EMR & Clinical Trials

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Data: Electronic Medical Records of 243,837 patients from Duke Health Systems (2007-2011)

❖ **Objectives**

1. Evaluate the effects of health coaching intervention on patients' health and future medical costs.

2. Help Accountable Care Organizations determine the probability that they can qualify for the Medicare Shared Savings program and their expected shared savings.
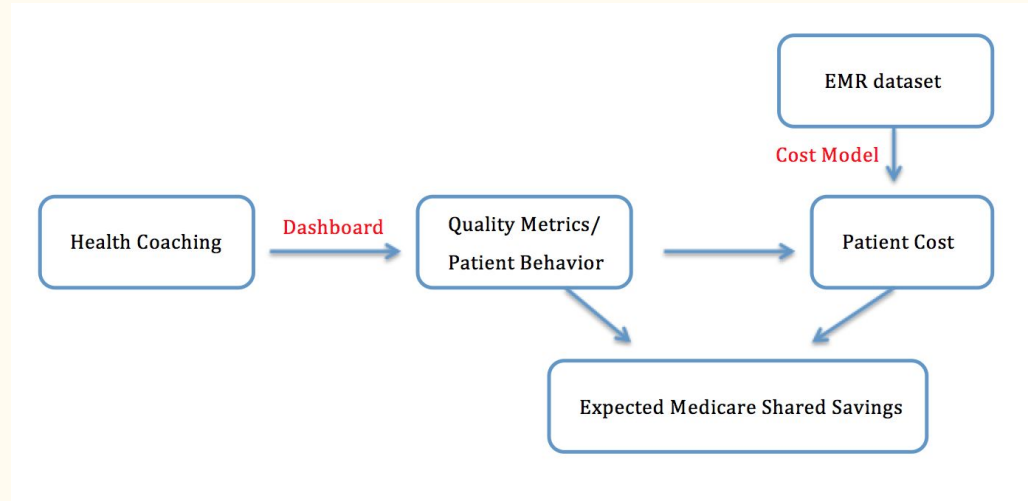

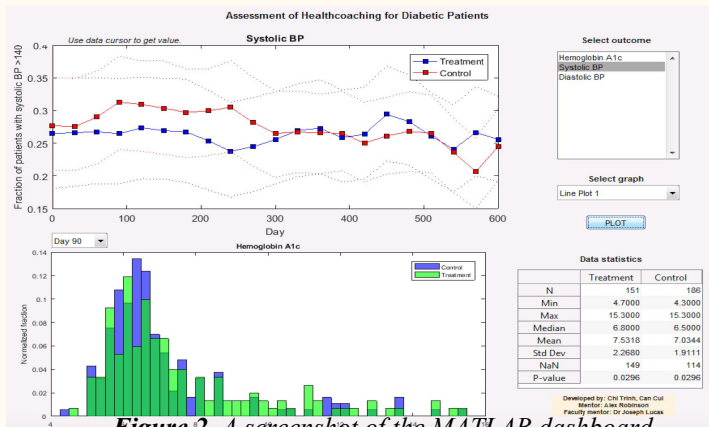***Figure 1:*** *A roadmap of the project*

Figure 2. *A screenshot of the MATLAB dashboard*

Figure 3. *Distribution of cost buckets in each HbA1c group*

❖ Effect of Coaching on Patient Health

We built a MATLAB GUI that can load, analyze and display information from the health coaching clinical trial. The difference in health quality metrics, such as hemoglobin A1c, blood pressure, eye exam, use of statin, etc., between patients in the treatment and control groups can be examined from a t-test statistic, changes in quality metrics over a year at 95% confidence bounds, and the estimated probability that treatment is better than control at different follow-ups.

