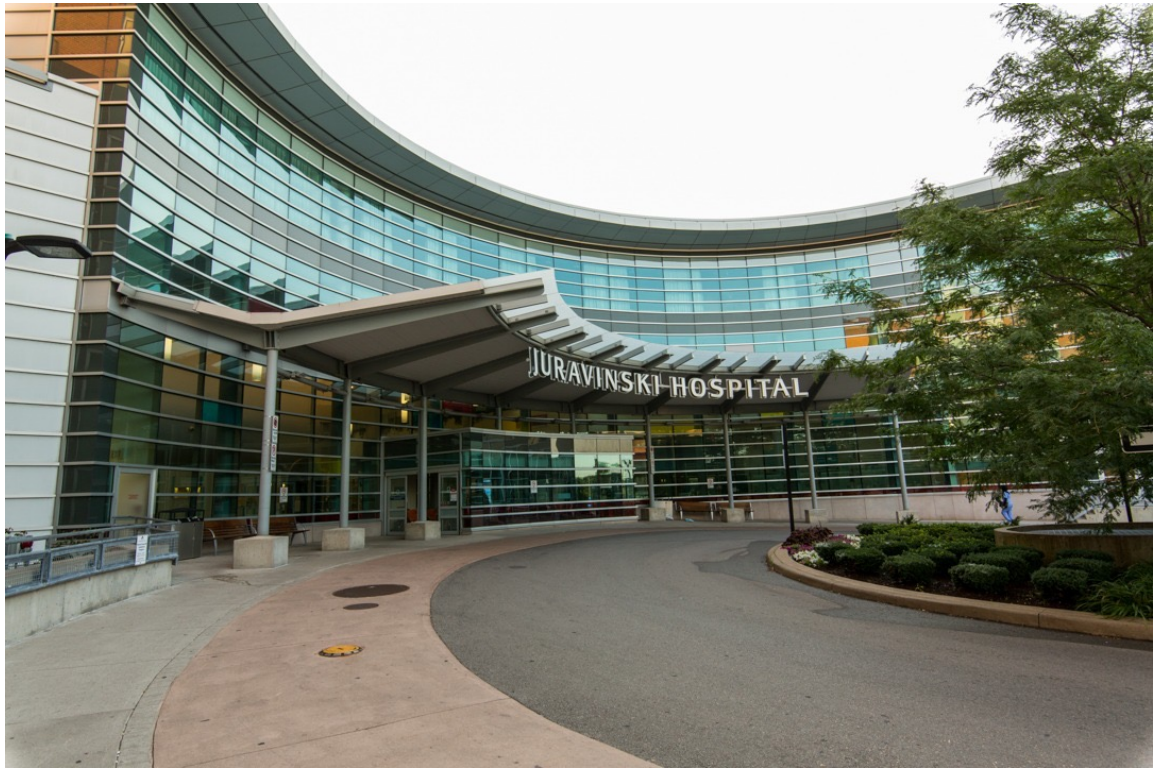

Picard Health Solutions

Michael Evans, Chris Griffiths, Nicholas Means Parker, Orgil Nyamaa, Caio Resende

