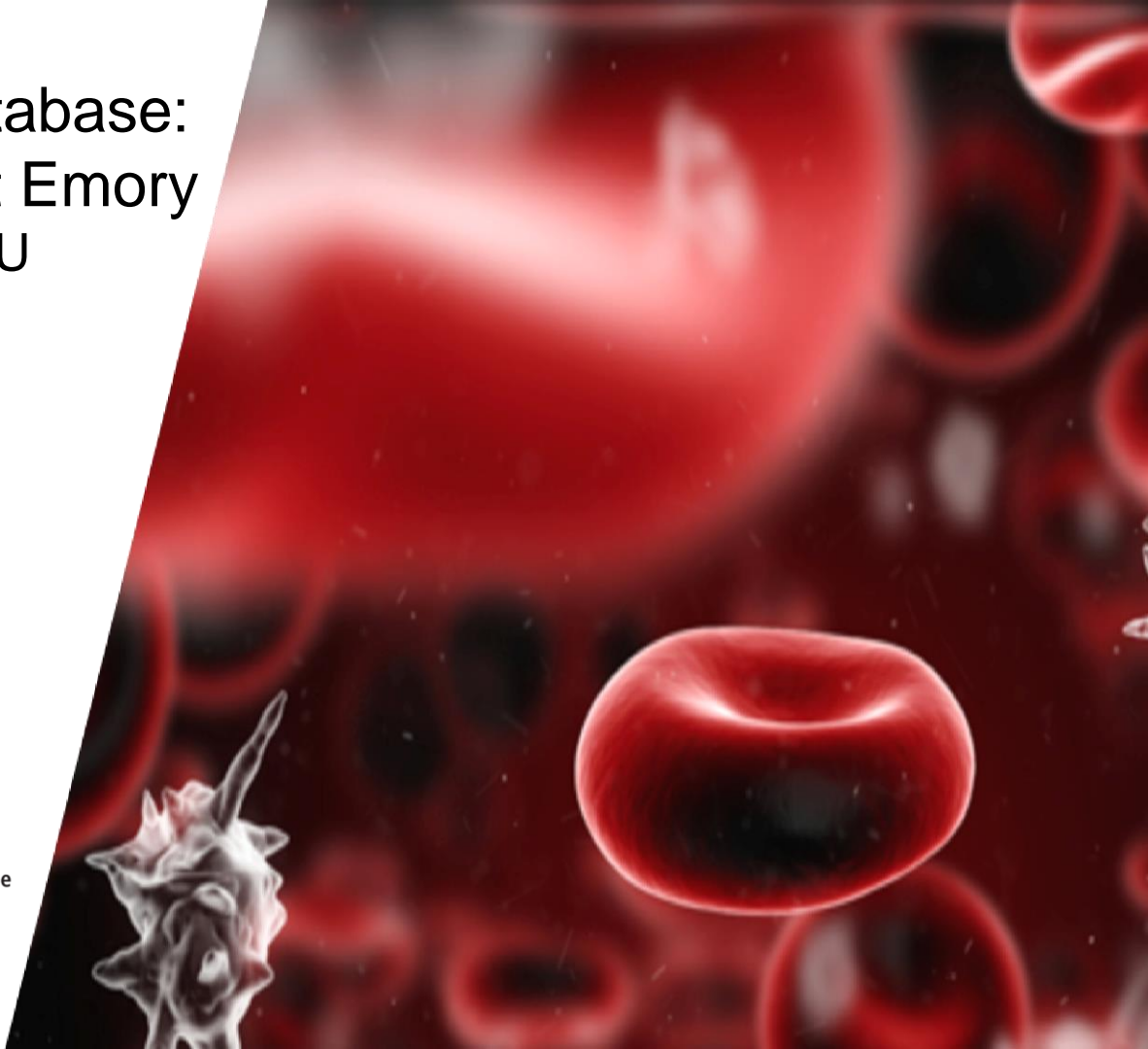# Leveraging the eICU database: Streaming Informatics at Emory
Prediction of Sepsis in the ICU

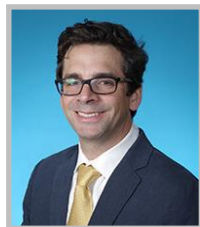EMORY UNIVERSITY | Department of Biomedical Informatics
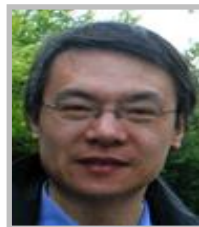Emory University School of Medicine

