

# Can Machines Amplify Expert Humans' to Provide Care?

**Suchi Saria**

Assistant Professor of Computer Science,  
Statistics, Biostatistics, and Health Policy

Malone Center for Engineering in Healthcare,  
Johns Hopkins University

 **@suchisaria**



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**Home Monitoring for Parkinson's Disease?**



# Home Monitoring for Parkinson's Disease?



Voice Test



Dexterity Test



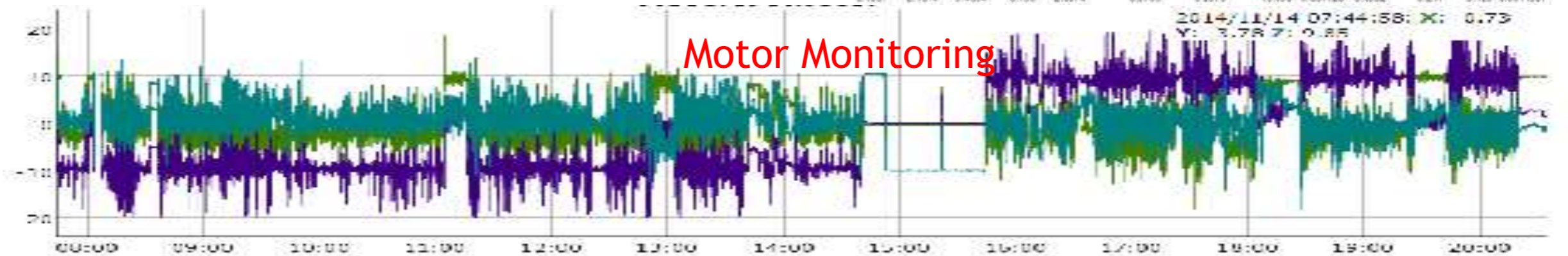
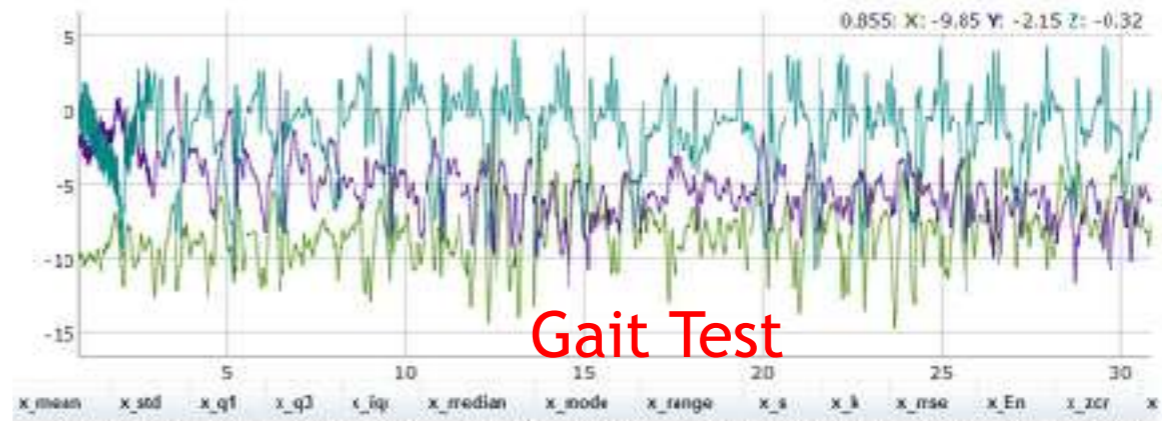
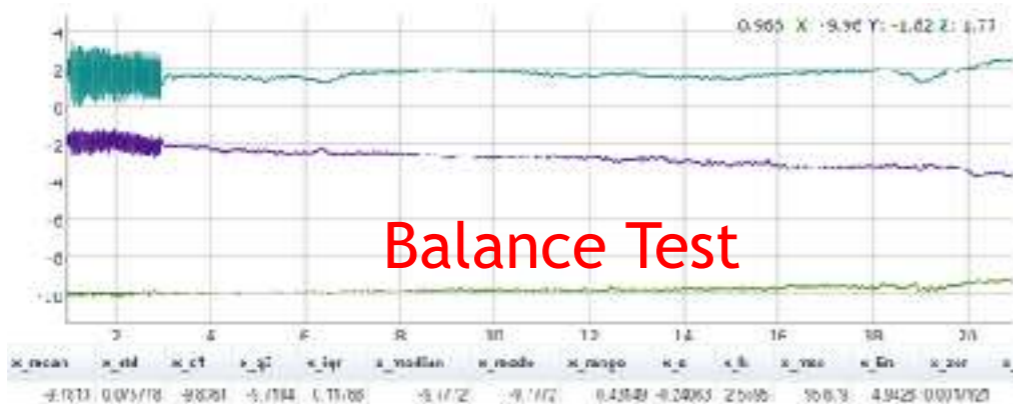
Gait Test



