Patient Flow at C.S. Mott Children's Hospital

CENTER FOR HEALTHCARE ENGINEERING & PATIENT SAFETY UNIVERSITY OF MICHIGAN

Mark Grum[1], Hassan Abbas[2], Prof. Amy Cohn[1], Dr. Michelle Macy[3], Dr. Allison Cator[3]

1. Industrial and Operations Engineering , 2. School of Nursing 3. Emergency Medicine at Mott Children's Hospital

Website: www.cheps.engin.umich.edu

@UofMCHEPS

Motivation

- Emergency departments (ED) and inpatient units (IU) are complex, interacting systems
- Understanding how these systems work or interact can improve patient care
- **Goal:** Improve quality of care delivery and help patients and their families understand hospital processes
- **Approach:** Incorporating clinician involvement, collecting data through observations and analyzing our findings

Visualization

Objective:

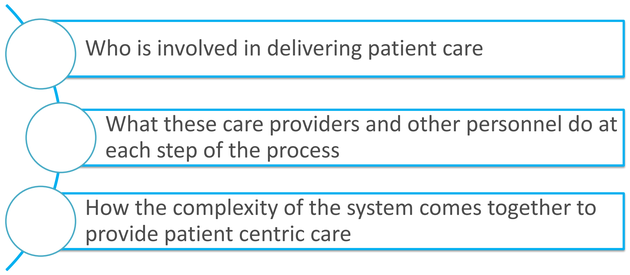
- Build an interactive map for those involved (patients, doctors, nurses, etc.) in ED and IU processes

Methods:

- Creating this flow chart involved over ***100*** hours of clinical observations to comprehend the following perspectives:
  - Attending Physicians
  - Resident Physicians
  - Nurses
  - Patients

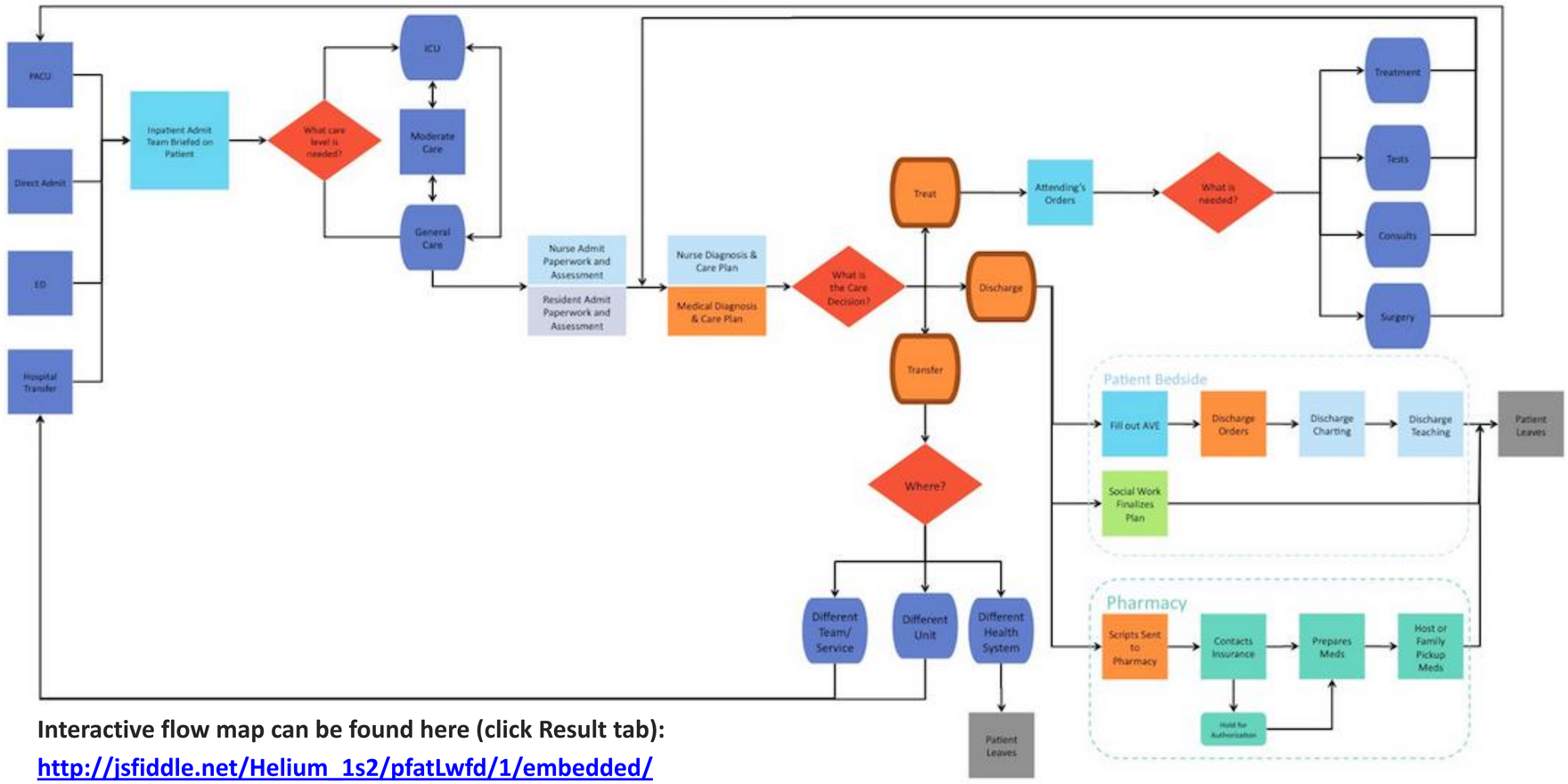
Implications:

- Educate patients, families, and providers on the following key concepts to facilitate care delivery for all stakeholders



Extensions:

- Creating an ED flow map will benefit those involved and help identify key differences between inpatient units and the ED



Interactive flow map can be found here (click Result tab):

http://jsfiddle.net/Helium_1s2/pfatLwfd/1/embedded/

Predictive Modeling

Objective:

- Create a tool to aid physicians in predicting disposition early to enable better resource planning

Methods:

- Used neural networks and a support vector machine to predict clinical outputs
  - We use 70% of our data for training, 15% for validation, and 15% for testing

Results:

NN Disposition

ED Dispo.	discharge	admit	
discharge	**83%**	17%	164
admit	21%	**79%**	77
	152	89	

NN: 81.74% accuracy

SVM Disposition

ED Dispo.	discharge	admit	
discharge	**91%**	9%	164
admit	47%	**53%**	77
	186	55	

SVM: 82.32% accuracy

Simulation

Objective:

- Determine whether (or not) an observation unit will benefit Mott, and if so, how to operate it

Methods:

- Analyze service level data, using the mean, standard deviation, and probability distribution of arrival waiting times and treatment processes
- Simulate in ProModel and Matlab using our analyzed data to replicate the current state and evaluate the appropriateness of an observation unit

Future Work:

- Compare the benefits and costs to determine if the observation unit would give value to patients, doctors, and nurses
- Fit service and arrival distributions
- Finish coding simulation
- Sensitivity analysis

We acknowledge the support and contribution of the following organizations: C.S Mott Children's Hospital , The Bonder Foundation, The U of M Center for Research on Learning and Teaching (CRLT), and The TDC Foundation.

We would also like to thank our team for all their work on this project: Gabriel Zayas-Caban, Elizabeth Olin, Vanessa Morales, Stephanie See, Thomas Cohn, and Joseph East.