The team

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Gari Clifford, PhD
Interim Chair
Biomedical Informatics

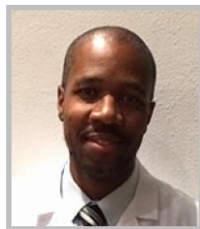**Shamim Nemati, PhD**
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Biomedical Informatics

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Research Scientist
Biomedical Informatics

Vibhore Kumar, PhD
Chief Executive Officer
Unscrambl, Inc.
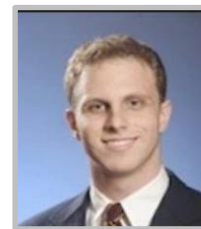
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Supreeth Prajwal
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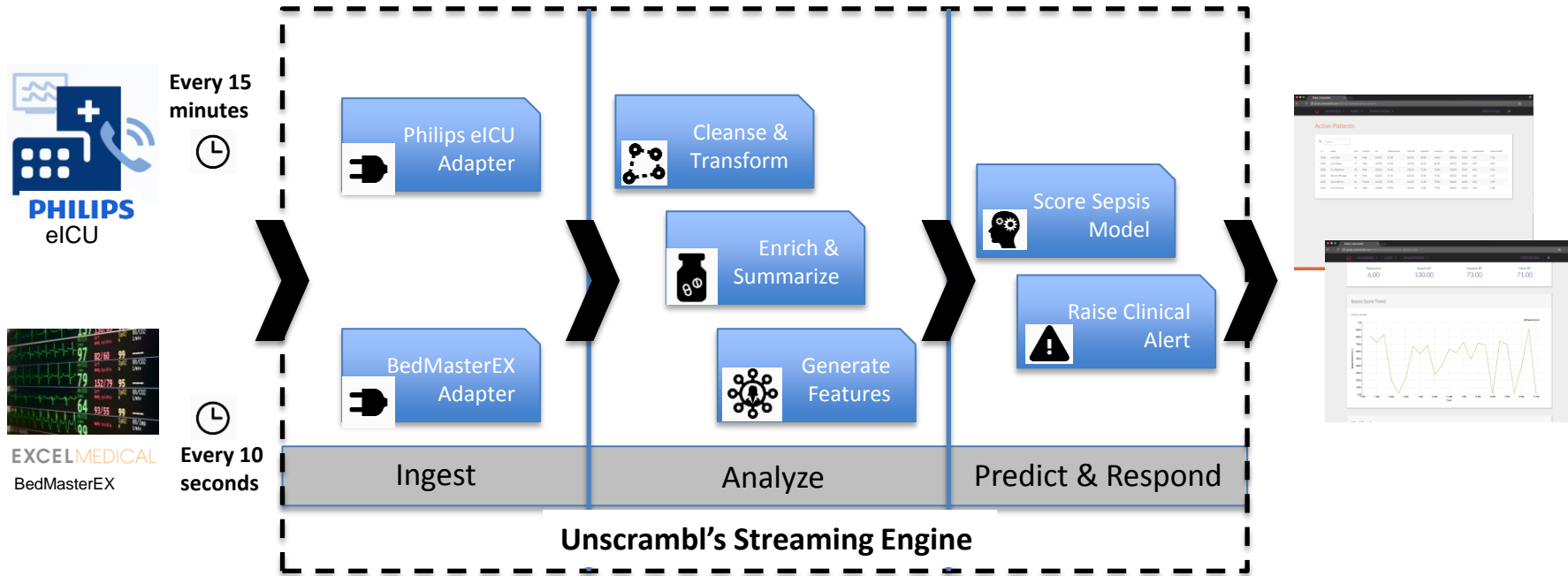Georgia Tech

Benjamin Arar
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EMORY UNIVERSITY | Department of Biomedical Informatics
Emory University School of Medicine

Georgia Tech

UNSCRAMBL

The data pipeline using Unscrambl Pulse

Presentation and notification at Emory

The dashboards show a list of active patients

Presentation and notification at Emory

The system show up alerts for patients whose sepsis score breaches a threshold. More complex triggers can be created.