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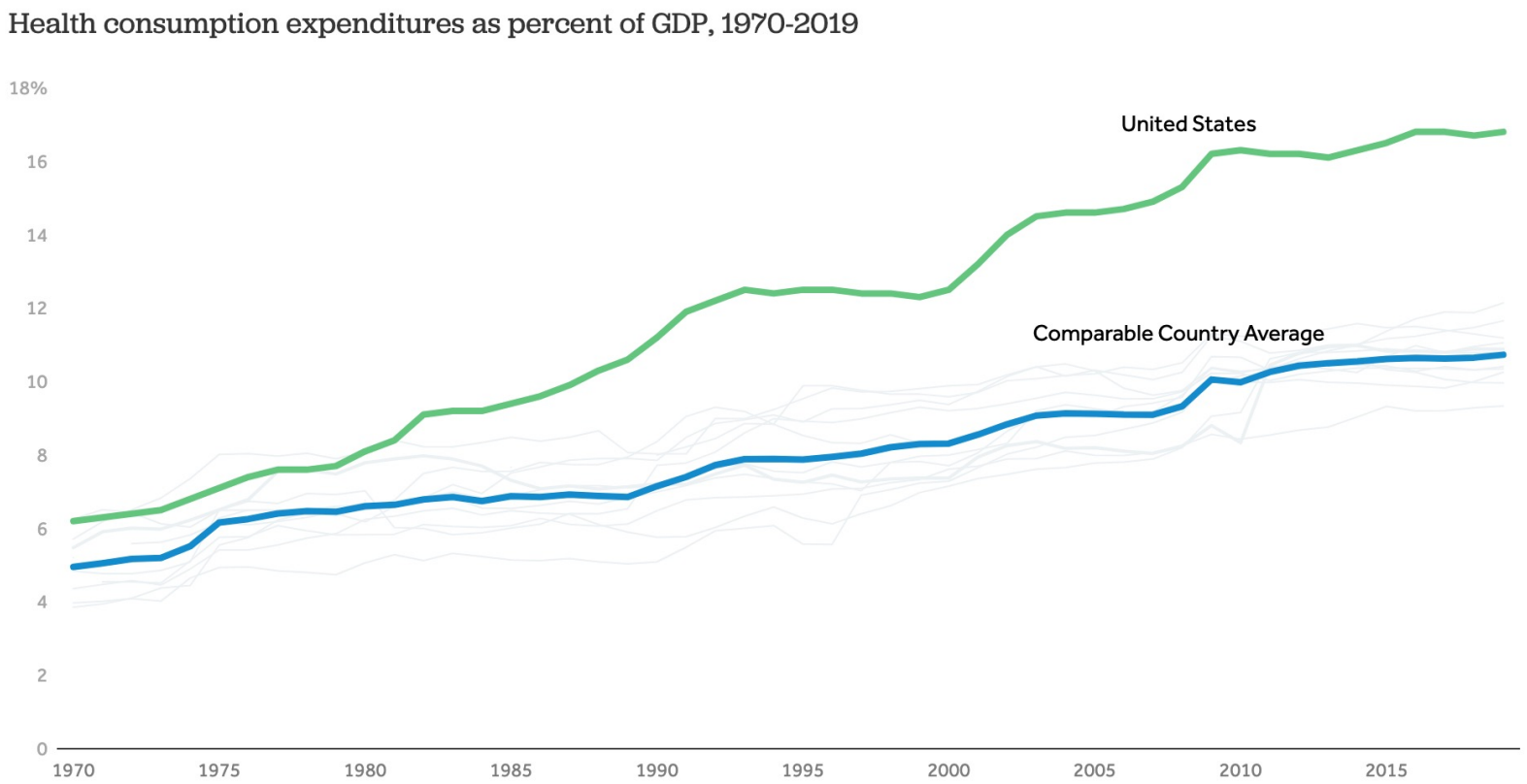
Healthcare expenditure in the United States represents ~17% of GDP and is climbing

