PREVENTING HOSPITALIZATIONS WITH MACHINE LEARNING

by Lili Beit

BUSINESS PROBLEM

- Predict which patients will be hospitalized over the next 12 months, based on demographic information and medical conditions

- Generate a list of high-risk patients, with a precision rate above 20%

- **Value-based payment systems** incentivize provider networks to deliver high-quality care at low cost

- Provider networks that reduce costs are entitled to a share of the **savings** to insurers

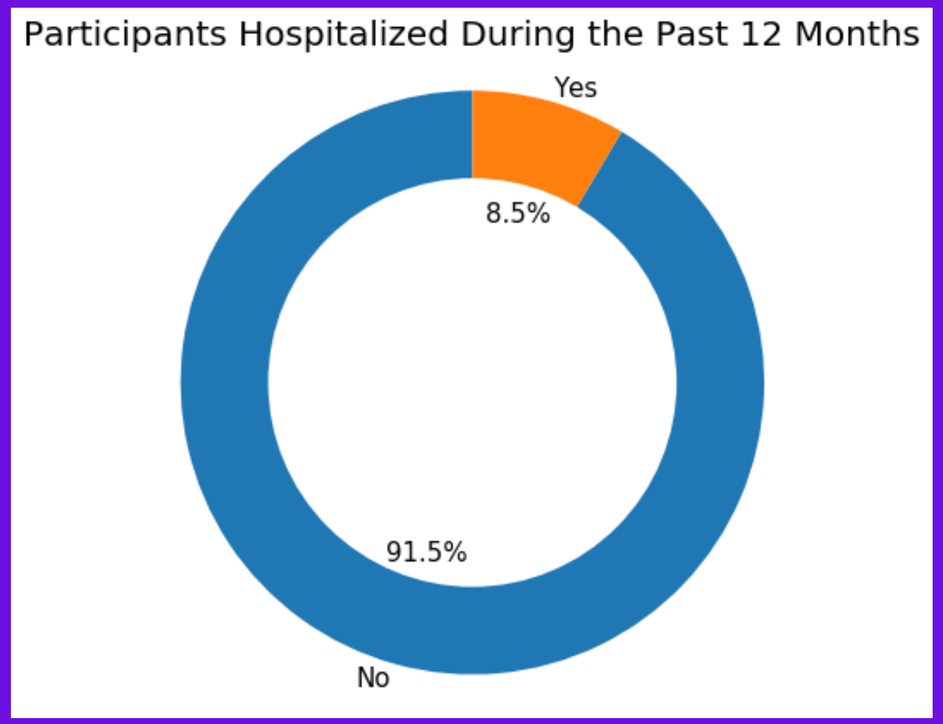
- Targeting these patients for **outreach** can prevent hospitalizations and reduce health care costs

- A **predictive model** can help providers identify high-risk patients

DATA

NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY (NHANES)

2017-2018



SURVEY POPULATION

- Nationally representative sample of 9,000 participants, from counties across the U.S.
- Excluded participants under two years old

HOSPITALIZATIONS (THE TARGET)

- Only 8.5% of participants were hospitalized over the past year
- This excludes hospitalizations for childbirth

PREDICTORS

- Demographic information
- Medical conditions (prior to 1 year ago)
- Prescription drug use (prior to 1 year ago)

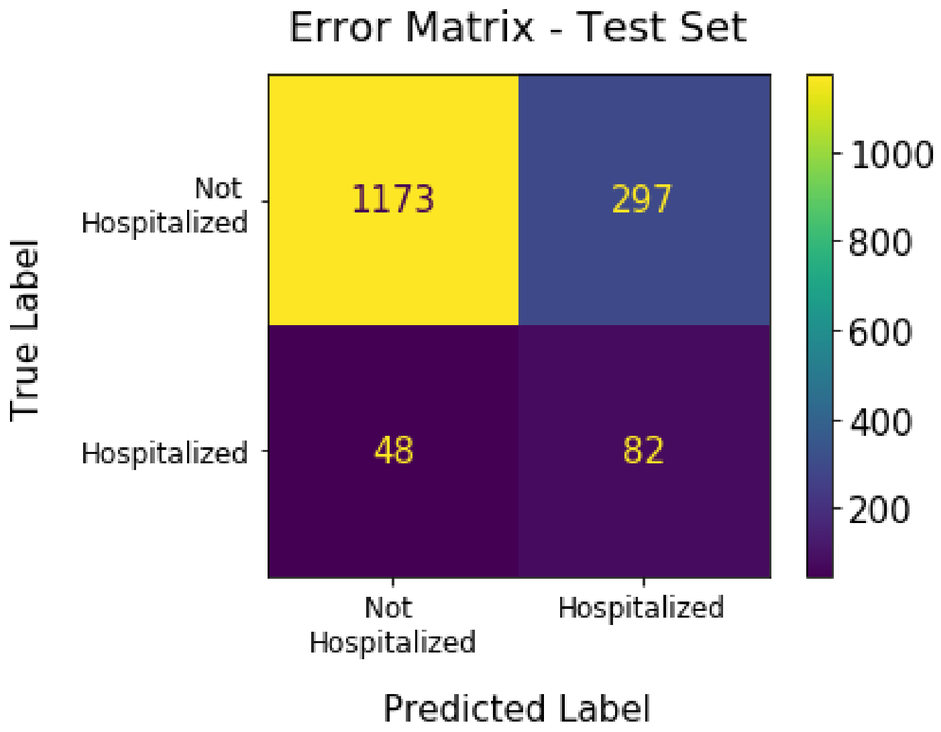
DATA GAPS AND AMBIGUITY

- Not true EHR data, relies on participant memory
- COPD
- Patients over 80
- Covid (lack thereof)

