Population Health Record: Foundations, Progress, and Future

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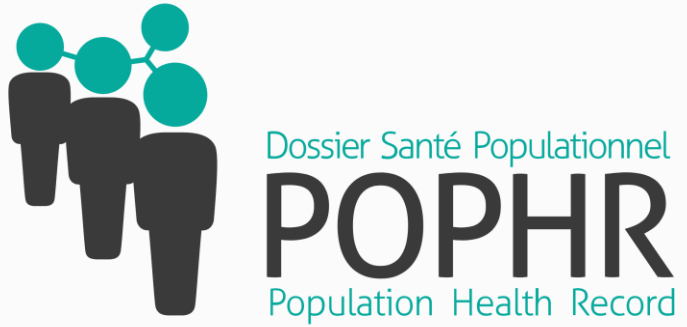
Foundations



Public Health Goal = Informatics Opportunity

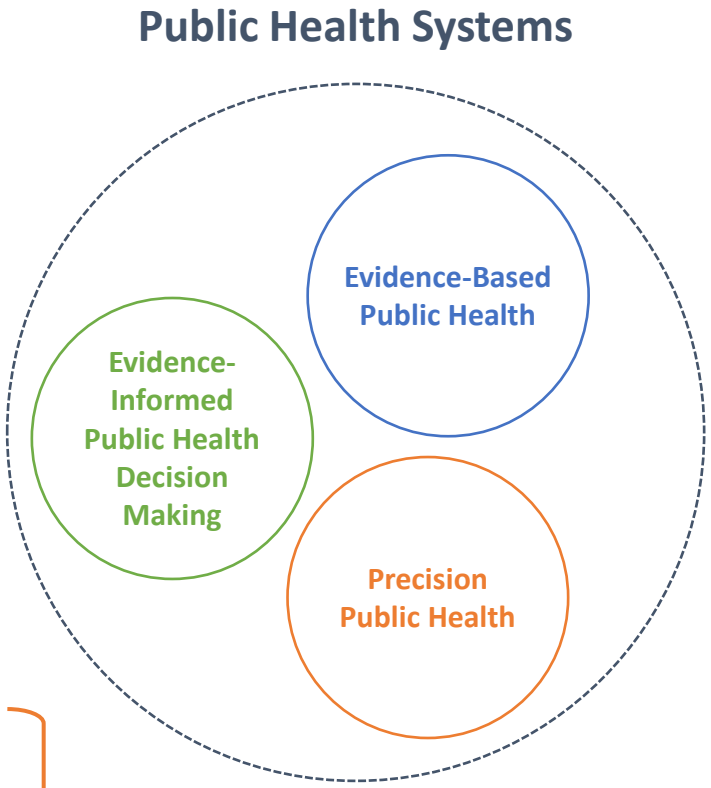
Public Health Goal

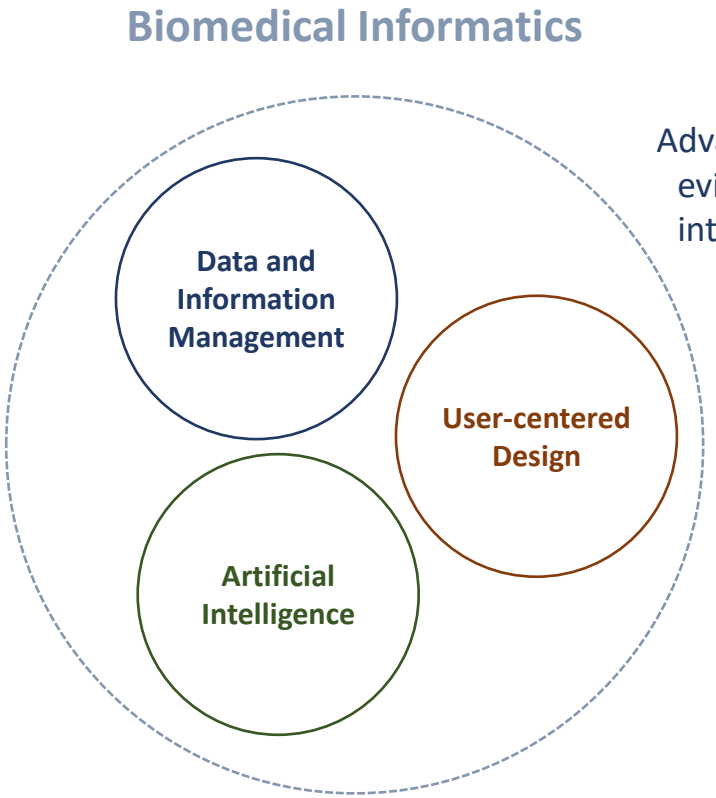
to make *efficient* use of the growing volume of population health evidence to make *effective* and *equitable* decisions about interventions.

