How a wealth of information begets a poverty of attention: The special case of data overload in the ICU

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DISCLOSURE

- No financial conflicts of interest
- Funding
  - U.S. Department of Health and Human Services
  - National Institute of General Medical Sciences (NIH)
  - Massachusetts General Hospital

Wealth of Data; Poverty of Attention

- Challenges in critical care informatics
- Strategy to identify and address knowledge and capability gaps
- Use cases
  - Public health emergencies
  - "Black box" for crashes

Get back on Course

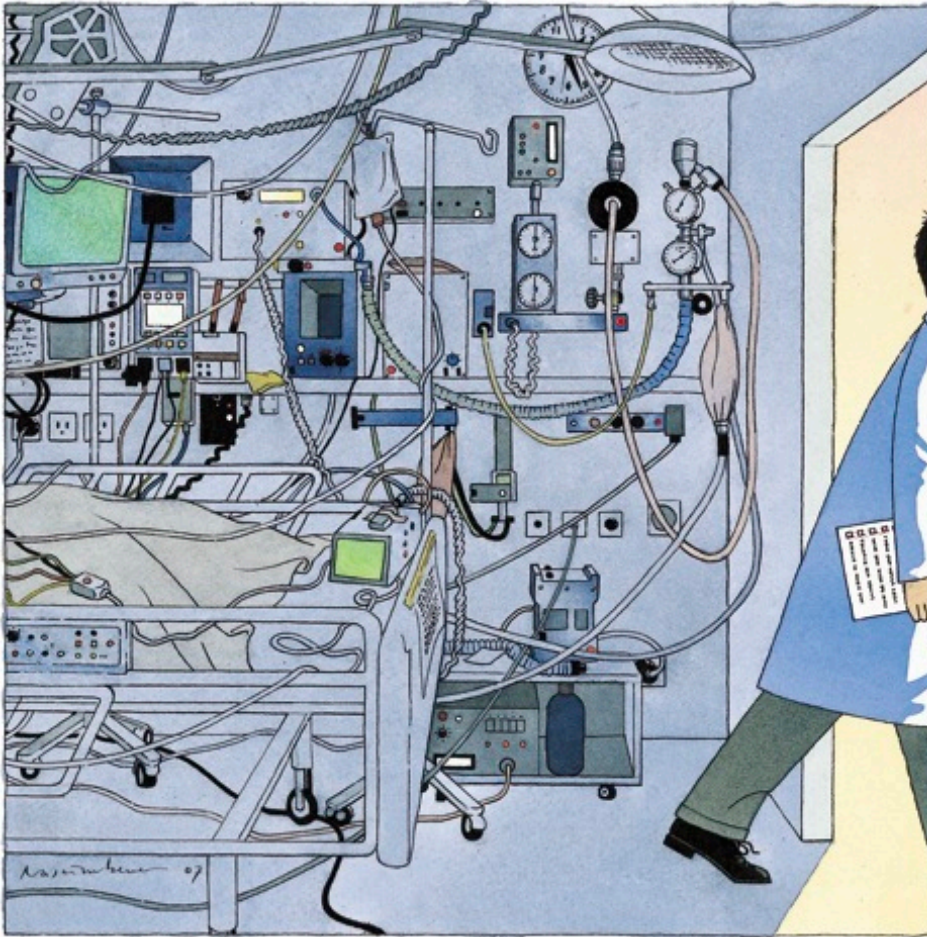http://www.flickriver.com/photos/canadagood/tags/tugboat/

Detour!!

