Data-Driven Healthcare

Canada’s Big Data Consortium
Working Group on Predictive Health

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University of New Brunswick, Saint John — October 03, 2016
Overview

1. Big Data
   ▶ The 5 V’s
   ▶ Drivers: Transactions, Mobile, Social Media, Internet of Things

2. My Last 24 Months in Big Data
   ▶ Canada’s Big Data Consortium
   ▶ Montreal International Panel of Experts
   ▶ Working Group on Predictive Health

3. Big Data in Healthcare and Health Research
   ▶ Cost Effectiveness
   ▶ Quality of Physical, Mental, and Emotional Health
   ▶ Data Access: Open, Secure, Privacy Control with End-User
   ▶ New Technology, New Data, New Social Norms

4. Working Group Recommendations
   ▶ Data
   ▶ Incubators
   ▶ Scale Out
What Happens in an Internet Minute?

- 20 victims of identity theft
- 47,000 app downloads
- 61,141 hours of music
- 6,398,800 GB of global IP data transferred
- 204 million emails sent
- 583,000 in sales
- 61,141 photo views
- 3,000 photo uploads
- 320+ new Twitter accounts
- 100,000 new tweets
- 135 botnet infections
- 1,300 new LinkedIn accounts
- 6 new Wikipedia articles published
- 277,000 logins
- 2+ million search queries
- 1.3 million video views
- 30 hours of video uploaded

And Future Growth is Staggering

Today, the number of networked devices = the global population
By 2015, the number of networked devices = 2x the global population
In 2015, it would take you 5 years to view all video crossing IP networks each second

Basics of Data-Driven (Clinical) Healthcare

**Figure 2: Framework to Create Clinical Value from EMR Data**

(Infoway Health Canada 2016)
Big Data

➤ The 5 V’s
➤ Drivers: Transactions, Mobile, Social Media, Internet of Things
Big Data (http://dsrc.encs.concordia.ca/what-is-bigdata.html)

Big Data
Definition of “Big” has changed as we have become more advanced

History
Hollerith Cards 1890 (US population census)
Economic Data 1952 (GDP etc)
Computers 1959 — The First Digital Data Tsunami
World Wide Web 1990’s — The Second Digital Data Tsunami
Social Media 1985 — The Third Digital Data Tsunami
Internet of Things 2000 — The Fourth Digital Data Tsunami
Big Science — 1960’s onwards
Deep Knowledge — 2011 onwards

A key notion is actionable data that is useful in supporting decisions, determining actions, and adding value to an endeavour.
Big Data

The 5 V’s

Volume: amount of data
Variety: different types of data
Velocity: rate at which data is generated
Veracity: trustworthiness, level of noise
Value: usefulness of data to a business

Drivers

Transactions
Mobile
Social Media
Internet of Things

MGI Report

McKinsey Global Institute, Big data: The next frontier for innovation, competition, and productivity, May 2011.
My Last 24 Months in Big Data

- Canada’s Big Data Consortium
- Montreal International Panel of Experts
- Working Group on Predictive Health
Canada’s Big Data Consortium

Who
Established by Ryerson University in mid 2014
Bring together Govt, Industry, and Universities
Four academic founding partners: Ryerson, SFU, Dal, Concordia

Lessons Learned
Govt keen to exploit Big Data job growth & economic growth
and improve efficiency of govt operations

Some schools recognise importance of numeracy & analytics
Many universities introducing courses & programmes

Enormous talent gap between demand and supply

4 Job Types Identified:
Chief Data Officer, Data Scientist, Data Analyst, Data Architect
Montreal International Panel of Experts

Who — Dec 2014 to Dec 2015
MI profile of Big Data industry in Montreal and Quebec
All the “movers and shakers”
  quebec govt: industry, trade, research, labour
  open montreal director
  montreal smart city initiative
  industry, SME, university, CRIM

Lessons Learned
Montreal has what it takes!

Big Data is ideal space for innovative small start-ups!