Informatics Opportunity

to develop, adapt, and evaluate methods and infrastructure for integrating population health evidence and supporting public health decisions.

Supporting Theories and Methods





Advancing standards for evidence, indicators, interventions

Designing systems for public health workflows, analyses, objectives, skills, resources

Developing knowledge-based and machine learning methods to support public health tasks and decisions

Types of Evidence

Research evidence
- I. Causal
- II. Interventions
- III. Implementation

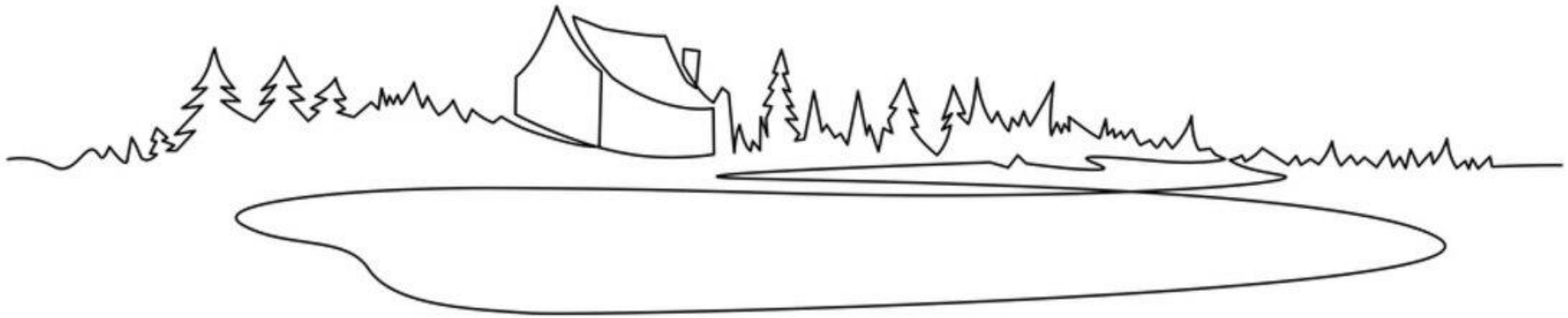
Local context (i.e., indicators)
Community preferences
Resources

Matching

Current Landscape in Public Health

Indicators and research evidence are siloed and not standardized

Mixture of tools requires time and expertise and are not integrated into public health workflows