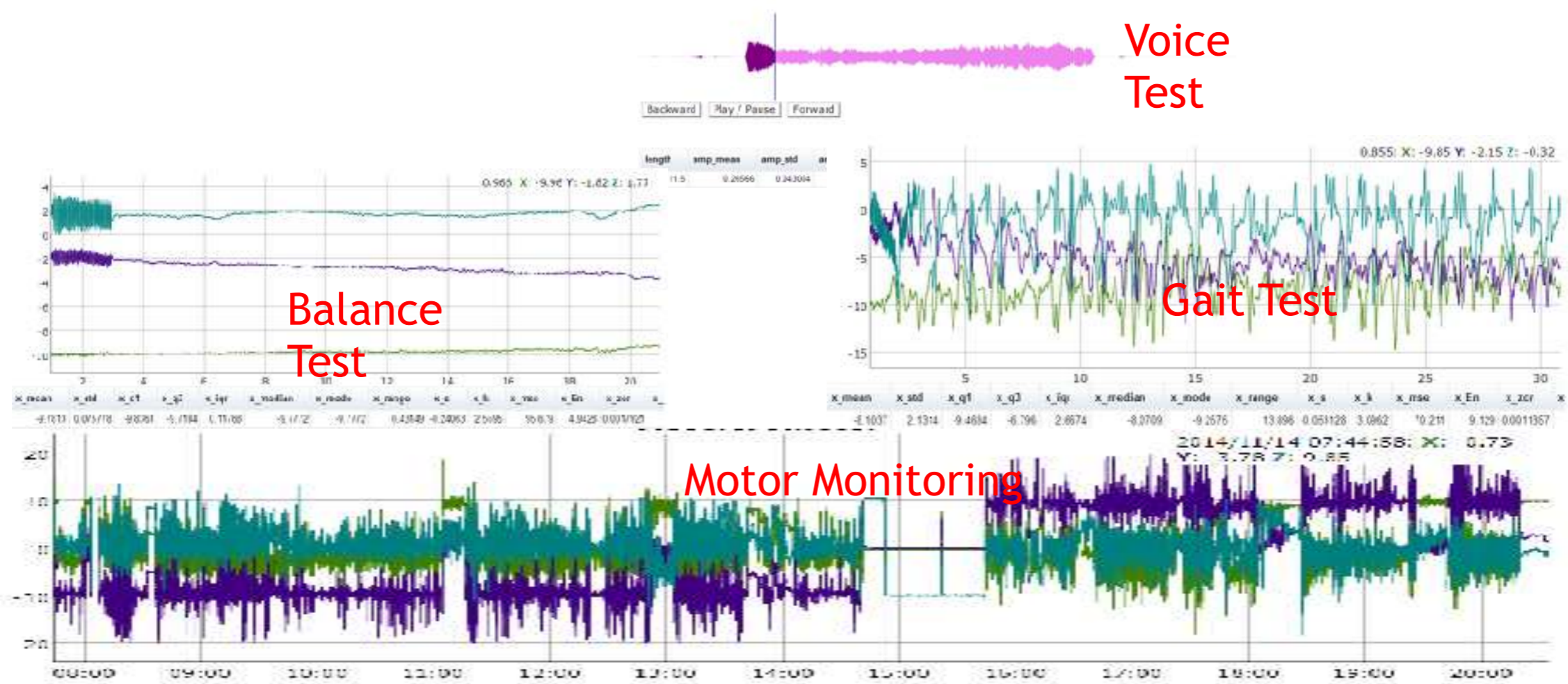
Rest Tremor Test



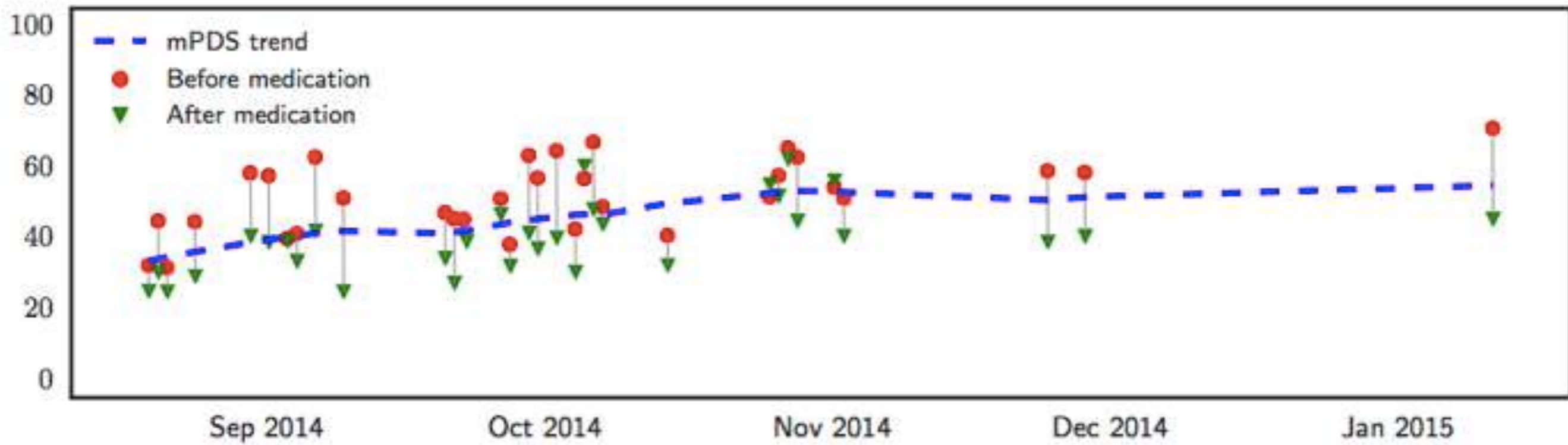
Location Monitoring







Intraday severity fluctuations captured using a mobile phone for a patient with 11 years of PD who worsened over 6 mths.

