Predicting Disposition for Pediatric Asthma Patients

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- Mark Grum, IOE MS
- Brooke Szymanski, Nursing
- Stephanie See, BSN

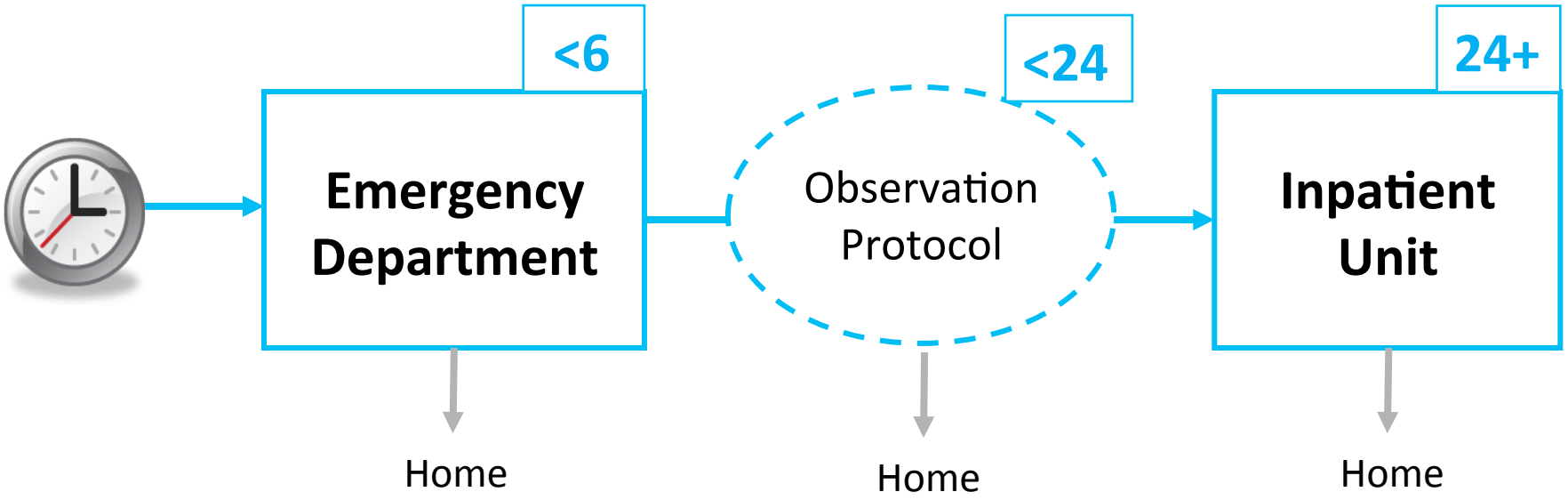
Agenda

- Background
- Data
- Preliminary Results
- Continuing Work
- Implications

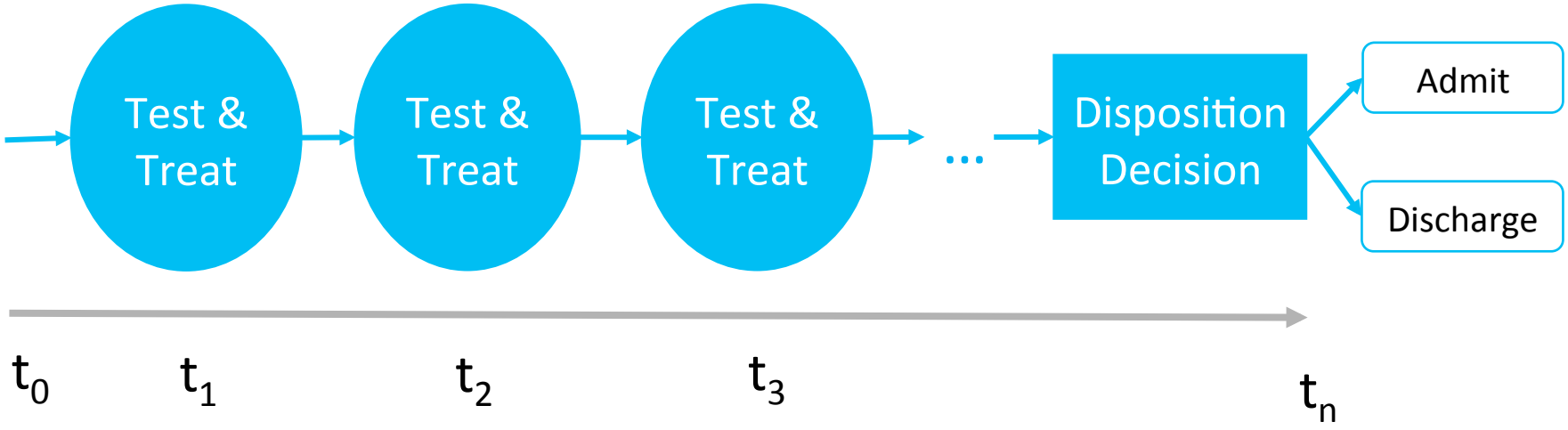
U of M Mott Children's Hospital

- Part of the University of Michigan Health System
- Brand new facility
- 350 Beds
- 28 Emergency Department beds

