

T-CAIREM SPEAKER SERIES - DECEMBER 12, 2023

# Artificial Intelligence in Primary Care: Opportunities & real-world examples

Stephanie Garies, PhD

Postdoctoral Fellow

The Upstream Lab, Unity Health Toronto

# Land Acknowledgement(s)



I gratefully acknowledge that my place of work lies on the traditional territory of many nations including the Mississaugas of the Credit, the Anishnabeg, the Chippewa, the Haudenosaunee, and the Huron-Wendat peoples and is now home to many diverse First Nations, Inuit, and Métis. I also acknowledge that Toronto is covered by Treaty 13 with the Mississaugas of the Credit.



I am grateful to work and live on the traditional territories of the peoples of Treaty 7, which include the Blackfoot Confederacy (comprised of the Siksika, the Piikani, and the Kainai First Nations), the Tsuut'ina First Nation, and the Stoney Nakoda (including Chiniki, Bearspaw, and Goodstoney First Nations). The City of Calgary is also home to the Métis Nation of Alberta (Districts 5 and 6).

- Fundamentals of OCAP course (FNIGC)  
<https://fnigc.ca/ocap-training/take-the-course/>
- First Nations, Inuit & Métis data & Indigenous data sovereignty webinars (POPLAR Network)  
<https://www.poplarnetwork.ca/webinars>
- Indigenous Health Data Governance Toolkit webinar (CPCRN)  
<https://www.youtube.com/watch?v=7vU5vmYHUS0>

# Disclosures

- No conflicts of interest to declare.
- Postdoctoral salary funding from CIHR & Unity Health Toronto; awards (Unity Health); honoraria (Alberta Strategies for Patient Oriented Research, Michener Institute)
- Co-investigator on various research grants in last 5 years from CIHR, Family Medicine Temerty Innovation Grant (University of Toronto), St. Michael's Hospital Foundation, Alberta Innovates, Pfizer Global Medical Grants, University of Calgary Office of Health & Medical Education Scholarship, Alberta Children's Hospital Research Institute, Alberta Health Services



# Learning Objectives

1. Understand more about primary care data;
2. Review opportunities for & examples of AI in primary care;
3. Discuss considerations for implementing AI tools in primary care.

# Agenda



1. Why primary care?
2. Data
3. Applications
4. Implementation





# Why Primary Care?

- Majority of encounters in healthcare system
- Comprehensive, relational & preventative care throughout lifespan
- High EMR system uptake & use
- Many potential applications to enhance patient care, address health inequities, improve clinical workflow & reduce administrative burden



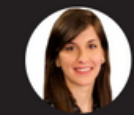
# Crisis in Primary Care

## Family doctor shortage creates stress for patients, communities – and physicians

Even offering generous housing and cash incentives, communities struggle to recruit doctors

[Nick Purdon & Leonardo Palleja](#) · CBC News · Posted: Apr 01, 2023 2:00 AM MDT | Last Updated: April 1

