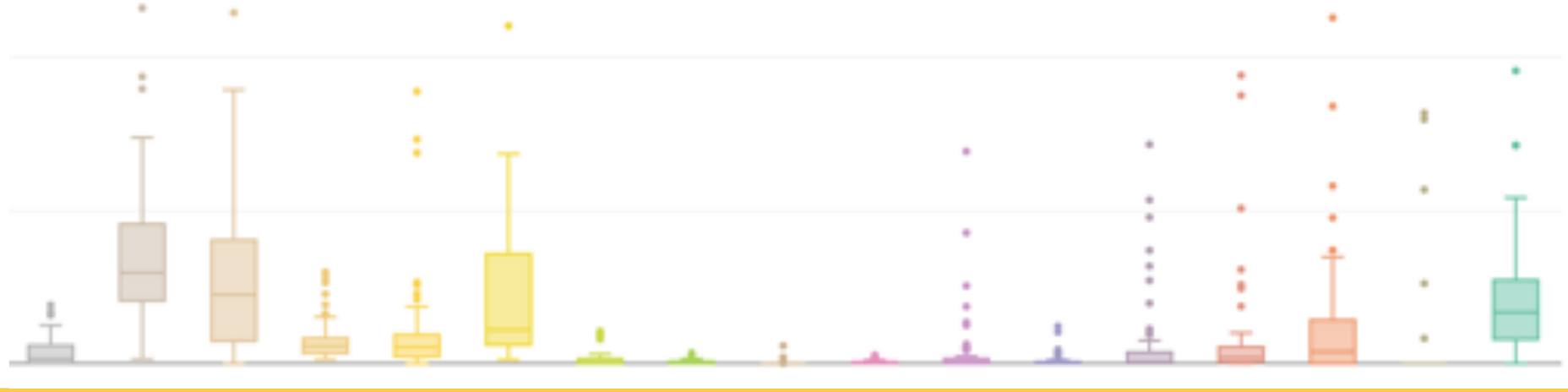


PRECISION CRITICAL CARE

How data can help us find the zebra in a herd of horses

David Maslove, MD, MS, FRCPC
Department of Critical Care Medicine
Queen's University
Kingston, Ontario

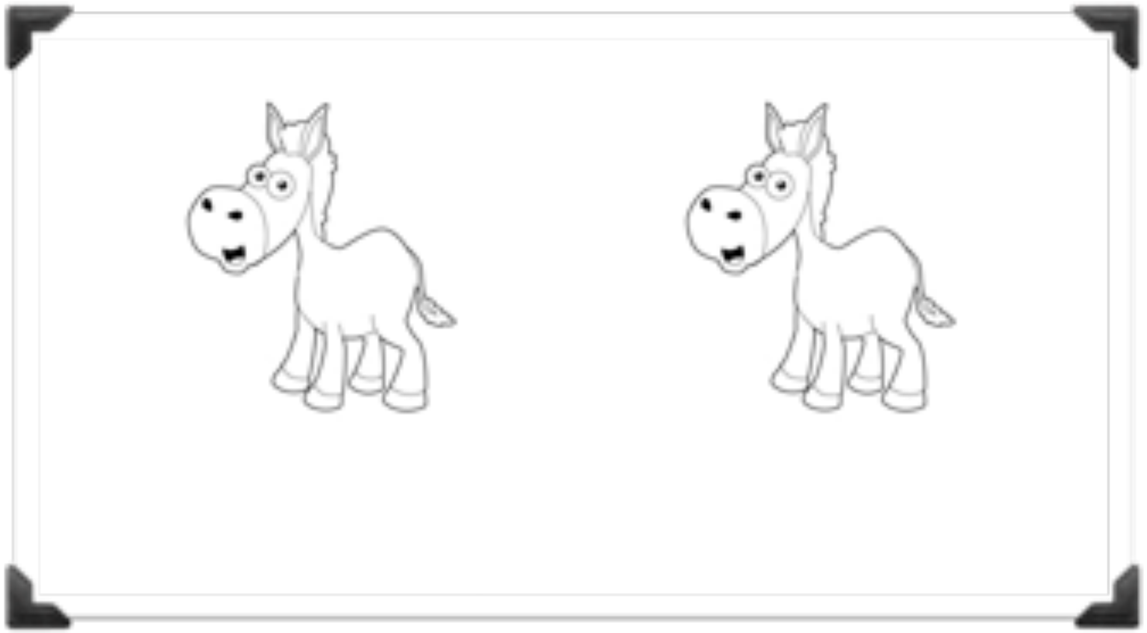
KHSC/Queen's Innovation Workshop
Feb 3, 2020

Queen's University

"When you hear hoofbeats, think of horses not zebras."

