Prioritization Support Tools for Emergency Triage

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Background

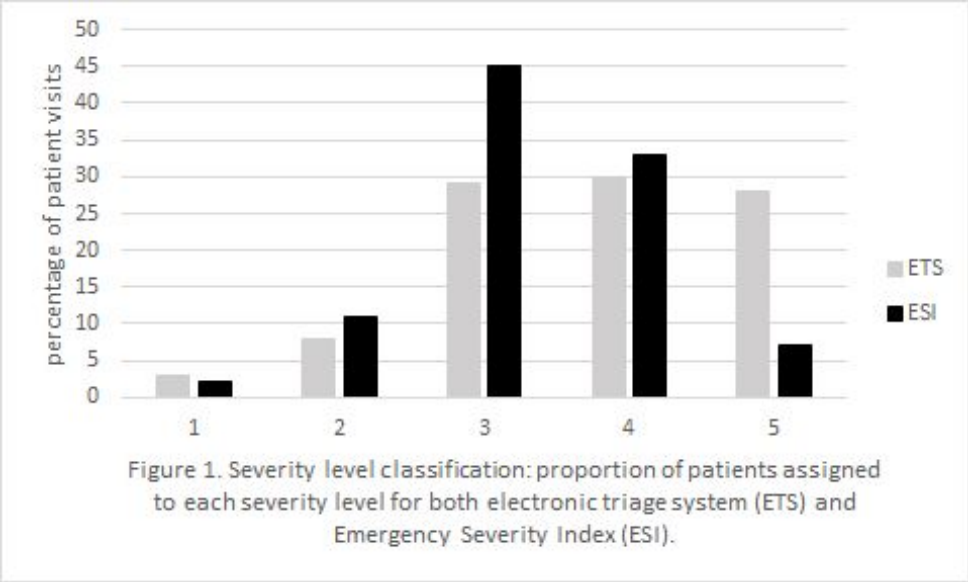


Figure 1. Severity level classification: proportion of patients assigned to each severity level for both electronic triage system (ETS) and Emergency Severity Index (ESI).

Dugas et al., “An Electronic Emergency Triage System to Improve Patient Distribution by Critical Outcomes”, The Journal of Emergency Medicine. Vol. 50, No. 6. Pp.910-918, 2016.

- The Emergency Severity Index (ESI) is a five-level emergency department triage heuristic
  - 1 is the most urgent, 5 is the least urgent
  - Rating based on severity health problems and anticipated number of resources needed to treat
  - “Resources” encompasses any interventions or diagnostic tools beyond a physical examination
- Subjective placement results in overutilization of middle rating