## Half of Canadians do not have a doctor, or battle for appointments: survey



By [Katie Dangerfield](#) · Global News

Posted August 17, 2023 7:26 am · Updated August 17, 2023 10:09 am

## Organization for medical residency placements reveals 100 family medicine slots went unfilled

[KELLY GRANT](#) > HEALTH REPORTER

[TU THANH HA](#) >

PUBLISHED APRIL 27, 2023

UPDATED APRIL 28, 2023



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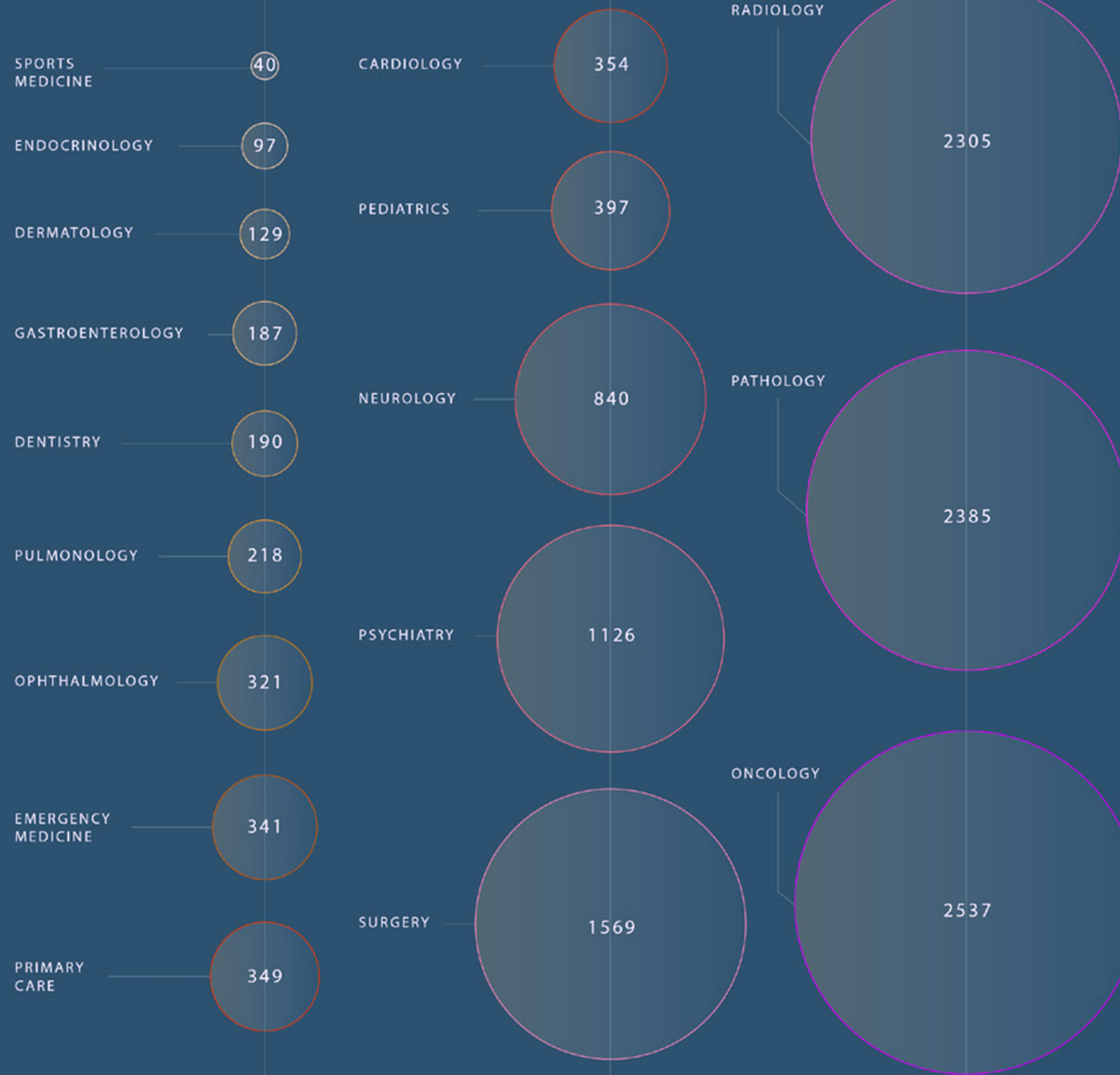
PUBLISHED APRIL 27, 2023

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- Provider burnout
- High administrative burden
- Family physician shortage
- Stretched resources
- Aging population
- Growing patient complexity
- Inequities in access & outcomes
- Waning continuity & integration
- Declining interest in FM training