MODELING

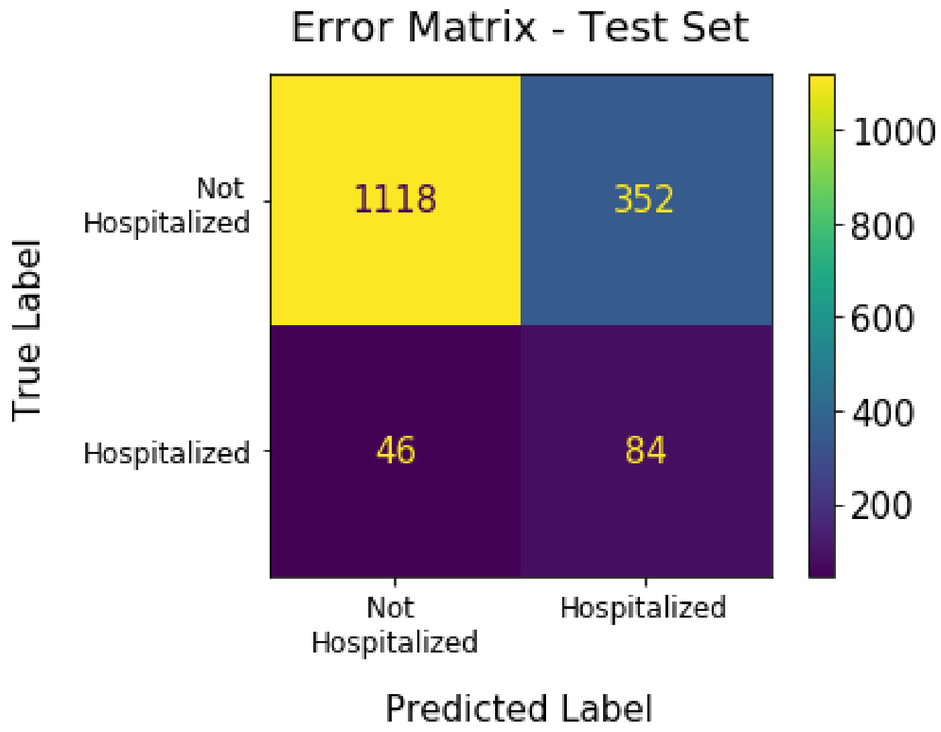
LOGISTIC REGRESSION

Recall / Sensitivity: 0.64
Precision / Specificity: 0.21

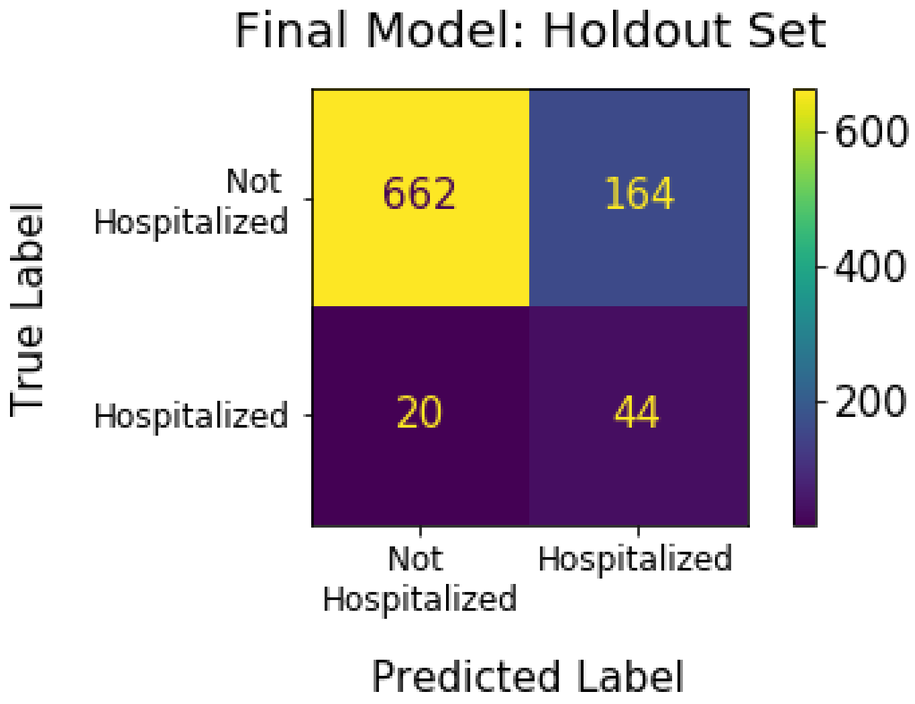


RANDOM FOREST

Recall / Sensitivity: 0.67
Precision / Specificity: 0.19



FINAL MODEL



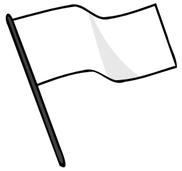
RECALL / SENSITIVITY: 0.69

PRECISION / SPECIFICITY: 0.21

- LOGISTIC REGRESSION
- BALANCED CLASS WEIGHTS
- FEATURES:
  - HEART CONDITIONS
  - CIRCULATORY CONDITIONS
  - RESPIRATORY CONDITIONS
  - NUMBER OF RX DRUGS
  - ARTHRITIS
  - CANCER
  - LIVER CONDITIONS
  - AGE
  - RACE

CONCLUSIONS AND FUTURE WORK

Model effectively flags patients at high risk for hospitalization



By closely managing these patients, ACOs can prevent hospitalizations and other adverse events

Decision tree-based models may perform better with more data, and merit further study

More data points (health information) about each participant may improve the model

THANK YOU

QUESTIONS?

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