

Enabling Evidence-Based Public Health through Informatics



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The Problem

The Framework

The System

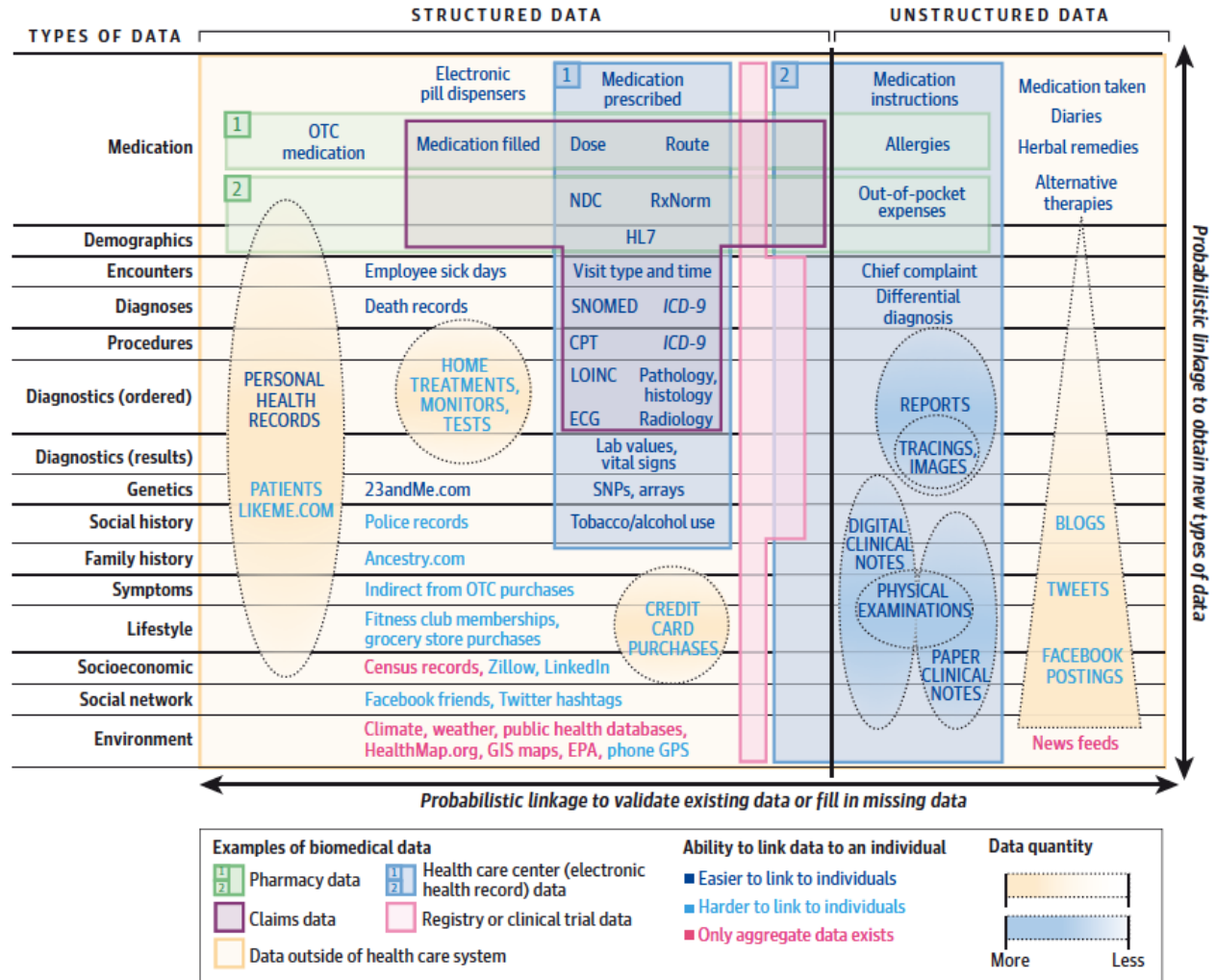
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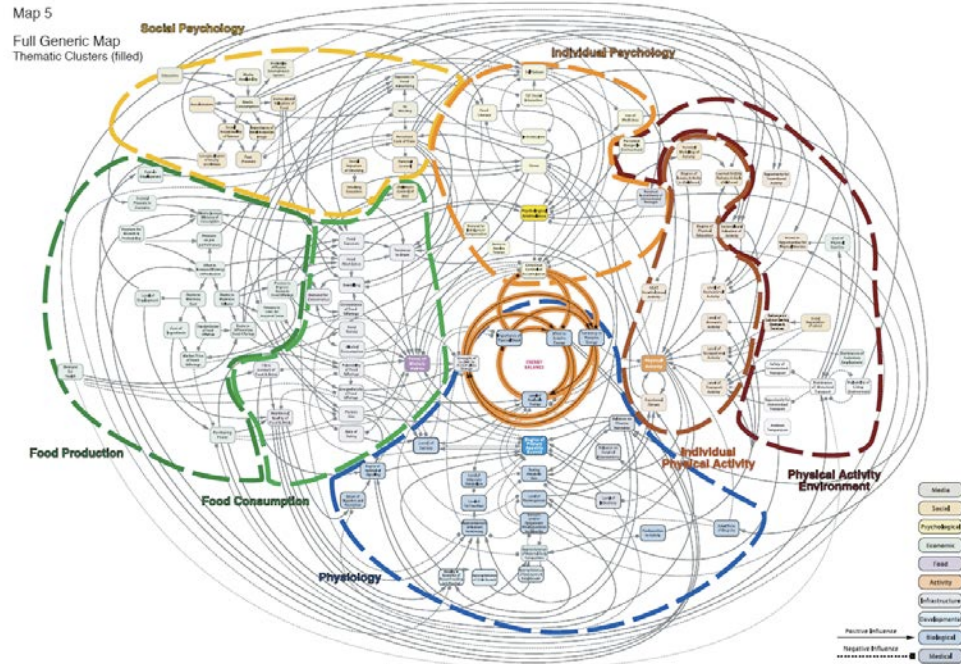
Lots of Relevant Data

Weber GM, Mandl KD, Kohane IS.
Finding the Missing Link for Big Biomedical Data.
JAMA.
2014;311(24):2479-2480.



