

Machine Learning Enabled Systems for Delivering Care to Critically Ill Patients

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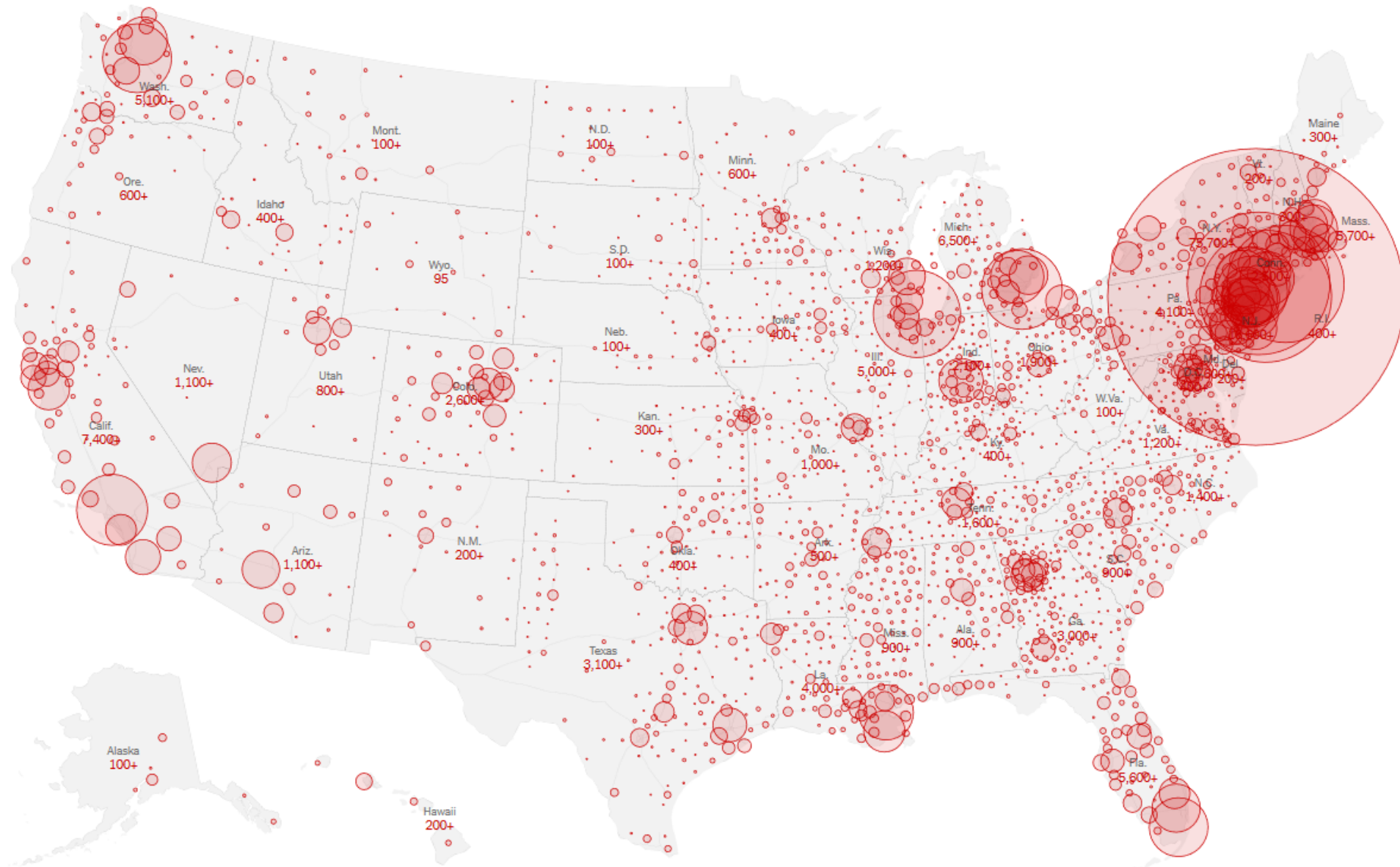
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Note: The map shows the known location of coronavirus cases by county. Circle size is proportional to the number of