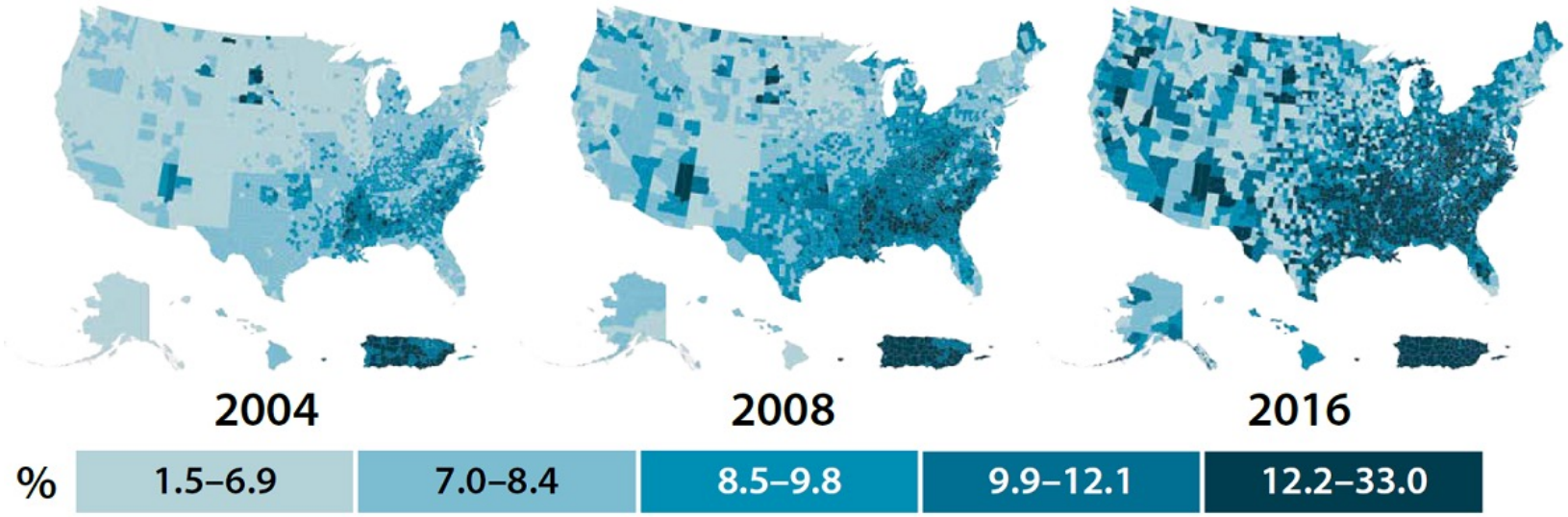


Kamal et al., 2020

Spending on healthcare is concentrated in hospitals, and on few patients with chronic conditions, such as diabetes

33% of healthcare spending is on hospitals

5% of population accounts for ***50%*** of healthcare expenditure in United States



Diabetes alone accounts for ***$90 billion*** annually

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Kim & Boye; CDC

Patients discharged from hospital who are readmitted within 30 days are considered treatment failures

Goals of treatment in hospital are to cure the current illness and get the patient home safely

Patients who are readmitted are said to have ”bounced back”

Readmitted patients have a high cost to the system

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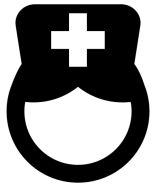
Kind et al.

If we can predict who is likely to “bounce back” to hospital, we can perform targeted interventions to prevent hospital readmissions and lower healthcare expenditure



The Camden Coalition has pioneered out of hospital interventions to keep patients with multiple admissions out of hospital using allied healthcare workers and emerging technology

Creating ***close follow up*** appointments with physicians in first two weeks after discharge could monitor for

Delaying discharge and ***keeping patients in hospital*** longer could allow for future bounce backs to “present themselves”

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We retrieved a dataset from VCU containing information around 107,000 hospitalizations for patients with Diabetes

Administrative Data	– Patient ID, encounter ID
Demographics	– Race, gender, age, weight
Admission and Discharge Data	– Admission source, discharge destination
Healthcare Use	– Number of inpatient, outpatient and emergency visits in last year
Hospital Stay	– Length of stay, procedures performed
Glucose Control	– HbA1C, max serum glucose
Medications	– 25 antihyperglycemic medications and whether patient is taking or had dose changed
Readmitted?	– No, <30 days or >30 days

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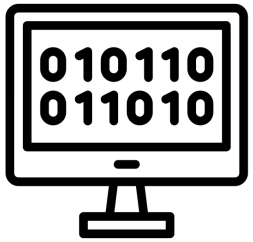
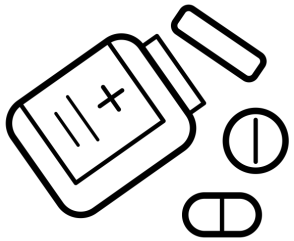
Strack et al.

After cleaning and reclassifying the data, we slightly modified some important variables



We reclassified our dependent variable to be binary, considering only readmissions within 30 days to be important



