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WHERE **THE WORLD** CONNECTS FOR HEALTH

Conference & Exhibition | March 5–9, 2018

Las Vegas | Venetian – Palazzo – Sands Expo Center

Empowering Data Driven Health

Session #109, March 7, 2018

Kevin Ross, General Manager, Precision Driven Health

PRECISION DRIVEN HEALTH

COMMITMENT

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Conflict of Interest

Kevin Ross, Ph.D.

Has no real or apparent conflicts of interest to report

Employed by Precision Driven Health

- Jointly funded by Orion Health and the New Zealand Government

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Agenda

- Precision Driven Health Partnership Overview
- New Zealand health system and data
- Partnership model and objectives
- Some exemplars
- The future

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Learning Objectives

- Explain how data is transforming the practice of medicine
- Show the results of research examining the application of machine learning in health
- Create an understanding of how data-driven solutions benefit global health outcomes
- Show how New Zealand research is contributing to the transformation of health IT

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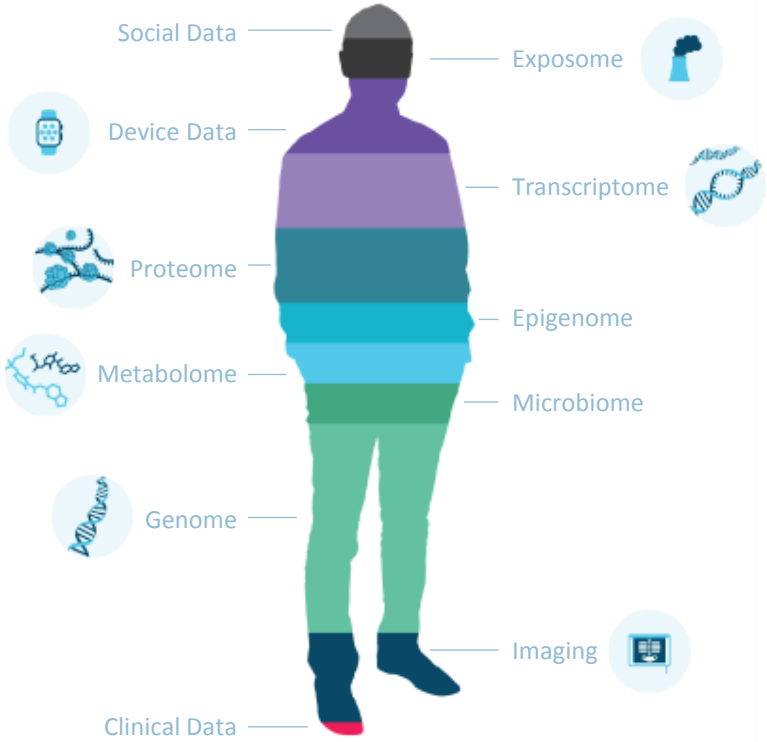
Machine Learning will Disrupt Health

- Mass customization
- Self service
- New markets – often peer to peer
- Recommendation / reputation models
- New ways to collect and understand (lots of) data
- Health has 20-40% waste, according to WHO

The Data that Describes Us



[1]IBM Watson – Fortune 2016

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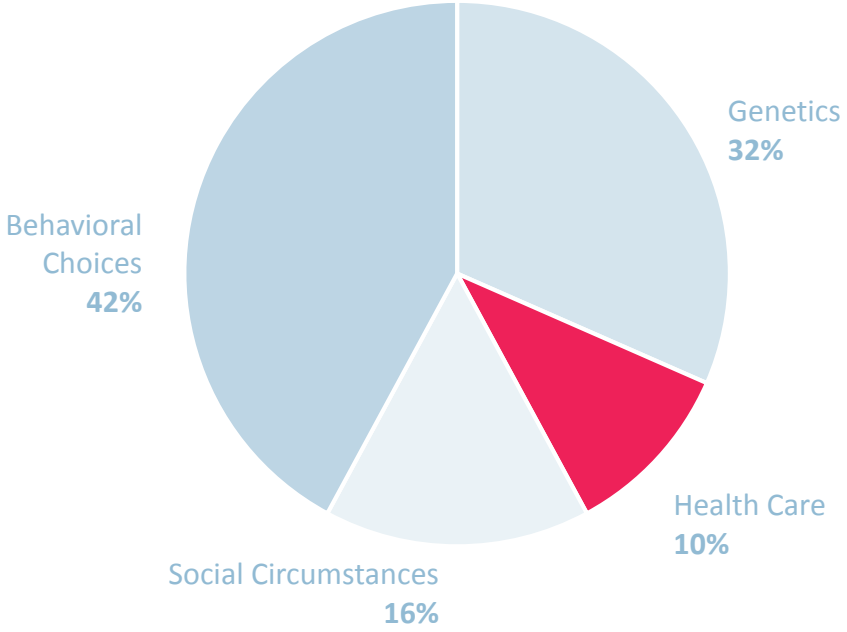
The Data that Determines Our Health



