Prioritization Support Tools for Emergency Triage

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The ESI and Central Problem

Emergency Severity Index
- Five defined levels of condition severity and potential resource usage
- Should not depend on the conditions of other concurrent patients or on overall hospital resources
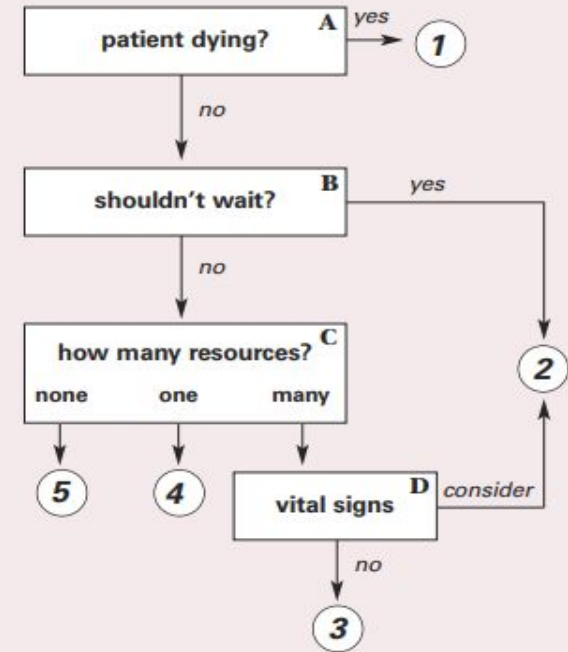
CDC 2009 Data:
- 35% of those who died received a rating between 3 and 5
- 187/534 people

Johns Hopkins Data:
- Elderly patients more likely to be under-triaged

Figure 2-1. Emergency Severity Index Conceptual Algorithm, v. 4

patient dying? **A** yes → (1)

no

shouldn't wait? **B** yes

no

how many resources? **C**

none   one   many

(5)   (4)   vital signs **D** consider

(2)

no

(3)

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2

Our Models

NHAMCS Data
~24,000 valid cases per year

Predictors:
- Age
- Sex
- Temperature
- Pulse
- Systolic blood pressure
- Respiration rate
- Oxygen saturation
- Mode of arrival (e.g. Ambulance)
- Chief complaints: Abdominal Pain, Chest Pain, Fever, Nausea, etc.

Critical Indicators:
- Death, **or**
- Admitted to ICU, **or**
- Admitted to operating room, **or**
- Admitted to cardiac catheterization suite

Priority Rating:
Based on the probability of the binary outcome, we can make a recommendation for ESI rating for each individual.

MVP – What are we doing differently?

- Using deep learning for better performance of models
- Creating an API that can be used by any EMR application
- API visualizations for deep learning conclusions
- Provide information to support decision-making by triage nurses

Service REST API Details
- Receives Predictors in JSON format
  - Target Protocol: FHIR standard
- Interacts with the model to generate all output
- Using OpenSSL for encryption
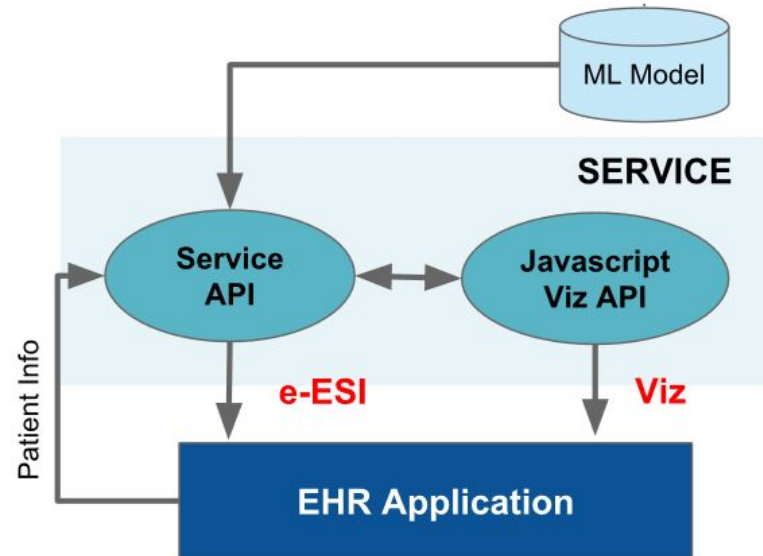
Progress

- Downloaded additional CDC files
  - 2009-2015 (different formats)
  - ~126,000 records
- Met with ex IT director for an ED physician group (MIDS alumni)
  - Developed additional EDA viz
  - Potential product validation: ED medical directors
- Researched similar products and industry standards
  - Qventus optimizes hospital operations and flow
  - E-triage utilized at Johns Hopkins Medical
  - Legal liability (similar to IBM Watson)
- Designed further API
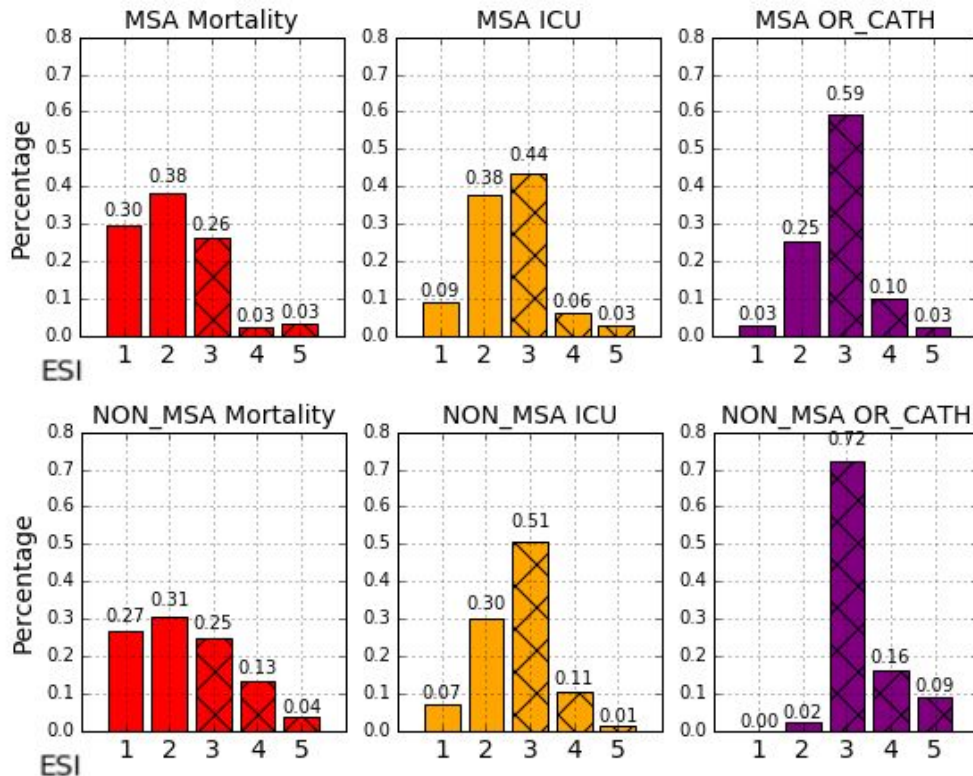
Moving Forward

Week 8-9
- Construct neural network model
- Develop initial visualizations for model decision-making
- Develop Flask service

Week 10-11
- Implement newer models with Flask service
- Revise visualizations
- Product Validation with ED medical personnel

Week 12-13
- Implement modifications based on user's feedback