Presentation and notification at Emory
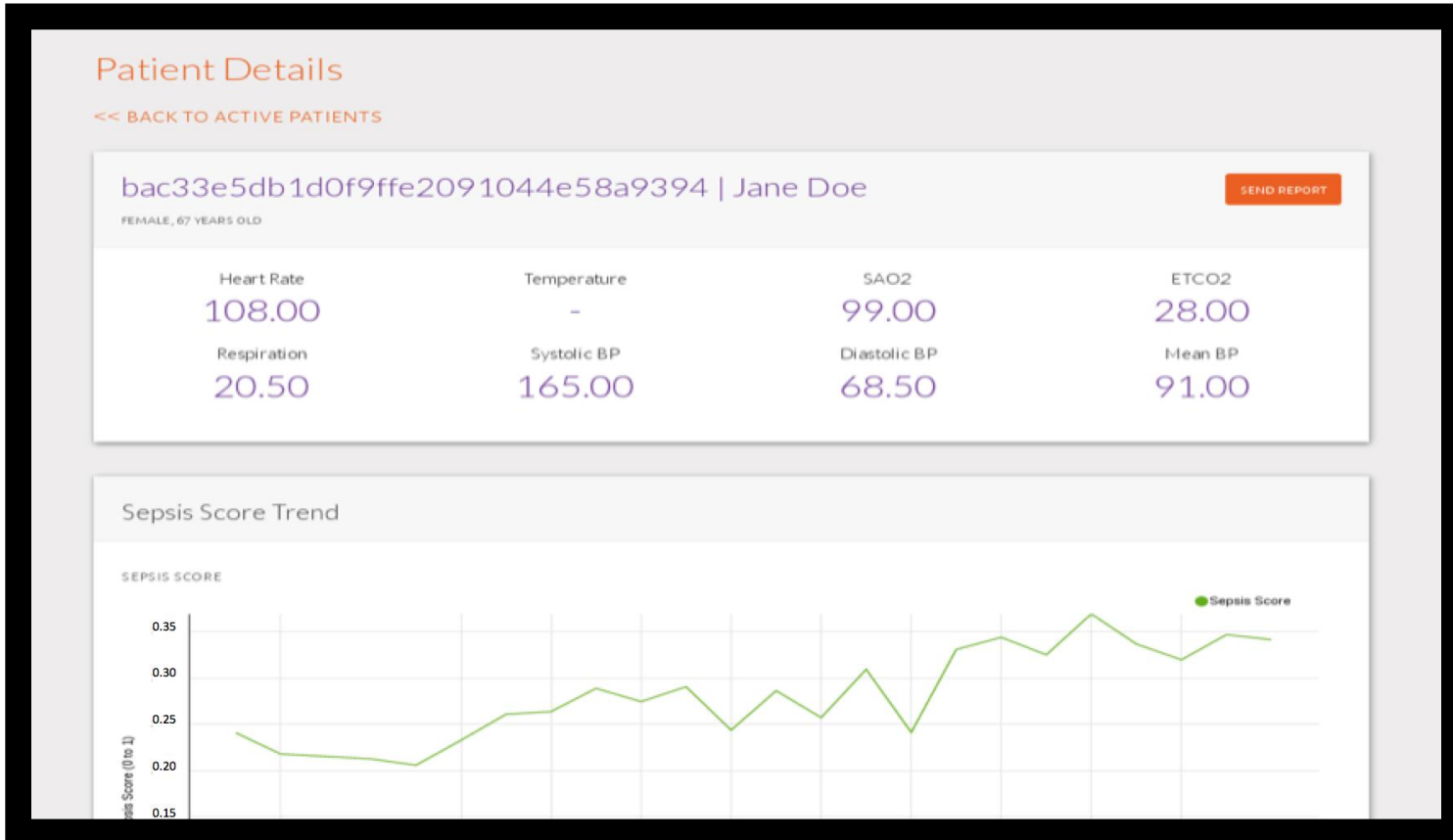
The patient details page show various vitals, sepsis score trend and other parameters. This could be emailed by clicking on the send report button.