McGinnis et. al. Human Affairs, Vol 22 (2)

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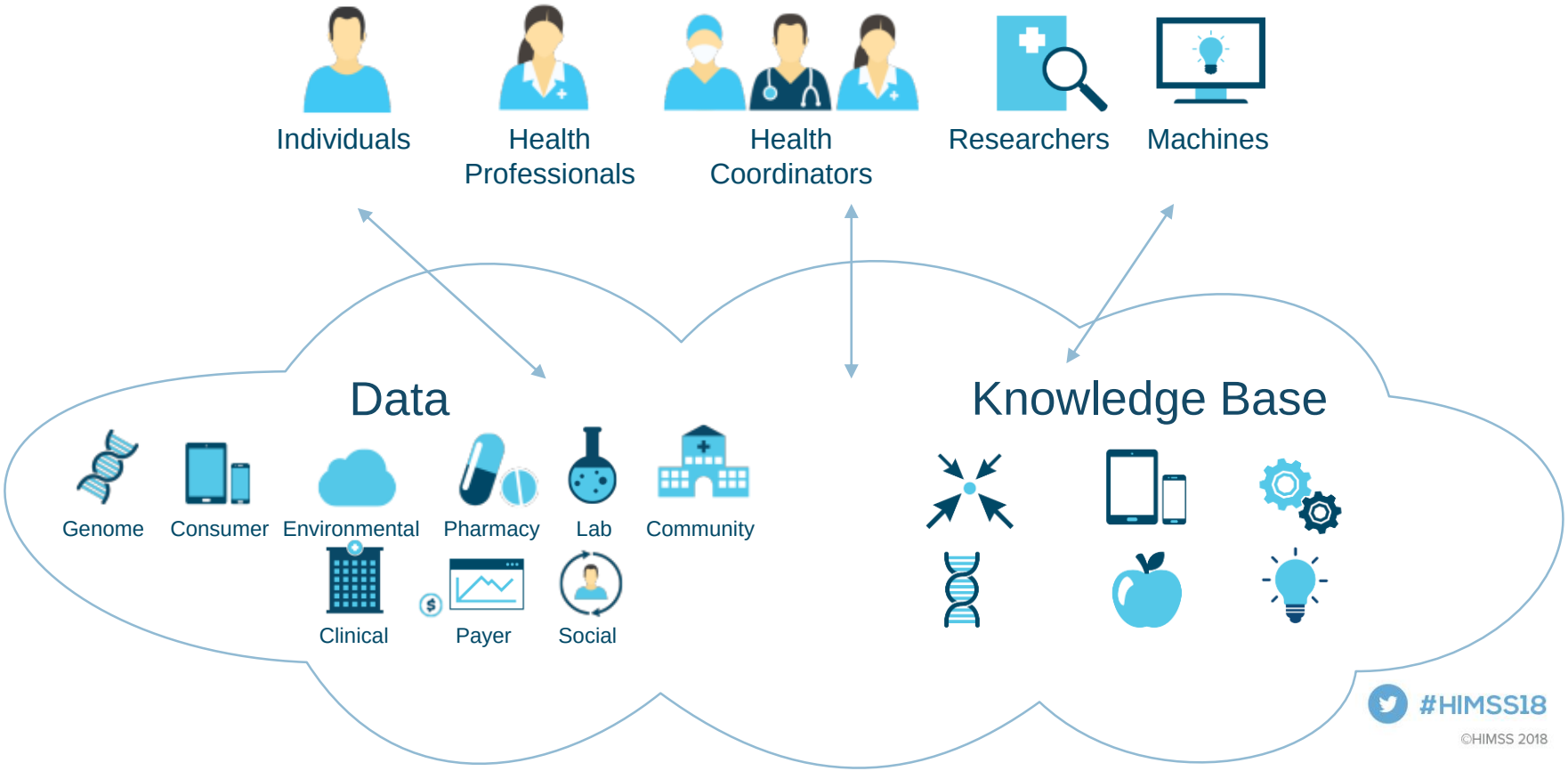
Individuals
Health Professionals
Health Coordinators
Researchers
Machines
Data
Genome
Consumer
Environmental
Pharmacy
Lab
Community
Clinical
Payer
Social
Knowledge Base