<https://www.primarycarecrisis2023.ca/resources>

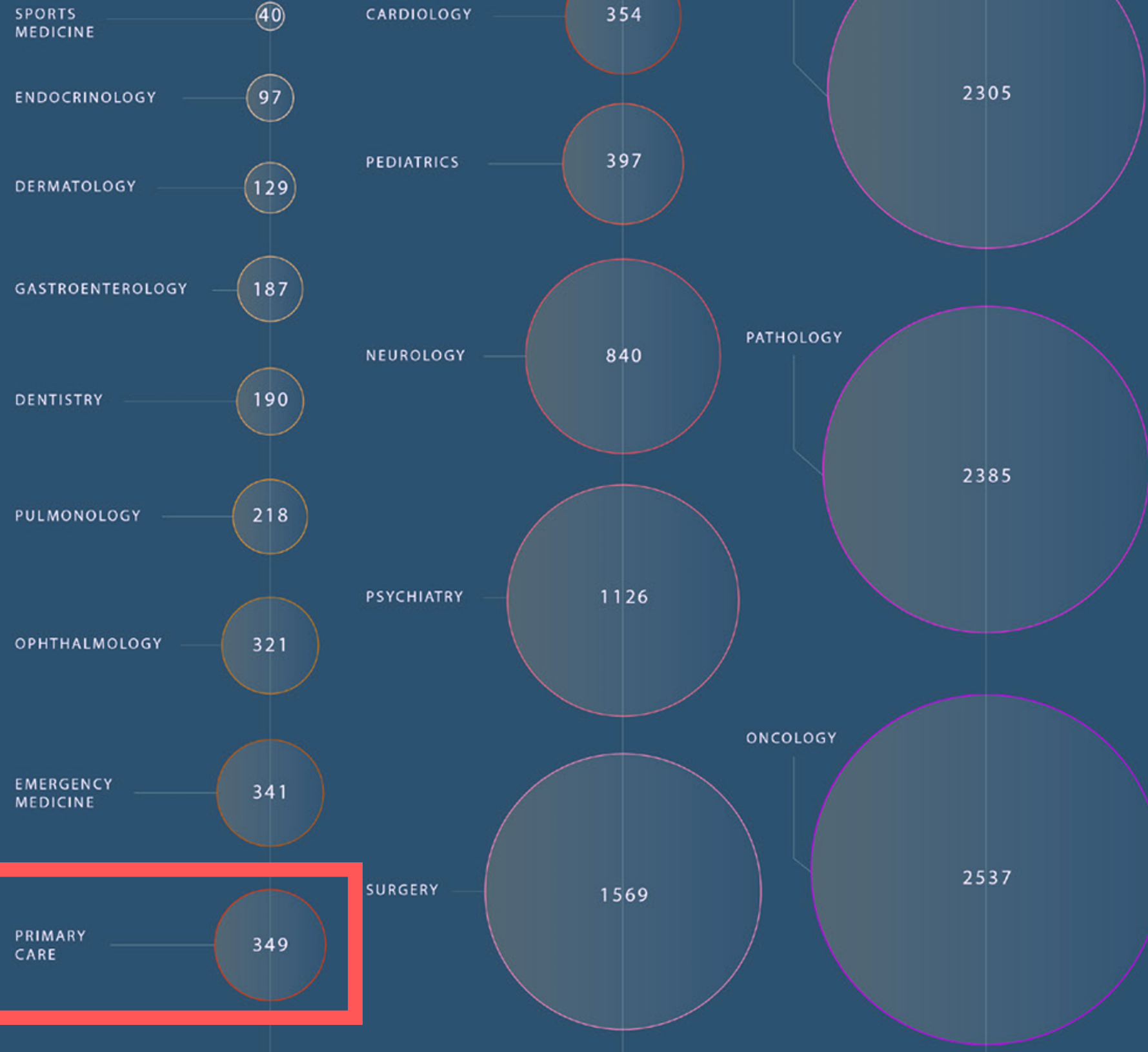
## STUDIES PER SPECIALTY



# AI in Healthcare Settings

Meskó B & Radó N. A guide to artificial intelligence in health care. The Medical Futurist 2019.

## STUDIES PER SPECIALTY



# AI in Healthcare Settings

Many challenges but  
big opportunities!

Meskó B & Radó N. A guide to artificial intelligence in health care. The Medical Futurist 2019.