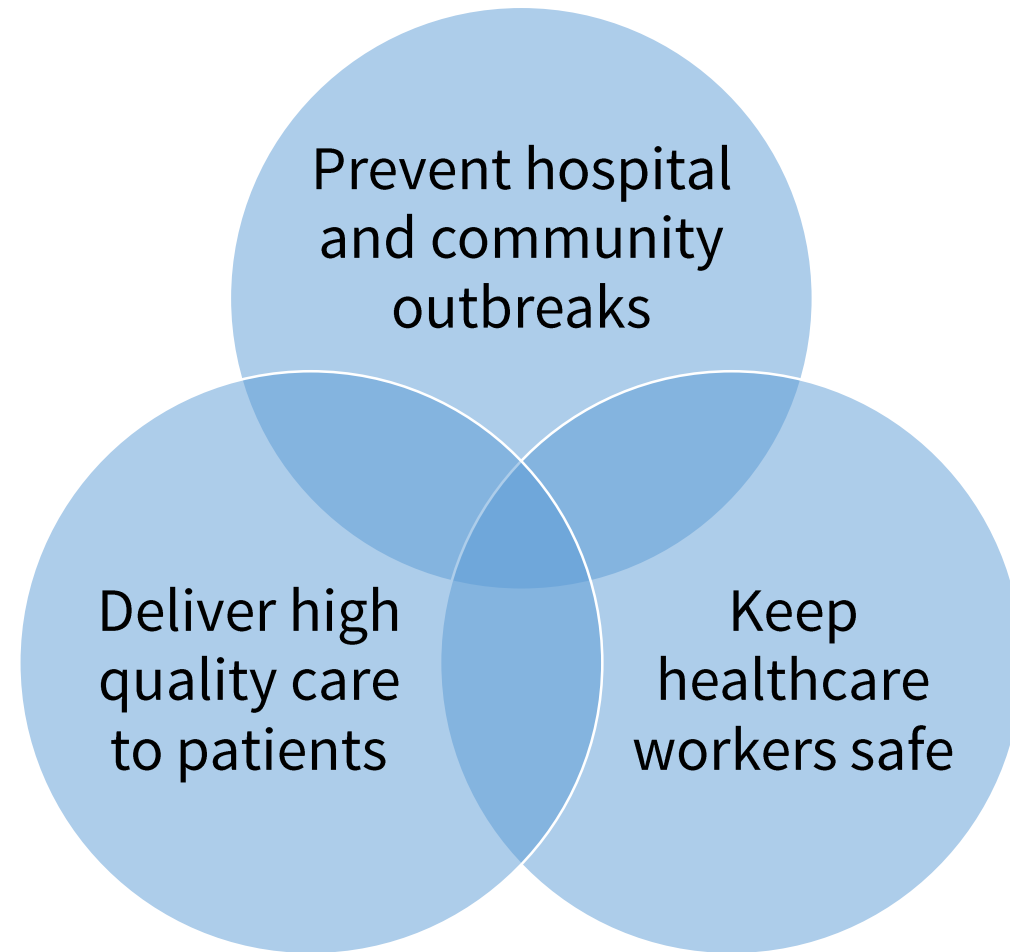
Nurses Die, Doctors Fall Sick and Panic Rises on Virus Front Lines

The pandemic has begun to sweep through New York City's medical ranks, and anxiety is growing among normally dispassionate medical professionals.

At least 5000 healthcare worker (HCWs) illnesses and 61 deaths from COVID-19 in Italy.

Nearly 14% of Spain's confirmed COVID-19 cases are HCWs.

Early reports from the US show multiple HCW illnesses and at least two deaths.



Control the COVID-19 Pandemic

Healthcare is complex . . .