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New Zealand

- Population 4.5M
- Well-educated, diverse population, suited for developing new technology
- Single payer (government-funded)
- Moving toward national electronic health records system
- New Zealand universities lead in data science

New Zealand Health Data

- Single patient identifier for 20 years
- Integrated data infrastructure
  - Linked database of data records, including health, education, social programs, justice
- Hosted significant longitudinal studies
  - Dunedin study tracked lives of people from 1974 till now

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Precision Driven Health Partnership
Empowering Data-Driven Precision Health

The Precision Driven Health Research Partnership is creating the capability to optimize the health of each individual and their whanau by combining and learning from all available data.

This will improve health outcomes globally, increase health provider efficiency, and enable commercial success.

THE UNIVERSITY OF AUCKLAND NEW ZEALAND
ORION HEALTH
Waitemata District Health Board Best Care for Everyone
cure kids
clinithink
MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT HIKINA WHAKATUTUKI

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Research Program Highlights

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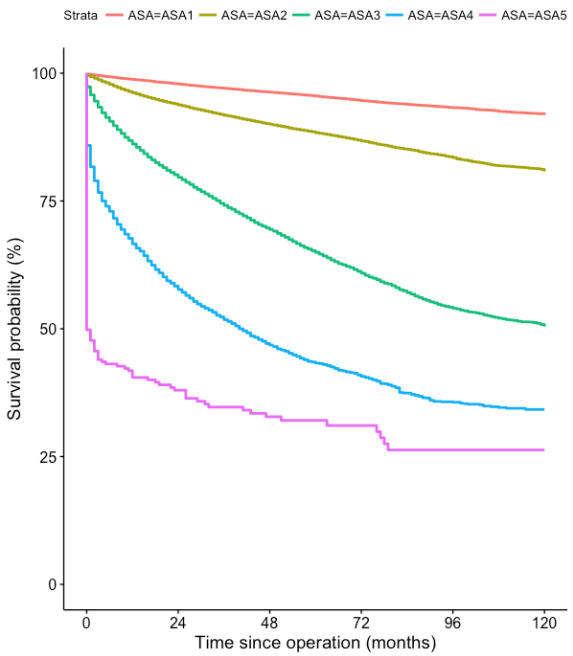
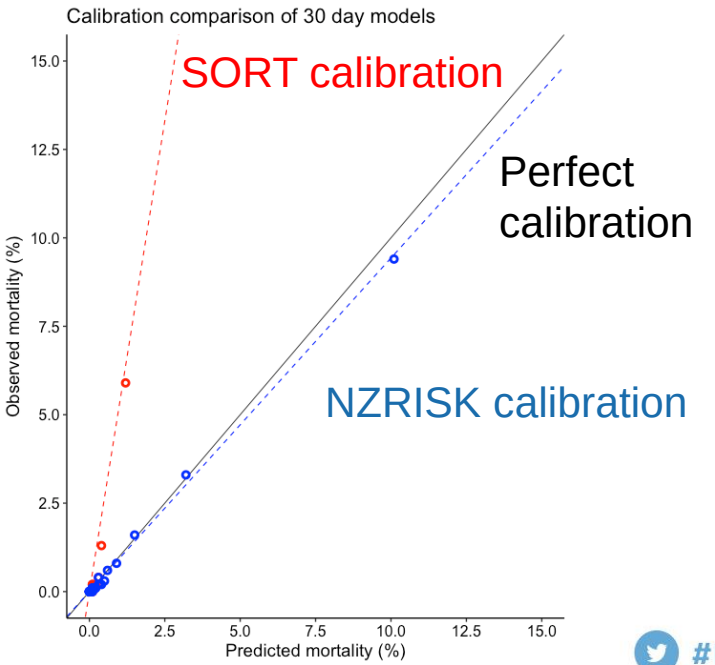
Surgical Outcome Calculator

- Full national, unbiased dataset of 360,000 surgeries
- Multiple outcomes and timeframes
- Data includes specialty, health, acuity, severity, age, gender, ethnicity
- Patients and clinicians can make better shared decisions