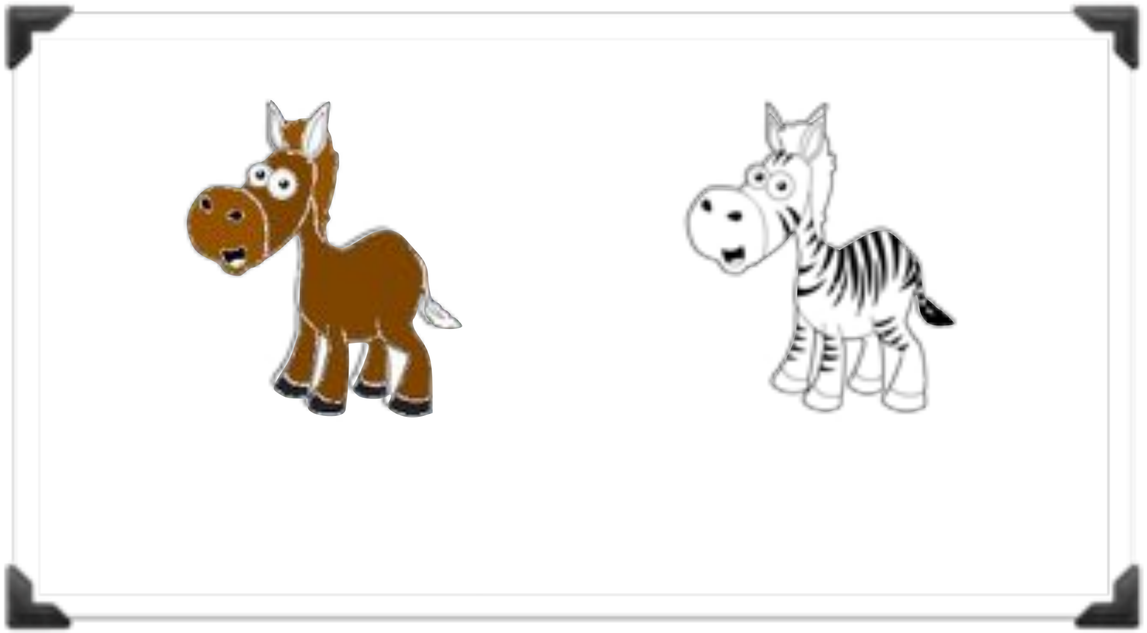
—Dr. Theodore Woodward

DATA TO ENABLE DISTINCTIONS



59 KB

DATA TO ENABLE DISTINCTIONS



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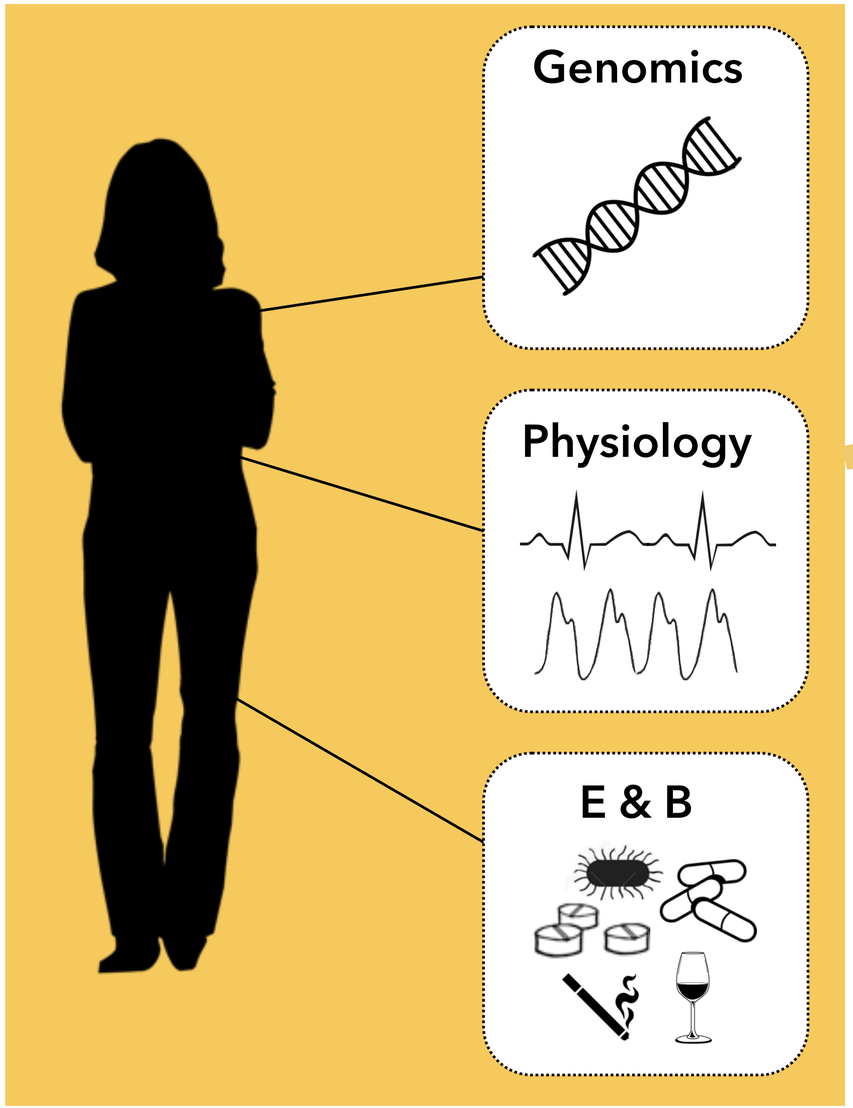
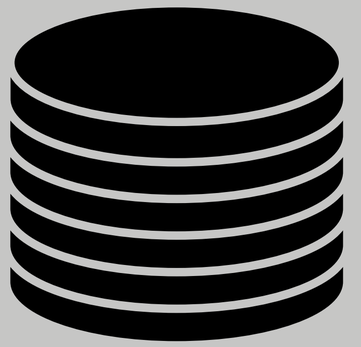
DATA TO ENABLE PRECISION