U of M Mott Children's Hospital



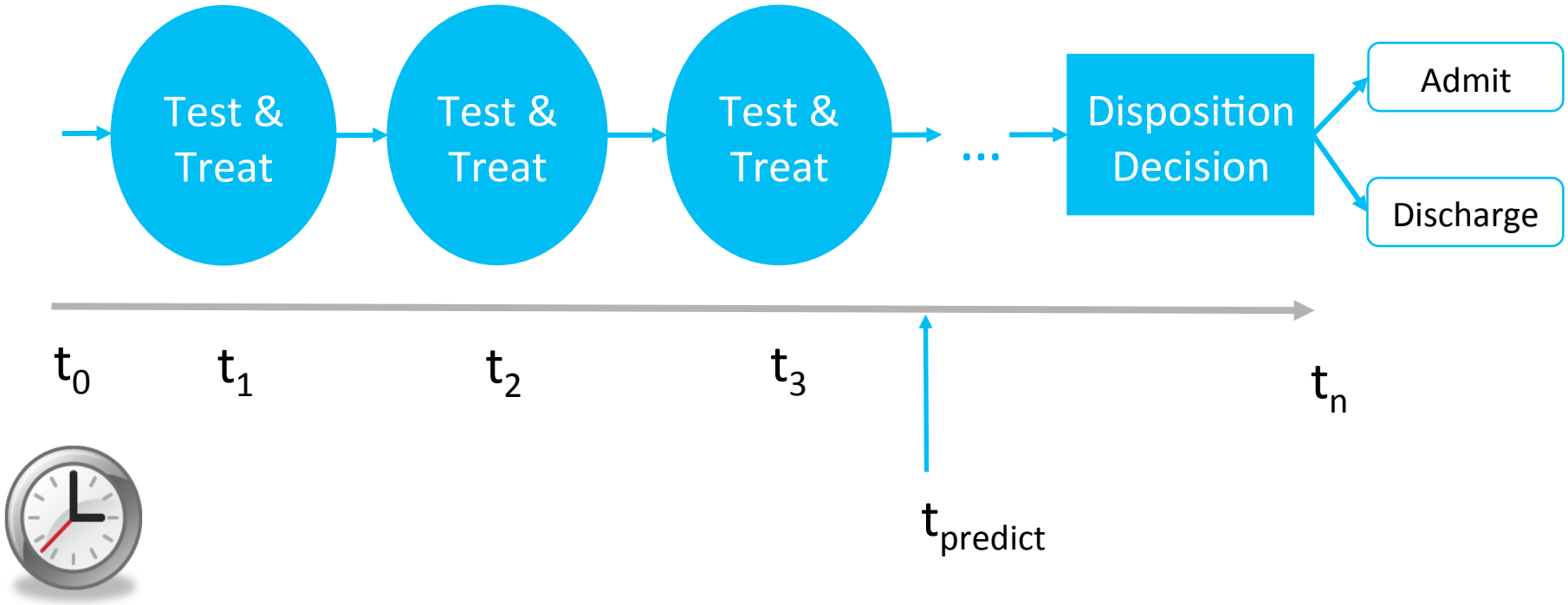
Emergency Department



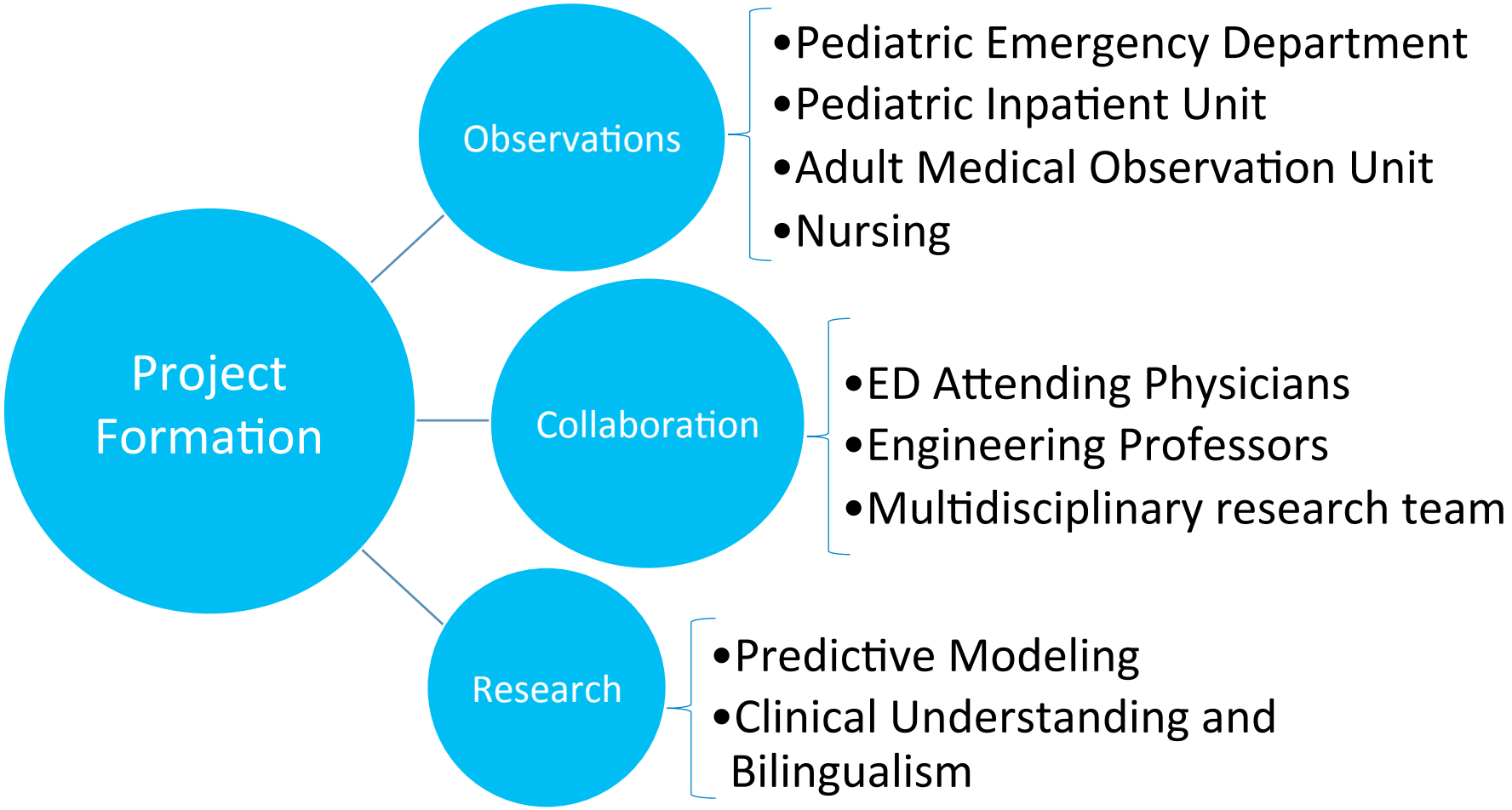
Project Motivation

- Difficult to make disposition decisions
- Ramifications of incorrect decisions
  - ED Readmits
  - Inappropriate admissions
- Mobilization of resources
  - Many levels of coordination in the hospital system
  - Long length of stays