Not a Blackbox: Interpretable Machine Learning for Early Prediction of Sepsis (Nemati et al. CCM, 2017)
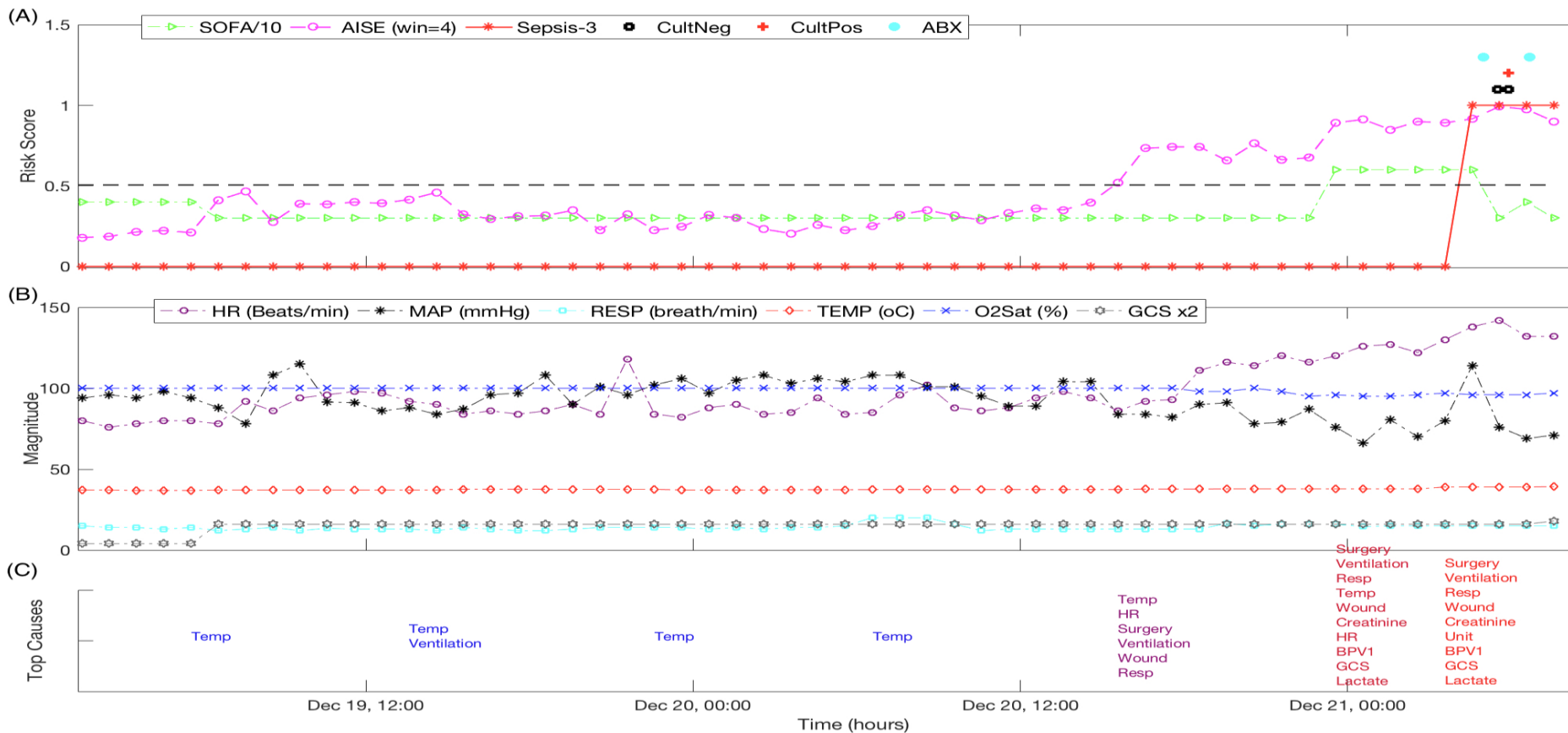
T₀ Sepsis

ROC curve (AUC=0.87)

(sensitivity, specificity)
= (0.85, 0.71)

T₀ SOFA

ROC curve (AUC=0.89)

(sensitivity, specificity)
= (0.85, 0.77)