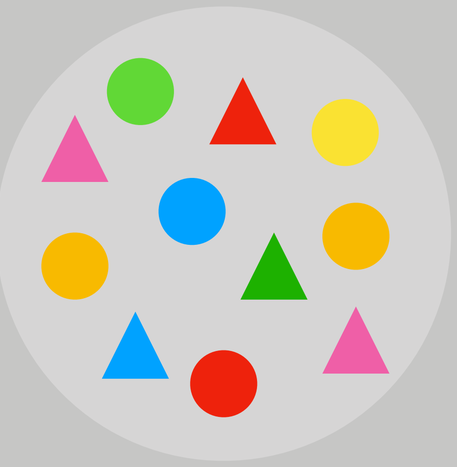


R_x

THE ICU IS A PROVING GROUND FOR PRECISION MEDICINE



Lots of data

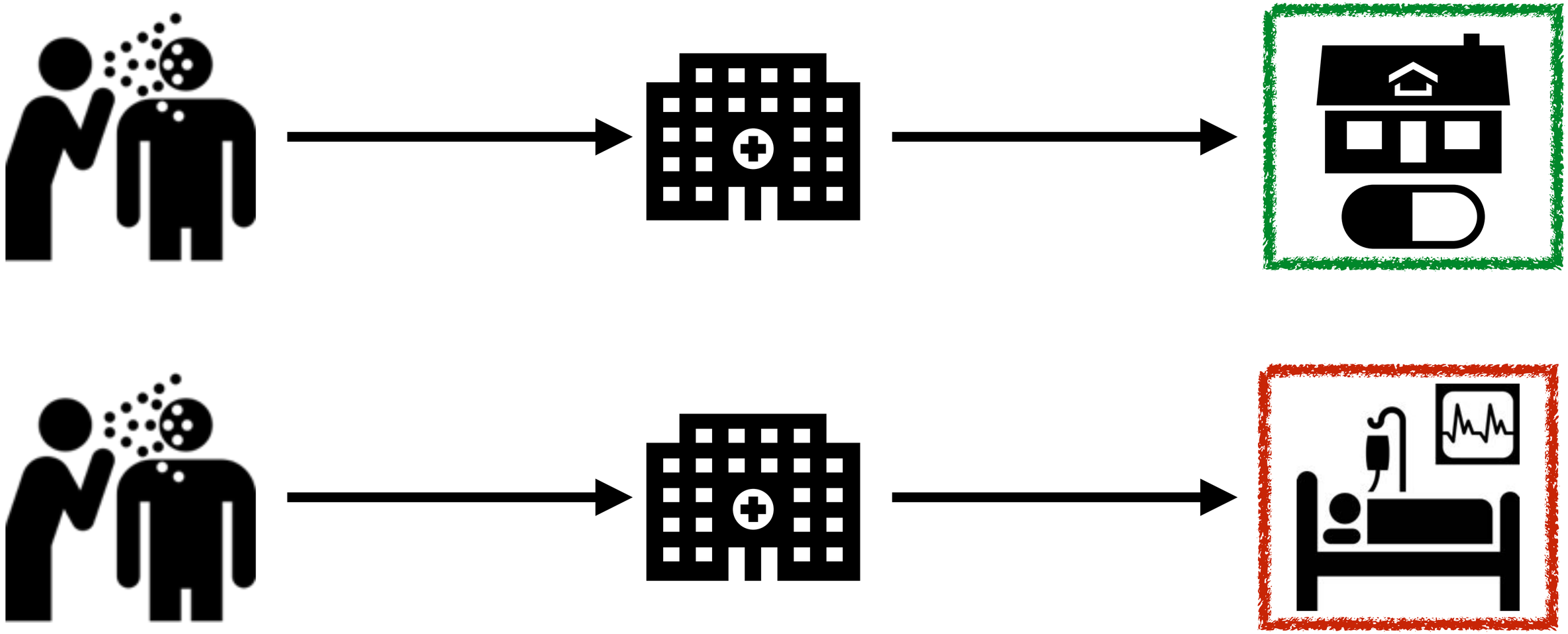


Lots of heterogeneity

Critical illness is defined by syndromes

...and syndromes are heterogeneous

Critical illness is defined by syndromes

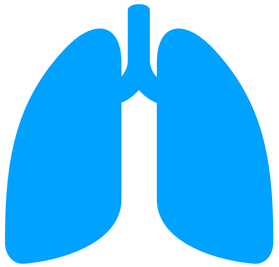


Critical illness is defined by syndromes

SEPSIS = infection + life-threatening organ dysfunction

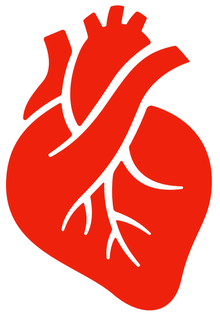
(and is implicated in 1 out 5 deaths worldwide)

?