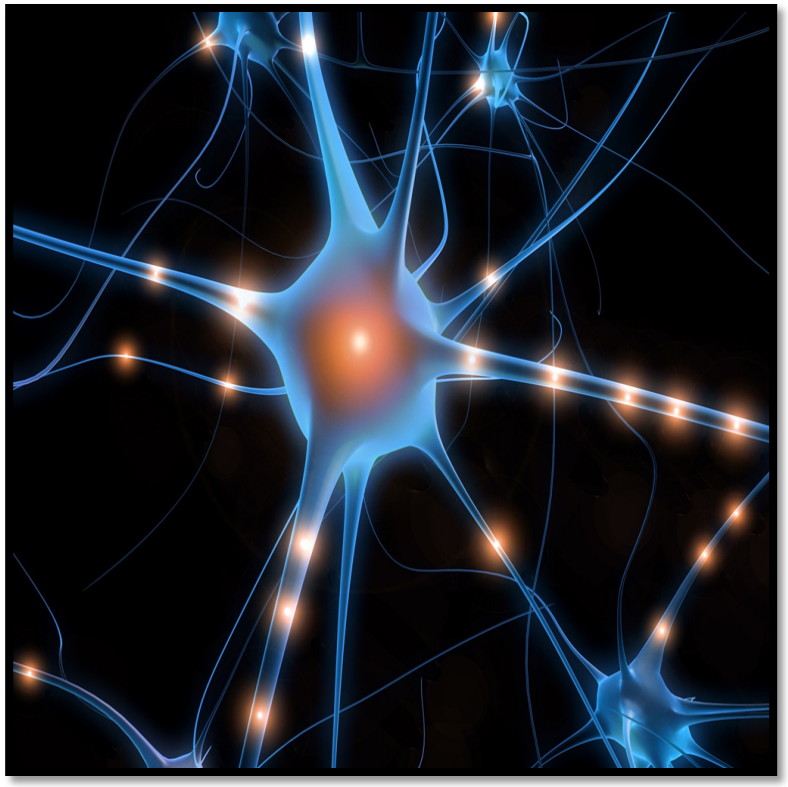
Objective and Approach



Method of Development



Approach: Neural Networks

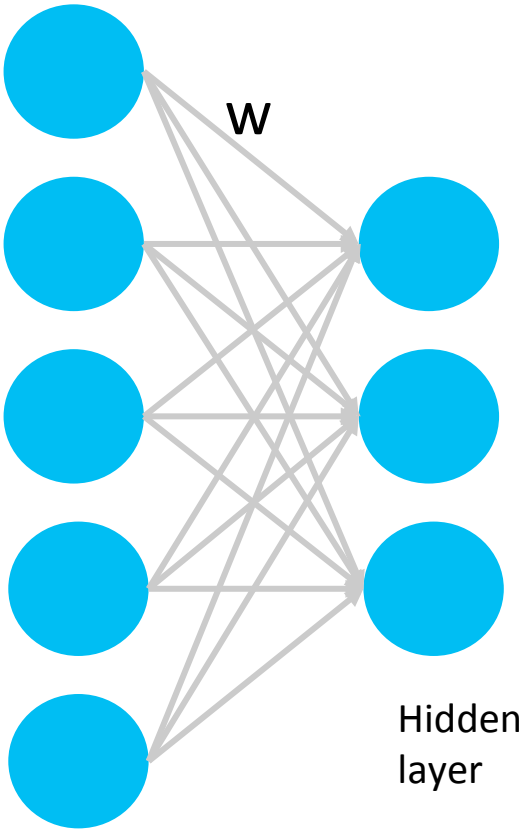


- Supervised Machine Learning
- Mathematical way to model how our brain learns
  - Neuron
  - Synapses
- Captures and represents complex nonlinear relationships