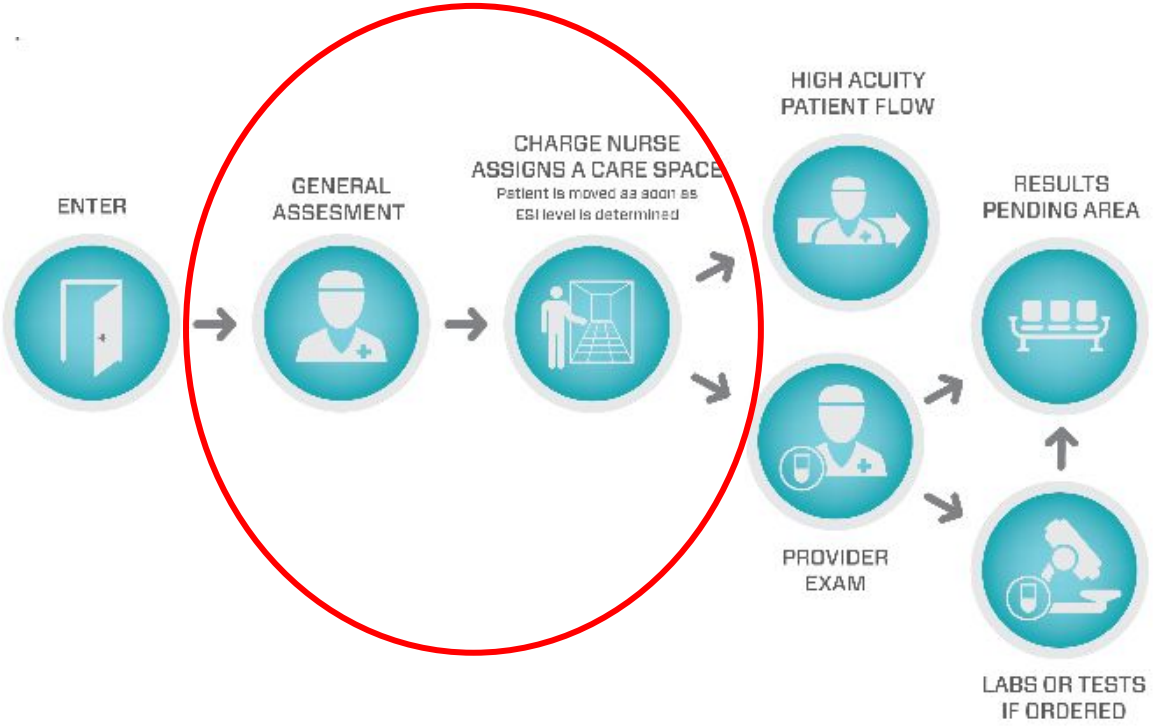
Existing Research Samples

- Dugas et al., “An Electronic Emergency Triage System to Improve Patient Distribution by Critical Outcomes”, 2016.

- Levin et al., “Machine-Learning-Based Electronic Triage More Accurately Differentiates Patients With Respect to Clinical Outcomes Compared with the Emergency Severity Index”, 2017.

- Rajkomar et al., “Scalable and Accurate Deep Learning for Electronic Health Records”, 2018.

Current state



Triage nurse uses gross patient state to make a determination

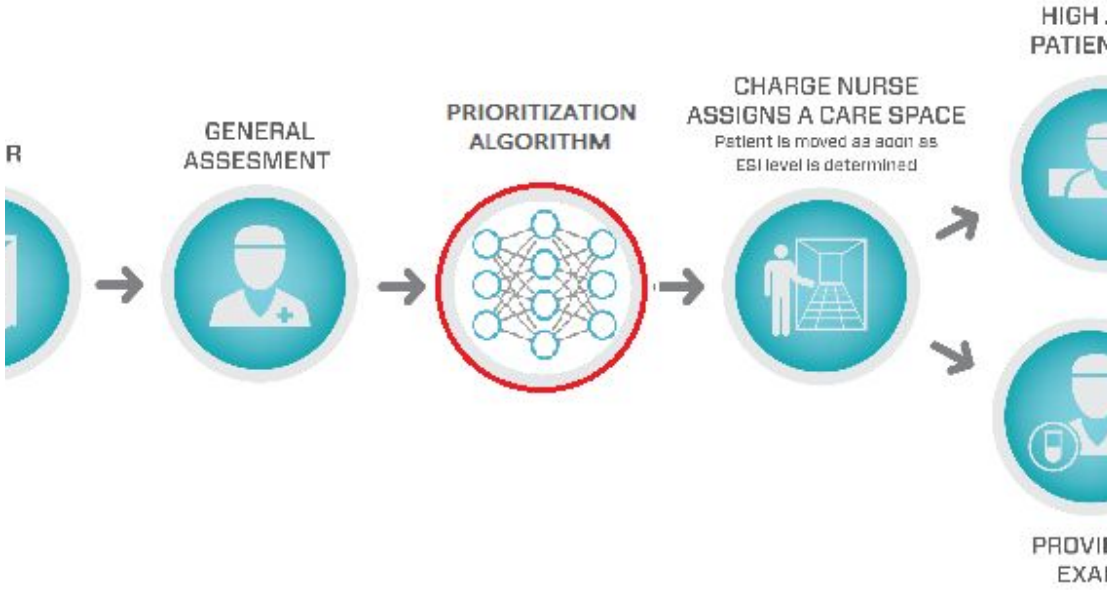
Patient is then routed to appropriate care based on ESI rating

ESI rating is correlated to the wait time the patient experiences

Miscategorized urgent or emergent patients may experience slow service, thus impacting outcomes

Miscategorized non-urgent patients take up limited resources

Proposed approach



Introduce a prioritization algorithm that makes use of the general assessment and previous outcome data to provide a more effective rating

Triage nurse would receive this assessment in real-time and the rationale behind it