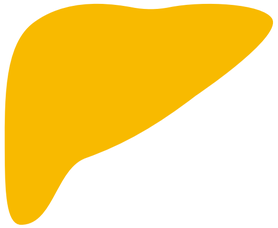


Lung

Brain



Heart



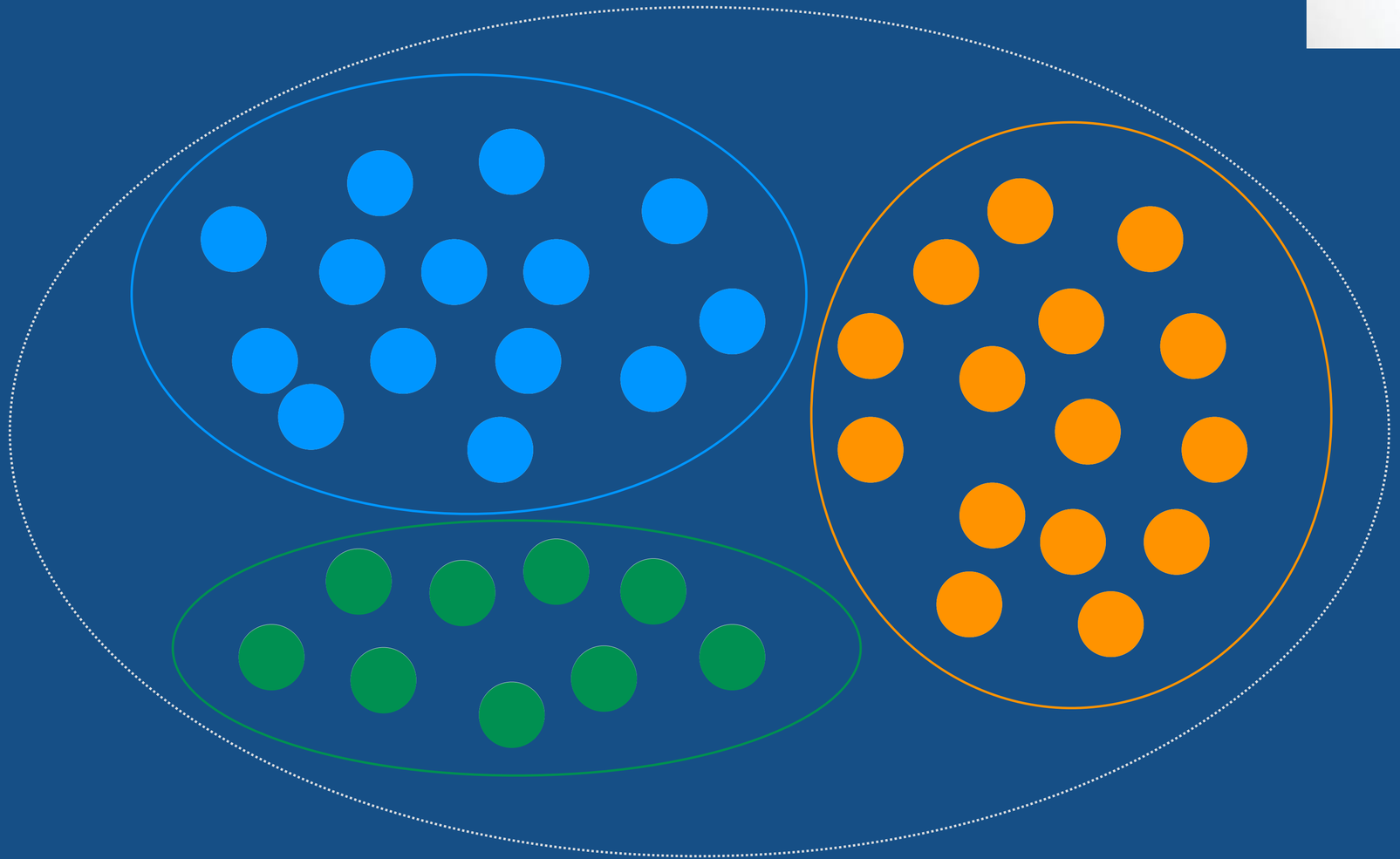
Liver

Machine learning & sepsis

Where are we now?

Sepsis subtypes

Gene expression data



Sepsis subtypes

Not ready for Prime Time

Gene expression data

Predicting sepsis onset

A Machine Learning Algorithm to Predict Severe Sepsis and Septic Shock: Development, Implementation, and Impact on Clinical Practice*

Heather M. Giannini, MD[1]; Jennifer C. Ginestra, MD[1]; Corey Chivers, PhD[2]; Michael Draugelis, BS[2]; Asaf Hanish, MPH[2]; William D. Schweickert, MD[2,3]; Barry D. Fuchs, MD, MS[2,3]; Laurie Meadows, RN, CCRN[4]; Michael Lynch, RN, CEN[4]; Patrick J. Donnelly, RN, MS, CCRN[5]; Kimberly Pavan, MSN, CRNP[6]; Neil O. Fishman, MD[2]; C. William Hanson, MD, III[2]; Craig A. Umscheid, MD, MSCE[2,7,8]

Predicting sepsis onset

Not ready for Prime Time

A M…ithm to Predict
