
# Integration of AI in healthcare requires an interoperable digital data ecosystem

## *Lessons learned from SMART on FHIR*

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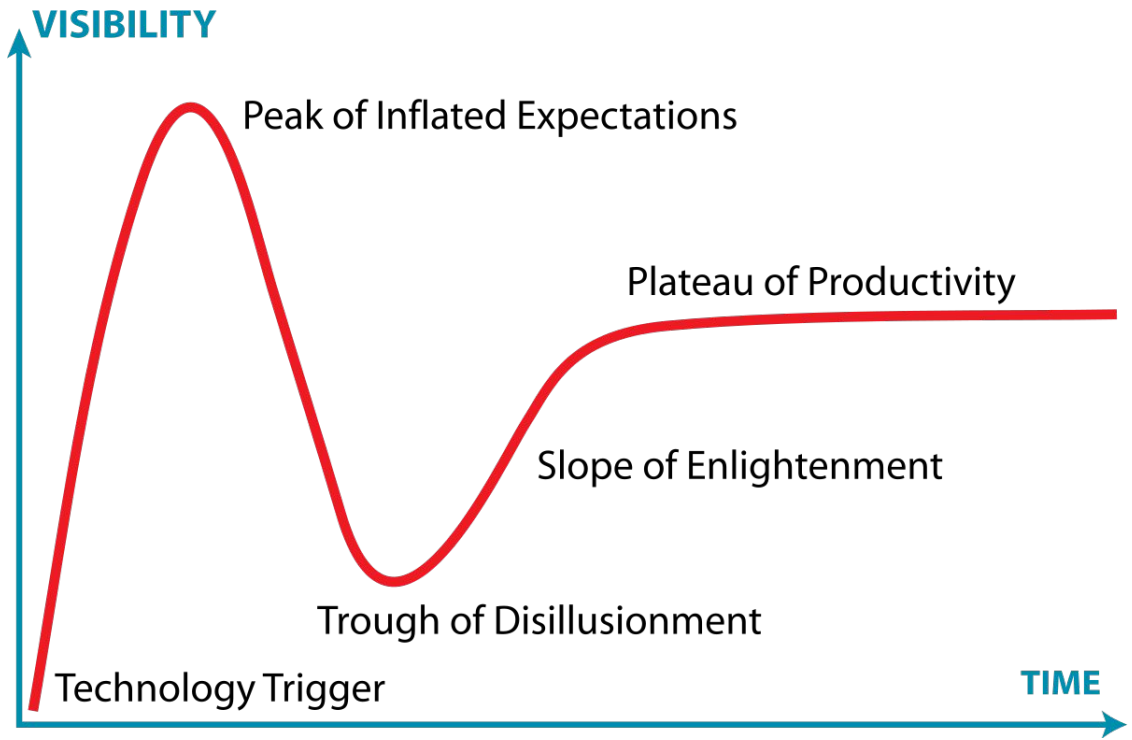
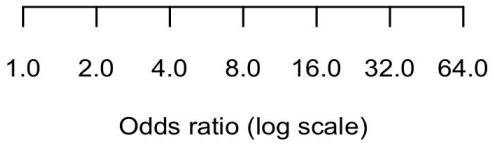
# Does the Gartner hype cycle apply to AI in this moment?



# Two comorbidities

# Epilepsy risk in autoimmune diseases

| Autoimmune Disease (AD) | N | Epilepsy (%) | Odds Ratio [95% CI] |
|---|---|---|---|
| SLE | 123 | 7.3 | 21.6 [ 11.0 , 42.7 ] |
| Celiac disease | 261 | 5.7 | 16.7 [ 9.9 , 28.2 ] |
| Ulcerative colitis | 201 | 3 | 8.4 [ 3.7 , 19.0 ] |
| Hashimoto's thyroiditis | 369 | 2.4 | 6.8 [ 3.5 , 13.3 ] |
| Crohn's disease | 360 | 2.2 | 6.2 [ 3.1 , 12.6 ] |
| Grave's disease | 118 | 1.7 | 4.7 [ 1.2 , 19.1 ] |
| Type 1 diabetes | 1354 | 1.4 | 3.9 [ 2.5 , 6.1 ] |
| Rheumatoid arthritis* | 533 | 1.1 | 3.1 [ 1.4 , 7.0 ] |
| Psoriasis** | 1017 | 0.9 | 2.4 [ 1.3 , 4.7 ] |
| Any of the above AD | 4163 | 1.8 | 5.2 [ 4.1 , 6.5 ] |