chance=0.50
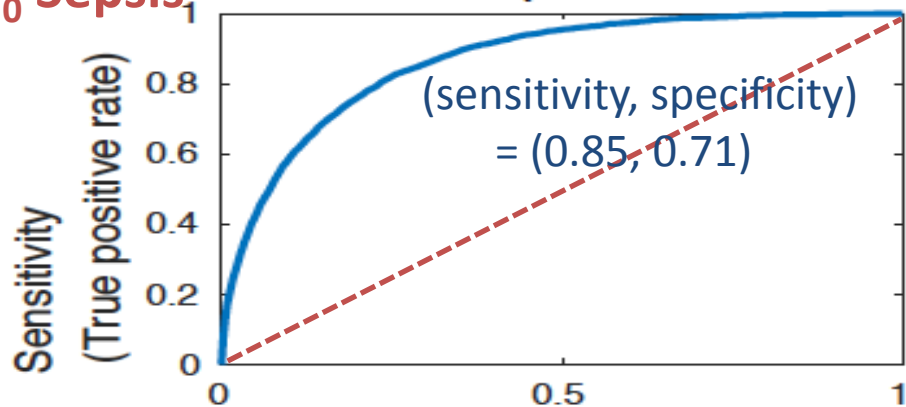
- T0-Sepsis: Prediction of clinical suspicion (sepsis-III)
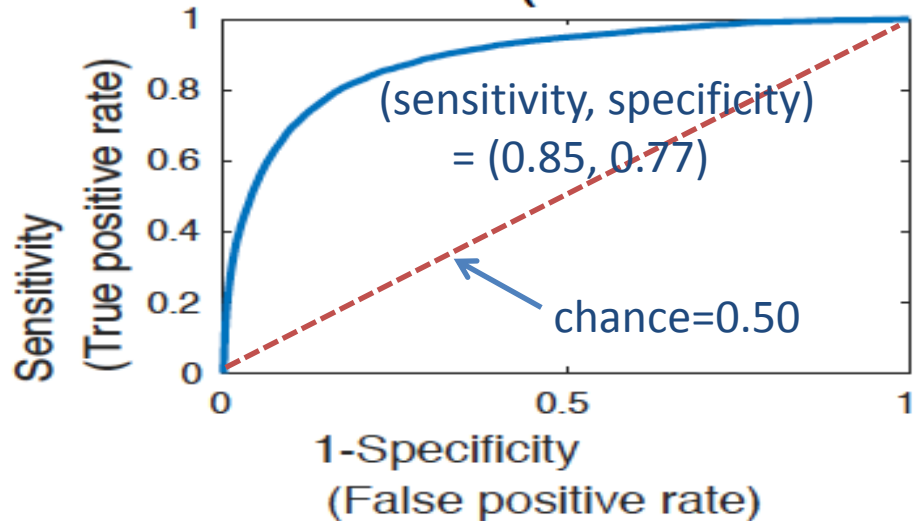
- T0-SOFA: Prediction of organ dysfunction (ΔSOFA >= 2)

(Nemati et al. CCM, 2017)

How far in advance can we predict?
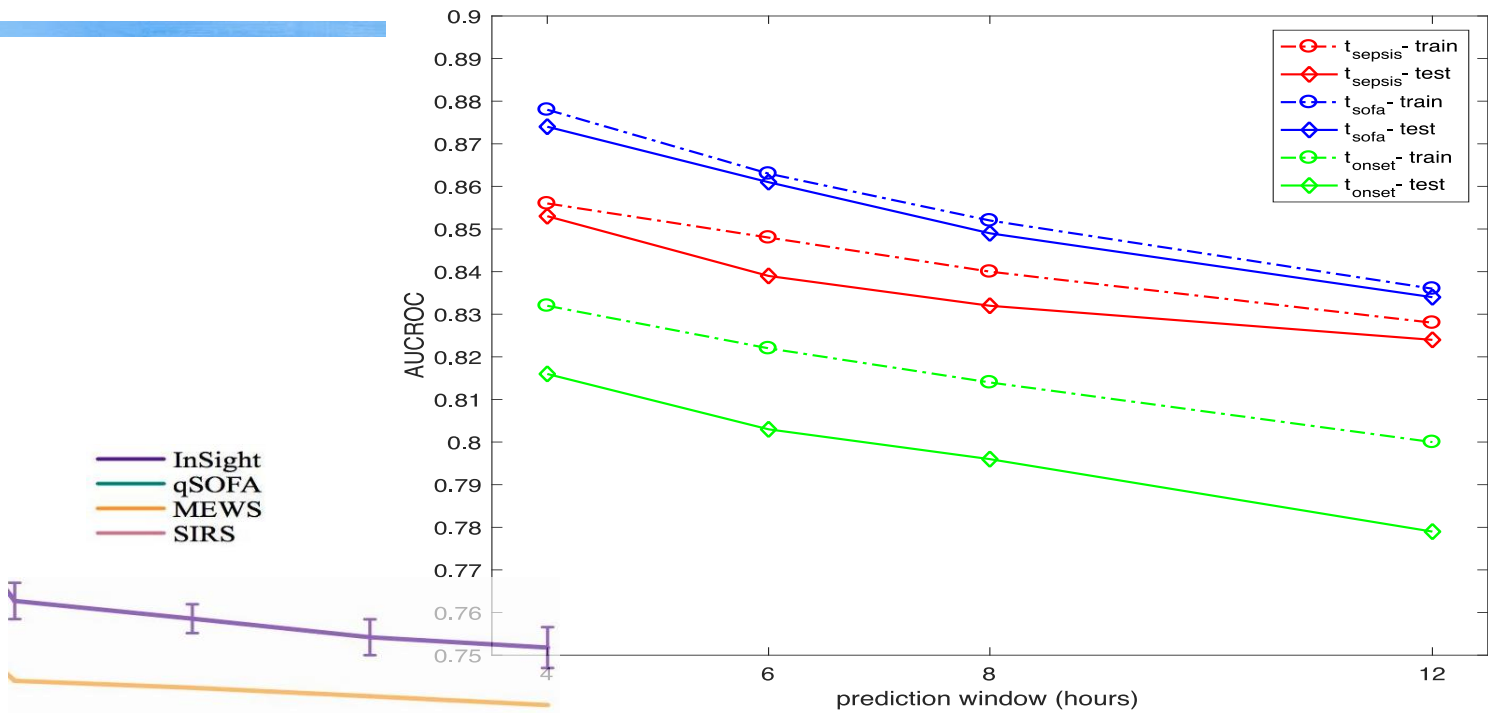
T_{sepsis} = sepsis 3 definition
T_{sofa} = time of 2-point change in SOFA associated with the definition of sepsis.
T_{onset} = minimum of T_{sepsis} and T_{sofa}, so the earlier time of when a clinician became suspicious (T_{sepsis}) or there was a change in physiology (T_{sofa})