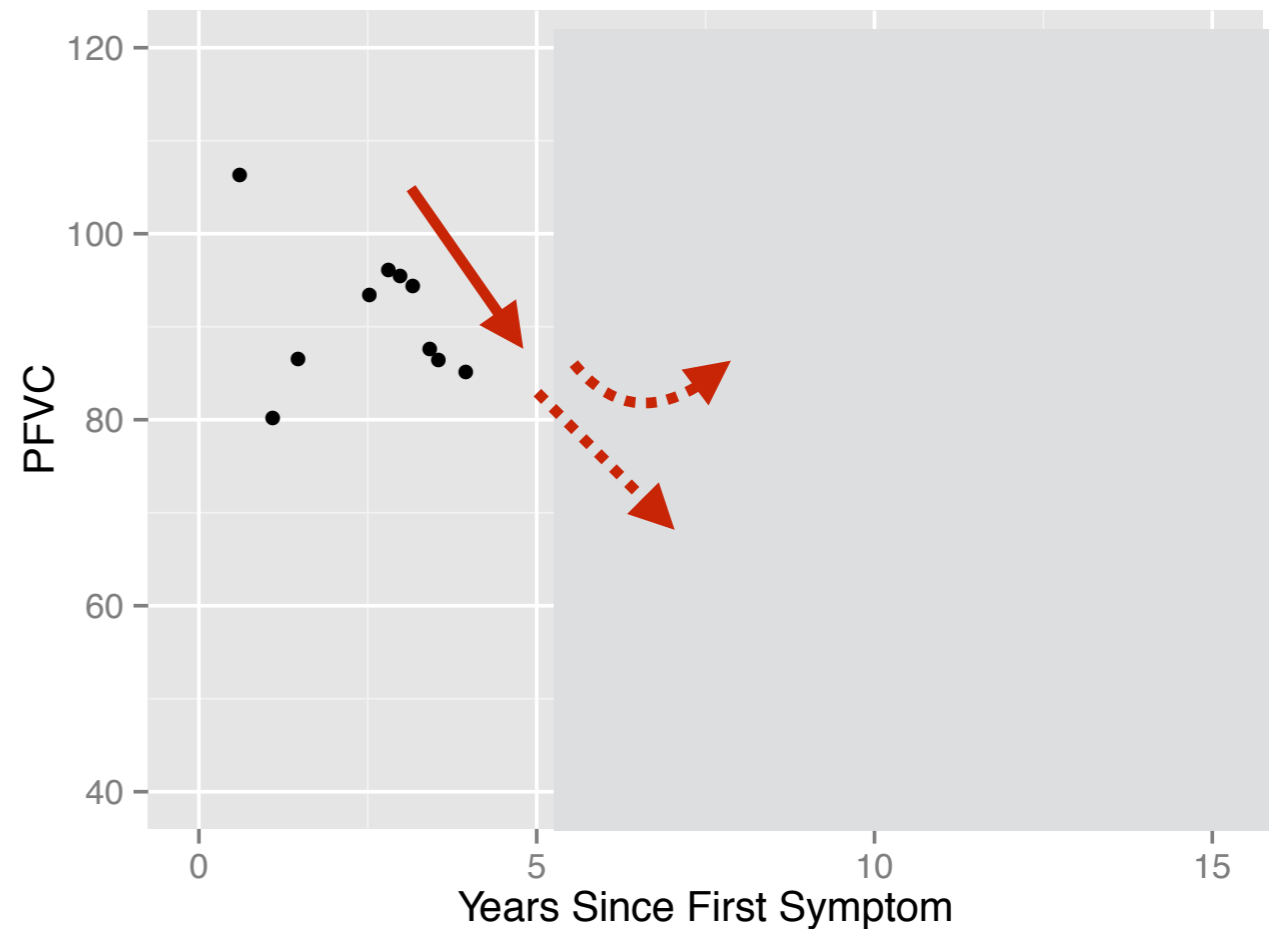
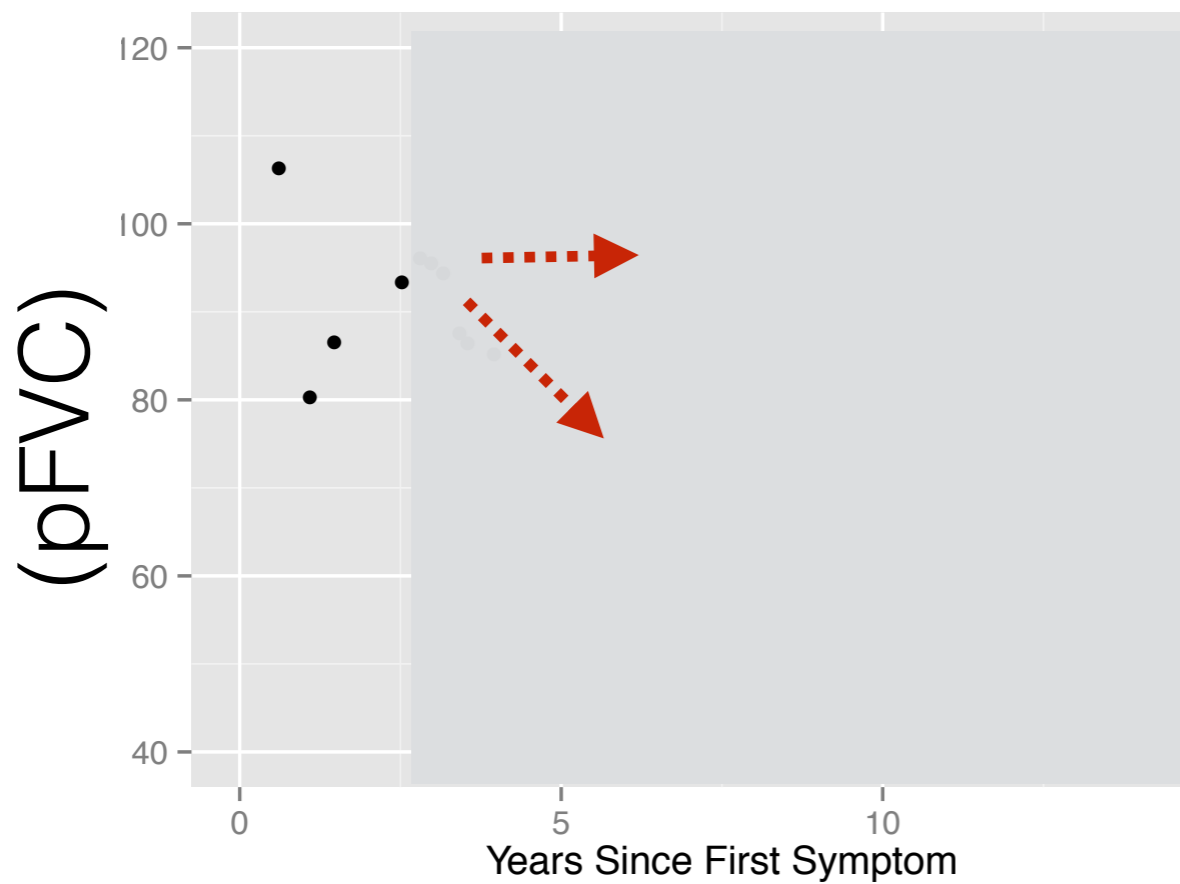