No Simple Solution

- Chronic diseases have complex causality
- Analysis requires longitudinal, linked data from multiple sectors
- Resulting indicators must be presented in interpretable manner



“the United States lacks a coherent template
for population health information ... to
assess how well the nation’s efforts and
investments result in improved population
health”

Institute of Medicine (2010). For the Public’s Health: The Role of Measurement in Action and Accountability. IOM, Washington, DC.

The Problem

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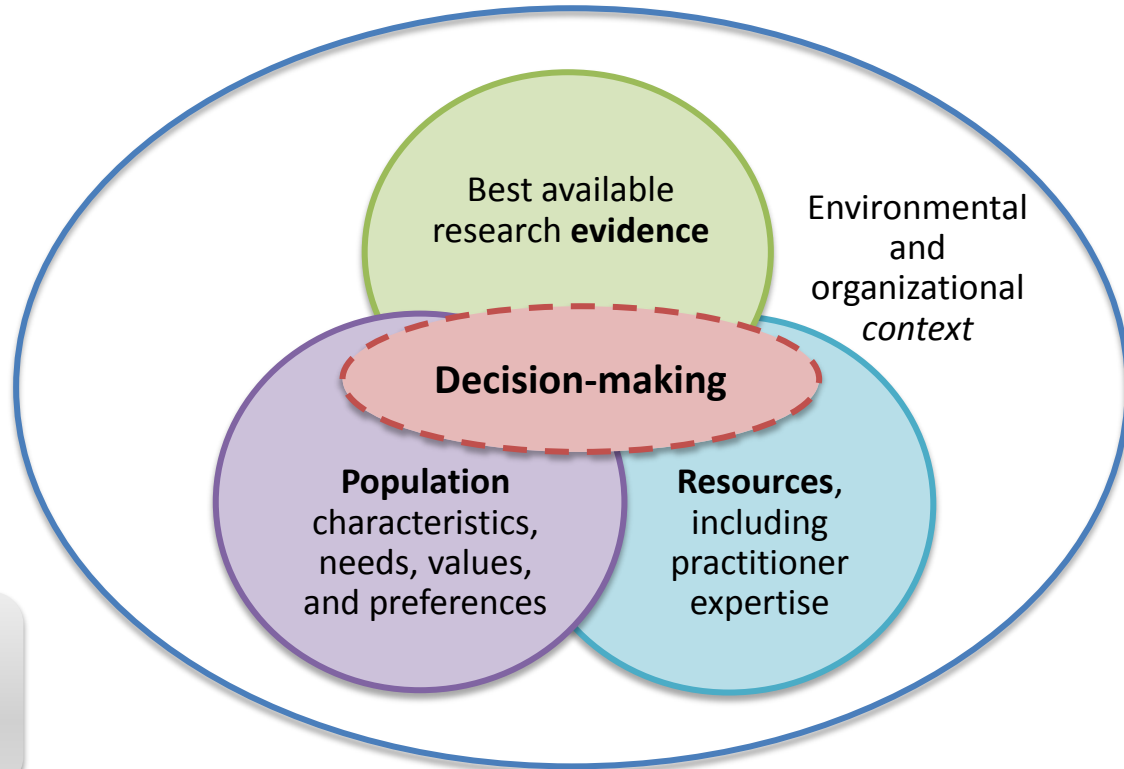
The System

Potential of Public Health

- Public Health System has produced considerable gains in population health
- Further gains possible
- Improving the **efficiency and effectiveness of decisions** is one strategy



Evidence-Based Population Health



Brownson, R. C., Fielding, J. E. & Maylahn, C. M. Evidence-based public health: a fundamental concept for public health practice. *Annu Rev Public Health* 30, 175–201 (2009).

Types of Scientific Evidence

Characteristic	Type One	Type Two	Type Three
Typical data/ relationship	Size and strength of preventable risk—disease relationship (measures of burden, etiologic research)	Relative effectiveness of public health intervention	Information on the adaptation and translation of an effective intervention
Common setting	Clinic or controlled community setting	Socially intact groups or community wide	Socially intact groups or community wide
Example	Smoking causes lung cancer	Price increases with a targeted media campaign reduce smoking rates	Understanding the political challenges of price increases or targeting media messages to particular audience segments
Quantity	More	Less	Less
Action	Something should be done	This particular intervention should be implemented	How an intervention should be implemented