Help is on the way

Intensive Care Unit

- High risk
- Lots of patients
- Lots of resources

- *LOTS OF DATA*

Gawande A, The Checklist
The New Yorker, December 10, 2007

Top 10 Technology Hazards

THE LIST FOR 2013

1. Alarm hazards
2. Medication administration errors using infusion pumps
3. Unnecessary exposures and radiation burns from diagnostic radiology procedures
4. Patient/data mismatches in EHRs and other health IT systems
5. Interoperability failures with medical devices and health IT systems
6. Air embolism hazards
7. Inattention to the needs of pediatric patients when using "adult" technologies
8. Inadequate reprocessing of endoscopic devices and surgical instruments
9. Caregiver distractions from smartphones and other mobile devices
10. Surgical fires

Emergency Care Research Institute (ECRI), 2013

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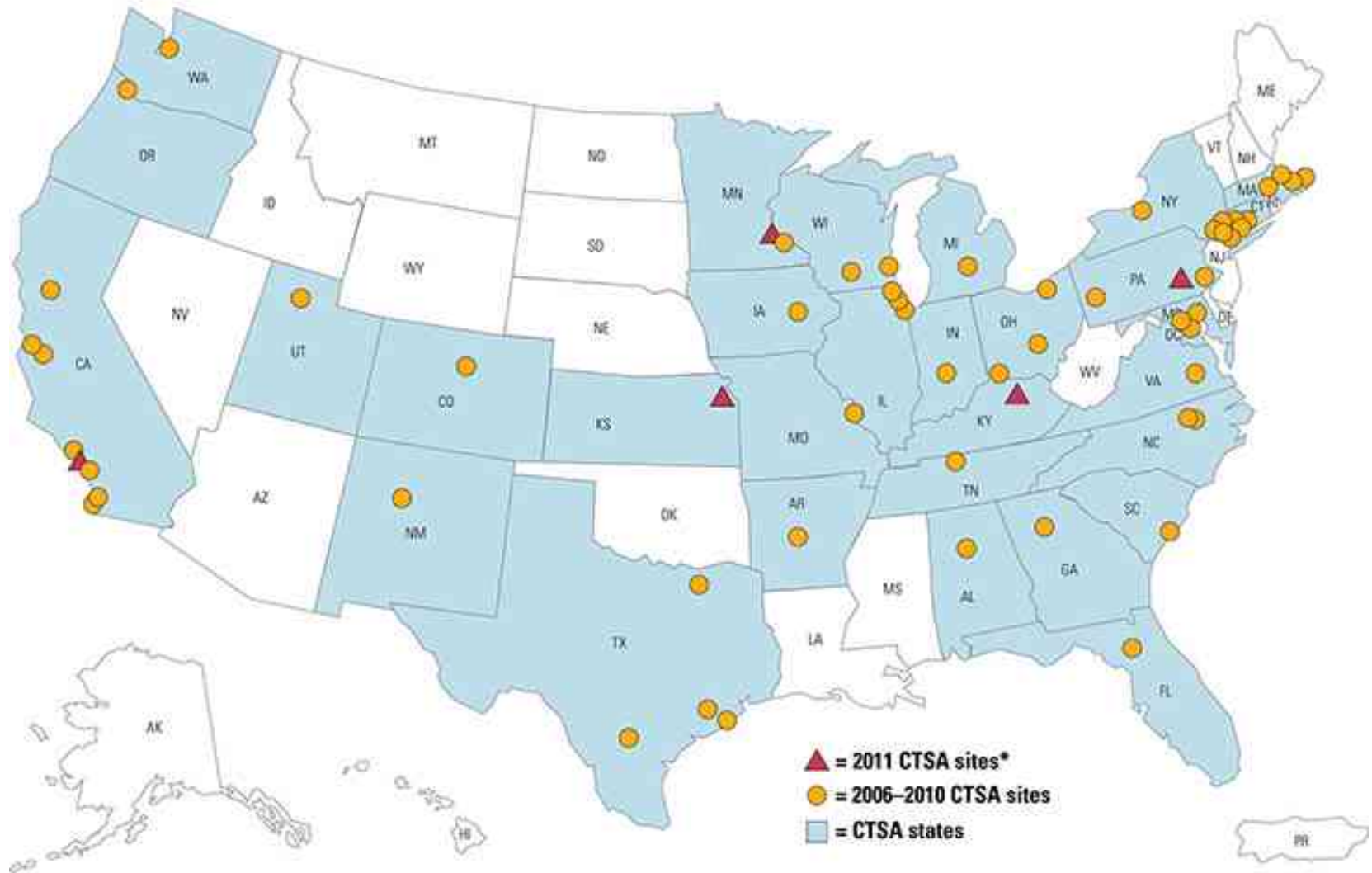 - "Black box" for crashes