**Scleroderma: Systemic autoimmune disease**  
**Challenging to treat because of heterogeneity**  
**in presentation and disease progression.**

- Should we **administer immunosuppressants, which can be toxic?**

Marker for lung decline

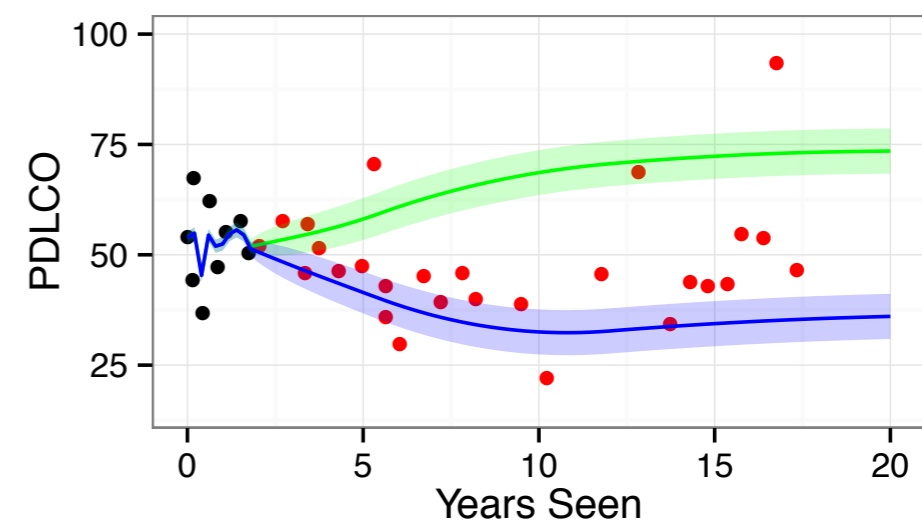
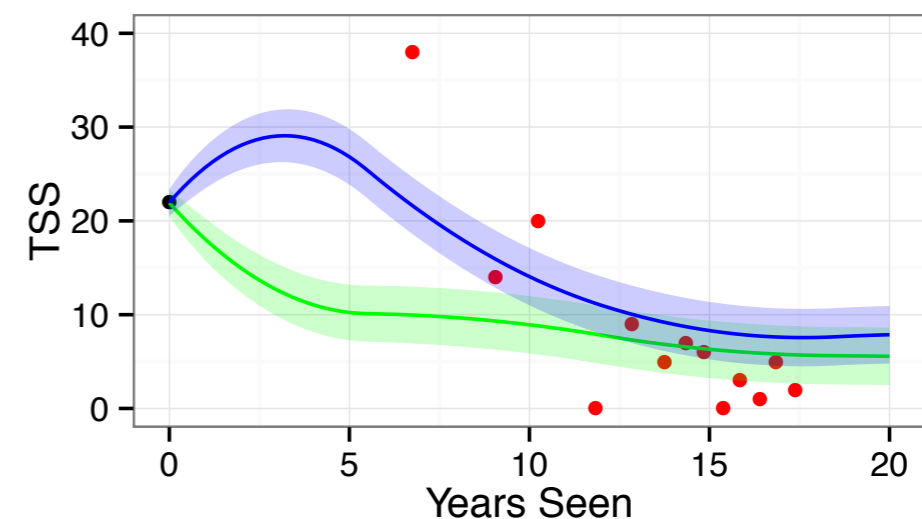