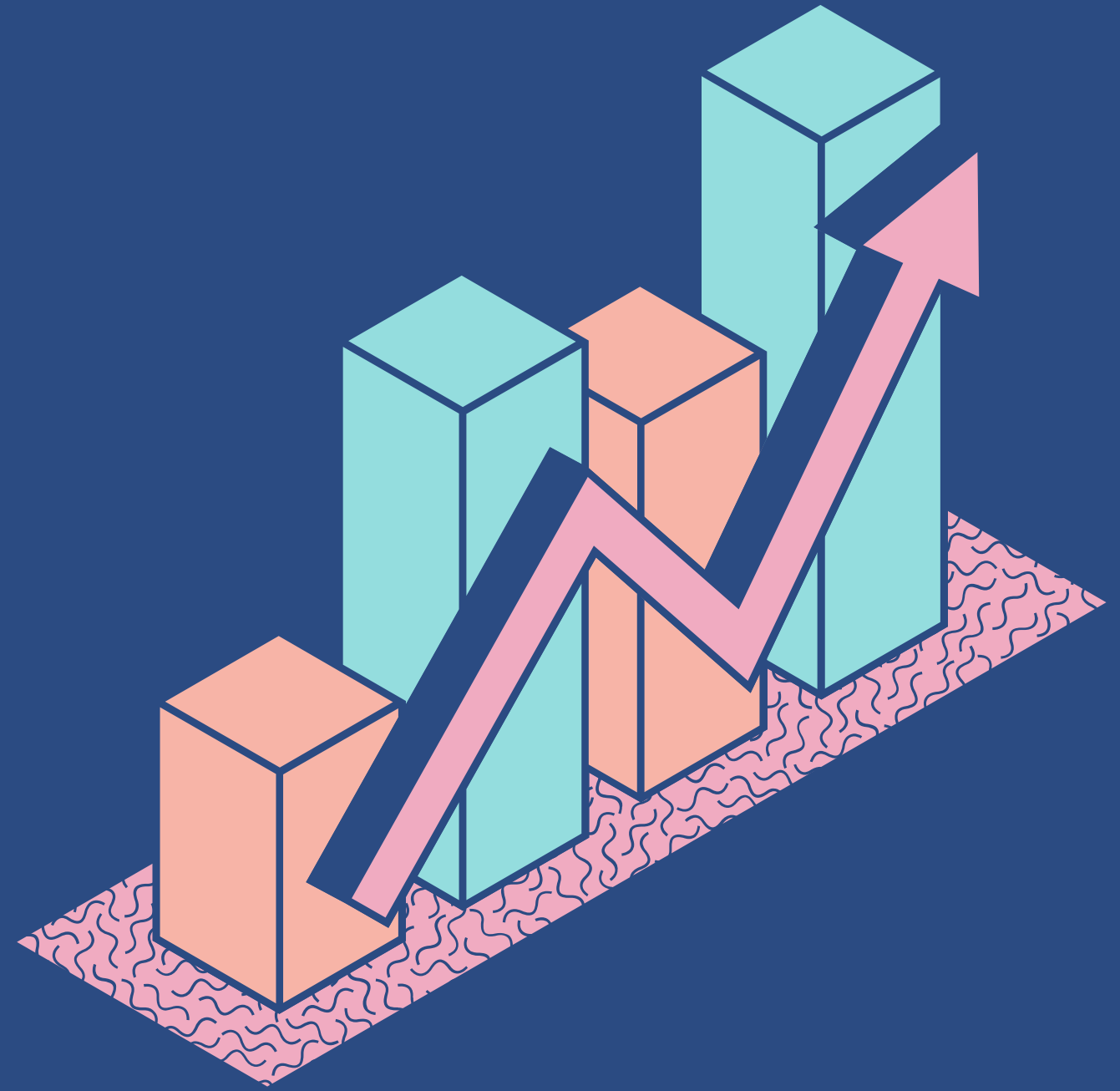
# Priorities for AI in PC

1. Preventative care and risk profiling
2. Patient self-management of condition(s)
3. Management and synthesis of information
4. Improved communication between PC and AI stakeholders
5. Data sharing and interoperability
- 6.(tie) Clinical decision support
- 6.(tie) Administrative staff support
8. Practitioner clerical and routine task support
9. Increased mental healthcare capacity and support





# Primary Care Data



# Primary Care Electronic Medical Record (EMR) Data



Images generated by DALL-E 2, Dec 6, 2023, Open AI, <https://labs.openai.com/>



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## Canadian Primary Care Sentinel Surveillance Network

[cpcssn.ca](http://cpcssn.ca)

- Pan-Canadian network of primary care practice-based research networks
- De-identified EMR data ~2M patients