www.usciitg.org

Transformative Approach

- Inclusive, transdisciplinary, time continuum
- "Network-of-networks"
  - Federally funded networks (ARDSnet, ROC, NETT)
  - Professional Organizations (CCSC)
- Triannual face-to-face meetings
  - Fall at NIH in Bethesda
  - Winter at SCCM (San Francisco)
  - Spring at ATS (San Diego)

USCIITG 2014

- 200+ investigators across 68 ICU's
- Four large Programs
  - Prevention of Organ Failure (PROOF)
  - Critical Illness Outcomes Study (CIOS)
  - Early ICU Rehabilitation (PEIR)
  - Program for Emergency Preparedness (PREP)
- ~$22m funding over last 4 years
  - NIH, CMS, ASPR, DOD

USCIITG NIH-CTSA-TSIG

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Use Case #1

Pubic Health Emergencies

SOUNDING BOARD

Research as a Part of Public Health Emergency Response

Nicole Lurie, M.D., M.S.P.H., Teri Manolio, M.D., Ph.D., Amy P. Patterson, M.D.,
Francis Collins, M.D., Ph.D., and Thomas Frieden, M.D., M.P.H.

"Although responses to recent events have typically used the best available science at the time, additional research, done in parallel with and after the response itself, is often essential to address the most pressing knowledge gaps presented by public health emergencies and to ensure that they are addressed by the time another similar disaster strikes. **Recent events have also illustrated gaps in planning for, and rapidly executing, scientific research in the context of disaster response.***"* [emphasis added]
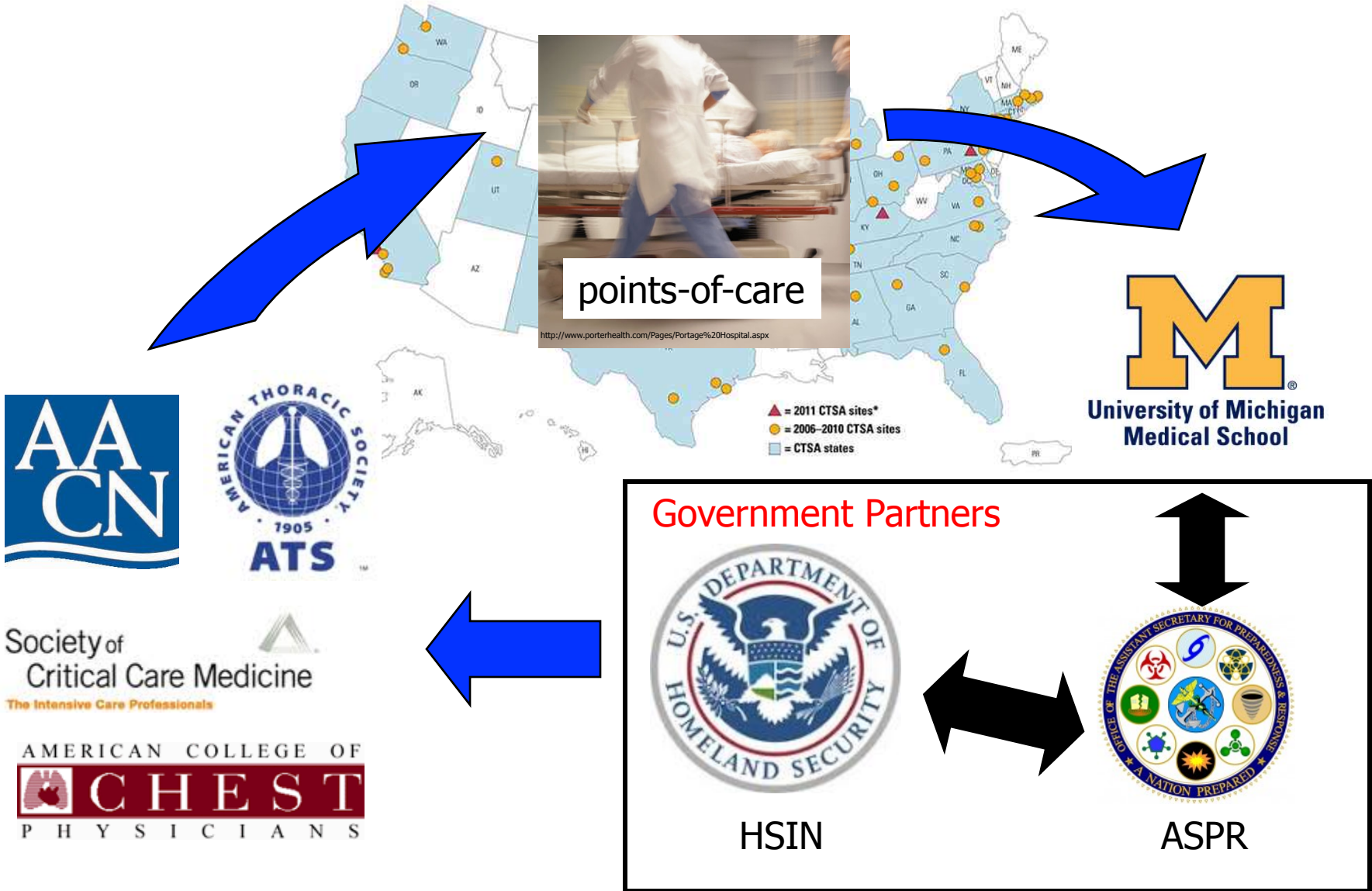
Pre-hosp ➡ **ED** ➡ **OR Floor** ➡ **ICU** ➡ **Rehab**