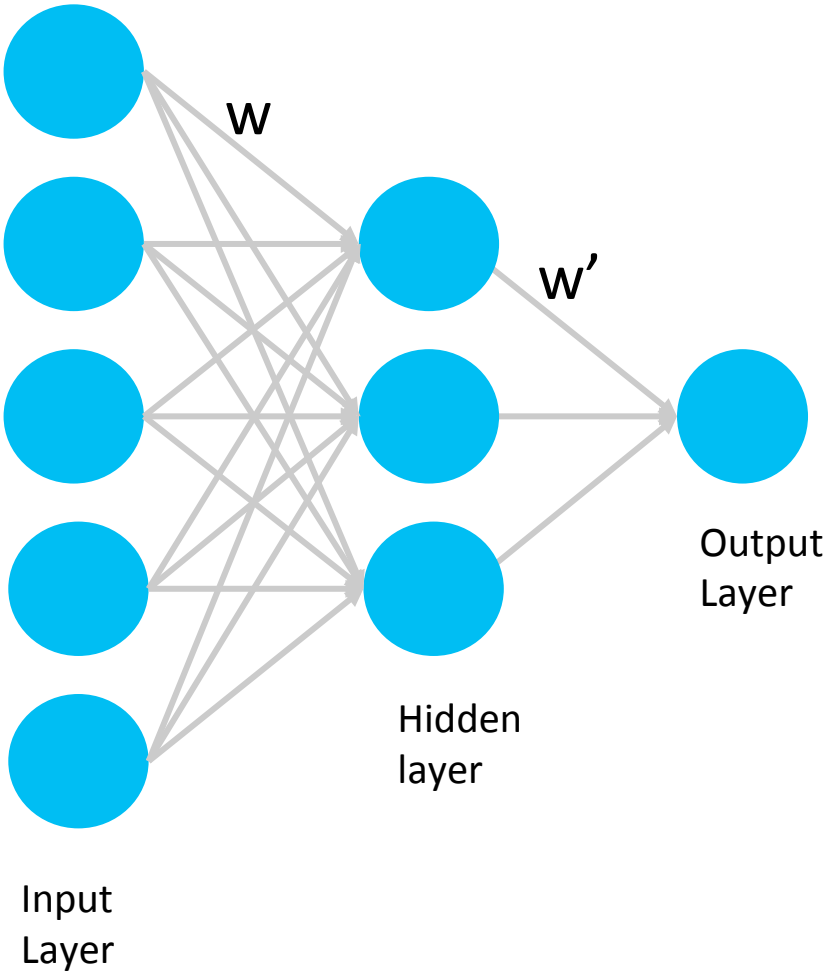
Neural Networks

Input
Layer

Neural Networks



Neural Networks



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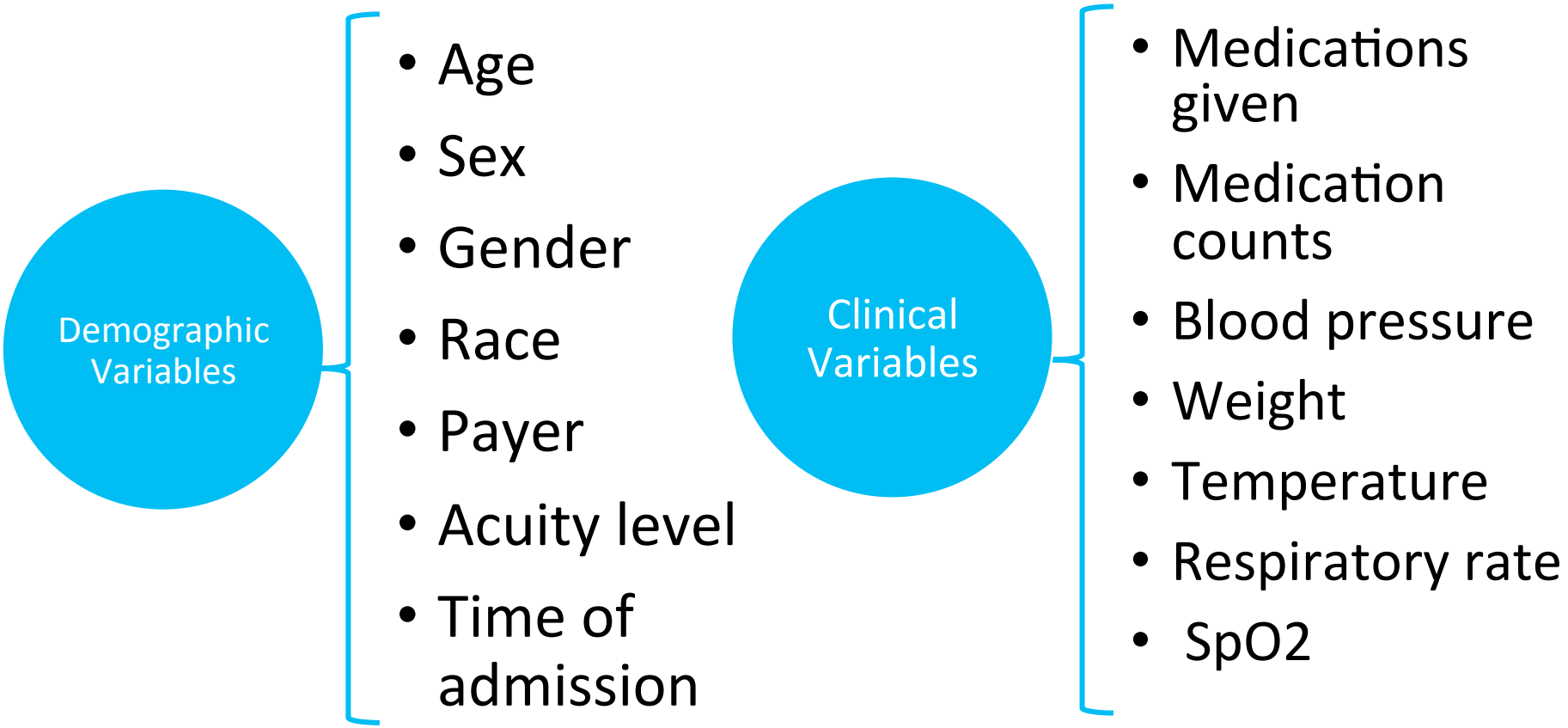