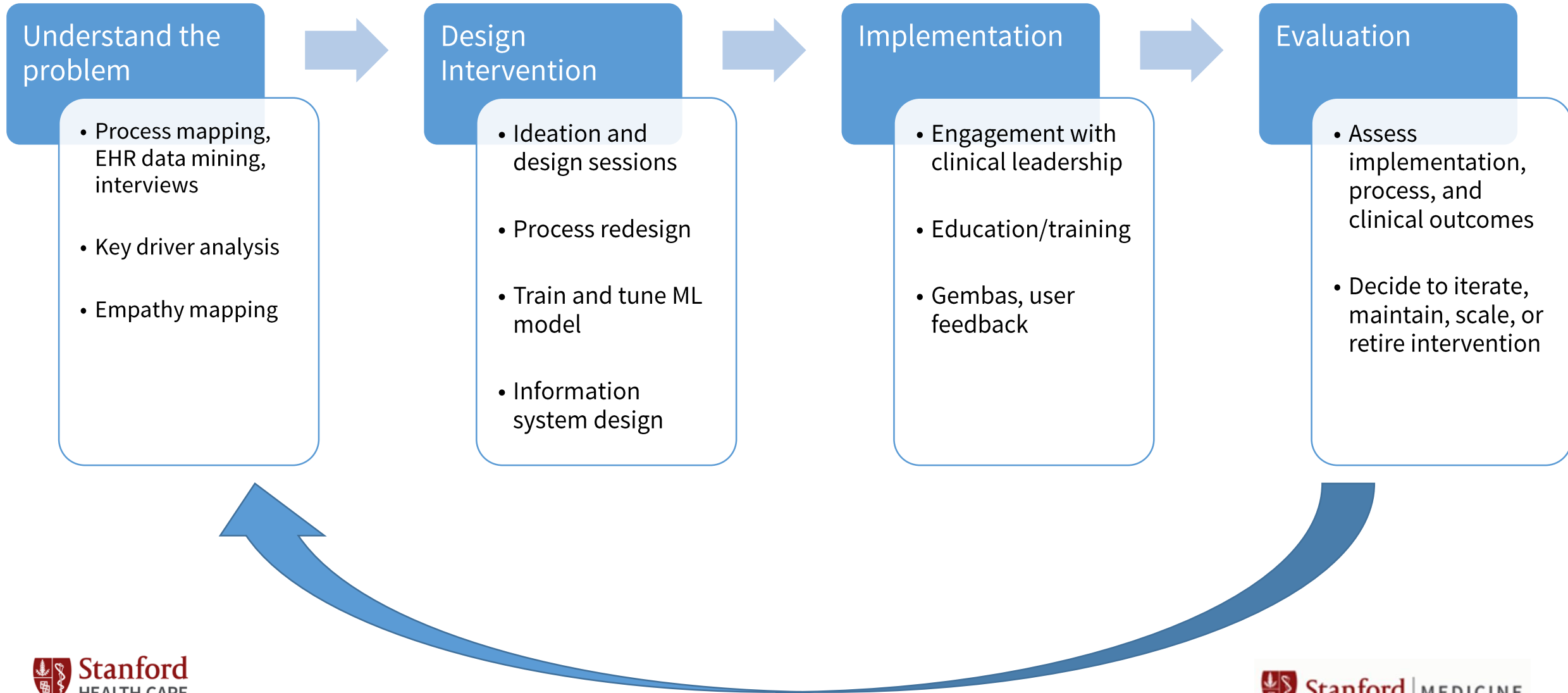
But we can build better **complex systems** to deliver better care.

How can we create **systems** enabled by AI?

