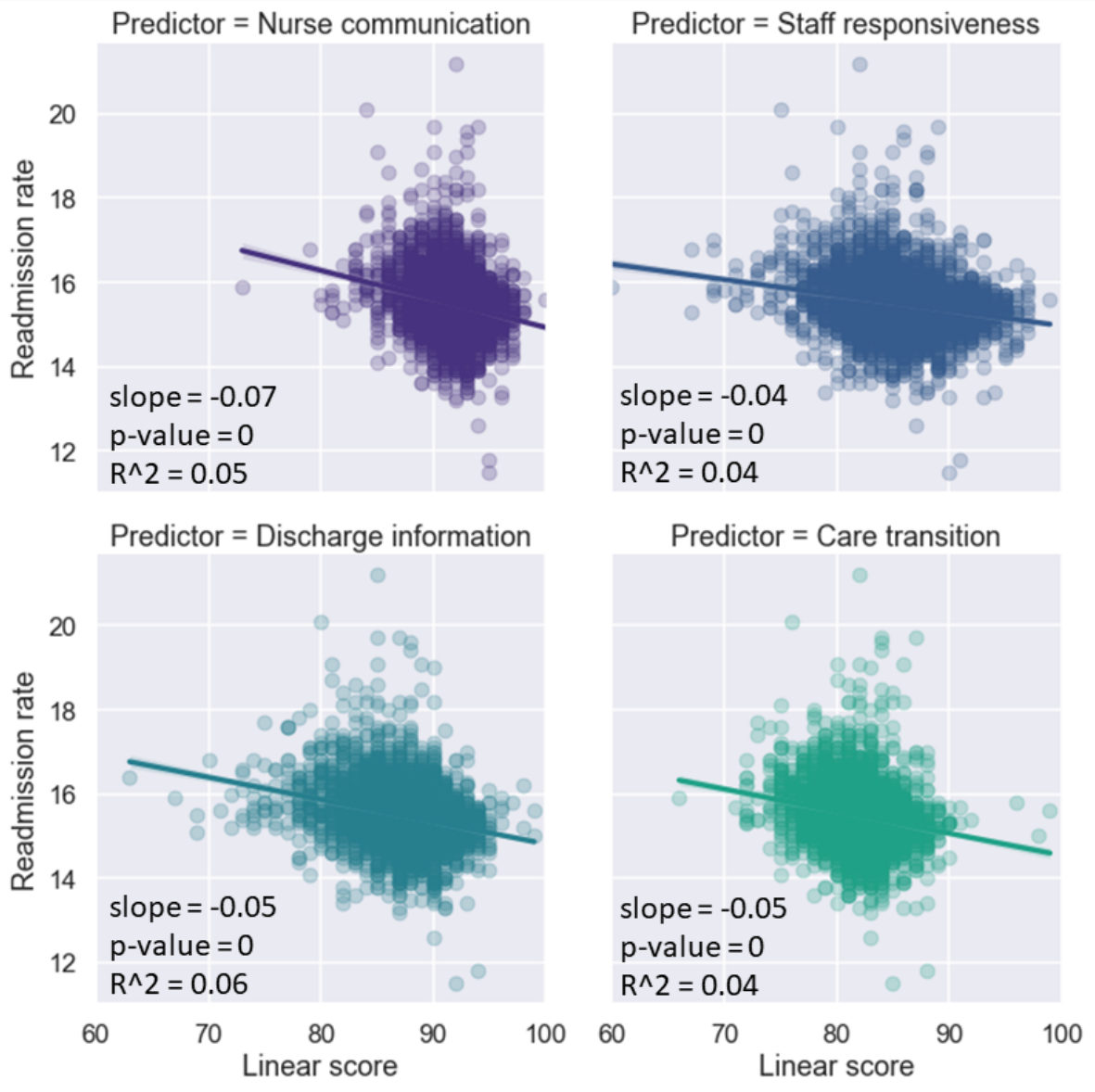
Omnibus:	537.283	Durbin-Watson:	1.803
Prob(Omnibus):	0.000	Jarque-Bera (JB):	2526.924
Skew:	0.688	Prob(JB):	0.00
Kurtosis:	7.004	Cond. No.	1.39e+04

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 1.39e+04. This might indicate that there are
strong multicollinearity or other numerical problems.

Readmission rate: correlations

Discharge information	-0.262240
Recommend hospital	-0.232840
Nurse communication	-0.226153
Overall hospital rating	-0.225432
Staff responsiveness	-0.212882
Care transition	-0.203613
Doctor communication	-0.197653
Cleanliness	-0.193883
Communication about medicine	-0.167898
Quietness	-0.157066

Readmission rate: concentrate on these predictors



Total HAC score: correlations

Staff responsiveness	-0.227254
Cleanliness	-0.211575
Quietness	-0.202352
Communication about medicine	-0.191847
Care transition	-0.180225
Nurse communication	-0.179704
Overall hospital rating	-0.173021
Doctor communication	-0.165452
Discharge information	-0.143240
Recommend hospital	-0.138713

Comparing strongest correlations for the two targets

Readmission rate	**Total HAC score**
Discharge information	Staff responsiveness
Recommend hospital	Cleanliness
Nurse communication	Quietness
Overall hospital rating	Communication about medicine

The intersection is empty.

Conclusions and recommendations

- The regressions were statistically significant.
- The effect sizes were small.
- Results were qualitatively interesting.

Relatively high readmission rate: try to improve discharge information and nurse communication.

In the data examined, each one point increase in the discharge information score corresponds to a 0.05% decrease in the 30 day readmission rate.

Relatively high total HAC score: try to improve staff responsiveness and cleanliness.

In the data examined, each one point increase in the staff responsiveness score corresponds to a 0.03 s.d. decrease in the total HAC score.

Future work

Improve

- Resolve issue of mismatched collection period dates.
- Better understand the patient survey process and timeline.
- Adapt regression methods to account for multicollinearity.
- Refine approach to address non-constant variance.

Extend

- Segment the data prior to analysis.
- Consider other response variables, such as from the *Complications and Deaths* dataset.

Replace

- Patient level data that would allow for a machine learning approach to predicting which patients are at high risk of readmission.

Thank you.

Any questions?