Nurse would then assign a rating to the patient

Process would continue as usual

Process

Initial data processing

- Extract vital signs and demographic information
- Normalize Chief Complaint

Optimize for outcome

- Composite metric that indicate likely outcome based on training disposition.
- Calculate AUC and optimize

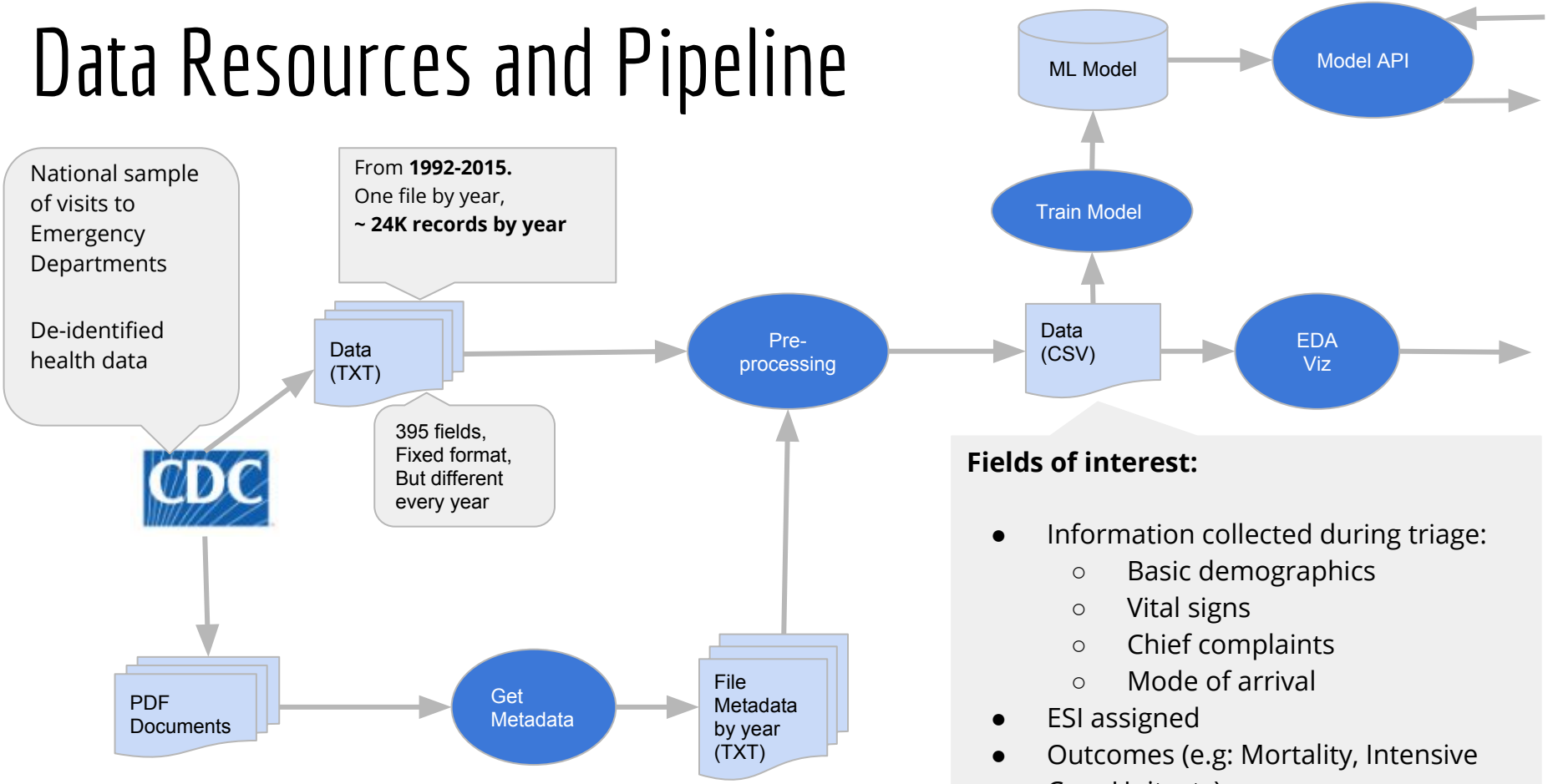
Design Goals

- Seamless integration into current workflow
- Provide suggestions without interfering with the duties of the staff
- Empower triage staff to make more informed decisions