JAMA Neurology

1

# What will happen to thought?

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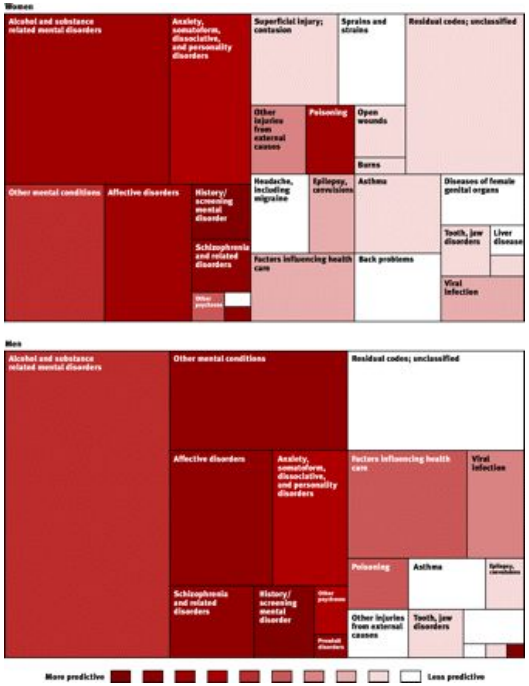
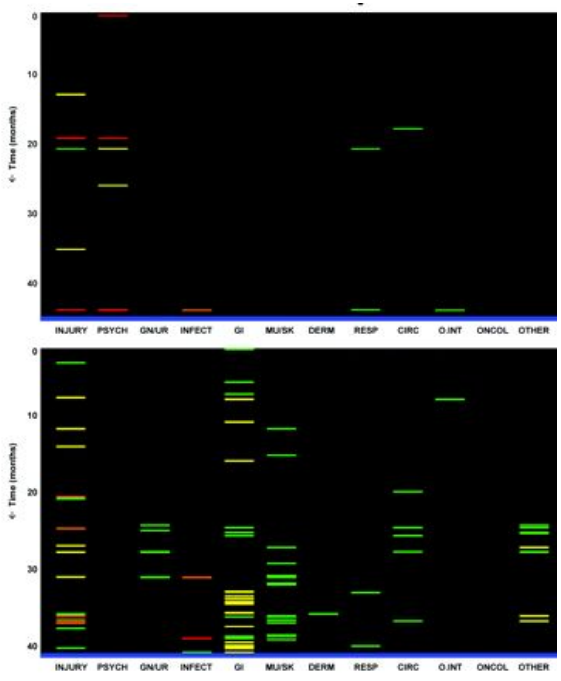
# Shrinking, shifting US MD workforce

- 1M physicians
- 80% now employed
- Increased ownership by for profit entities including private equity
- In the 2024 Residency Match cycle, only 80.2% of candidates secured a residency position, and primary care saw the highest number of unfilled slots: over 1,200 in family medicine, close to 1,000 in internal medicine, and more than 500 in pediatrics

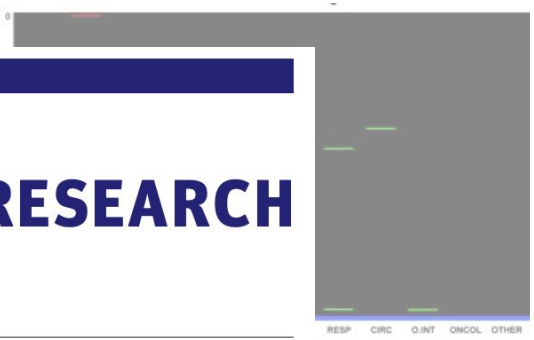
# Early predictive AI application

In 2009, could predict domestic violence up to 2 years in advance of an emergency department visit.