Calibration & ASA Survival Plots





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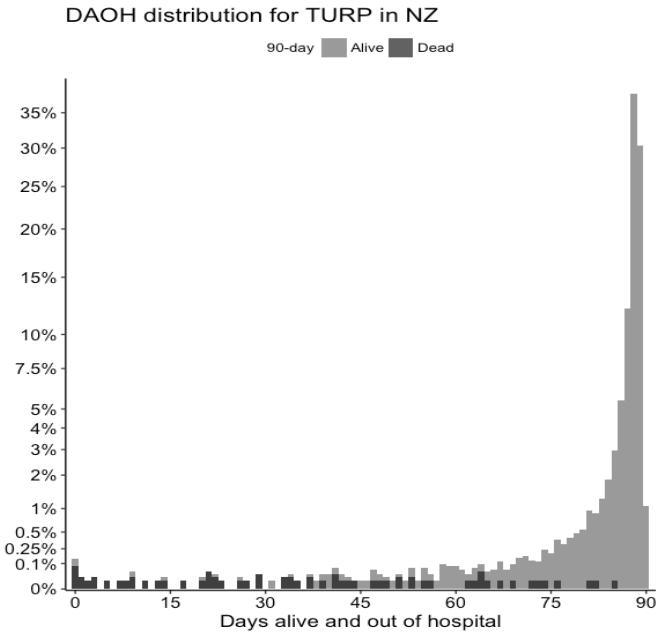
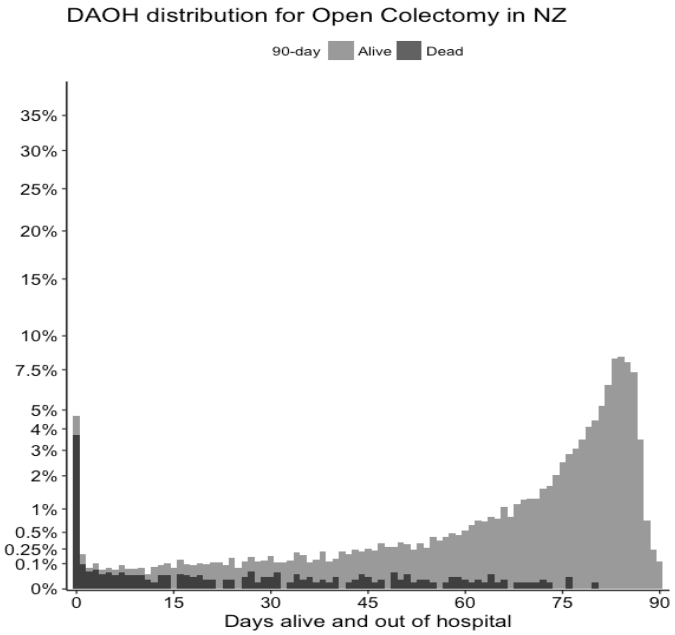
Days Alive Out of Hospital





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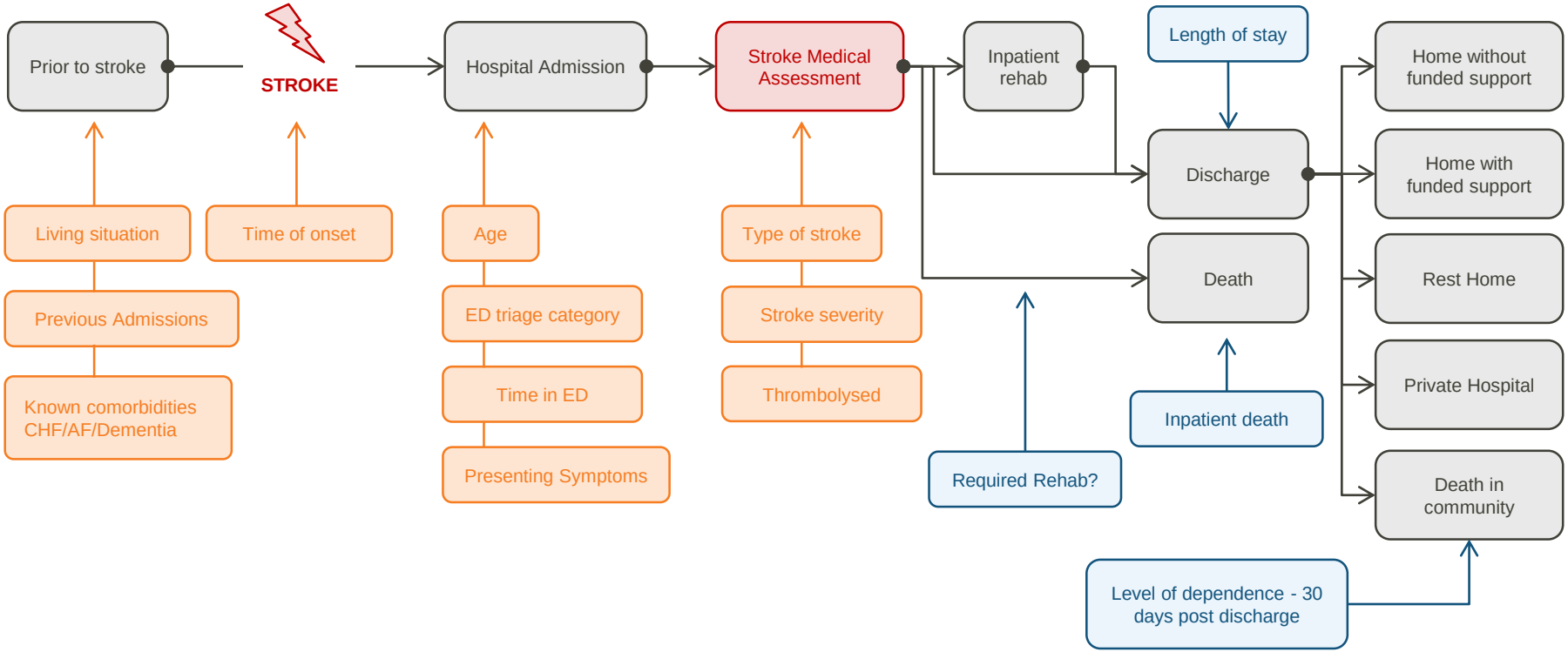
Stroke Outcome Prediction