(Nemati et al. CCM, 2017)

Emory's eICU-BMI Platform for Real-time Analytics
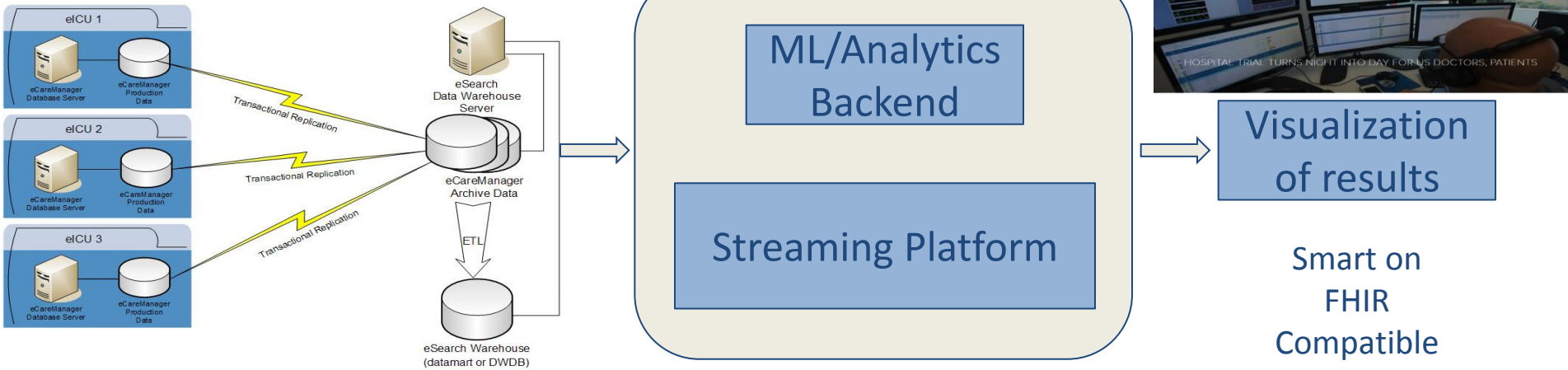
https://apps.smarthealthit.org/app/61

Road Map to Wider Implementation

- Retrospective Validation Studies
  - Emory Dataset (30K patients, 2 hospitals)
  - MIMIC III Database (~50K patients, Beth Israel Hospital)
  - Emory eICU Dataset (20K patients, 5 hospitals)
- Prospective Validation
  - Real-time implementation
- Clinical Trials
  - Stepped wedge trial design
  - Multi-center -> Clinical Evidence
- Impacting the *standard of care*
  - Surviving sepsis guidelines

Complex queries pulls data from the eICU ArchiveDB in real-time

Complex queries pulls data from the eICU ArchiveDB in real-time

RALPH,HCO3,30.8000,492072c8c46742aeb0bcfd6063c2cca4,2017-08-22 17:31:00.000,93,16,96,0.0000,159,Phosphorus Level,3.6000,d1dcb
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Unscrambl Platforms Unscrambles this data in real-time!