Measures of Success

- For MVP, how recommended rating would improve the patient outcome compared to ESI outcomes
- Positive feedback from MVP customer reviewers
- Compare AUC for model with the AUC from ESI and ETS

Data Resources and Pipeline



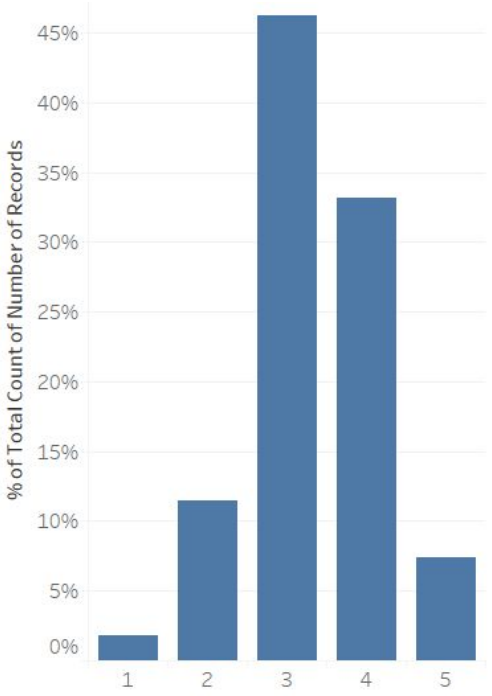
Fields of interest:

- Information collected during triage:
  - Basic demographics
  - Vital signs
  - Chief complaints
  - Mode of arrival
- ESI assigned
- Outcomes (e.g: Mortality, Intensive Care Unit, etc)