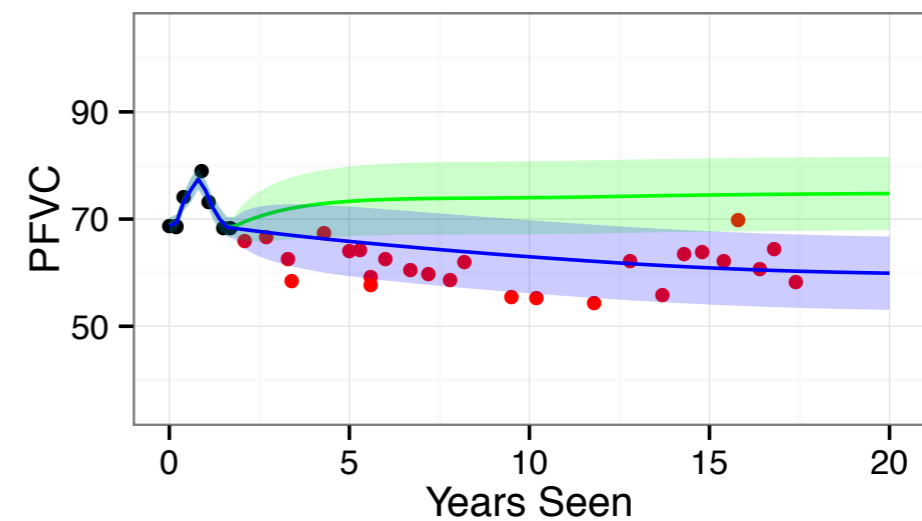
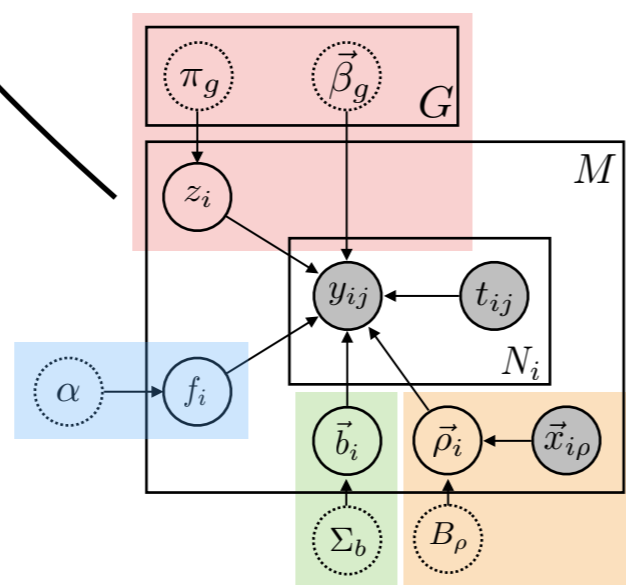
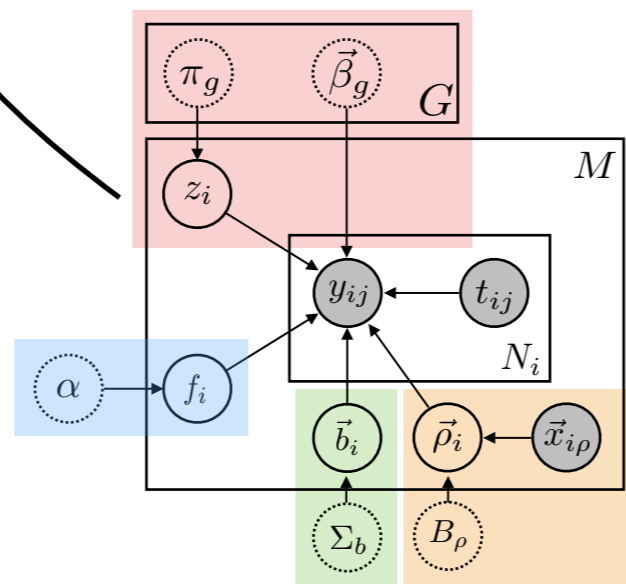
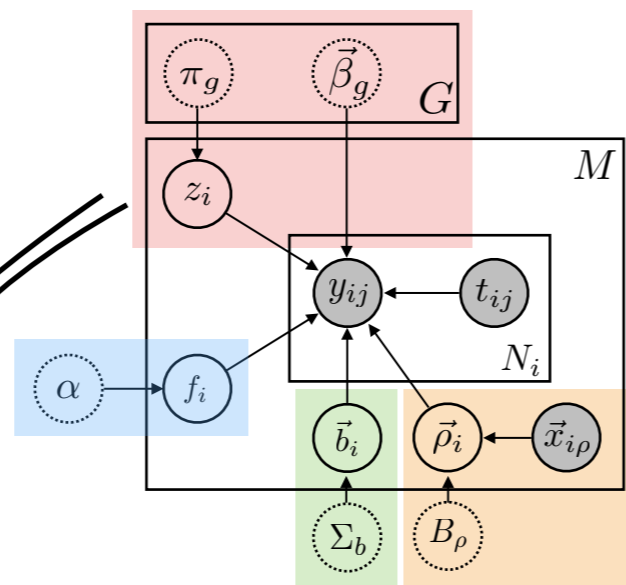


Affects 300K individuals; 80 other autoimmune diseases — lupus, multiple sclerosis, diabetes, Crohn's — many of which are systemic & highly multiphenotypic.