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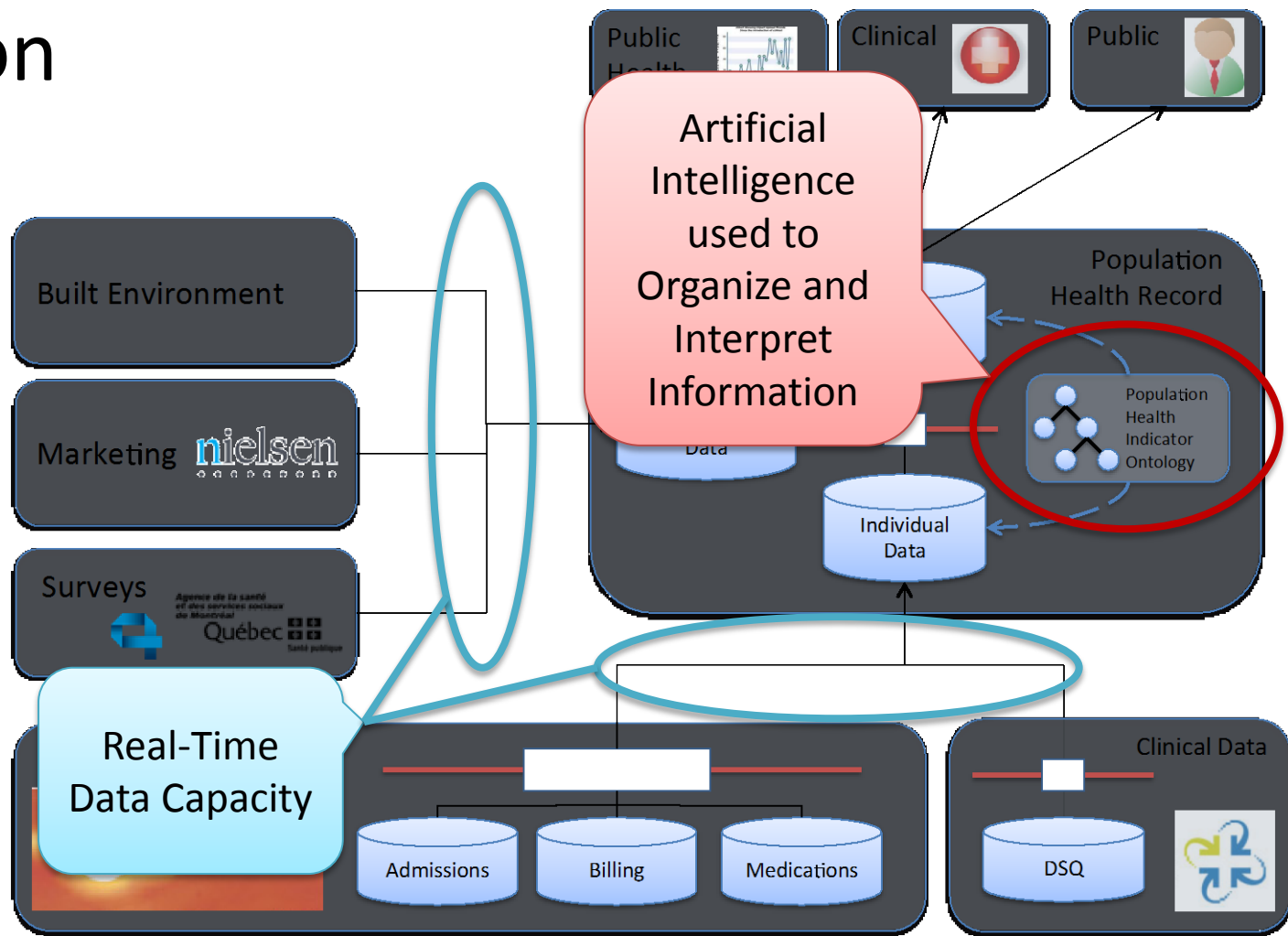
The Framework

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Defining a Population Health Record

- Representative information for a defined population
- Evidence about population health and health systems
- Explicit population health framework used to organize information and evidence
- Facilitates population health decision making
 - Integrated data on determinants, outcomes, healthcare
 - Alignment of information and evidence regarding population health and health system interventions

Population Health Record



Buckeridge, D. L. et al. An infrastructure for real-time population health assessment and monitoring. *IBM Journal of Research and Development* 56, (2012).

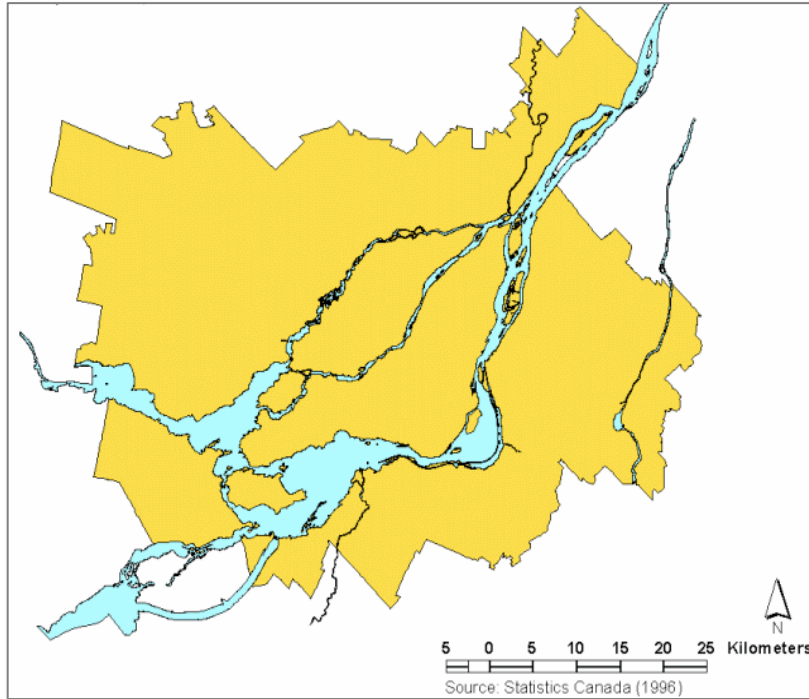
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The System [Information]