# POPLAR

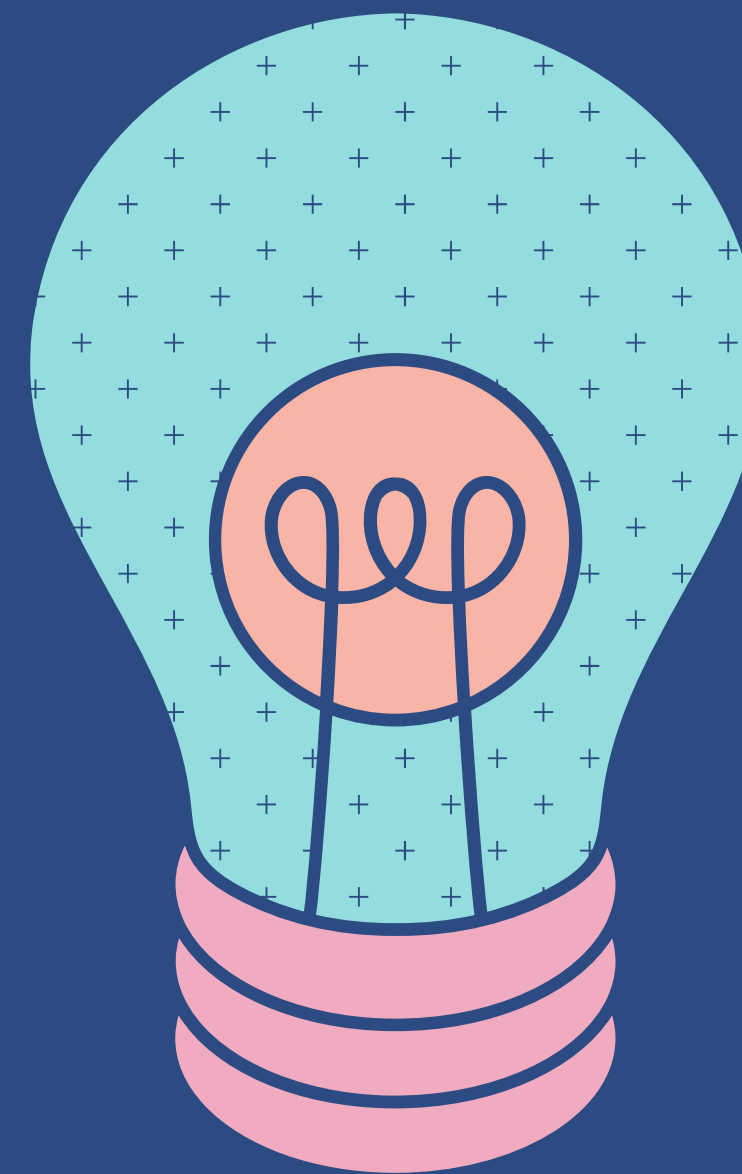
PRIMARY CARE ONTARIO PRACTICE-BASED LEARNING  
AND RESEARCH NETWORK

[poplarnetwork.ca](http://poplarnetwork.ca)

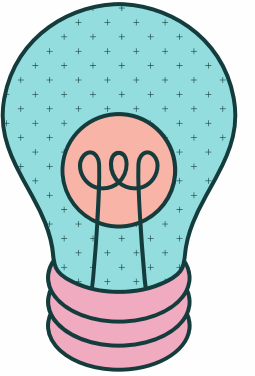
- Network of 7 Ontario PBRNs
- De-identified EMR data ~1.5M patients
- Supports multi-jurisdictional clinical research in Ontario



# AI Applications for Primary Care



# 1. Enhancing Health Equity



Harnessing EMR data and artificial intelligence methods to identify health inequities and support action on the social determinants of health in primary care

Data to Enable a Learning Health System

**In Progress**

Artificial Intelligence, Electronic Medical Records, Primary Care, Social Determinants of Health

September 2021 - August 2023 | Funders: CIHR Health System Impact Postdoctoral Fellowship | Partners: Unity Health Toronto (St. Michael's Hospital)

# Objectives

1. Can we use AI to derive social determinants of health (SDoH) from primary care EMR data?
2. What do primary care clinicians & leaders think?
3. How can we co-design AI-derived SDoH information for use in a Family Health Team?