We pooled all medications into their respective classes

We determined how many diabetic medications each patient was taking

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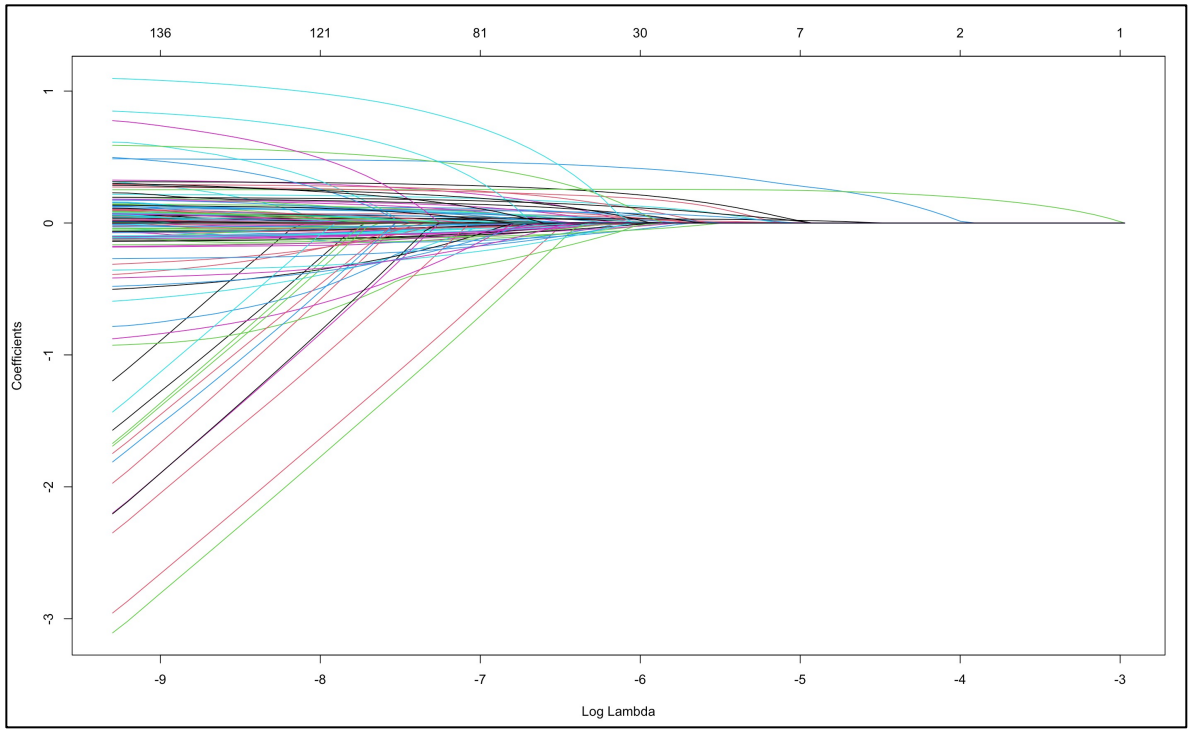
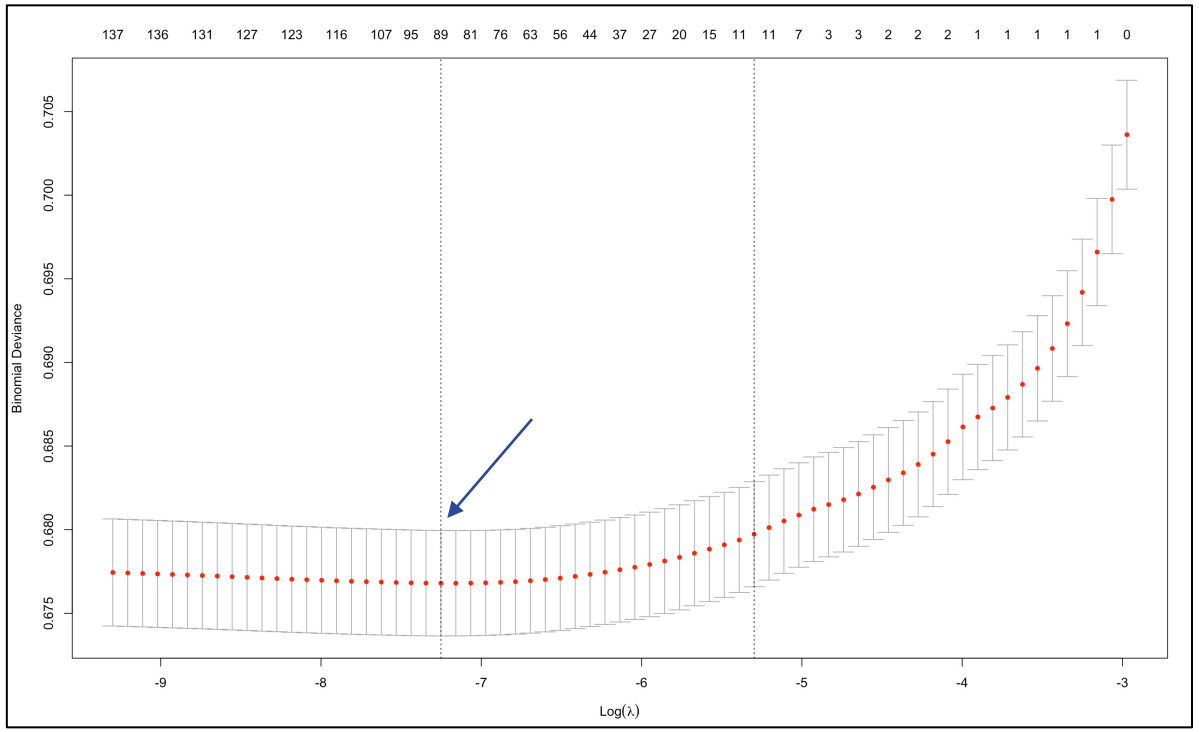
We used Lasso to narrow down our variables to those of greater importance, choosing fit over simplification