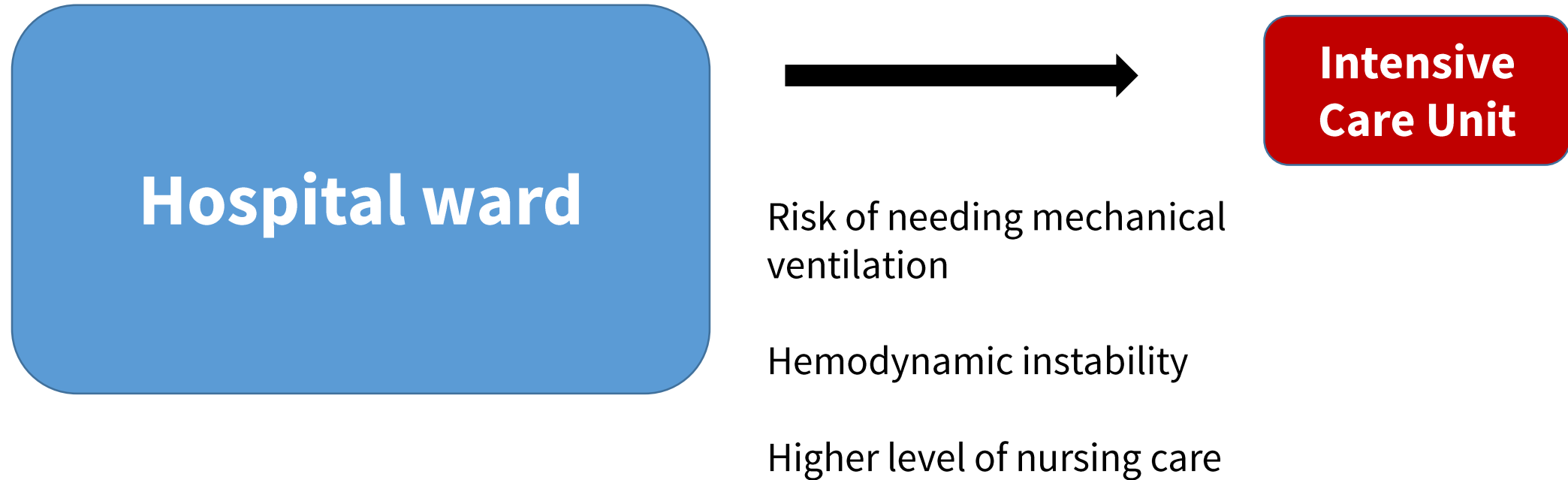
Machine learning model(s)



Intelligent care delivery system
(New **structures, processes, and patterns**
for delivering care enabled by ML models)



Mobilize critical care resources early

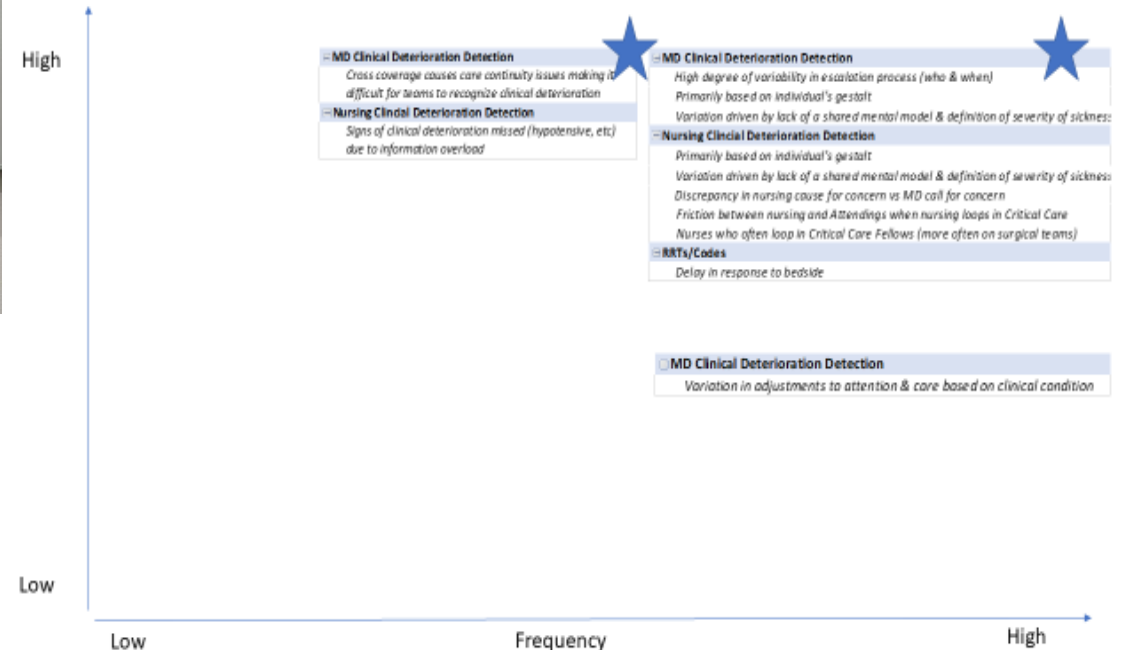


How can we identify sick patients with COVID-19 before they emergently need critical care?