Data Source

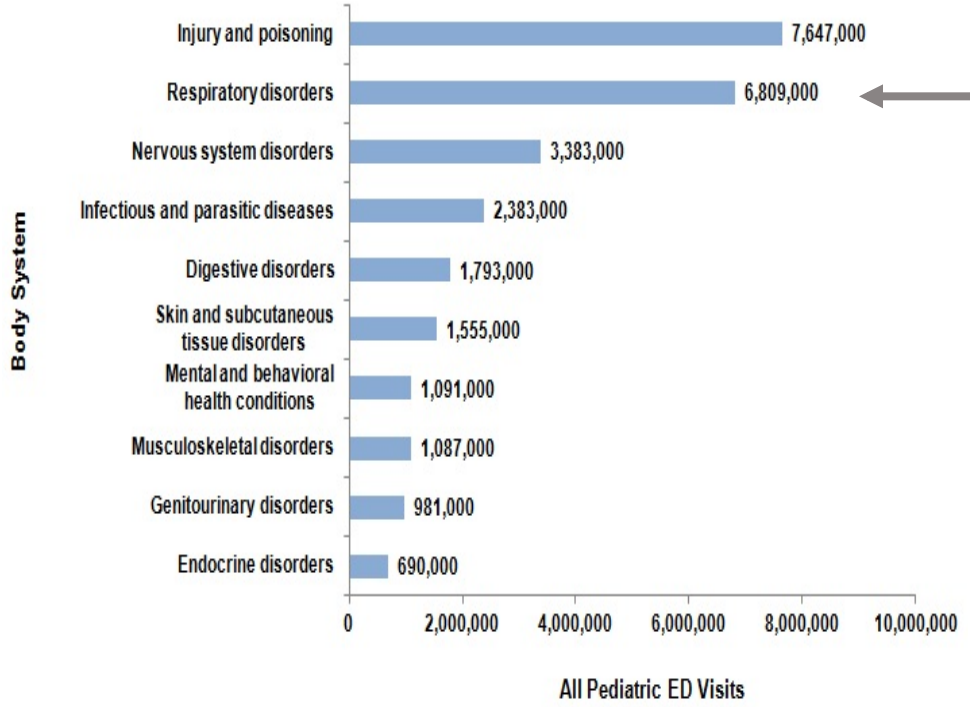
- C.S. Mott Children's Hospital ED
- Electronic Medical Record - MiChart (EPIC)
- June 2012-March 2013
- 18,000 cases