All variables are automatically entered into system therefore we chose a higher lambda with better fit rather than a simpler model

We ran our dataset through multiple regression models, changing hyperparameters, obtaining AUC's in the 60s

Model	***AUC***
CART	0.643
Lasso	0.625
XGBoost	0.635

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We sought to optimize the threshold of our model by examining the money spent according to each intervention, using multiple models

1	***Delay Discharge***	*Average cost of admission*	$2,300
2	***Physician Follow Up***	*Two physician appointments*	$750
3	***Allied Health Follow Up***	*One physician appointment* *Four nursing visits*	$1,000

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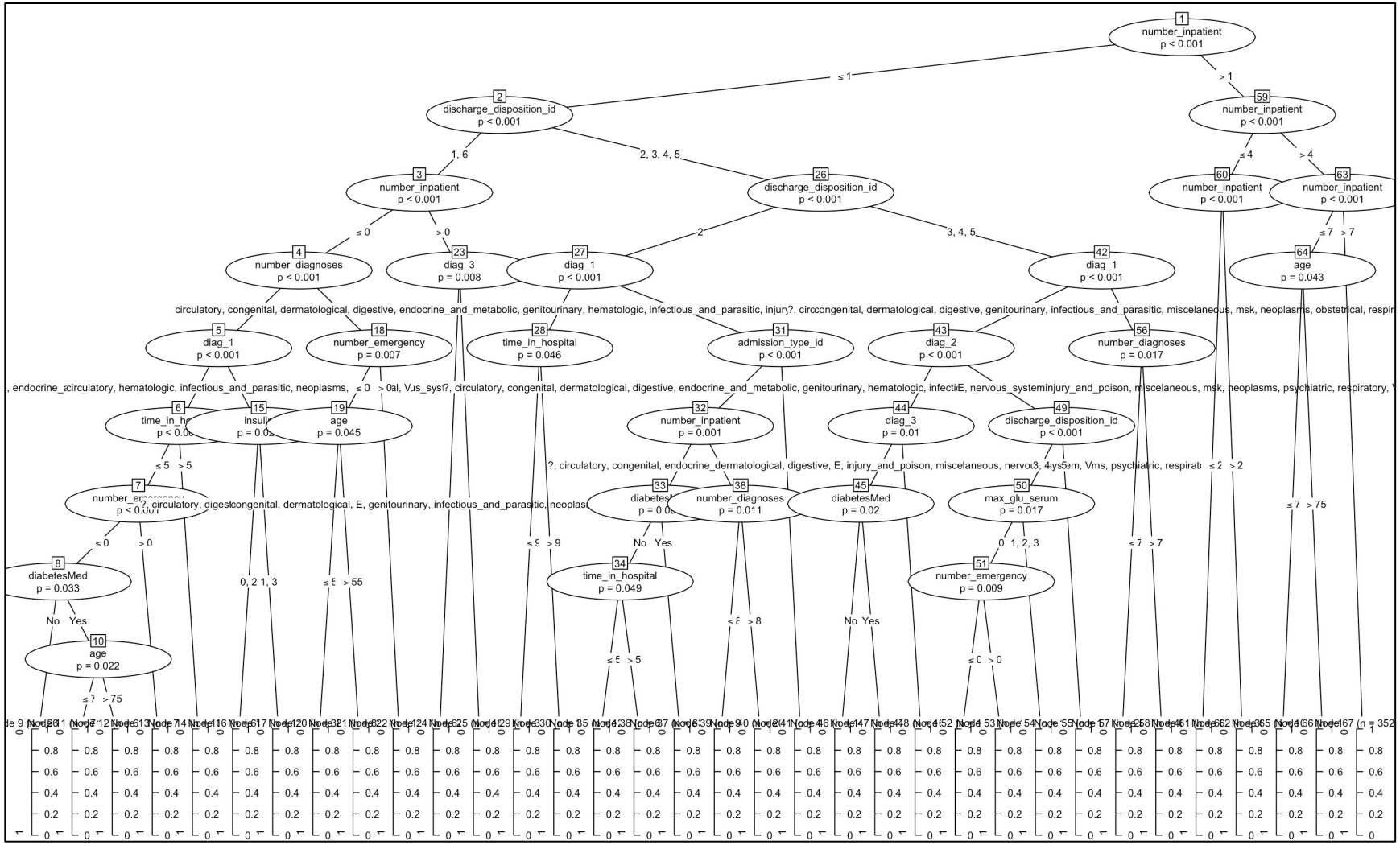
Pfunter et al., Finkelstein et al.