# High impact journal paper but no clinical impact

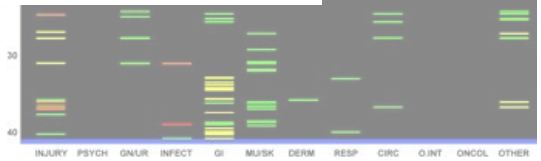

BMJ

RESEARCH

## Longitudinal histories as predictors of future diagnoses of domestic abuse: modelling study

Ben Y Reis, assistant professor,[1,2] Isaac S Kohane, professor,[1,2] Kenneth D Mandl, associate professor[1,2]





The NEW ENGLAND JOURNAL of MEDICINE

# No Small Change for the Health Information Economy

Kenneth D. Mandl, M.D., M.P.H., and Isaac S. Kohane, M.D., Ph.D.

The economic stimulus package signed by President Barack Obama on February 17 included a $19 billion investment in health information technology. How can we best take advantage of this unprecedented opportunity to computerize health care and stimulate the health information economy while also stimulating the U.S. economy? A health care system adapting to the effects of an aging population, growing expenditures, and a diminishing primary care workforce needs the support of a flexible information infrastructure that facilitates innovation in wellness, health care, and public health.

Flexibility is critical, since the system will have to function under new policies and in the service of new health care delivery mechanisms, and it will need to incorporate emerging information technologies on an ongoing basis. As we seek to design a system that will constantly evolve and encourage innovation, we can glean lessons from large-scale information-technology successes in other fields. An essential first lesson is that ideally, system components should be not only interoperable but also substitutable.

The Apple iPhone, for example, uses a software platform with a published interface that allows software developers outside Apple to create applications; there are now nearly 10,000 applications that consumers can download and use with the common phone interface. The platform separates the system from the functional-

# Computer science concept of abstraction

The essence of abstraction is preserving information that is relevant in a given context, and forgetting information that is irrelevant in that context.

- John V. Guttag

# Two APIs required by regulation since Dec 31, 2022

**21st Century Cures Act Certification 'has published application programming interfaces** and allows health information from such technology to be accessed, exchanged, and used **without special effort** through the use of application programming interfaces or successor technology or standards, as provided for under applicable law, including **providing access to all data elements of a patient's electronic health record** to the extent permissible under applicable privacy laws'

## SMART on FHIR

*Connect apps to the EHR for providers or patients*


## SMART/HL7 Bulk FHIR Access

*Extract standardized data on populations*

SMART®

Research

JAMA Internal Medicine | Original Investigation

# External Validation of a Widely Implemented Proprietary Sepsis Prediction Model in Hospitalized Patients

Andrew Wong, MD; Erkin Otles, MEng; John P. Donnelly, PhD; Andrew Krumm, PhD; Jeffrey McCullough, PhD; Olivia DeTroyer-Cooley, BSE; Justin Pestrue, MEcon; Marie Phillips, BA; Judy Konye, MSN, RN; Carleen Penoza, MHSA, RN; Muhammad Ghous, MBBS; Karandeep Singh, MD, MMSc

**IMPORTANCE** The Epic Sepsis Model (ESM), a proprietary sepsis prediction model, is implemented at hundreds of US hospitals. The ESM's ability to identify patients with sepsis has not been adequately evaluated despite widespread use.

**OBJECTIVE** To externally validate the ESM in the prediction of sepsis and evaluate its potential clinical value compared with usual care.

**DESIGN, SETTING, AND PARTICIPANTS** This retrospective cohort study was conducted among 27 697 patients aged 18 years or older admitted to Michigan Medicine, the academic health system of the University of Michigan, Ann Arbor, with 38 455 hospitalizations between December 6, 2018, and October 20, 2019.