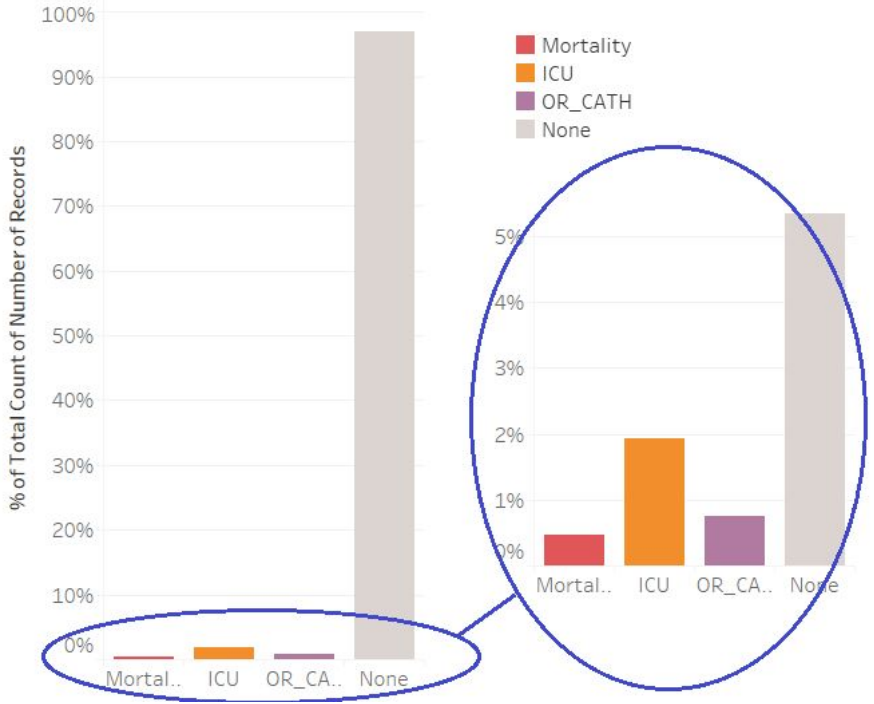
Preliminary EDA - CDC 2009 File

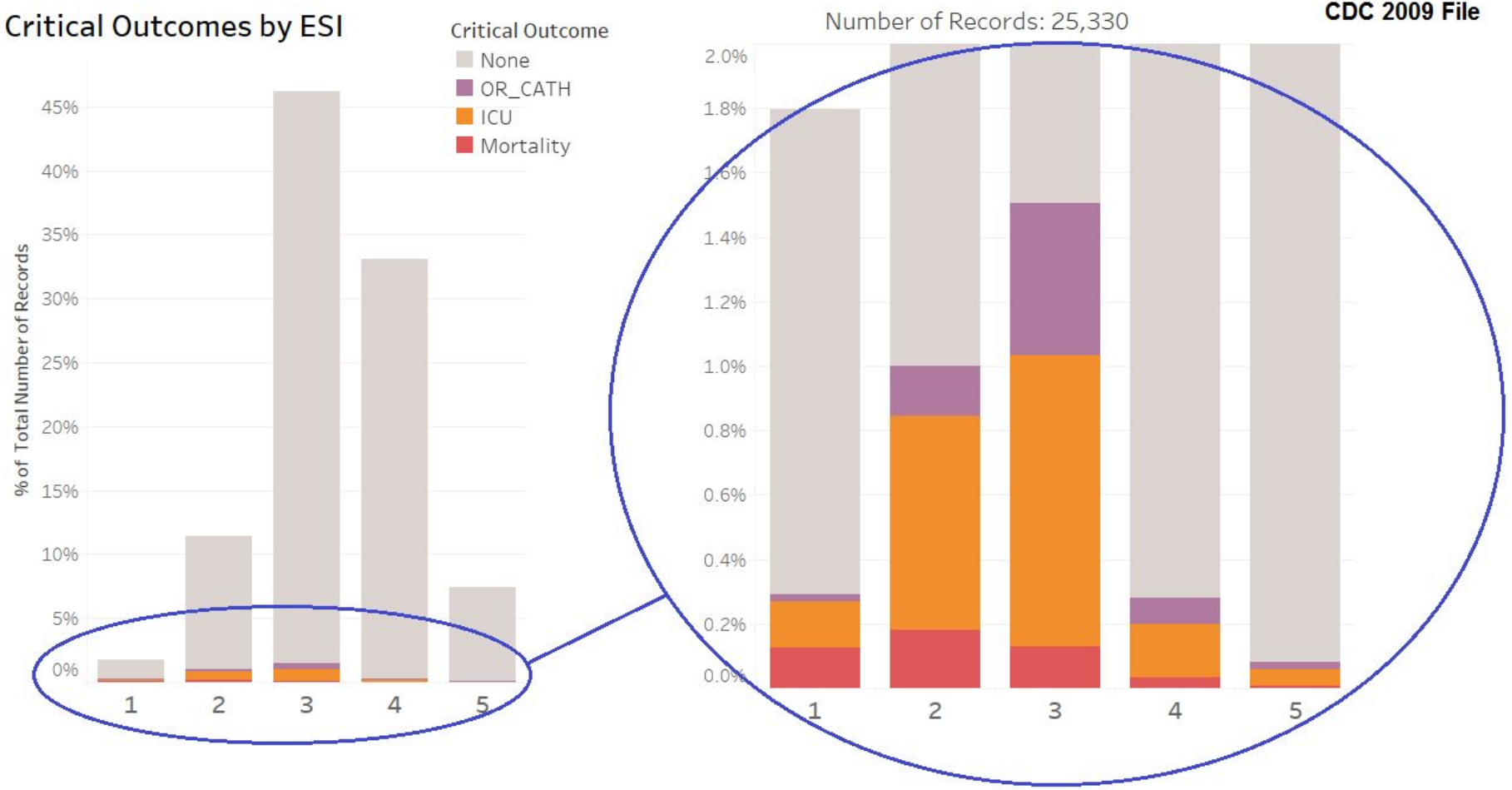
Exclusion Criteria	Remaining Records
	34,942
Age < 18 or missing original DOB	26,401
Patients dead on arrival	26,390
Transfer to a psychiatric hospital	25,957
Unknown outcome	25,449

ESI Distribution



Critical Outcomes Distribution




Critical Outcomes by ESI
Critical Outcome
None
OR_CATH
ICU
Mortality
% of Total Number of Records
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
1
2
3
4
5
Number of Records: 25,330
2.0%
1.8%
1.6%
1.4%
1.2%
1.0%
0.8%
0.6%
0.4%
0.2%
0.0%
1
2
3
4
5
CDC 2009 File

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