Running each model, we found optimal savings with CART



Recent hospitalization

Discharged home?

Diagnosis

Diabetic Control

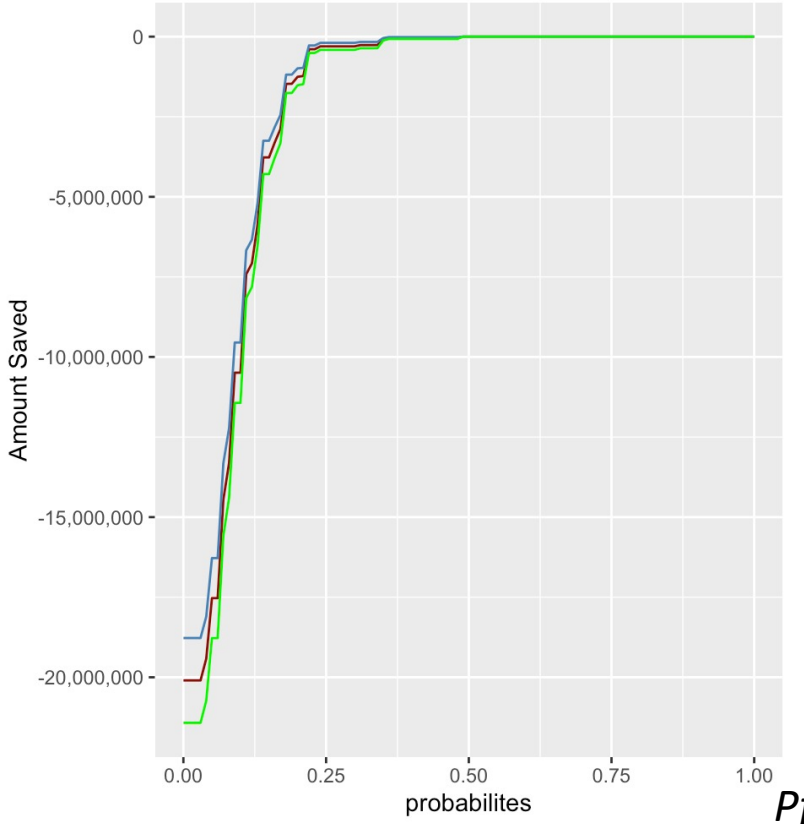
With a cost of readmission of $12,200, we find that keeping patients admitted an extra day is not cost effective

Keep the patient in hospital one extra day

Cost = $2,300

Efficacy = 25% (+/- 10%)

		Actual	
		Not Readmitted	*Readmitted*
Predicted	*Not Readmitted*	$0	$12,200
	Readmitted	$2,300	$11,450



Optimal situation has us saving zero dollars, when we do not intervene at all

To save money, this intervention would need to prevent >75% of readmissions

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Pfunter et al.