United States Critical Illness and Injury Trials Group
Program for Emergency Preparedness
(USCIITG-PREP)

Rapid Analysis and Data Dissemination Plan

points-of-care

http://www.porterhealth.com/Pages/Portage%20Hospital.aspx

- ▲ = 2011 CTSA sites*
- ○ = 2006–2010 CTSA sites
- ▢ = CTSA states

University of Michigan Medical School

Government Partners

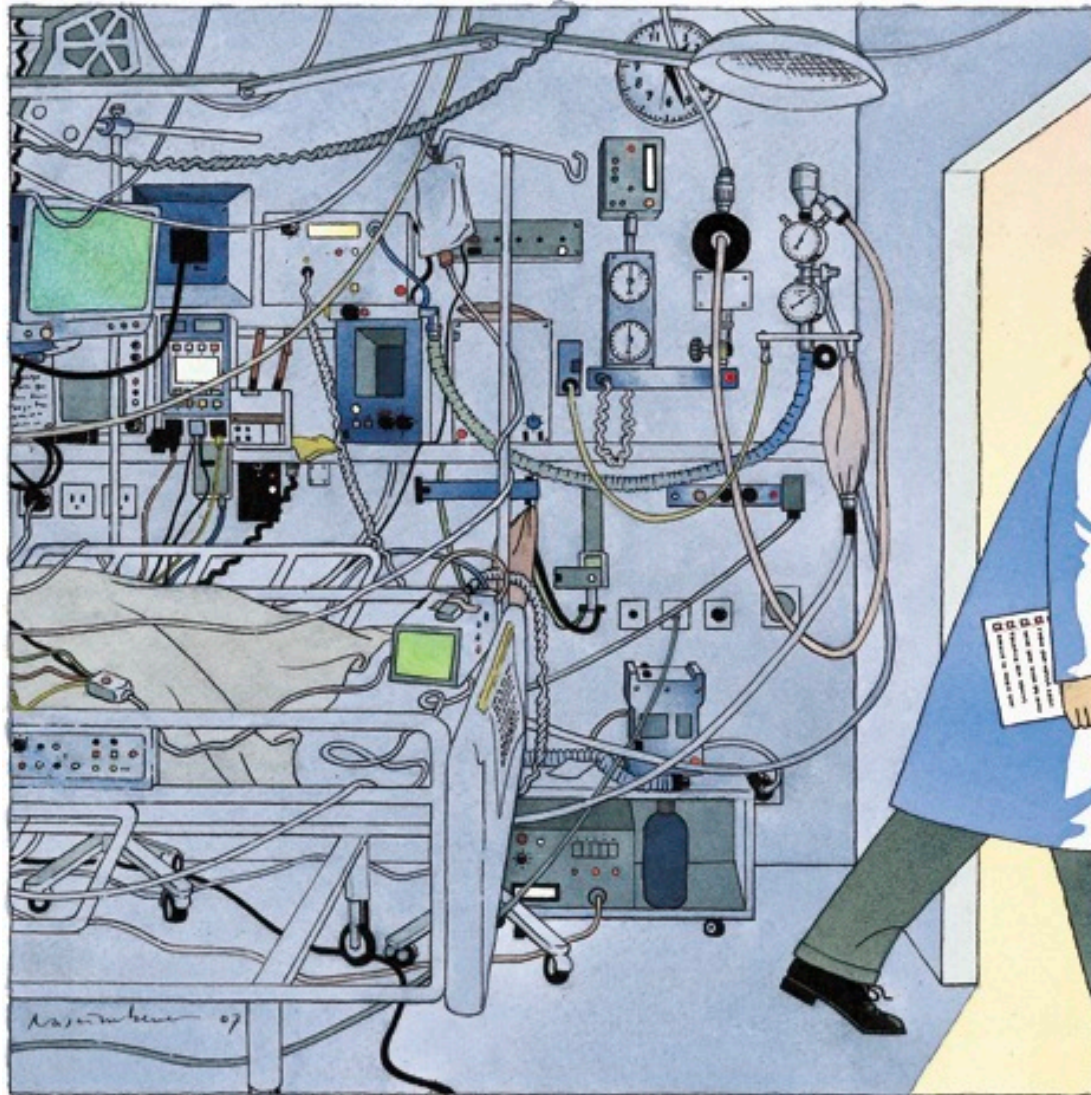HSIN   ASPR

Use Case #2

ICU "Black Box"

Health Engineering in 2032

- 20 years from now
  - Current problems that are unresolved
    - Which data to collect, monitor?
    - Prediction and modeling
    - "Sniffers", automated responses
  - Future problems created
- Anticipated solutions of the future
  - "Disruptive technology"

July 19, 2012

What if something goes wrong?

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MASSACHUSETTS GENERAL HOSPITAL

CRITICAL CARE CENTER

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Reanimation - "Sickness" Group

Bill
Davood
Dustin
Michael
Perren

July 19, 2012

State Descriptors and Responses

- Continuum: Health – sick – "really sick"
- All available clinical expertise brought to bear
  - Identify degree of robustness, system failures, bifurcations
  - Act to "bend" the curve, redirected towards health
    - Devices gather data, detect, analyze, react
    - Non-linear systems
  - Integrated communication
- Defines "individualized/personalized" medicine
- Leverages telemedicine – bring expertise to resource-poor settings

Data Security and Confidentiality

- Balance tension of security and trust
- Safety for individual
  - Holds key to aggregate, individualized data
  - Releases data publically to inform population health
    - Determines classes
    - Responses to "nudges"
    - Prediction and modeling
- Data are "secure but shared"

Senescence and Reanimation

"The idea is to die young as late as possible"
- Ashley Montagu

- Artificial organs
- Induced pluripotent stem (iPS) cells
- Molecular medicine
  - Action to bed the curve, to "*reprogram*" at the molecular level

Speakers

- Gianrico Farrugia (Mayo)

- Tim Buchman (Emory)
- Emory Brown (MIT – MGH)
- Ogie Gajic (Mayo)