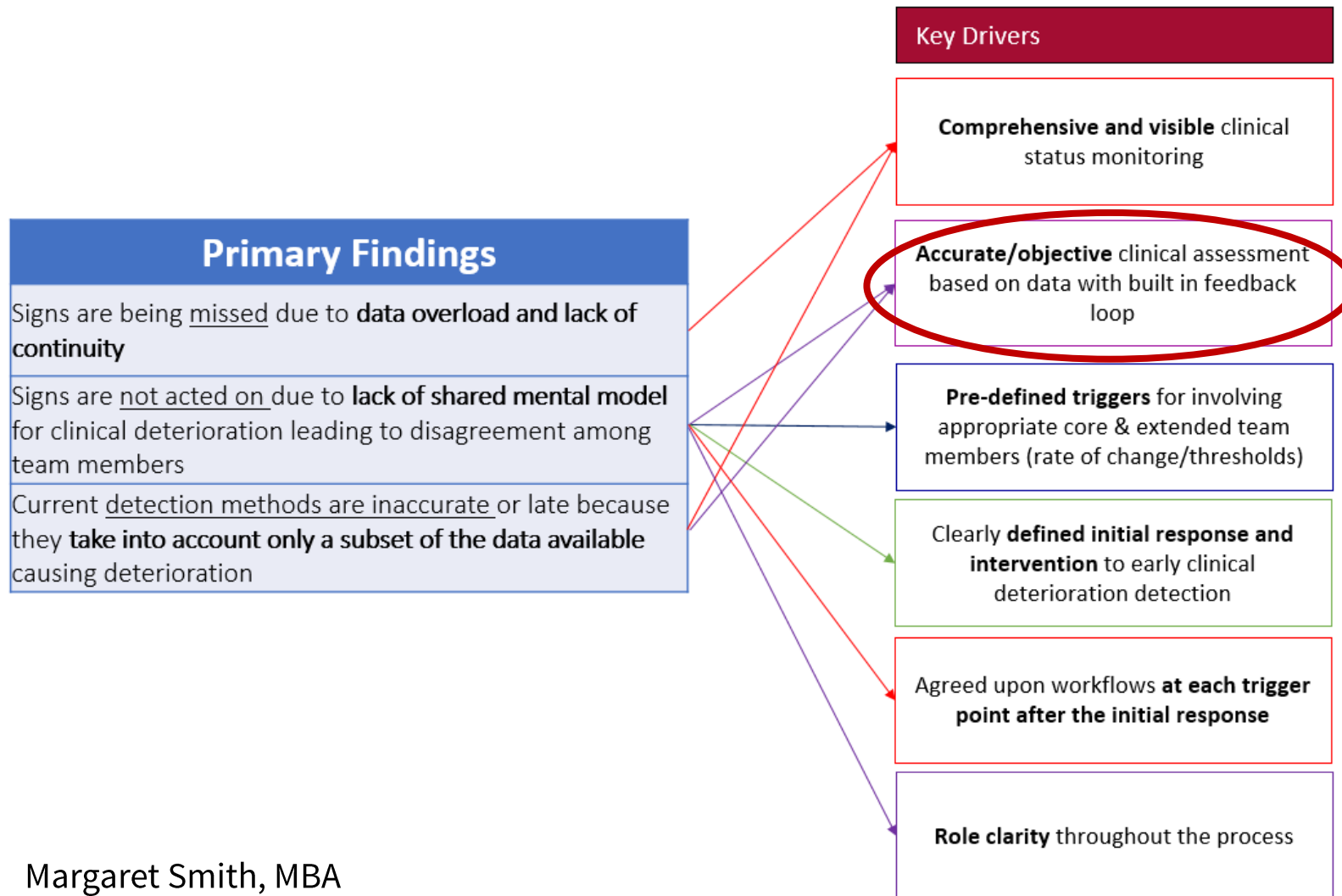
Understanding the current state and barriers