- Predict health outcomes for stroke patients using machine learning
  - Predicts mortality
  - Inpatient stay
  - Post hospital care support
- Predictions built into clinician decision support
- Testing models versus expert clinician judgment



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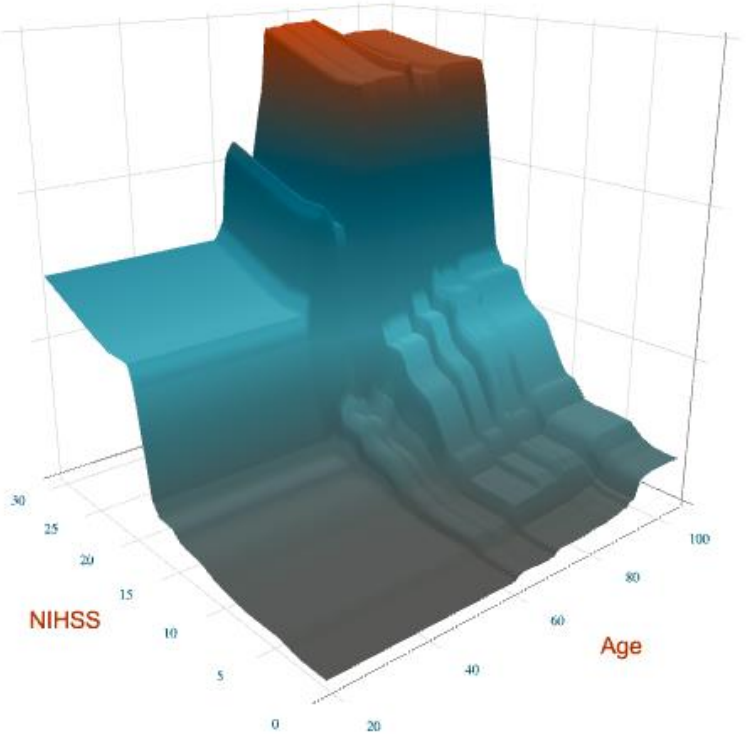
Stroke Outcome Prediction



- Models are at least as accurate as an expert
- The impact of each factor changes with context
- Physician or patient now has access to unbiased assessment