With a cost of readmission of $12,200, we estimate savings of $945,600 per 10,000 patients with extra physician follow up

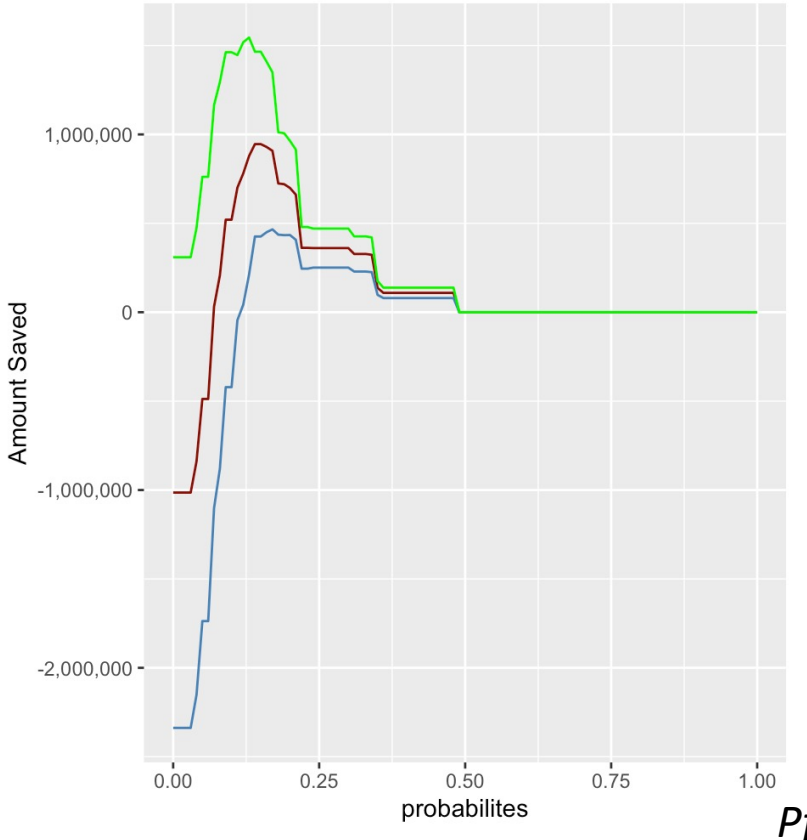
Arrange for two extra clinic visits

Cost = $750

Efficacy = 50% (+/- 10%)

		Actual	
		Not Readmitted	*Readmitted*
Predicted	*Not Readmitted*	$0	$12,200
	Readmitted	$750	$6,850

Optimal situation at threshold of 15.5%, saving $0.46M - $1.54M per 10,000 patients



Pfunter et al.

With a cost of readmission of $12,200, we estimate savings between $1.17M per 10,000 patients with multidisciplinary approach

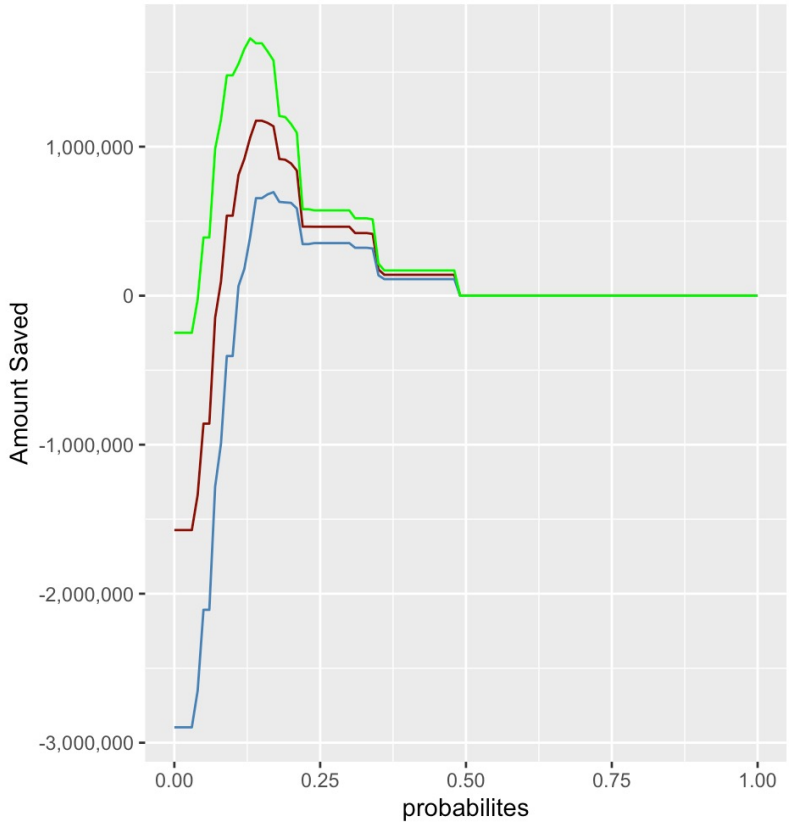
Have allied healthcare workers follow at home