CLINICAL DETERIORATION PRIORITIZED PAIN POINTS



Deriving the components for a new system



Currently performed by human experts, can be translated into a machine learning task

Identifying the prediction task and model

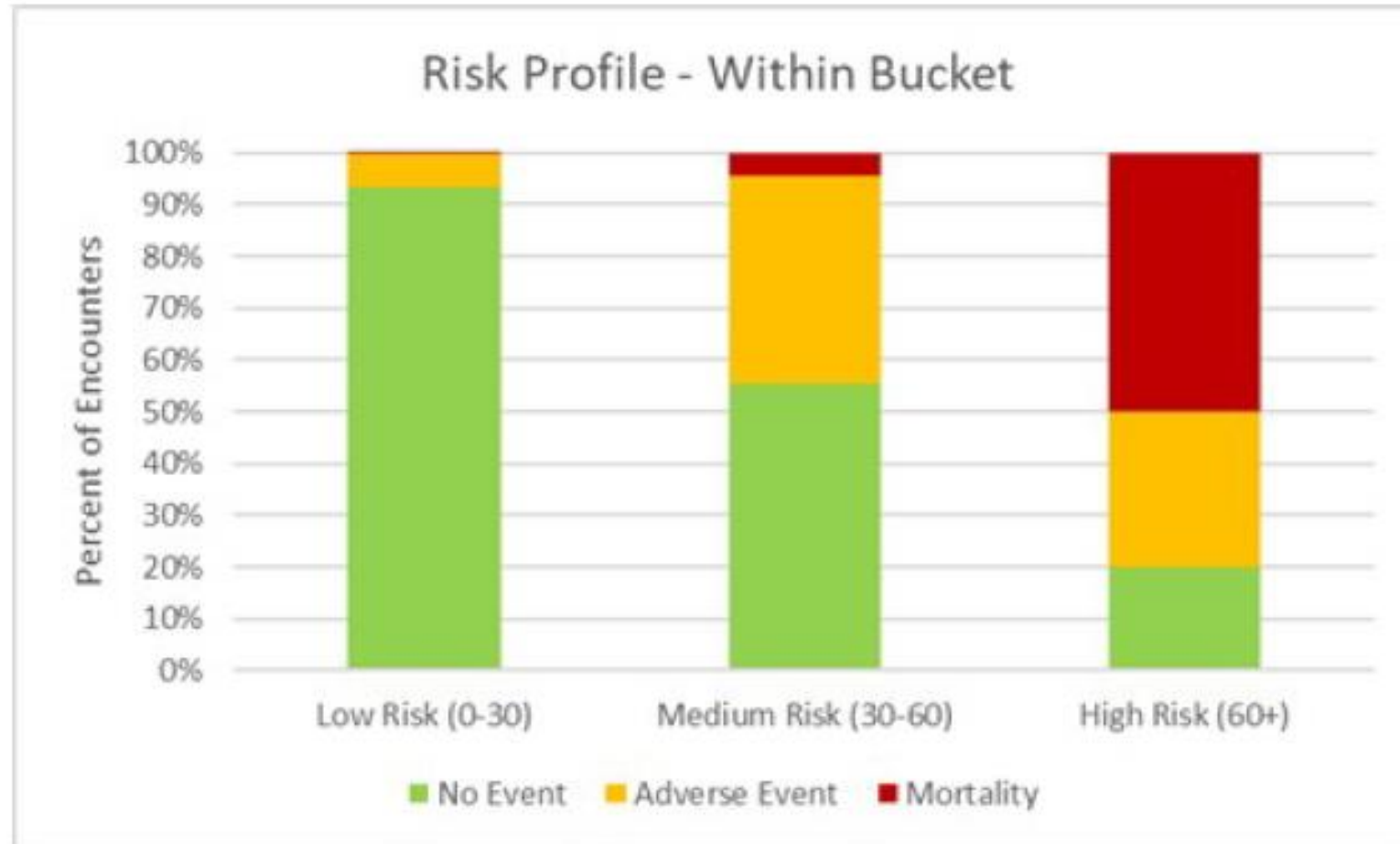
- **Prediction task requirements**

- Outcome should reflect an overall state of “being critically ill”
- Time of prediction needs to be early enough prior to the time of outcome