Big Data essential for biotech, pharma industries and research
  and Quebec is lagging in such data-driven life sciences

Importance of open source and open data
Working Group on Predictive Health

Who — WG of Canada’s Big Data Consortium

I Learned
Infoway Health Canada since 2001
    ...and still no wide use of EHR’s
    ...and no digitally connected healthcare system
Canada Institute for Health Information
    ...to provide comparable, actionable information
Ontario Health Innovation Council report
    ...alas, reality is promoting SME health instrument makers
St Michael’s Hospital data warehouse now online linking
    research, clinical, and patient data
Alberta govt has open data as default

Lessons Learned
Theme of rest of this talk
    ...and more to come from WG ... look for our whitepaper late 2016
Big Data in Healthcare and Health Research

- Cost Effectiveness
- Quality of Physical, Mental, and Emotional Health
- Data Access: Open, Secure, Privacy Control with End-User
- New Technology, New Data, New Social Norms
  eg, Internet of Things, Gamification, attitudes to privacy

Some Examples of Predictive Health

- Predict need for intervention in real-time for crisis healthcare such as heart-attacks, and strokes;
- Predict state of a disease during disease progression;
- Predict disease epidemics and locate source of outbreak;
- Predict diagnosis of disease;
- Predict lifestyle risk factors;
- Predict environment and nutrition factors for and against good health;
- Predict genetic factors for and against good health.
A Starting Point

Big Data Analytics in Health White Paper,
Canada Health Infoway
https://www.infoway-inforoute.ca/
The Data Perspective

Taglang et al (Gynecologic Oncology, 2016)
The IT Perspective

Wang et al (Tech. Forecasting & Social Change, 2016)
The Big Data Analytics Perspective

Dimitrov (Health Informatics Research, 2016)
The Big Data Future

Dimitrov (Health Informatics Research, 2016)
Recommendations of Working Group

Data Access is Key!

Open data by default will be the future.
Data secure in the cloud and on personal smartcards
Privacy and sharing of data is in control of patient!
Anonymised data using “id servers” for data integration
Future is linked open data using RDF, ontologies, semantic web

Incubators need Technology + Business + Healthcare

See example at St Michaels Hospital and MARS in Toronto.
Physicians must buy-in ... or ... it’s a no-go!

Scale Out beyond Incubators

Need community engagement ...
for acceptance, use, and data sharing
to establish agreed terminology for data sharing
to reap benefits of innovation from Big Data
Closing Remarks

**Big Data Important**

Great space for innovation!
Great space for SME!
Great space to leverage IT, CS, and people skills!

**Big Data** *(Extremely)* Important in Health and Life Sciences

**Big Data in Scientific Literature**

Use it! eg, Open PHACTS

**Big Data in Social Media and Internet of Things**

Big Brother 1984? or Star Trek tricorders?
Working Group on Predictive Health

My thanks to ...

Eugene Wen, MD, PhD (WHSB), CDO, Chair
Greg Dashwood (Microsoft), Technology, Co-Chair
Abidin Ashok (Ryerson), Coordinator
Ayse Bener, PhD (Ryerson), CS Academic
Greg Butler, PhD (Concordia), CSE Academic
Linda Koechli (Ryerson) Business Academic
Brigid Elmy (Ryerson) Business Academic
Muhammad Mamdani, PharmD (St Michael’s Hospital) Director, Healthcare Analytics Research and Training
Laura Morin (Industry Canada)
David Hume (BC Govt) Citizen Engagement
Greg Horne (SAS)
Mike Miller (Ernst & Young)
Young Lee (Deloitte)
Daniel Zikovitz (GE Healthcare)
Jas Klotia (GE Digital)
Nicholas Yee (Manulife)
Paresh Yadav (PHEMI) IT
Daniel Lewis (RightBlueLabs) SME CTO — prevent sports training injury
Ronen Benin (RightBlueLabs) SME CEO
James Schuback (RightBlueLabs) SME Data scientist
Meir Dick (VISR) SME — monitor social media
Robert Reichmann (VISR) SME CEO
Gabriel Musso, PhD (RTDS) SME — simulation
Thank You!

Questions Please?
References


The Catalyst towards an Ontario Health Innovation Strategy, Ontario Health Innovation Council (ohic.ca), December 2014.