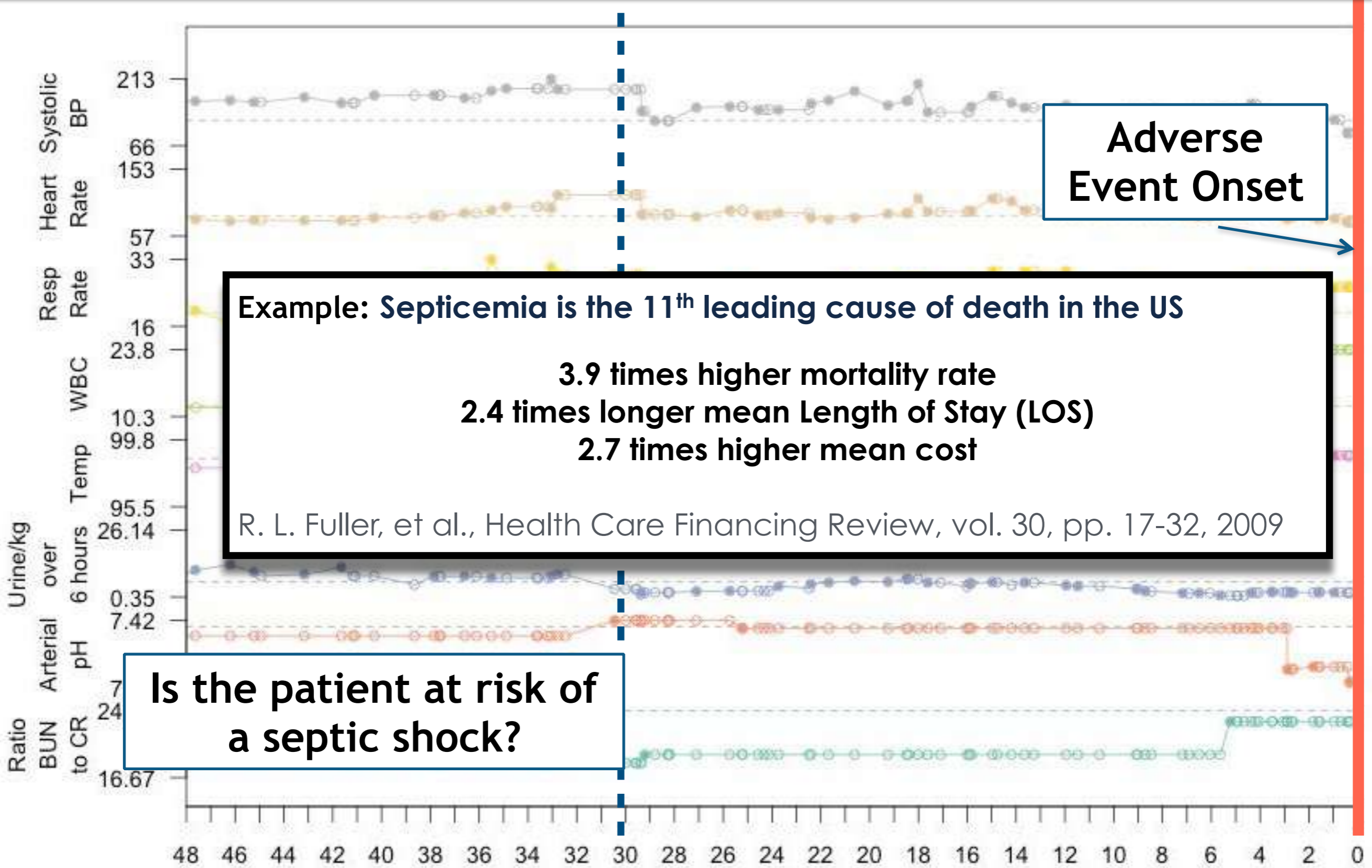


Coupled Latent Variable Model to predict latent disease trajectory

Conditional random field (CRF) to model pairwise dependencies



# Early Warning Systems for Potentially Preventable Conditions?

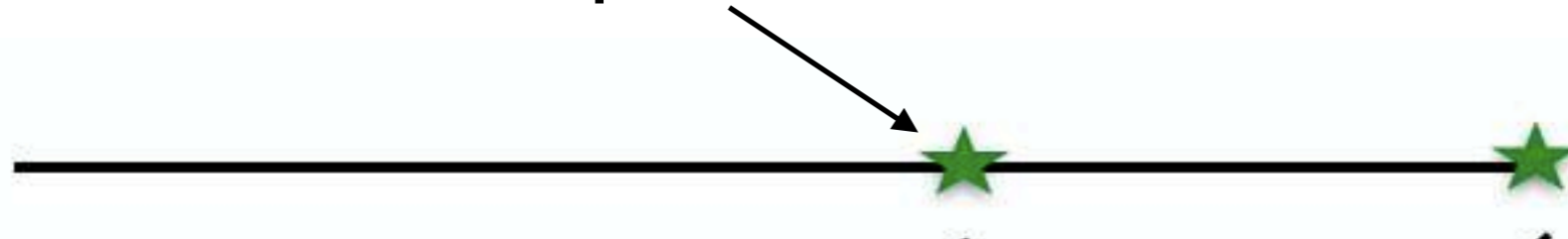




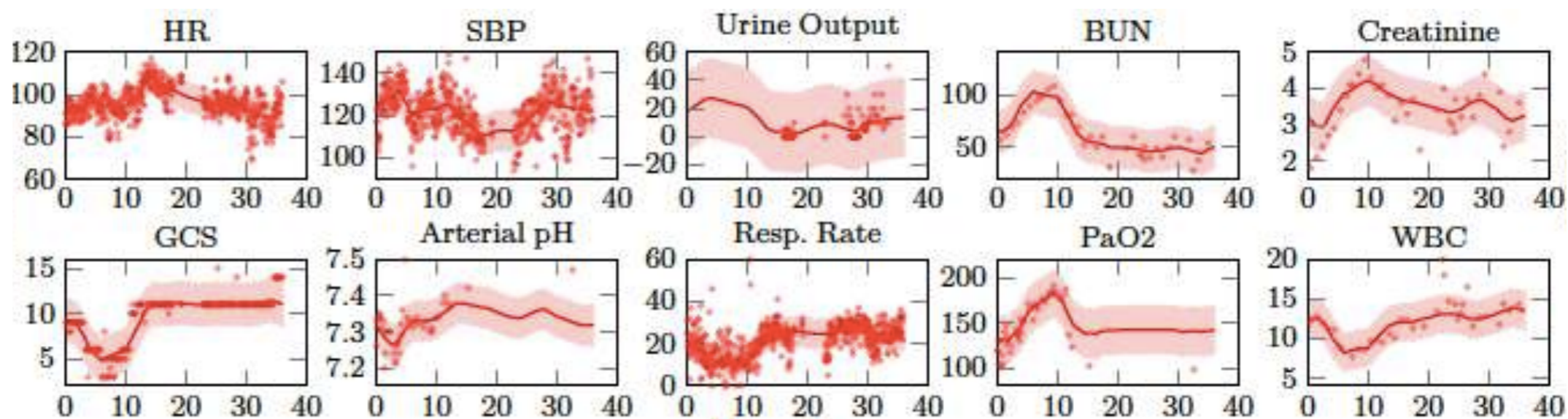
# Scalable Joint Modeling for Reliable Event Prediction