Editorial page 1040
Multimedia
Supplemental content
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Research Letter

ONLINE FIRST

April 3, 2023

# Factors Associated With Variability in the Performance of a Proprietary Sepsis Prediction Model Across 9 Networked Hospitals in the US

Patrick G. Lyons, MD, MSc[1,2]; Mackenzie R. Hofford, MD[3]; Sean C. Yu, PhD[3]; Andrew P. Michelson, MD[1]; Philip R. O. Payne, PhD[3]; Catherine L. Hough, MD, MSc[4]; Karandeep Singh, MD, MMSc[5]

» Author Affiliations

*JAMA Intern Med.* Published online April 3, 2023. doi:10.1001/jamainternmed.2022.7182

HEALTH TECH

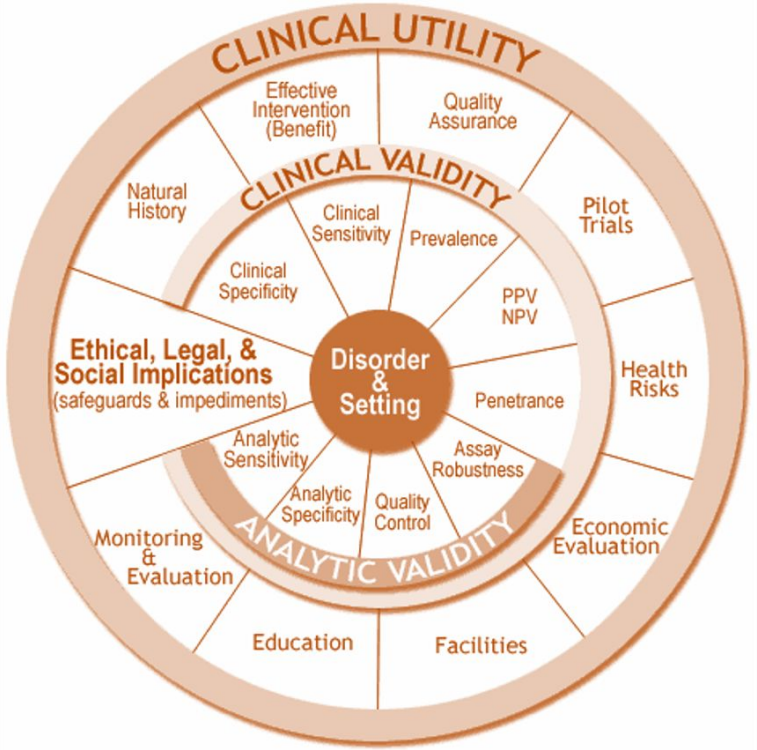
STAT+

# In new guidance, FDA says AI tools to warn of sepsis should be regulated as devices

By Casey Ross Sept. 27, 2022

Reprints

# Digital infrastructure must support full AI lifecycle



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PERSPECTIVE

# Escaping the EHR Trap — The Future of Health IT

**Authors**: Kenneth D. Mandl, M.D., M.P.H., and Isaac S. Kohane, M.D., Ph.D. Author Info & Affiliations

Published June 14, 2012 | N Engl J Med 2012;366:2240-2242 | DOI: 10.1056/NEJMp1203102 | VOL. 366 NO. 24



It is a widely accepted myth that medicine requires complex, highly specialized information-technology (IT) systems. This myth continues to justify soaring IT costs, burdensome physician workloads, and stagnation in innovation — while doctors become increasingly