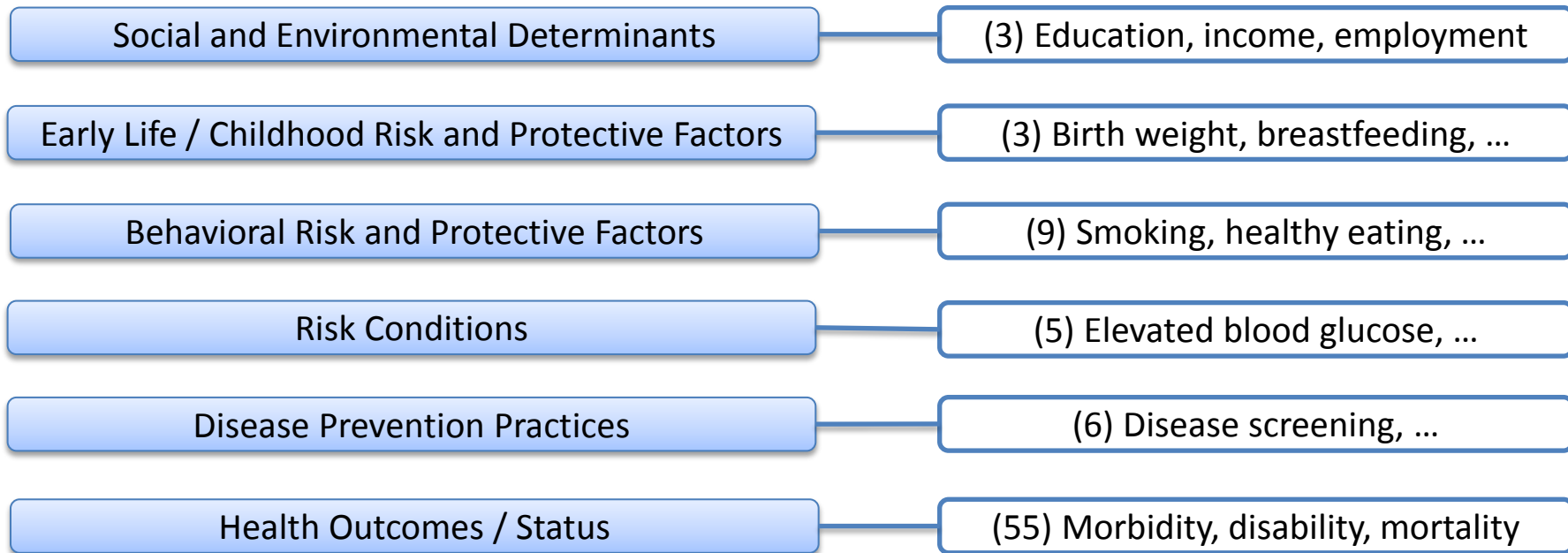
Current PopHR Implementation

3.8 million people (2011)



- Data from 1998 to present
- 25% random sample
- 1 million people at any one time

Chronic Disease Indicator Framework

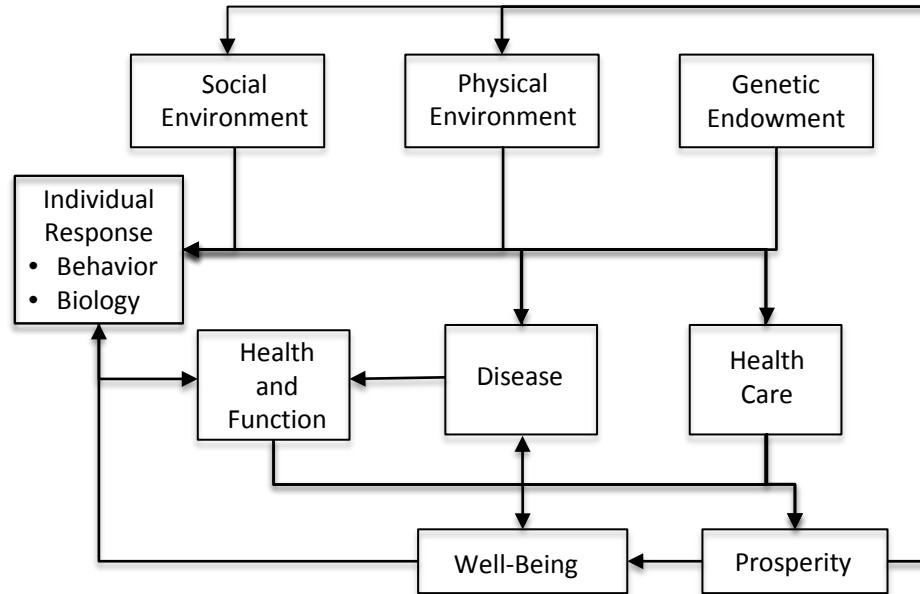


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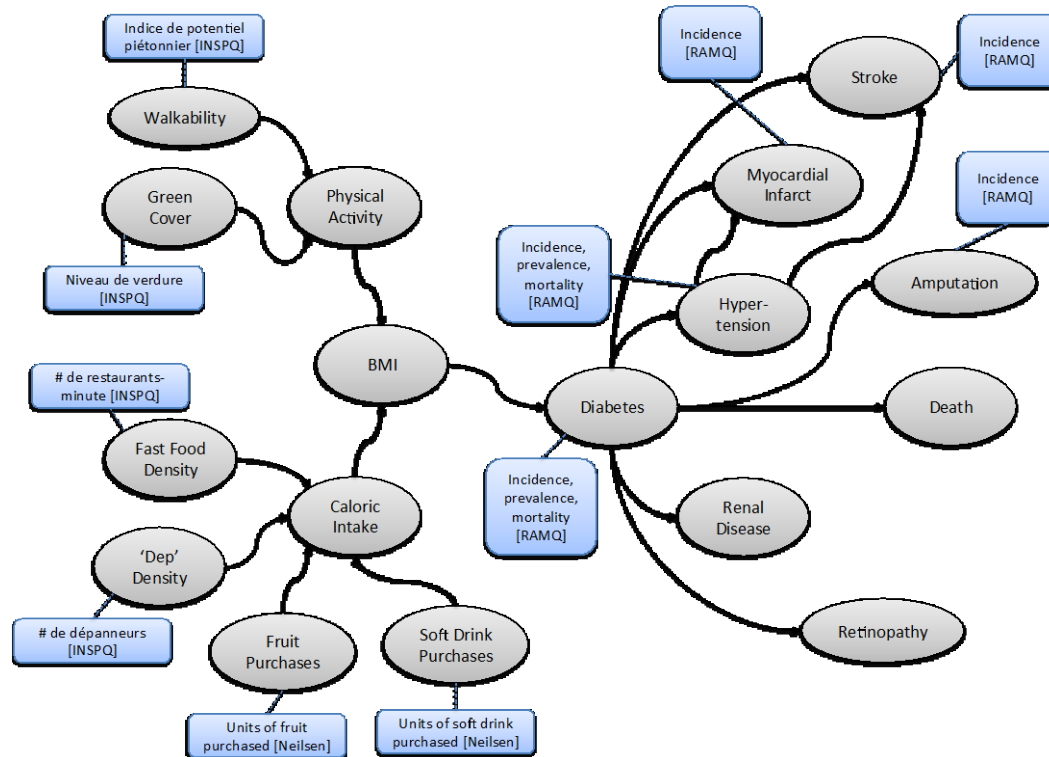
The Framework

