Achieving Hospital Patient Satisfaction

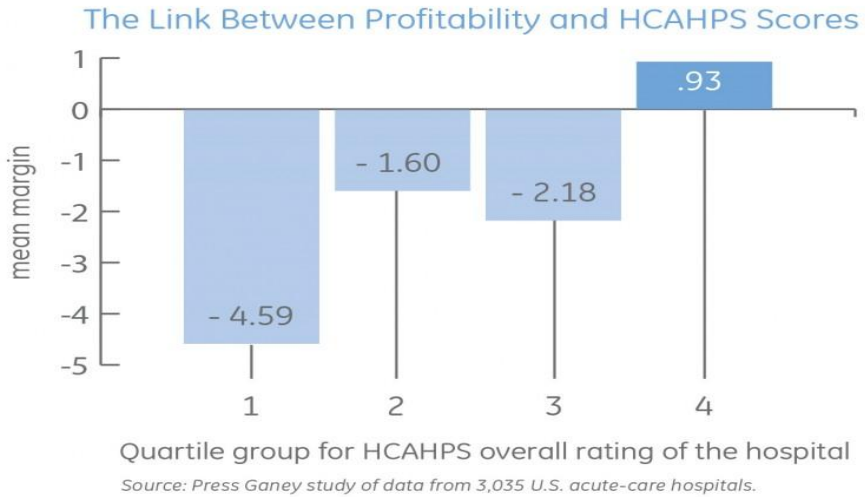
A Study of HCAHPS Survey Results

Benton Maples

HCAHPS Survey is Standard Measure of Patient Satisfaction

- Conducted by US Government (Center for Medicare and Medicaid Services) since 2006
- First standardized survey of its type
- Comprises over 4000 hospitals and 3 million annual patient surveys
- Medicare reimbursement rates are impacted based on hospital performance on the survey

HCAHPS Survey is Correlated with Hospital Profitability



Hospitals in top quartile of HCAHPS results are the most profitable according to Press Garvey study

Our Mission: Discovery of What Drives Patient Satisfaction

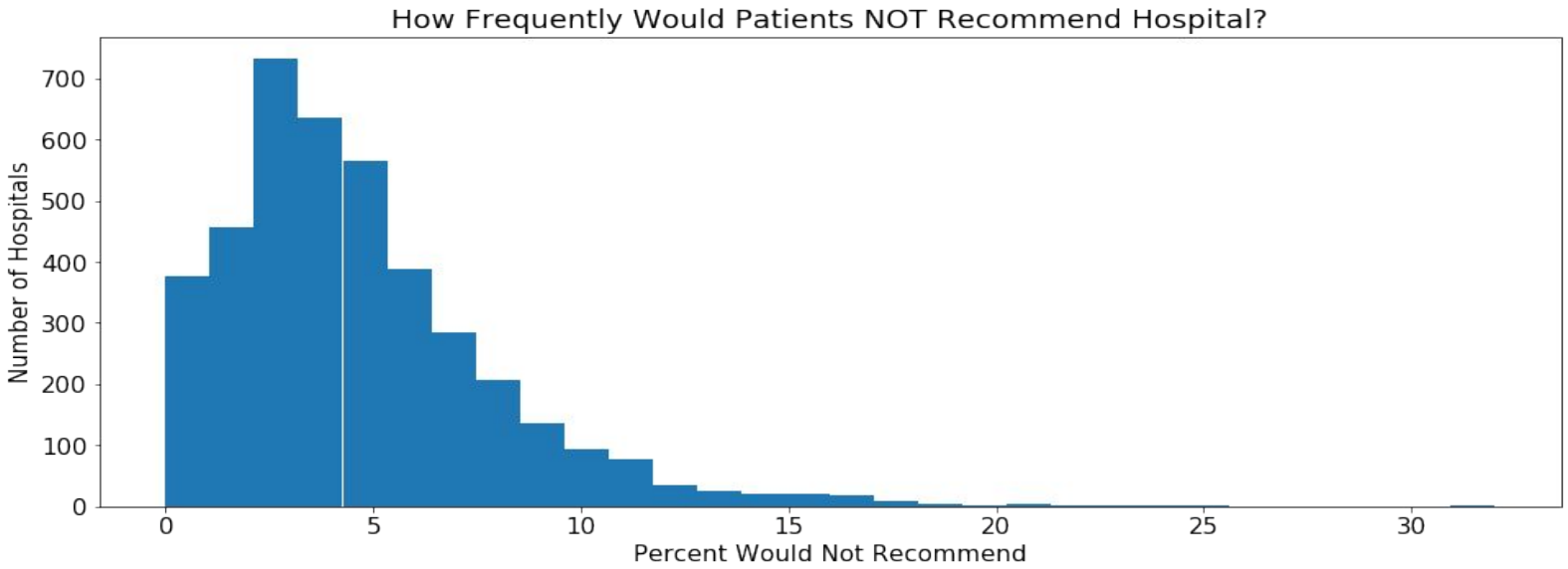
Patient satisfaction is a moral and financial imperative for hospitals. Since we have robust patient data from the HCAHPS surveys, we need to discover which hospital activities are driving overall positive and negative hospital satisfaction.