❖ Effect of Quality on Cost

In order to examine the relationship between quality metrics and cost, we first computed each patient's annualized medical cost using the 2012 Physician Fee Schedule Relative Unit and classified patients into different cost buckets using quantiles. We also assigned patients into different quality metrics groups based on how they perform after a year. We attained a significant p-value from the chi-square test and observed some trends in the relationship between quality metrics and costs. Future work will further examine the causal effect of quality metrics on healthcare costs.
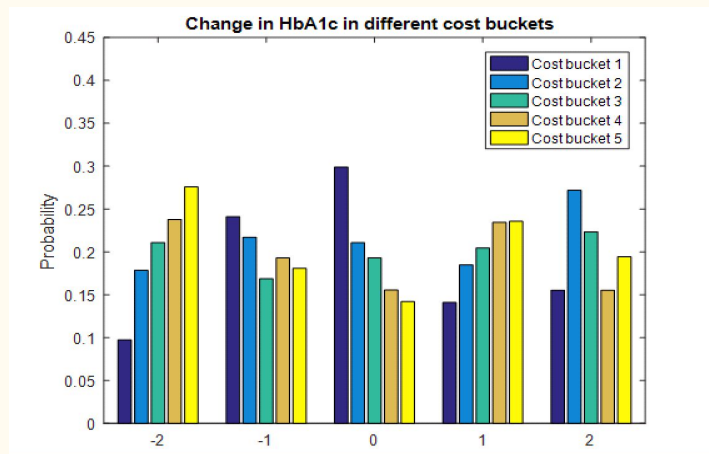
Figure 4. *Confusion matrix of cost model*

Figure 5. *Predicted cost vs actual cost in RVUs (2011)*

❖ Cost Prediction

We used an ensemble bagging algorithm to build a predictive model of healthcare costs for a sample of 1,963 patients diagnosed with diabetes in 2009. The model features include prior costs, quality metrics, and the factors from a non-negative matrix factorization of diagnosis, medication, and lab test codes. The model has a 5-fold cross-validated accuracy of 45.1%, with some patients in the middle cost buckets misclassified into their immediate neighboring buckets. The average predicted expenditure for 2011 is 283.59 RVUs--3% higher than the actual average expenditure.

❖ Summary

❏ An ACO can evaluate the effects of a health coaching program on patient health using the MATLAB GUI we developed.

❏ There is some relationship between quality metrics and costs, but more analysis needs to be done to understand whether this is a causal relationship, and in what direction.

❏ The cost model does a reasonable job of classifying patients into cost buckets and predicting annualized average cost; future work could exp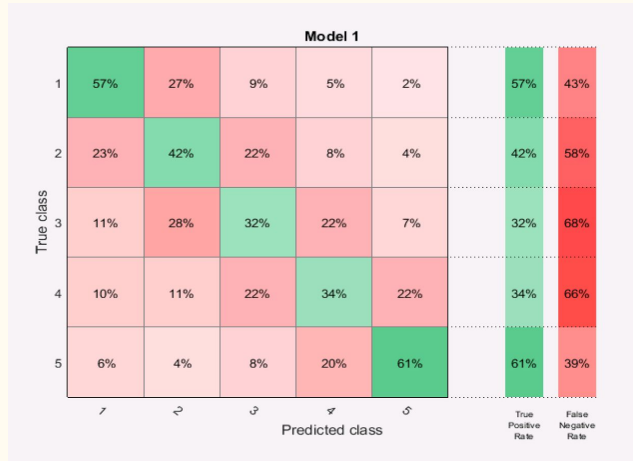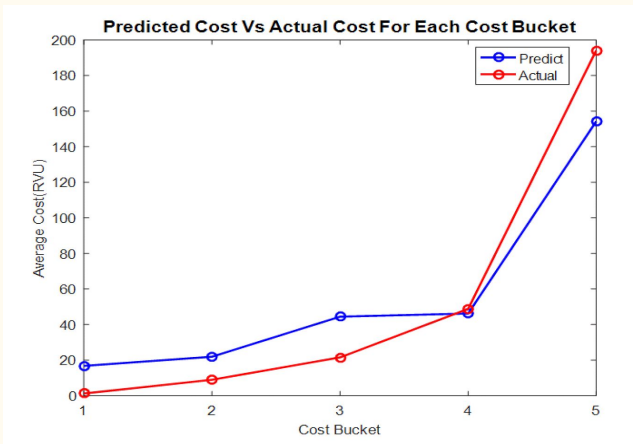lore ways to refine this model.