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Precision Screening

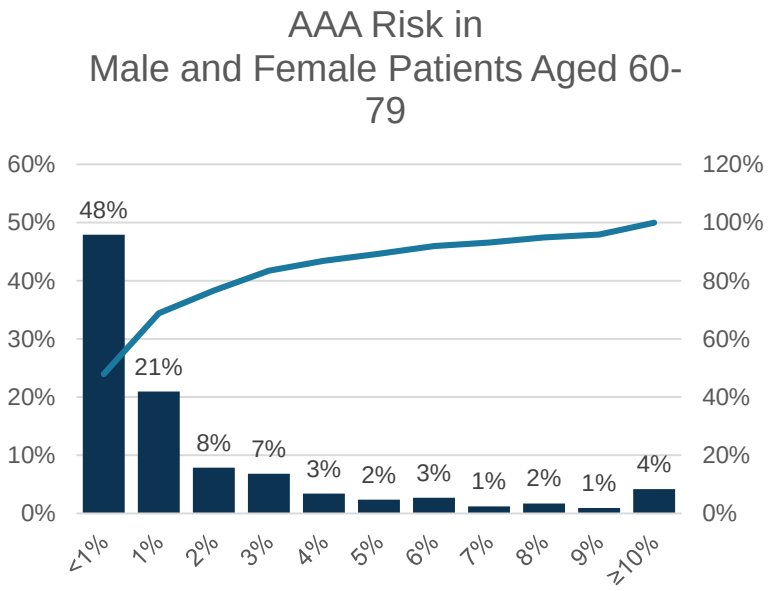
Population
screening inefficient

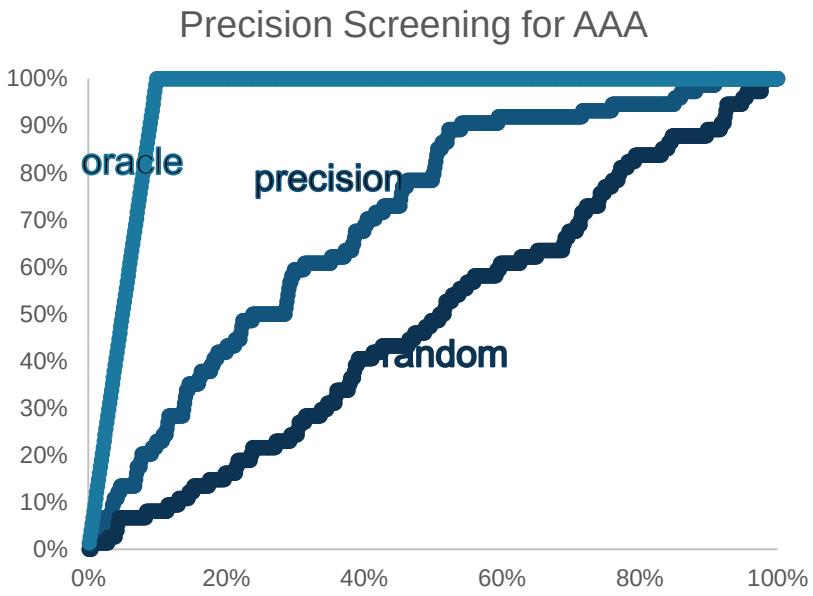
- Screening costs time, money and stress
- Can miss high risk individuals

Precision screening
targets risk

- Eligibility criteria found using machine learning
- Criteria updated real-time

AAA Screening





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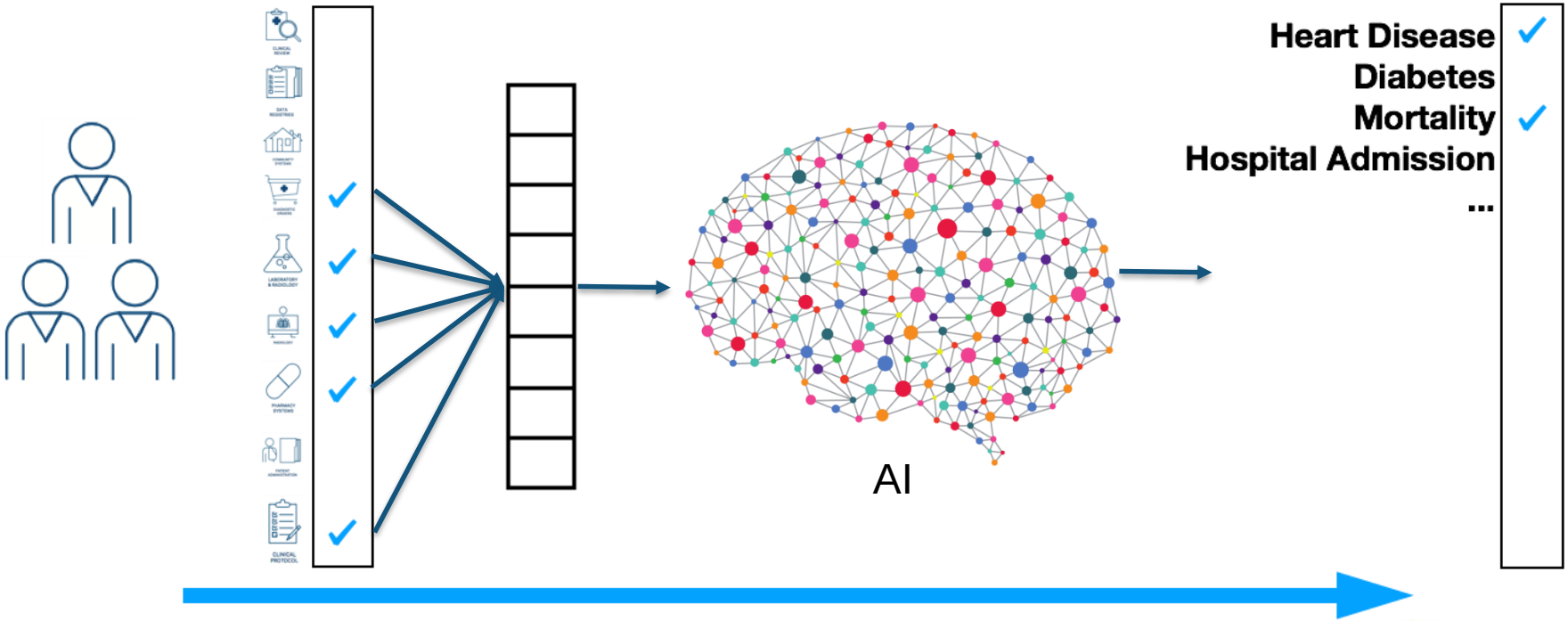
The Case of Mr R