# Methods

- EMR data from St. Michael's Hospital Family Health Team (~17,000 patients)
- Tested rule-based approach & supervised machine-learning

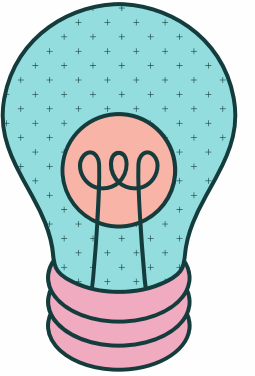


# Findings

- Variable performance
- Overall accuracy for 5 determinants:
  - Immigrant status: 60.5% (rule), 65.0% (ML)
  - \*Housing instability: 93.8% (rule), >80% (ML)
  - \*Income insecurity: 68.9% (rule), >73% (ML)
  - \*Sexual orientation: 37.4-99.8% (rule), 88.3% (ML)
  - \*Gender: 98.9-99.7% (rule), 90.5-99.5% (ML)

*\*preliminary results*

# 2. Data Science Methodology



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Research

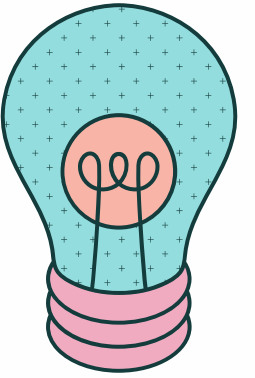
⌚ Using machine learning to standardize medication records in a pan-Canadian electronic medical record database: a data-driven algorithm study focused on antibiotics prescribed in primary care

Stephanie Garies, Matt Taylor, Boglarka Soos, Cliff Lindeman, Neil Drummond, Anh Pham, Zhi Aponte-Hao and Tyler Williamson

October 31, 2023 11 (5) E1020-E1024; DOI: <https://doi.org/10.9778/cmajo.20220235>



# 2. Data Science Methodology



## Prescribed Medication Text

fusidic acid  
fusidic acid (ophth)  
gatifloxacin  
gentamicin  
hydrocortisone & antibiotics  
hydrocortisone & antiinfectives  
hydrocortisone & antiinfectives  
metronidazole (derm)  
metronidazole (gyne)  
Miconazole (gyne)  
moxifloxacin (oph sol'n)  
mupirocin  
nystatin  
nystatin (gyne)  
nystatin (oral)  
nystatin combos  
ofloxacin (ophth)  
prednisolone & anti-infectives

Semi-supervised ML  
using Health Canada DPD

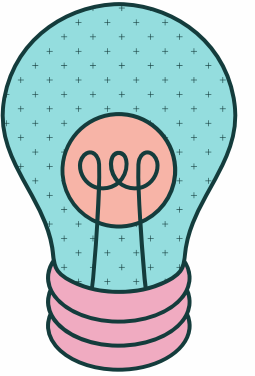


## ATC Codes

D06AX01  
S01AA13  
S01AE06  
S02AA14  
D07CA01  
S02CA03  
S01CA03  
D06BX01  
G01AF01  
G01AF04  
S01AE07  
D06AX09  
D01AA01  
G01AA01  
A07AA02  
G01AA51  
S01AE01  
S01CA02