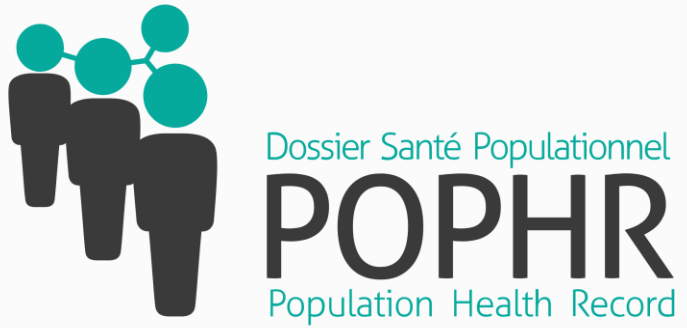


Broad agreement among agencies that digital infrastructure needed

PopHR is an approach to providing this infrastructure

High demand from public health practitioners for supporting infrastructure

Progress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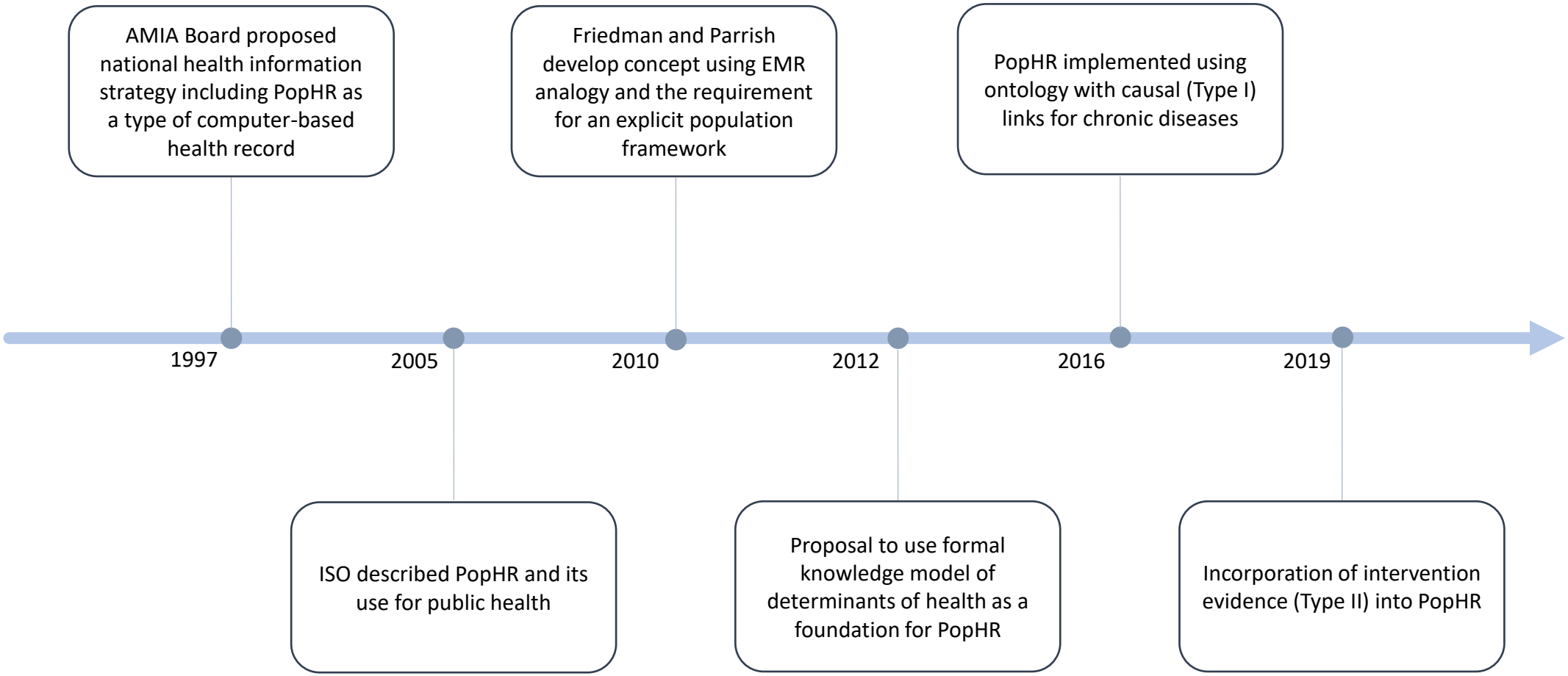
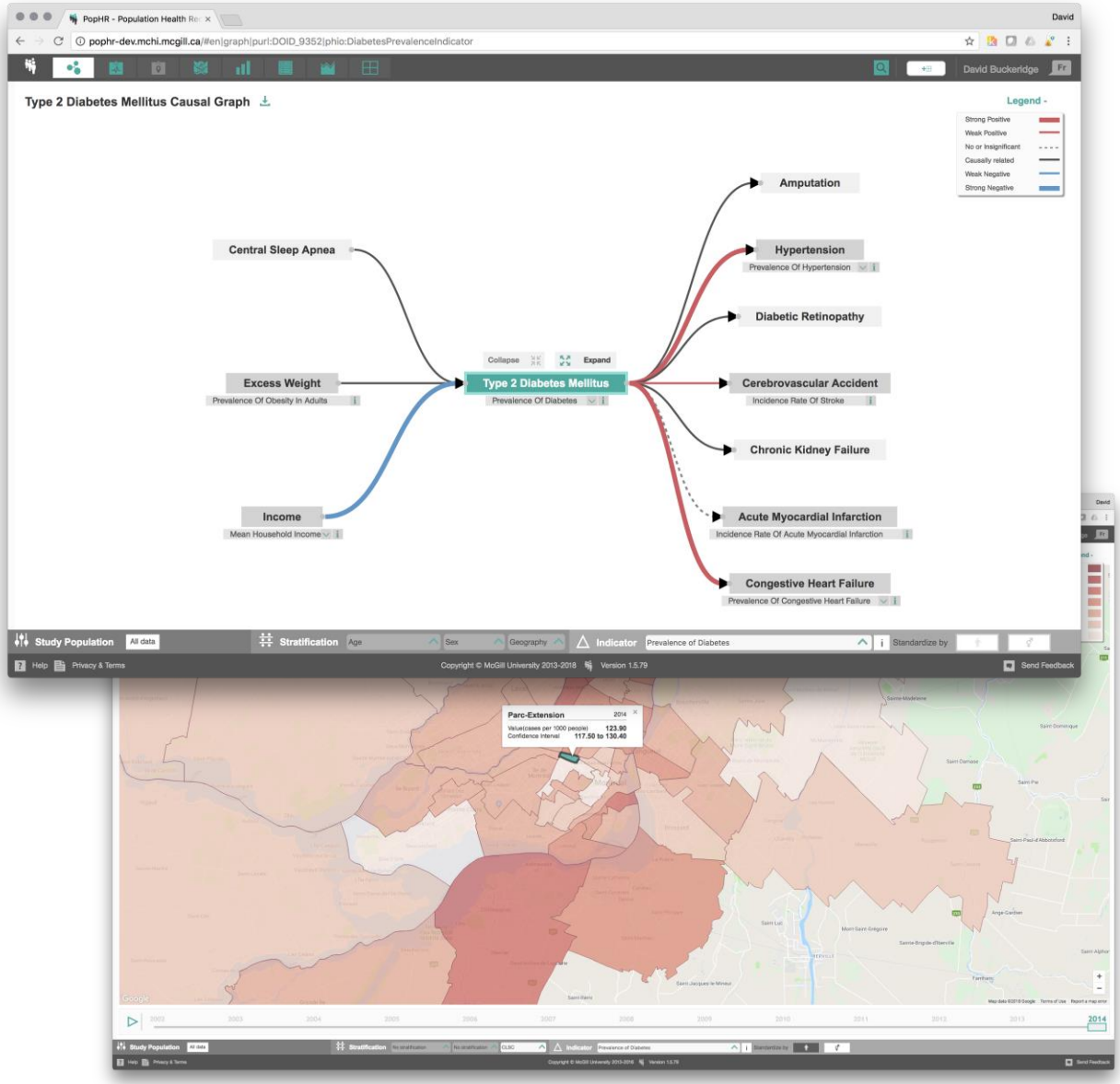
The PopHR Concept and Implementation