- 78 year old European man
- Ex-smoker (quit 2002)
- No family history of AAA
- No major comorbidities
- Estimated AAA risk 11.6%
- 60mm AAA found and repaired

Deep Learning

- Predict multiple outcome from multiple data sources
- Transfer learning from one population or condition to another
- Automated feature learning
- Patients like this



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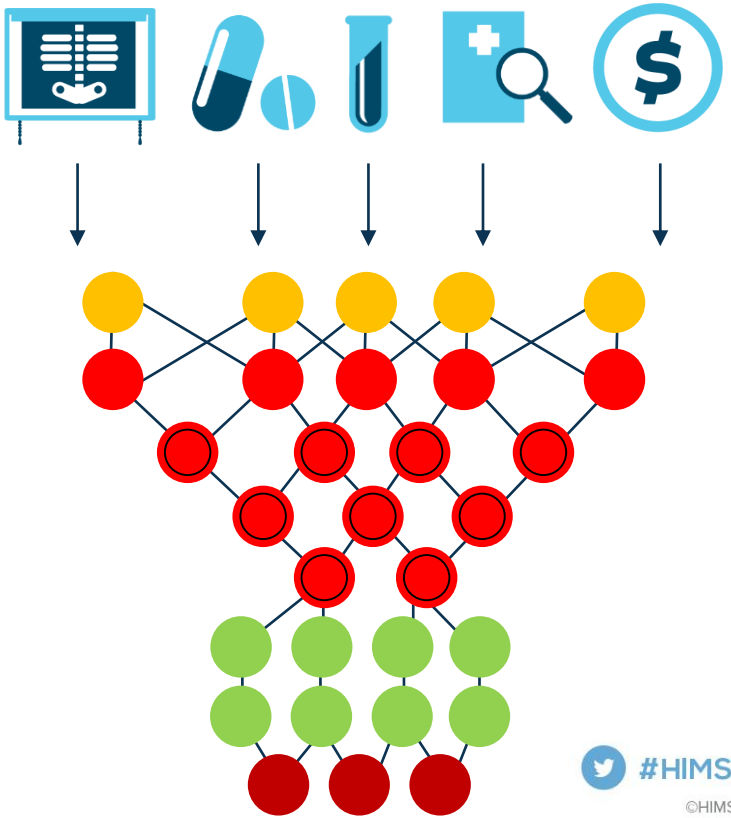
Deep Learning