Septic Shock

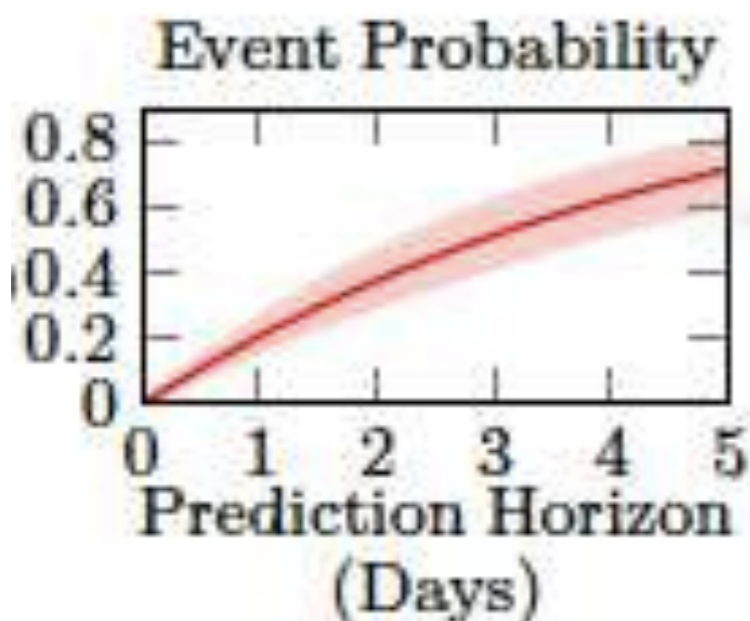
Event Data



Longitudinal Data



Joint Model of Trajectory and Event Data



Patients w/ shock identified a median time of 25 hours prior to shock onset.

At higher sensitivity, increase in the Positive Predictive Value from 6% to 50%

Henry et al., Science TM 2015

Soleimani, Hensman, Saria. TPAMI 2017

# Making Inferences available to providers

- Every hospital EMR is slightly different: **data wrangling technologies** to account for differences
- Monitoring every patient: **flexible scalable inference** and **fault tolerant distributed computation**
- Enabling providers to reason w/ model: **joint human-machine reasoning**
- Many other open questions:
  - How do we communicate when to trust and when not to trust the resulting computation?
  - How do we understand and estimate the different sources of error?





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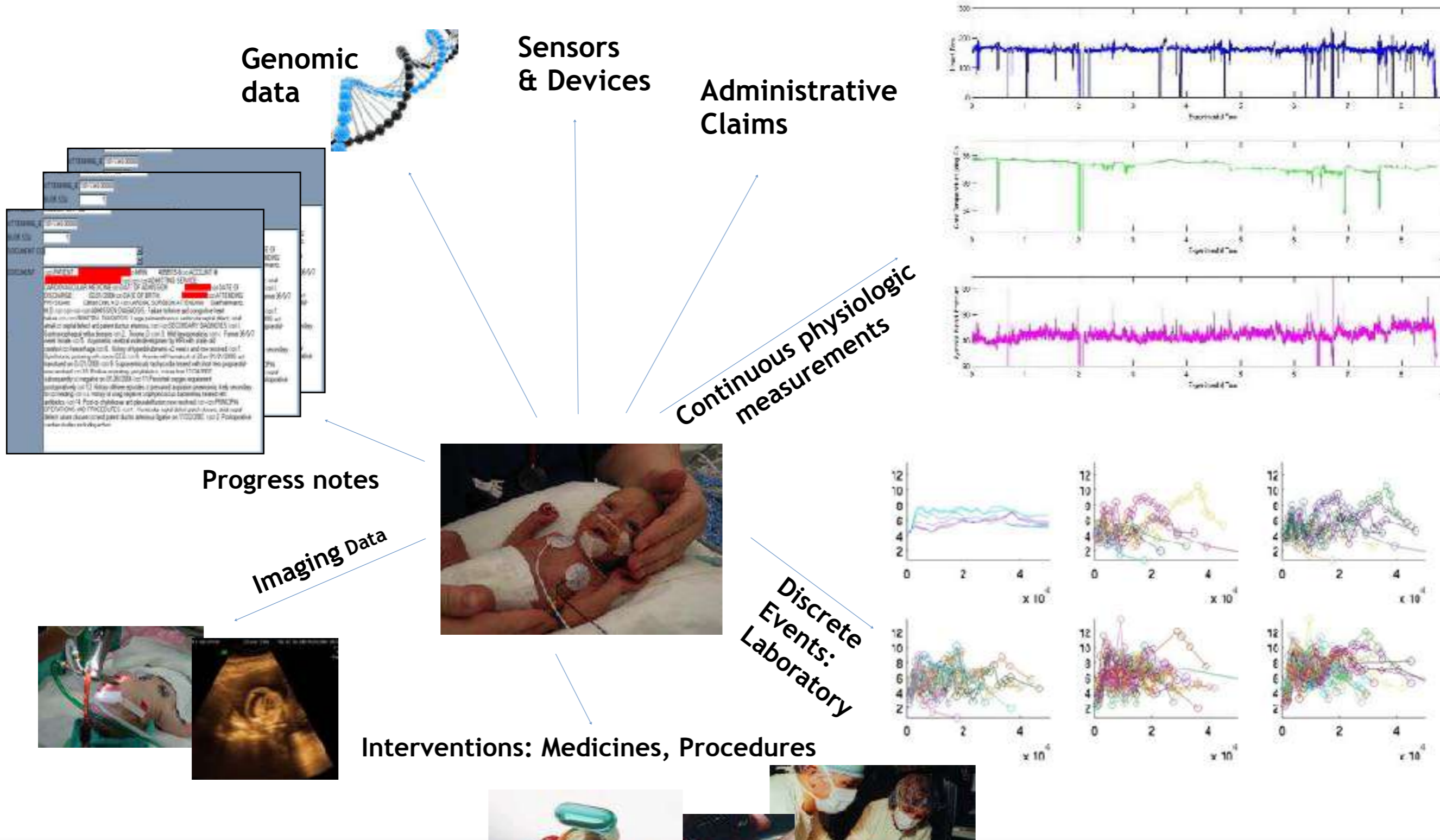