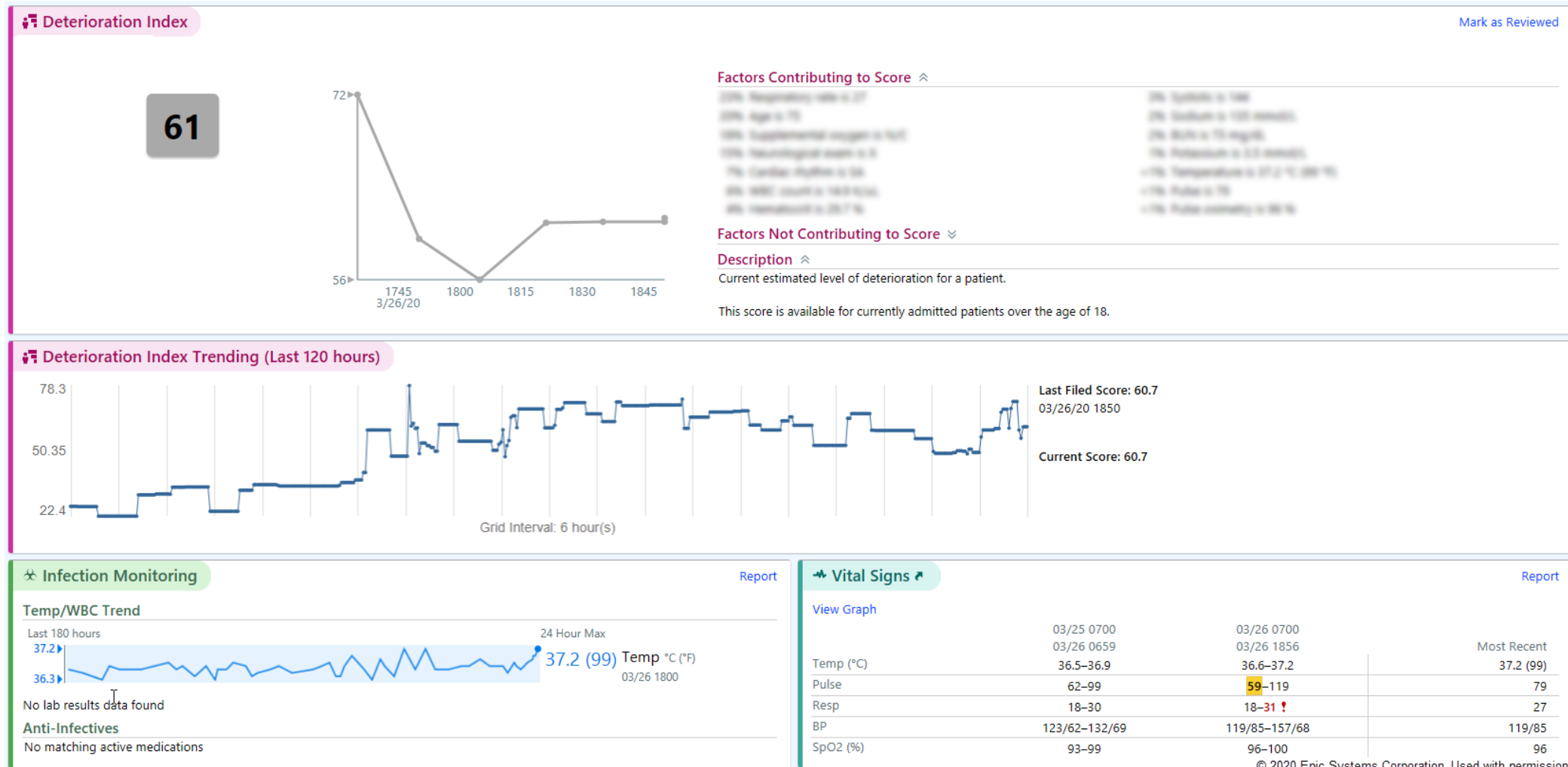
- **Model selection**

- Model developed by EHR vendor (Epic Systems)
- Trained across three hospitals with ~327k patient encounters using ordinal labels (rapid response/code event, ICU transfer, inpatient death)
- At runtime, outputs a “deterioration index” from 0-100