Reported HCAHPS Data Has 3 Logical Categories

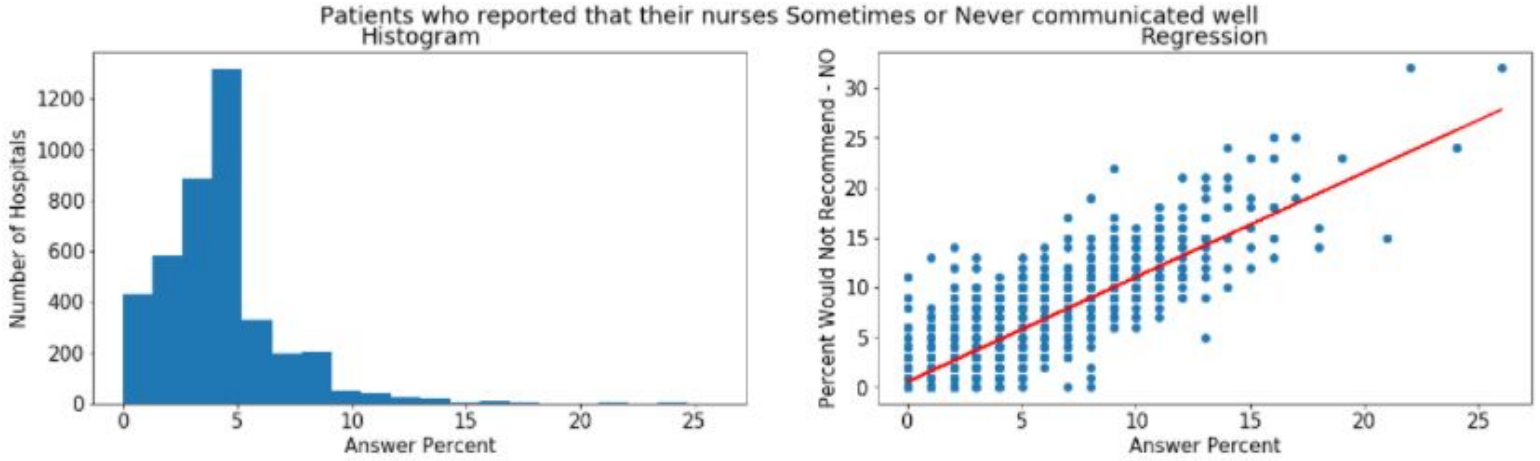
1. Responses measuring patient experiences on individual metrics such as nurse attentiveness, cleanliness, pain management and transition care
2. Responses measuring overall patient satisfaction with the hospital
3. Linear mean scores and star ratings

The third category represents HCAHPS calculations and won't be relevant to our own calculations. We will contrast individual experience metrics against overall experience.

Bad Hospital Experiences Are Captured in Patient Refusal to Recommend



Correlation Coefficients of Univariate Regressions Give Insight Into Responses Driving Bad Experiences



slope: 1.04947557922 intercept: 0.556994145415 r_value: 0.825906126404 p_value: 0.0 std_err: 0.011
1873630532 r-squared: 0.682120929631

Simple Linear Regression Suggests Responses Most Correlated with “NO” Recommendations are:

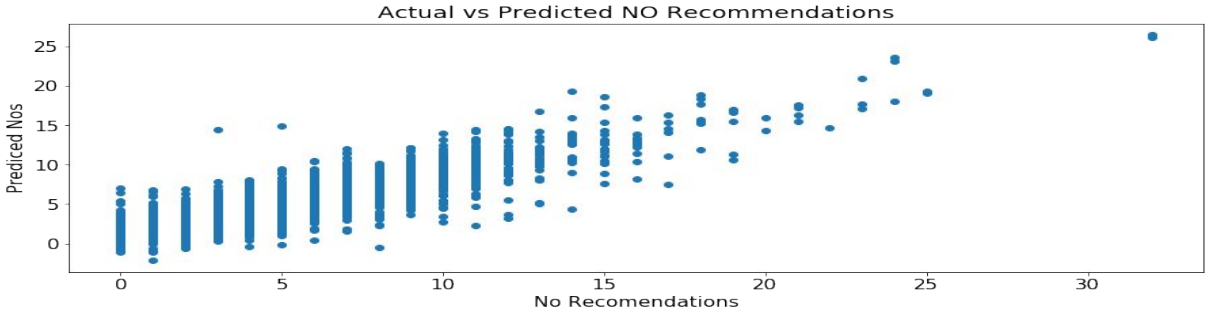
1. Patients who reported that their nurses Sometimes or Never communicated well
2. Patients who disagree or strongly disagree they understood their care when they left the hospital
3. Patients who reported they sometimes or never received help as soon as they wanted

Multiple Linear Regression Model can Better Reveal Drivers of Bad Experiences

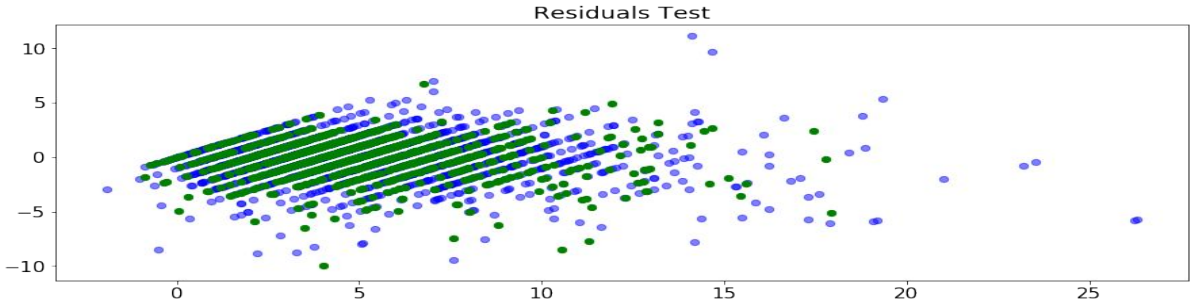
- Multiple linear regression model can make predictions based on multiple variables
- Model’s accuracy is easy to test and verify
- If model performs well, feature selection algorithms can compare model success with subsets of variables, determining which variables have the biggest impact on prediction accuracy

Linear Model Shows Skill at Predicting “NO’ Recommendation Percentages

RMSE = 1.612. Predicted ‘NO’ recommendation percentages differ from actual values by an average of 1.6%.



Cross validation test splits data into training (blue) and testing (green) subsets. Random distribution of green indicates good fit. RMSE = 1.61 for training data, 1.63 for test data.



Recursive Feature Elimination Ranks Questions That Drive Model Accuracy

Recursive feature elimination systematically removes survey responses, and tests linear model accuracy as responses are eliminated in order to generate a ranking of responses that have greatest impact on prediction accuracy.

While our simple linear regression model showed high correlation with specific negative responses, multiple linear regression and RFE show it is question category rather than positive, negative or neutral responses that drive model prediction accuracy.

Thus we can determine which HCAHPS question categories are driving patient satisfaction.

	Questions	RFE Ranking
21	Bad_Nurse_Com	1
6	Usual_Nurse_Com	2
13	Always_Nurse_Com	3
5	Pain_Always	4
10	Usual_Pain	5
12	No_Pain_Control	6
15	Usually_Doc_Com	7
8	Always_Doc_Com	8
17	Bad_Doc_Com	9
23	Yes_Info	10
3	No_Info_Recover	11
20	Usually_Clean	12
7	Always_Clean	13
16	Dirty_room	14
1	No_Unerstood_Care	15
2	Mostly_Understood_Care	16
0	Really_Understood_Care	17
14	Usually_Help	18
24	Always_Help	19
25	No_Help	20
19	Not_Quiet	21
18	Usually_Quiet	22
22	Always_Quiet	23
4	Usual_Medicine	24
9	Always_Staff_Med	25
11	No_Staff_Med	26

Linear Model Identifies Drivers of Patient Satisfaction in Order of Importance

1. Nurse Communication
2. Pain Management
3. Doctor Communication
4. Recovery Information
5. Room and Bathroom Cleanliness
6. Understanding of Care on Leaving Hospital
7. Timely Help When Wanted
8. Quietness at Night
9. Staff Explanations of Medicines