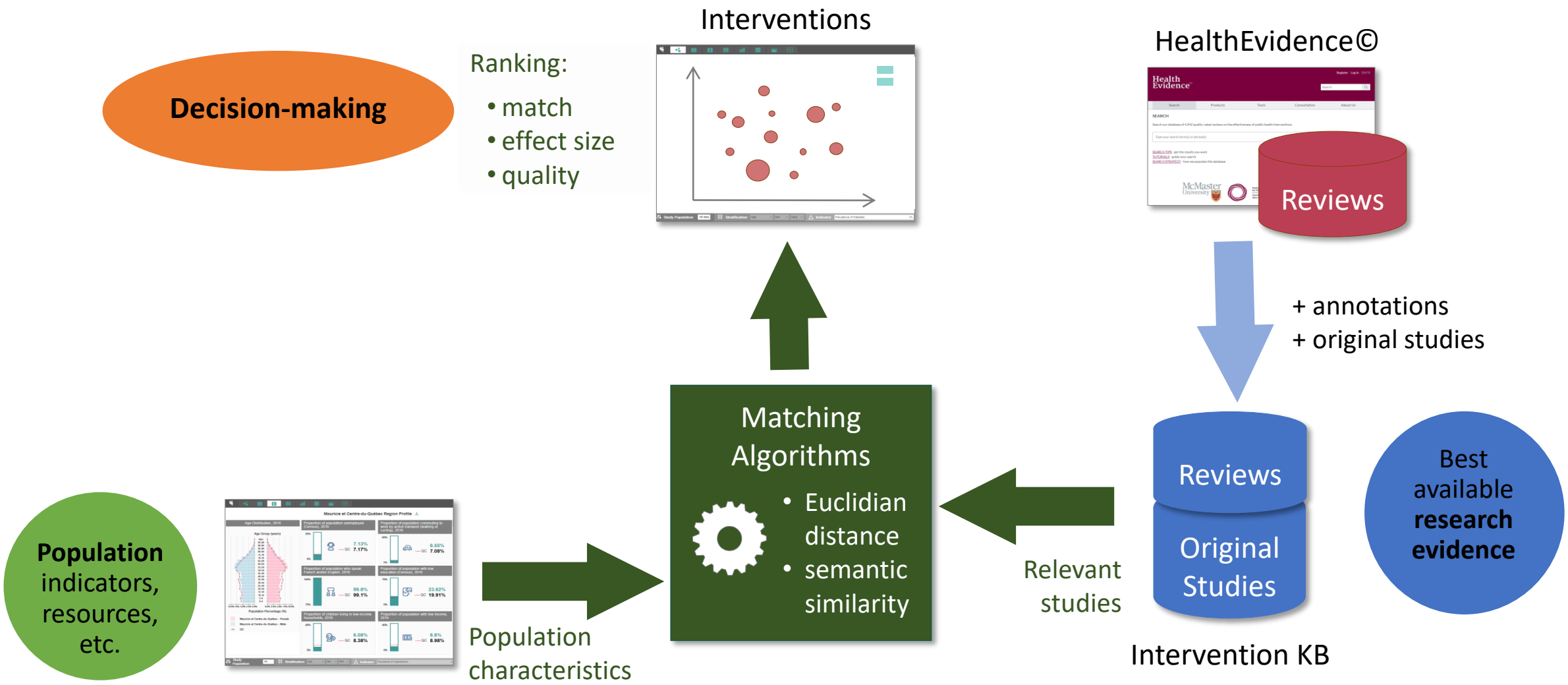


Current PopHR Status

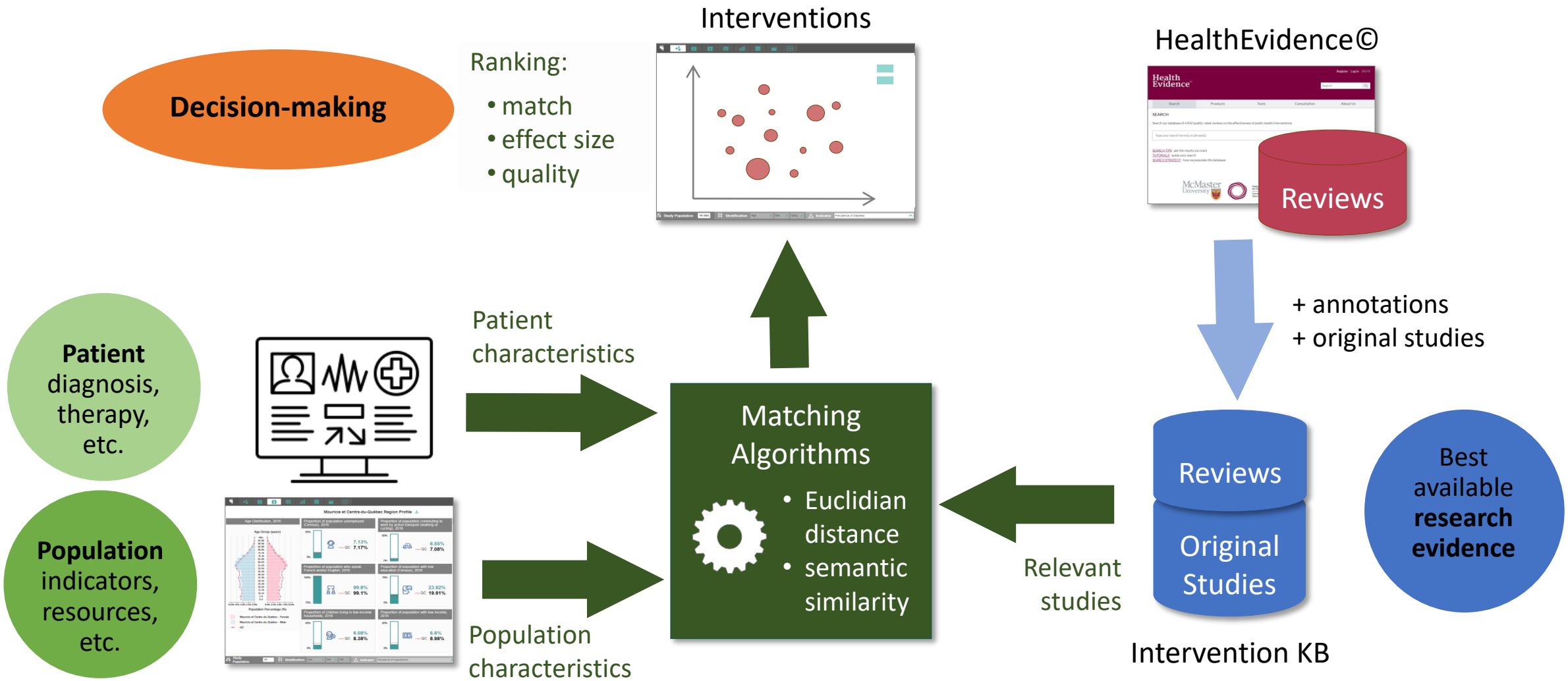
- Example implementation for chronic diseases in Canada
  - Application: https://pophr-ca.mchi.mcgill.ca
  - Information: https://mchi.gitbook.io/pophr/general/about
- Web client allows exploration of indicators for a risk factor or condition of interest for the general population or a sub-population
- Application programming interface (API) allows access to knowledge and indicators in JSON format and through R library
- Pilot interface to health evidence repository