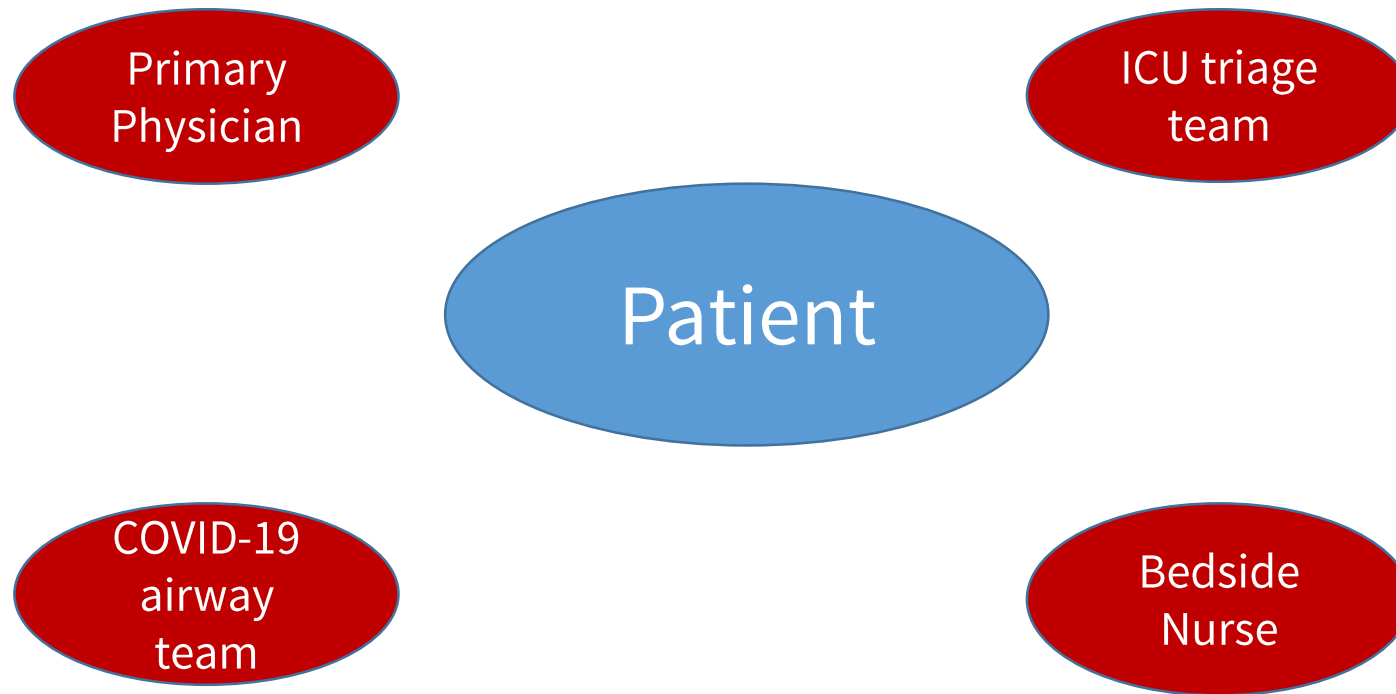
Good performance on predicting ICU transfers, rapid response events, and inpatient deaths



Digital interfaces that enable workflows



An intelligent system that enables new team structures and roles



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