Data Variables



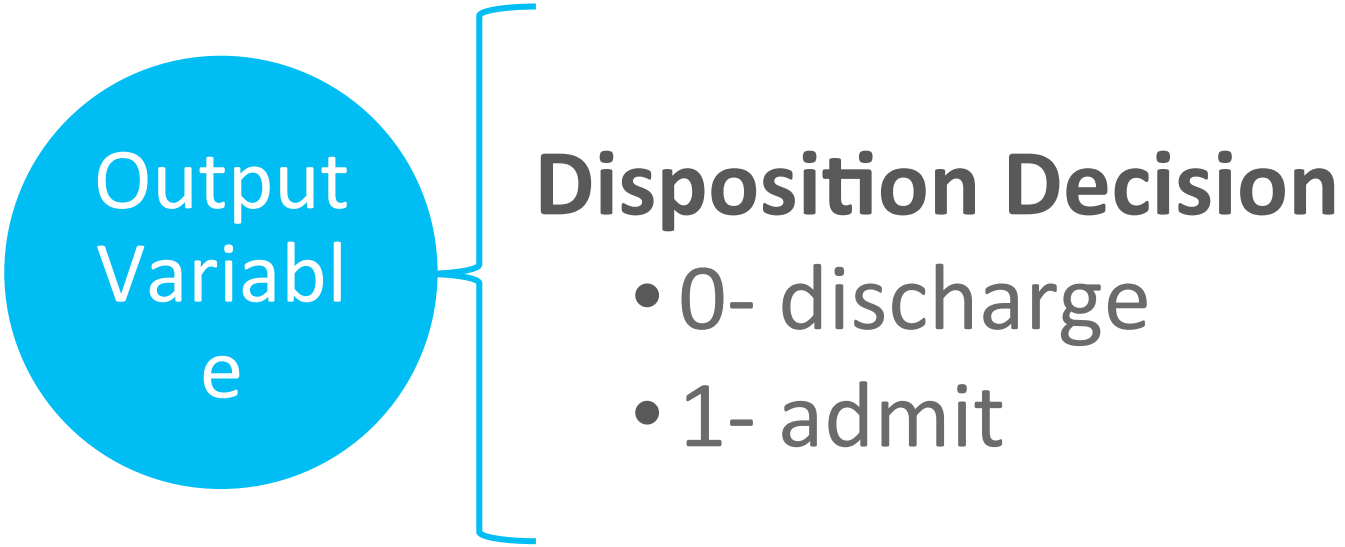
Population Selection

- Comparatively simple testing and treatments



Second leading cause of all pediatric ED visits

Data Variables



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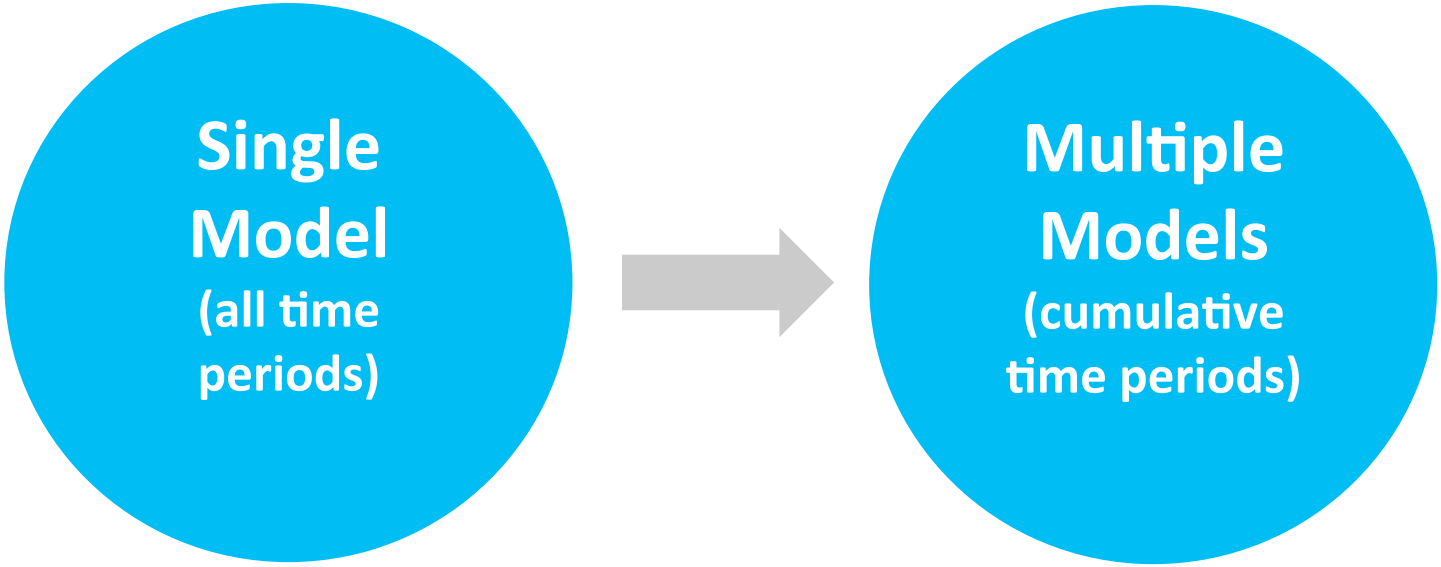
Preliminary Results