**Thank you!**  
**[ssaria@cs.jhu.edu](mailto:ssaria@cs.jhu.edu)**  
**[www.suchisaria.com](http://www.suchisaria.com)**



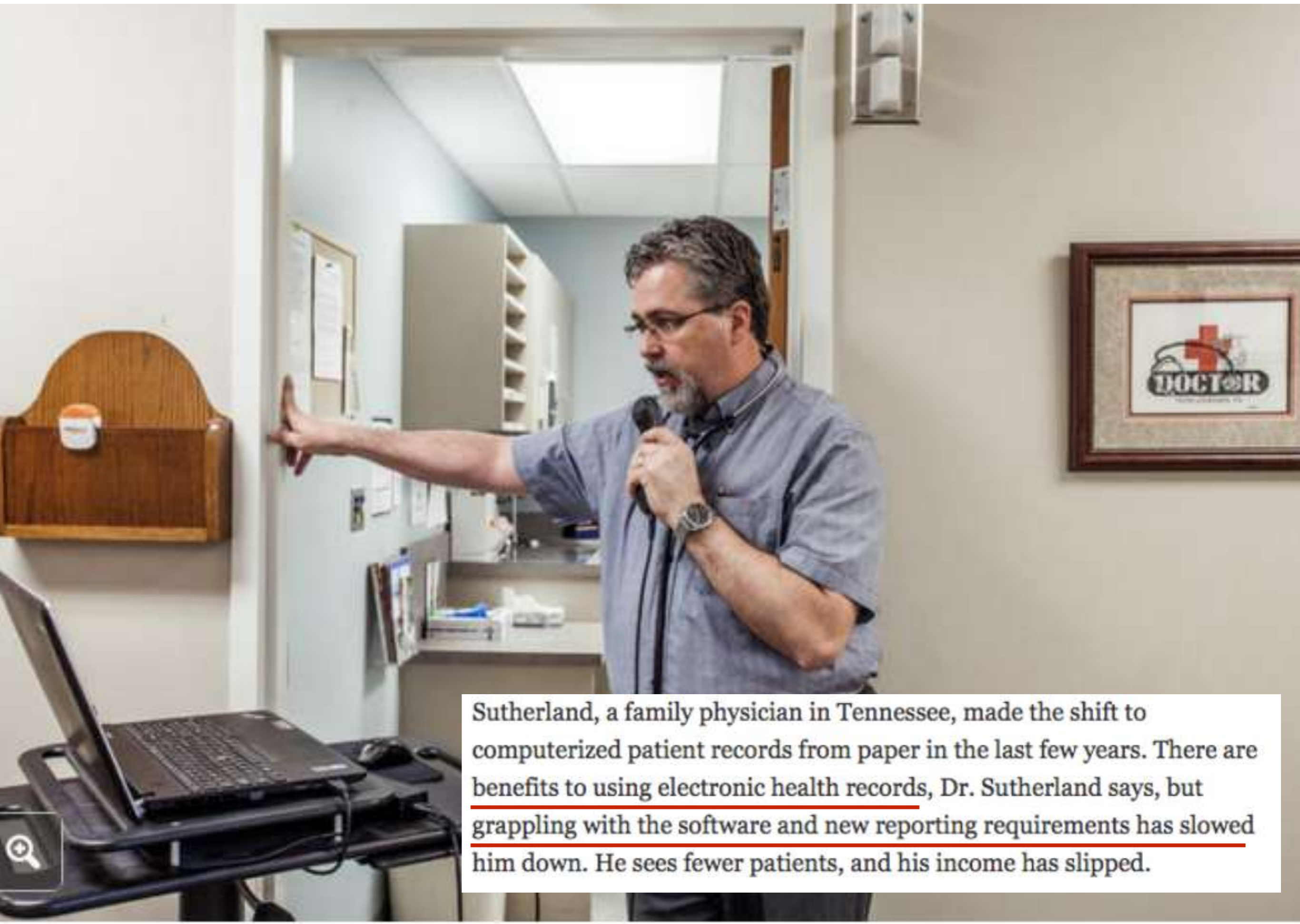


# Electronic Health Data



From 2008 to 2014, hospitals with EHRs rose to 75% from 9%, and in doctors' offices rose to 51% from 17%.

## \$32+ billion effort went into digitization. Benefits?



Sutherland, a family physician in Tennessee, made the shift to computerized patient records from paper in the last few years. There are benefits to using electronic health records, Dr. Sutherland says, but grappling with the software and new reporting requirements has slowed him down. He sees fewer patients, and his income has slipped.