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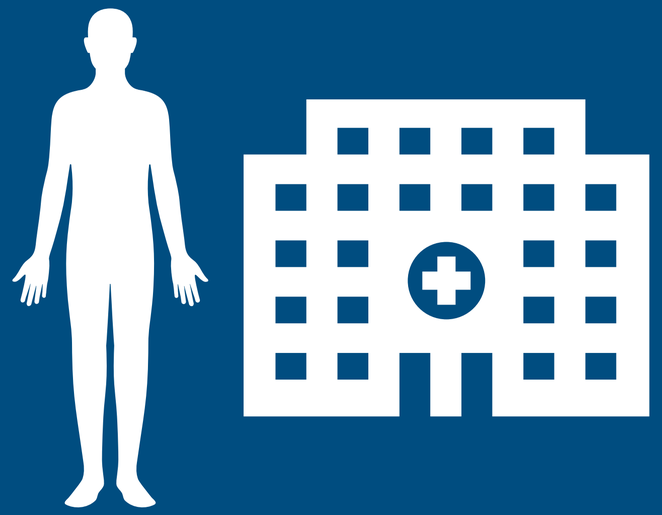
Challenges

CONDUIT

“regular” big data

≠

“medical” big data



Where are we at Queen's?/KHSC

CONDUIT

Genomics

Waveforms

EMR

Queen's University

QCPU
Queen's CardioPulmonary Unit

Kingston Health Sciences Centre
Centre des sciences de la santé de Kingston

Progress to date

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These data have tremendous potential to generate novel hypotheses.

- ☑ Every heartbeat from every patient, in every bed
- ☑ HDF5-based data standard
- ☑ Fast query system
- ☑ 30 TB of high-frequency data

What we need

1.  People!

2.  Computing resources (storage, GPUs for *deep learning*)

   KHSC vs CAC

3.  EMR data (for clinical context)

4.  Support from IT, Decision Support, Clinical Engineering

QUESTIONS & COMMENTS

david.maslove@queensu.ca

@DavidMaslove