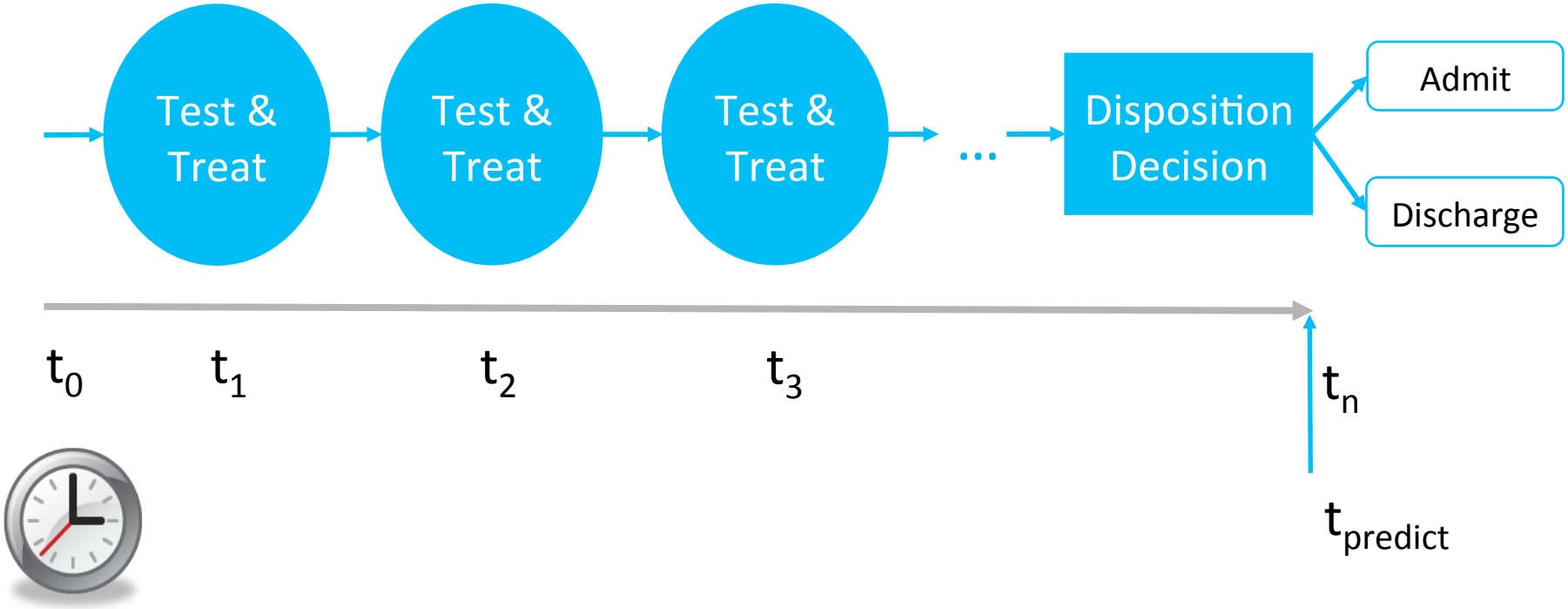


Preliminary Results: Single Model
(All Time Periods)