Patient profile
= lots of data



Summary vector

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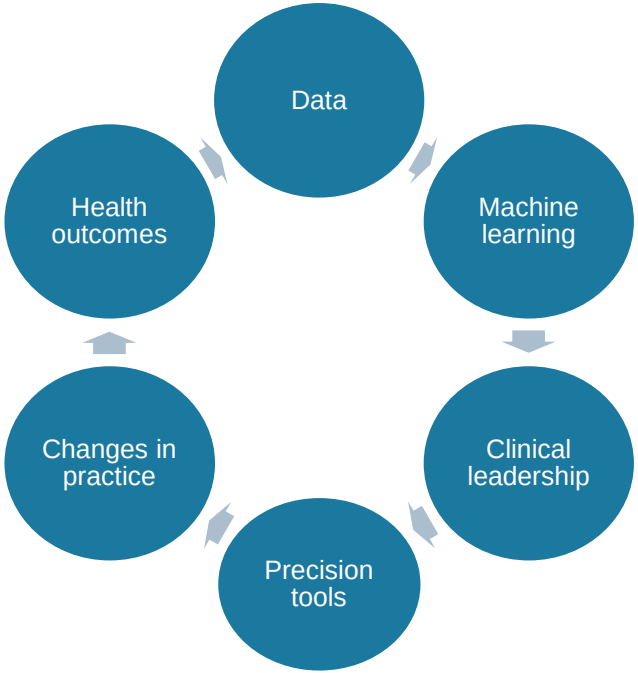
Machine learning: integral to health



- Data availability and analysis is transforming health delivery
- Data quality is improving
- New Zealand provides an ideal test environment
- Examples in New Zealand can be scaled globally – to other populations, conditions, and data sources

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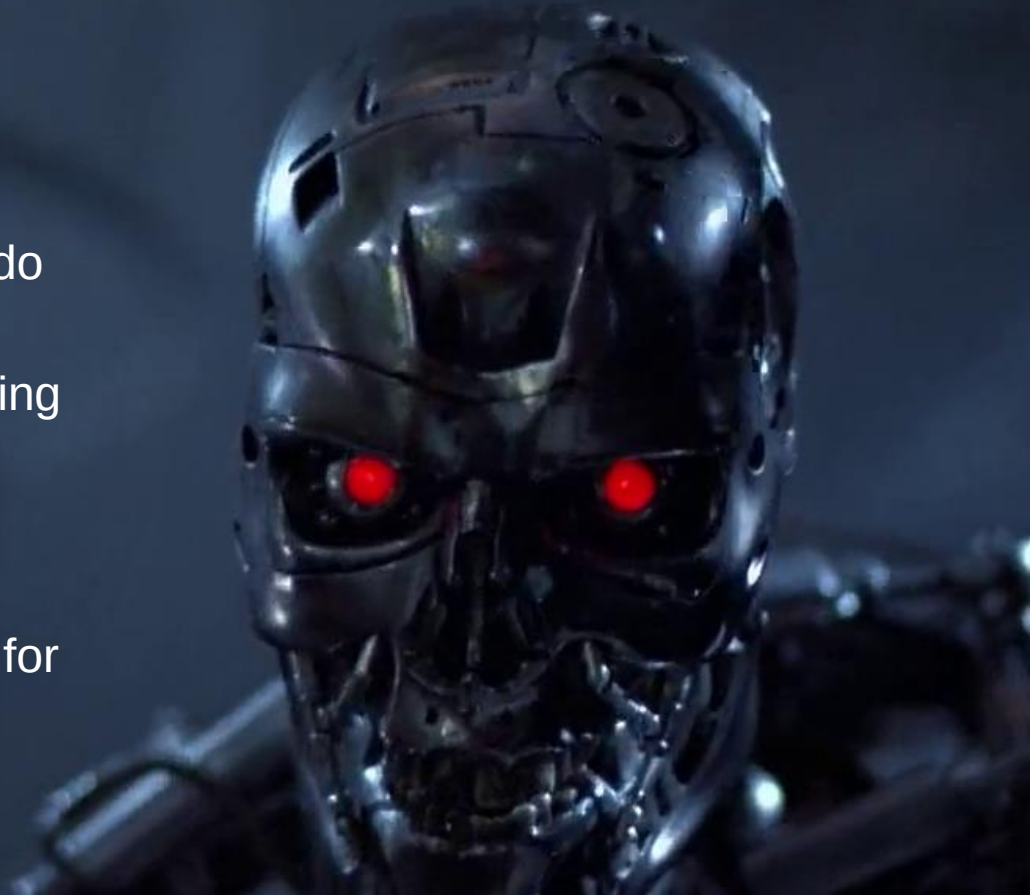
Food for thought

- Social license and consent – what do our citizens expect and accept?
- History is biased, so machine learning algorithms will reflect that
- How much better does a black box need to be before you trust it?
- How much privacy will we sacrifice for better health outcomes?



Where will machine learning take us?

- Real-time research
- Tunable risk calculators
- Transferable knowledge
- Precision treatment
- Open source
- Disruptive business models

Questions

- Kevin Ross
- kevin@precisiondrivenhealth.com
- precisiondrivenhealth.com

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