The System [Evidence]

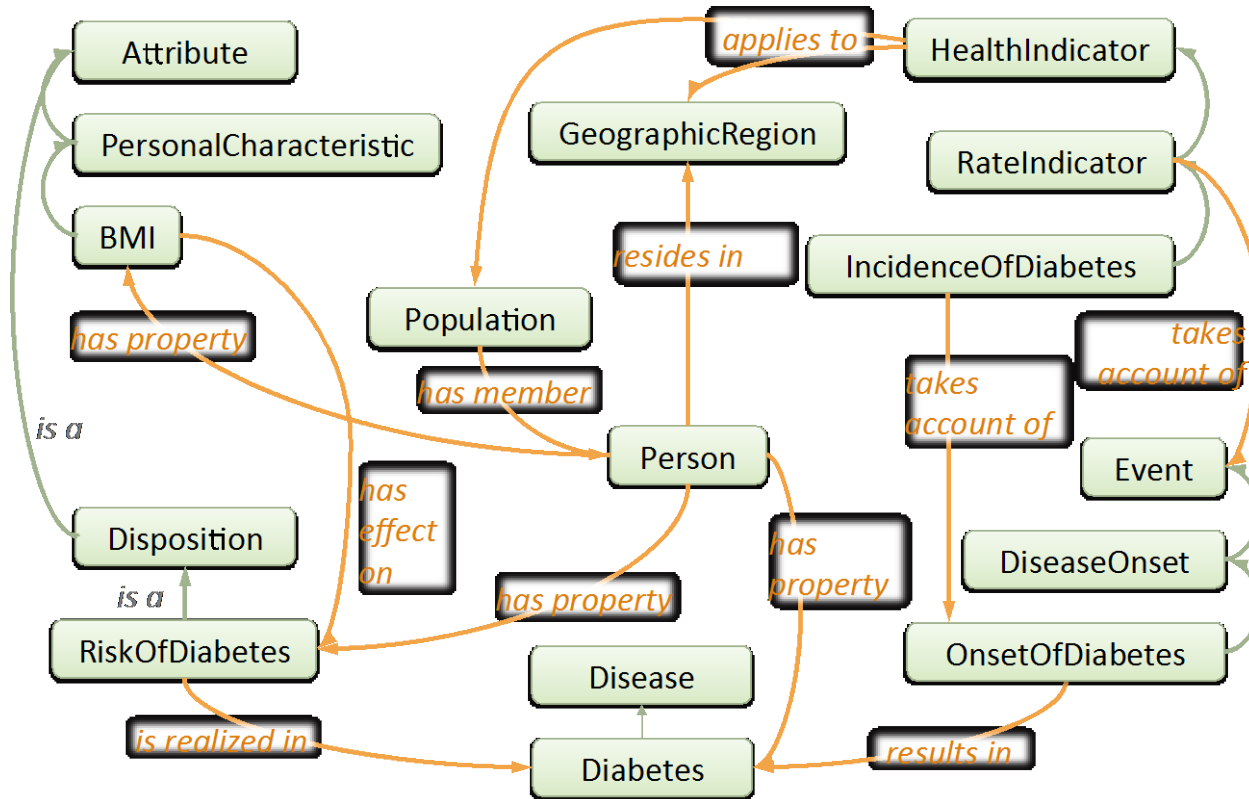
Template for Population Health



Informal Model



Formal Model



Shaban-Nejad, A. et al. PHIO: a knowledge base for interpretation and calculation of public health indicators. Stud Health Technol Inform 192, 1207 (2013).

Knowledge in PopHR System

Type 1
Causal relationships between health indicators

Type 2
Effectiveness of public health interventions

Type 3
Adaptation and translation of effective interventions

Interpret indicators using existing knowledge

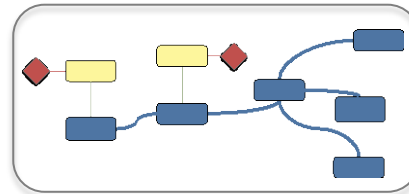
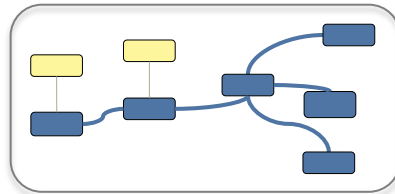
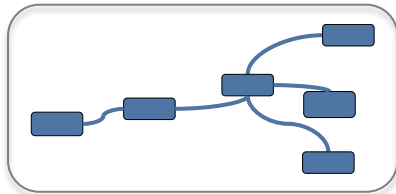
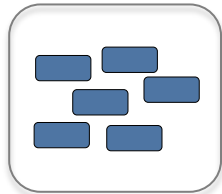
Identify interventions suited to a population