Example: Matching Interventions to Populations



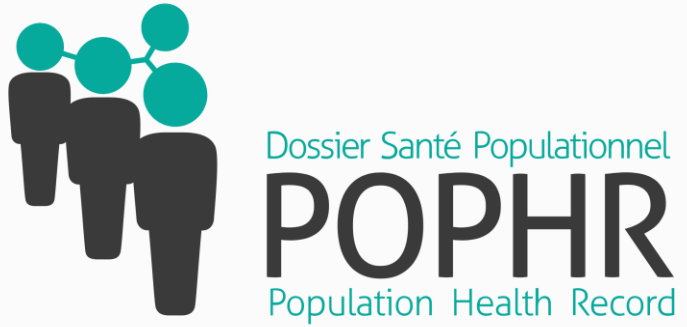
Example: Incorporating SDOH in Primary Care



Lessons Learned

- Integrating Evidence for Public Health Decision Making
  - Symbolic knowledge representation, machine learning, and generative AI
    - Precision matching requires complexity, with added cost, *inputs often unavailable*
    - Standard models for different types of evidence are needed
  - Federated model could enable data sharing / integration
- Public Health Informatics Research
  - Technology debt and resource limitations hinder innovation in practice and applied public health informatics research
  - Important to calibrate project technology and scope to capacity and ensure support from executive and frontline champions
  - Should be aligned with Global (GIDH) and National Digital Health Strategies

Future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Next Steps

- Public Health Contexts
  - Collaboration with Nantes Metropol
  - WHO-led project on epidemiological indicators
  - Integrating local and regional evidence in Canada
  - Intervention tracking
- Informatics
  - Public health terminology and knowledge models
  - Federated learning
  - Workflows and algorithms for AI-supported evidence integration

References

Brakefield, W. S., Ammar, N. & Shaban-Nejad, A. An Urban Population Health Observatory for Disease Causal Pathway Analysis and Decision Support: Underlying Explainable Artificial Intelligence Model. JMIR Form. Res. 6, e36055 (2022).

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).

Buckeridge, D. L. Precision, Equity, and Public Health and Epidemiology Informatics - A Scoping Review. Yearbook of medical informatics 29, 226–230 (2020).

Dhaliwal, B., Neil-Sztramko, S. E., Boston-Fisher, N., Buckeridge, D. L. & Dobbins, M. Assessing the Electronic Evidence System Needs of Canadian Public Health Professionals: Cross-sectional Study. JMIR Public Heal. Surveill. 7, e26503 (2021).

Dobbins, M. et al. A knowledge management tool for public health: health-evidence.ca. BMC public health 10, 496 (2010).

Friedman DJ, Parrish RG. The population health record: concepts, definition, design, and implementation. JAMIA 2010;17:359-366.

Shaban-Nejad, A., Adam, N. R., Lavigne, M., Okhmatovskaia, A. & Buckeridge, D. L. PopHR: a knowledge-based platform to support integration, analysis, and visualization of population health data. Annals of the New York Academy of Sciences 1387, 44–53 (2016).