Cost = $1,000

Efficacy = 65% (+/- 10%)

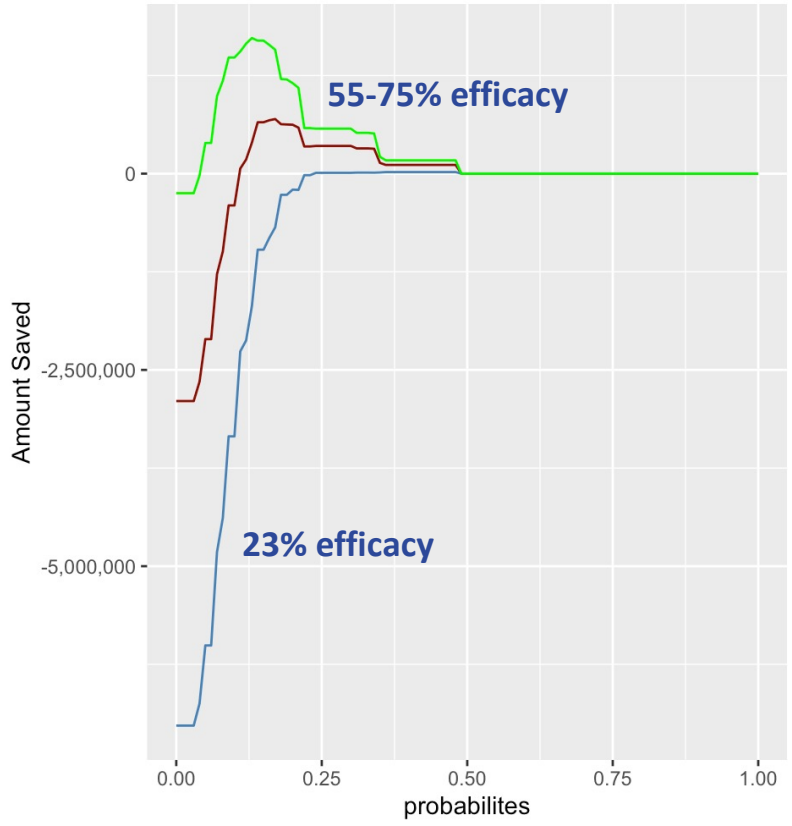
		Actual	
		Not Readmitted	*Readmitted*
Predicted	*Not Readmitted*	$0	$12,200
	Readmitted	$1,000	$5,270

Optimal situation at threshold of 15.5%, saving $0.70M - $1.72M per 10,000 patients



Pfunter et al.

With 6.4 million diabetic patients admitted each year, we estimate annual savings of $750M USD on healthcare expenditure using our CART model and a multidisciplinary intervention



Based on preventing readmissions in between 55% and 75% of patients, we predict savings between ***$448M - $1,101M***

At $1,000 per intervention, we would need to ***prevent one in four*** patients from being readmitted to break even

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Moving forward, we will integrate our algorithm into Epic, expand our analytics to more chronic diseases and improve our interventions

Operationalize our algorithm into discharge orders on common EMR platforms

Create models for other chronic diseases, like heart disease and cancer

Validate and improve cost effectiveness of intervention

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