Document implemented interventions

**EBPH
Types of
Evidence**

**PopHR
Function**

Display



Intervention Model

McMaster University
Health Evidence™
10 years

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Enter your search terms or phrases

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Update My Profile
My Saved Articles
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Language: EN FR
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Date
Latest update only
Published from 1995 to 2016

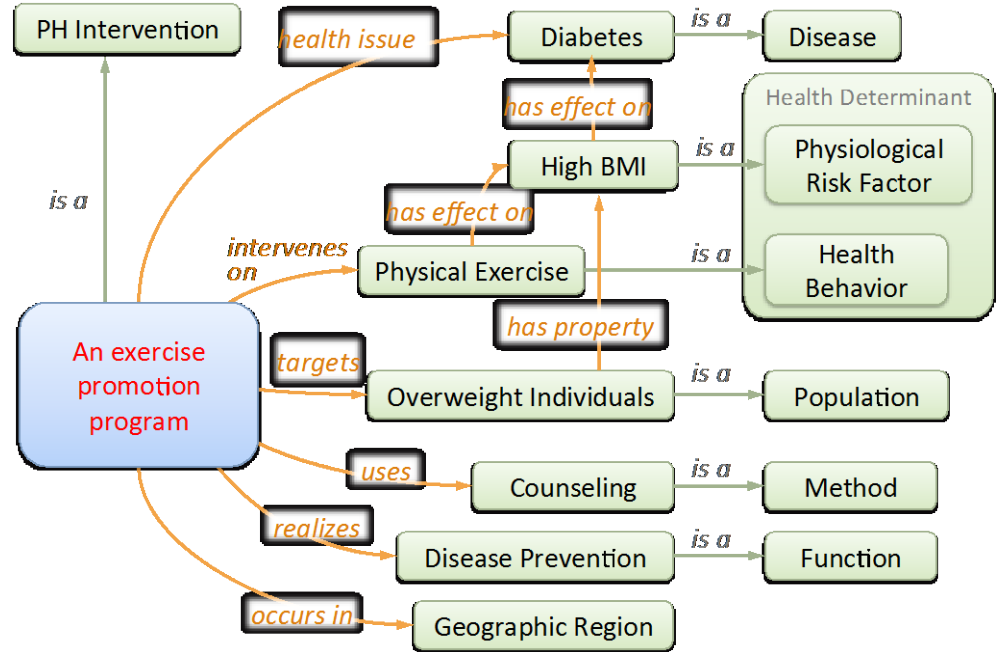
Review Quality Rating
Strong (8 to 10 / 10)
Moderate (5 to 7 / 10)
Weak (1 to 4 / 10)

Review Type
Meta-analysis
Systematic review of reviews

Text Options
Evidence summary available
Links to free full text
Links to full text in Cochrane Library
Highly accessed by registered users of healthevidence.org

Population
Adolescents (13-19 years)
Adults (20-59 years)
Cultural group

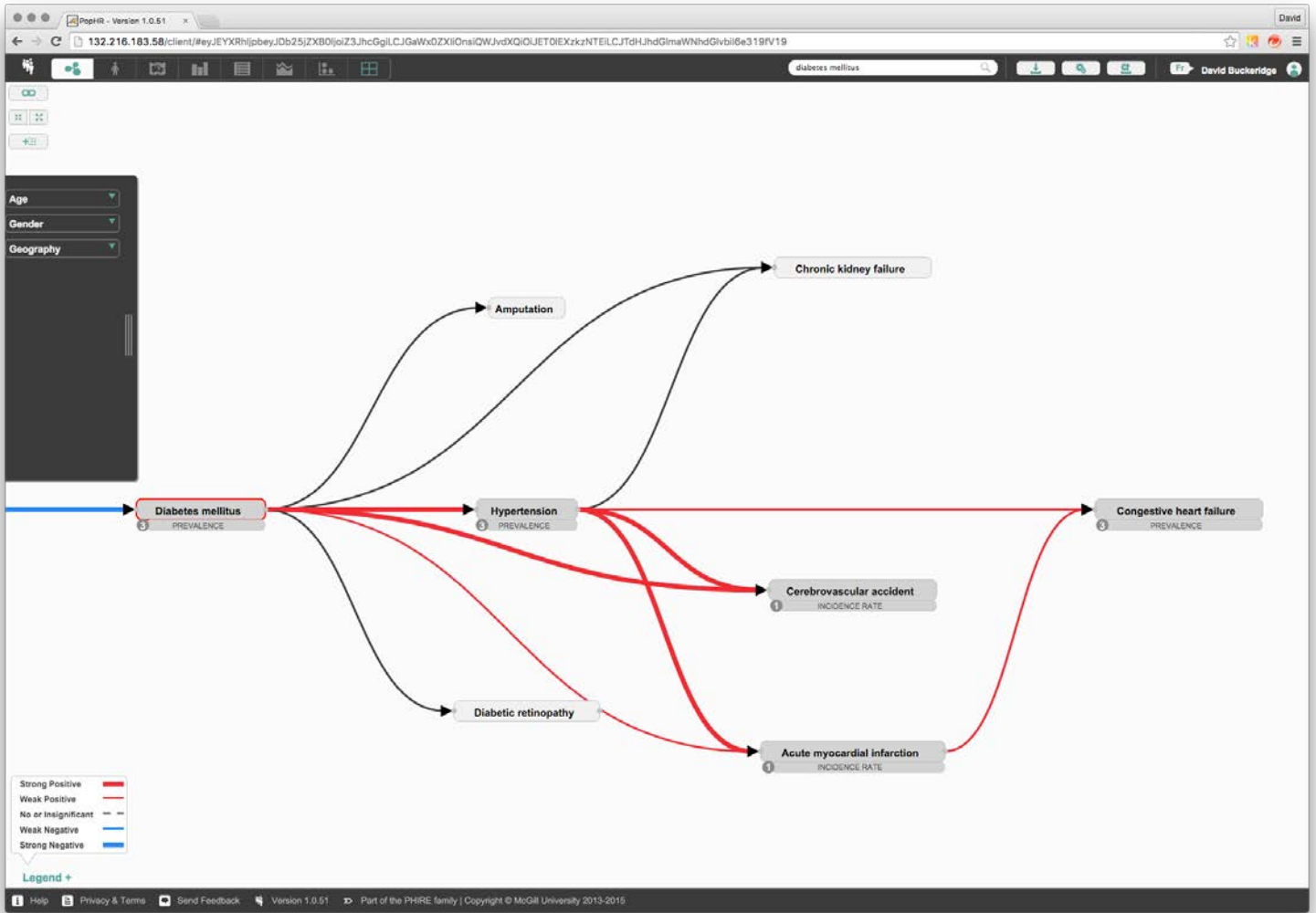
Topic Area
Addiction/Substance Use
Alcohol Abuse/Use
Drug Abuse/Use
Smoking Cessation/Tobacco Use
Chronic Diseases
Cancer
Cardiovascular Disease
Diabetes
Obesity
Communicable Disease/Infection
Dental Health
Emergency Preparedness & Response
Environmental Health
Health Through the Ages
Adult's Health (men's health, women's health)
Healthy Communities (e.g., community development, multicultural health, rural/urban health)
Reproductive Health & Healthy Families
Senior Health