# AI regulation is difficult so monitoring is key

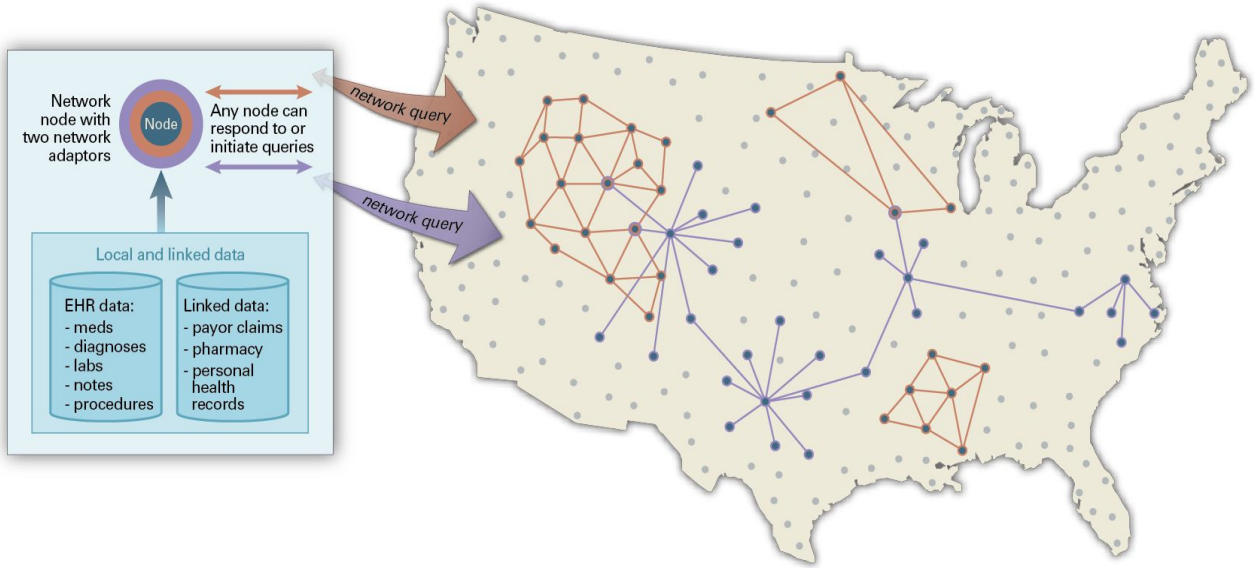
## Challenges in monitoring

- 🔄 Data Drift
- ⚙️ Data Shift
- 🎯 Ground Truth

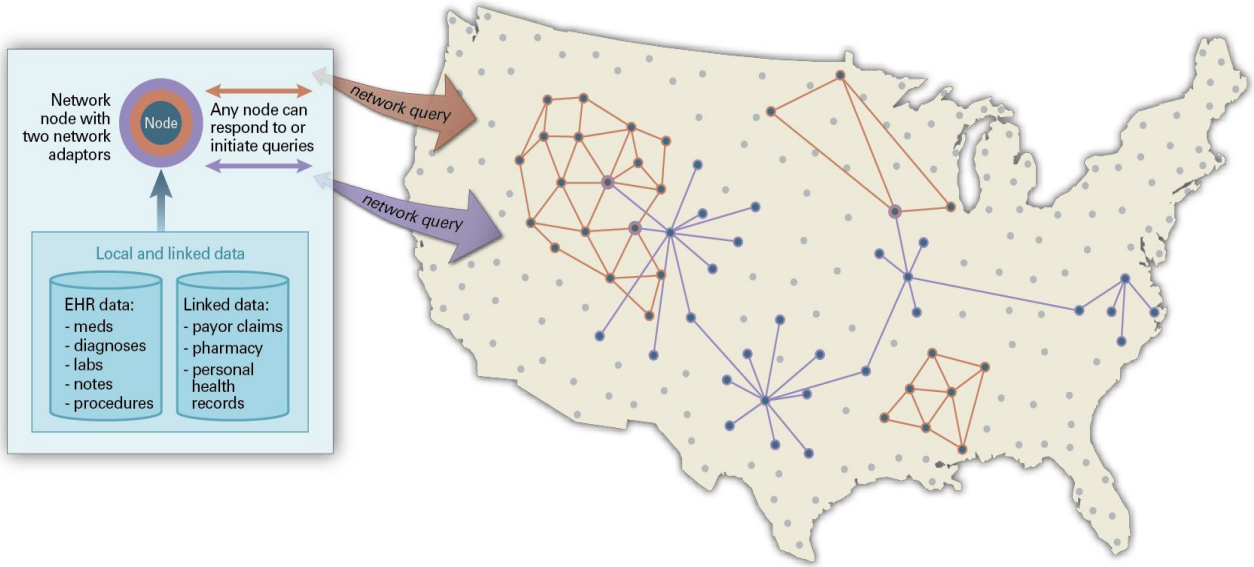
## Digital infrastructure must support

- 📊 Comprehensive Data
- 🗂️ Standardized Formats
- 🔗 Easily Shareable
- ♻️ Reusable Analytic Routines

# Federated data, fractal capabilities



# Federated data & fractal capabilities




Opportunities here may be greater than in US