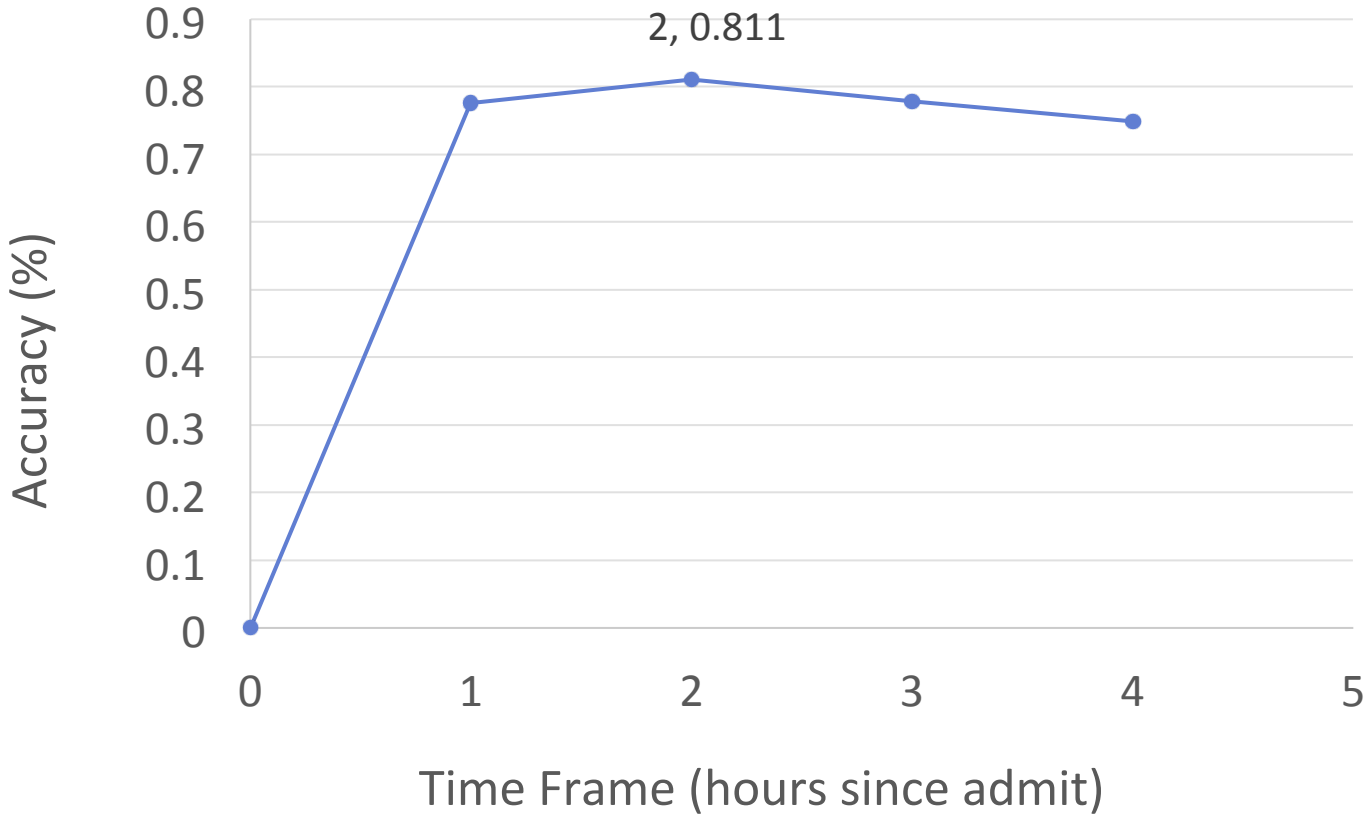
		Actual Disposition		
		discharge	admit	
NN Disposition	discharge	**89%**	17%	164
	admit	21%	**61%**	77
		152	89	

Actual Disposition 83% accuracy

Multiple Model Approach



Preliminary Results: Multiple Models
(Cumulative Time Frames)



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Continuing Work

- Better designed feature space
- More data
- Validate with different methods:
  - SVM
  - Regularized Logistic Regression, significant variables
- Analysis on “Corrected” Disposition
- Predict Length of Stay (LOS) as output:
  - Better aid to disposition decision ~ observation unit candidates
- Expanding to include other patient populations

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Implications

- Earlier disposition prediction = earlier mobilization of resources
  - Patients that should go home will **go some sooner** and **free up beds** for other patients in need
  - Very **sick patients will get treatment** at the appropriate level of care faster
- Accurate prediction of disposition can result in better patient outcomes
  - Fewer readmissions
  - Fewer inappropriate admissions

Acknowledgment

- Center for Healthcare Engineering and Patient Safety (CHEPS)
- C.S Mott Children's Hospital
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- The U of M Center for Research on Learning and Teaching (CRLT)
- The TDC Foundation

CHEPS and the HEPS Master's Program

- **CHEPS:** The Center for Healthcare Engineering and Patient Safety
- **HEPS:** Industrial and Operations Engineering (IOE) Master's Concentration in Healthcare Engineering and Patient Safety offered by CHEPS
- CHEPS and HEPS offer unique multidisciplinary teams from engineering, medicine, public health, nursing, and more collaborating with healthcare professionals to better provide and care for patients
- For more information, contact Amy Cohn at amycohn@umich.edu or visit the CHEPS website at: https://www.cheps.engin.umich.edu

Questions

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