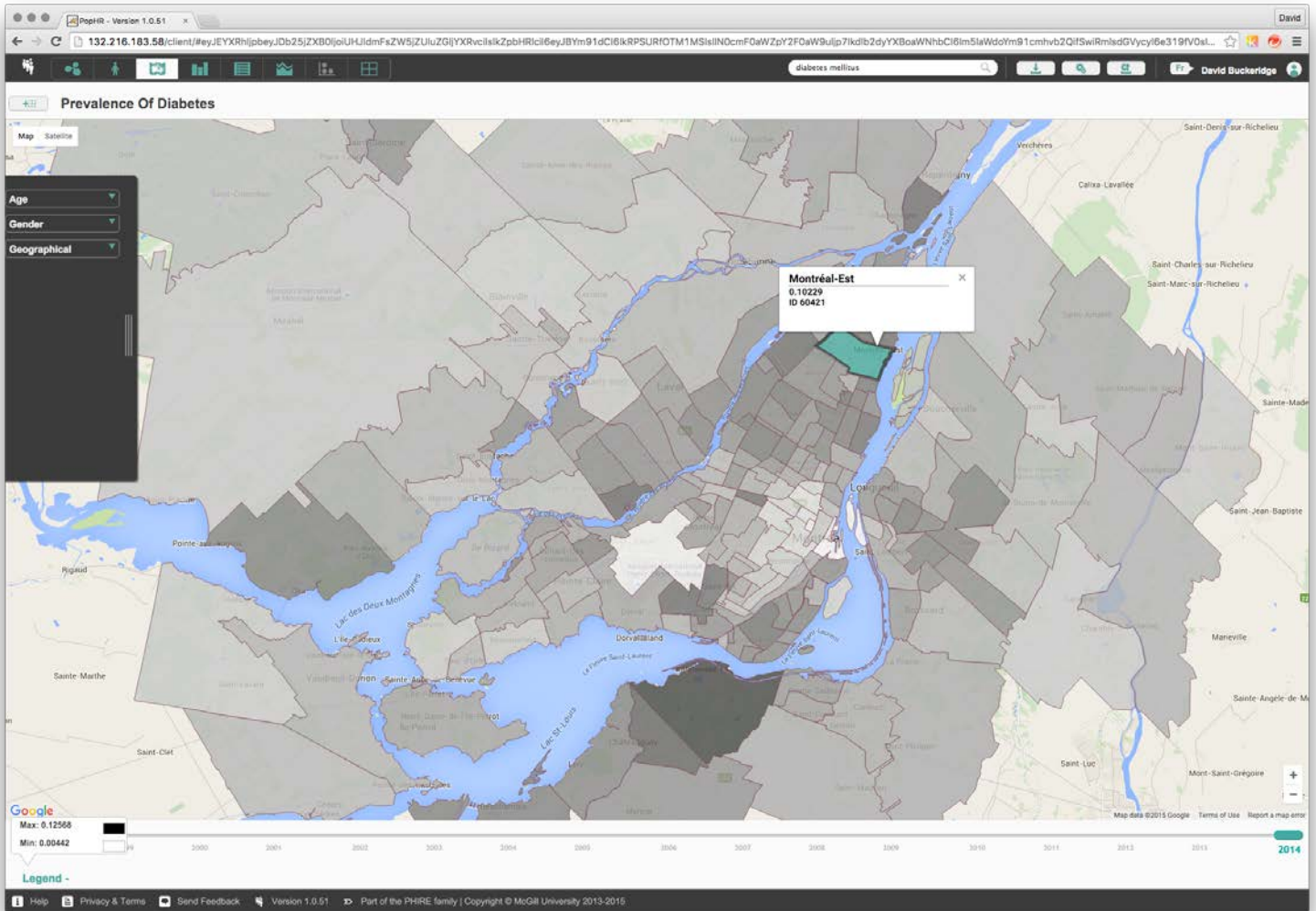


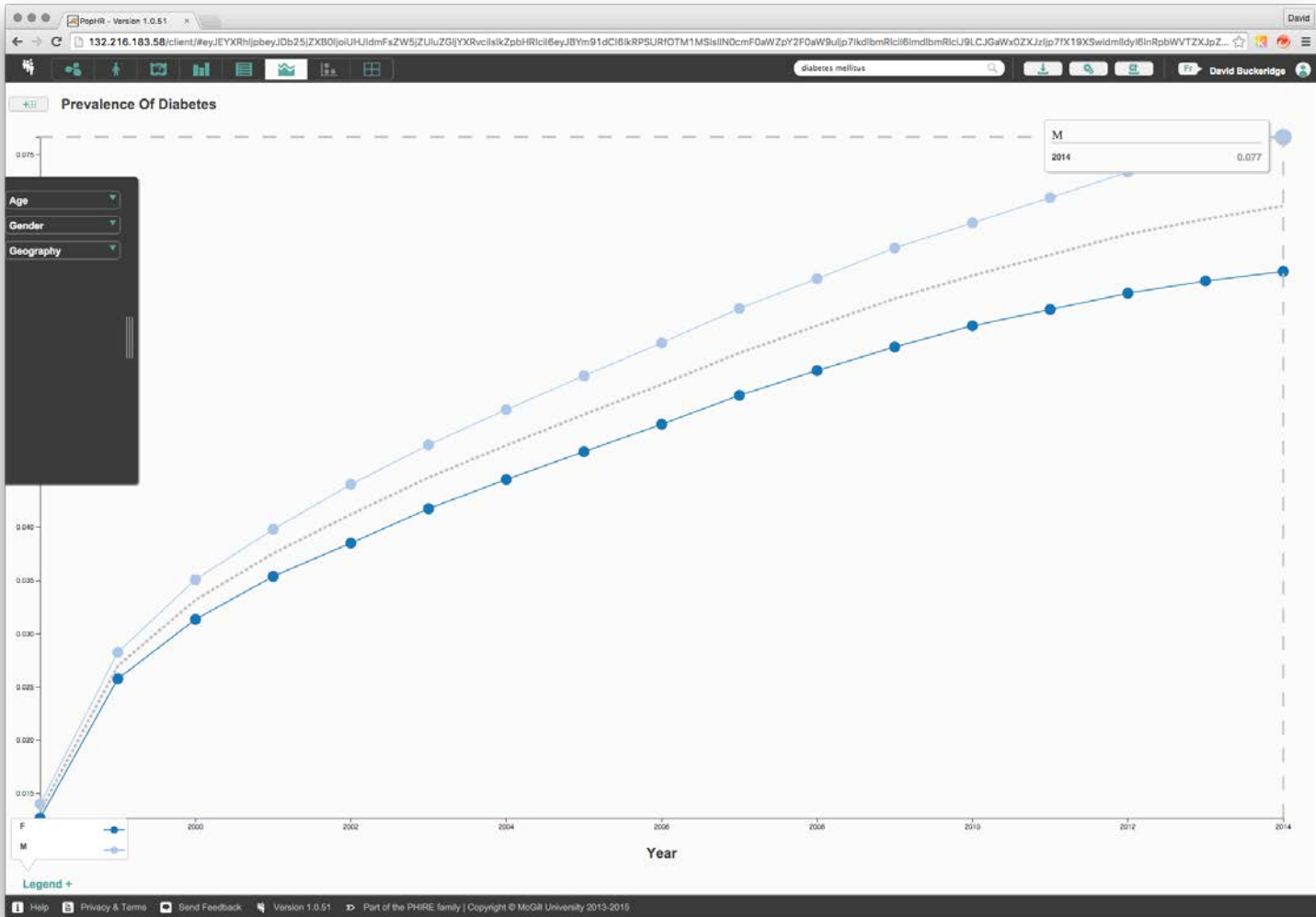
The Problem

The Framework

The System [Application]







Applications of PopHR in Québec

Population health
planning for diabetes



*Institut national
de santé publique*
Québec 

Primary care sensitive
admissions for chronic
disease



*Institut national
d'excellence en santé
et en services sociaux*
Québec 

Summary

Problem: Complex factors contribute to disease burden; existing systems limited

Framework: Evidence-based public health (EBPH) is strategy for improving public health efficiency

System: Informatics can enable EBPH; system implementation, evaluation underway

Contributors



BILL & MELINDA
GATES foundation



Public Health
Agency of Canada

Agence de la santé
publique du Canada



*Institut national
d'excellence en santé
et en services sociaux*
Québec 

*Institut national
de santé publique*
Québec 

*Agence de la santé
et des services sociaux
de Montréal*
Québec 
Santé publique

Some Publications

- Buckeridge DL, Izadi M, Shaban-Nejad A, Mondor L, Jauvin C, Dube L, Jang Y, Tamblyn R. An infrastructure for real-time population health assessment and monitoring. IBM Journal of Research and Development 2012;56(5):2.1-2.11.
- Buckeridge DL, Charland KM, Labban A, Ma Y. A method for population-based surveillance of food consumption. Annals of New York Academy of Science 2014; 1331:270-7.
- Lavigne M, Shaban-Nejad A, Okhmatovskaia A, Mondor L, Buckeridge D (2013). A Hybrid Natural Language Approach to Manage Semantic Interoperability for Public Health Analytics. To appear in Proc. of the 12th International Semantic Web Conference (ISWC 2013), 21-25 Oct 2013, Sydney, Australia.
- Shaban-Nejad A, Jauvin C, Lavigne M, Izadi M, Mondor L, Okhmatovskaia A, Buckeridge D (2013). PopHR: An Integrated Semantic Framework for Population Health Surveillance. To appear in Proc. of The 4th International Conference on Biomedical Ontologies (ICBO 2013), Montreal, Canada, 8-9 July 2013.
- Shaban-Nejad A, Okhmatovskaia A, Izadi M, Naderi N, Mondor L, Jauvin C, Buckeridge DL (2013). PHIO: A Knowledge base for Interpretation and Calculation of Public Health Indicators. to appear in Proc. of the 14th World Congress on Medical and Health Informatics (MedInfo 2013), Copenhagen, Denmark, 20-23 Aug 2013.