# 3. Public Health Surveillance



## ARtificial intelligence to ENable AAutomated REspiratory illness SUrveillance through PRimary care (AREA-RESP)

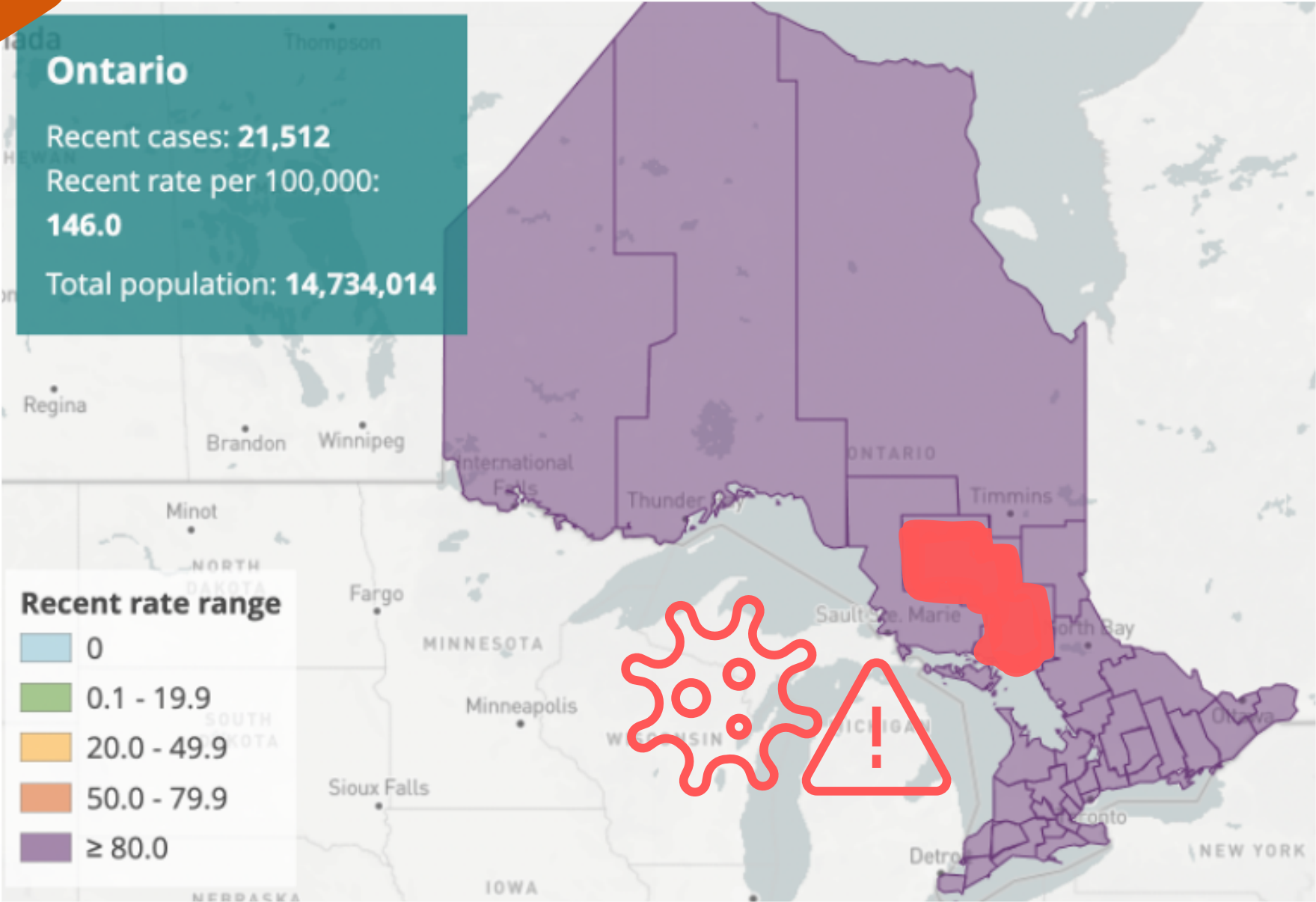
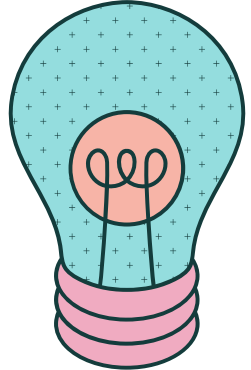
Data to Enable a Learning Health System

In Progress

Artificial Intelligence

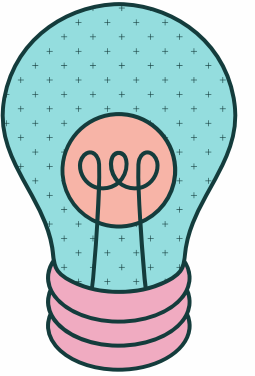
August 2022 - December 2023 | Funders: Canadian Institutes of Health Research

# 3. Public Health Surveillance





# 4. Addressing Family Physician Admin Burden



Research project: Artificial Intelligence Automation to Improve Family Medicine Workflow

Award: Family Medicine (FAFM & CFPC)-Temerty Innovation Grant - \$100,000 CAD

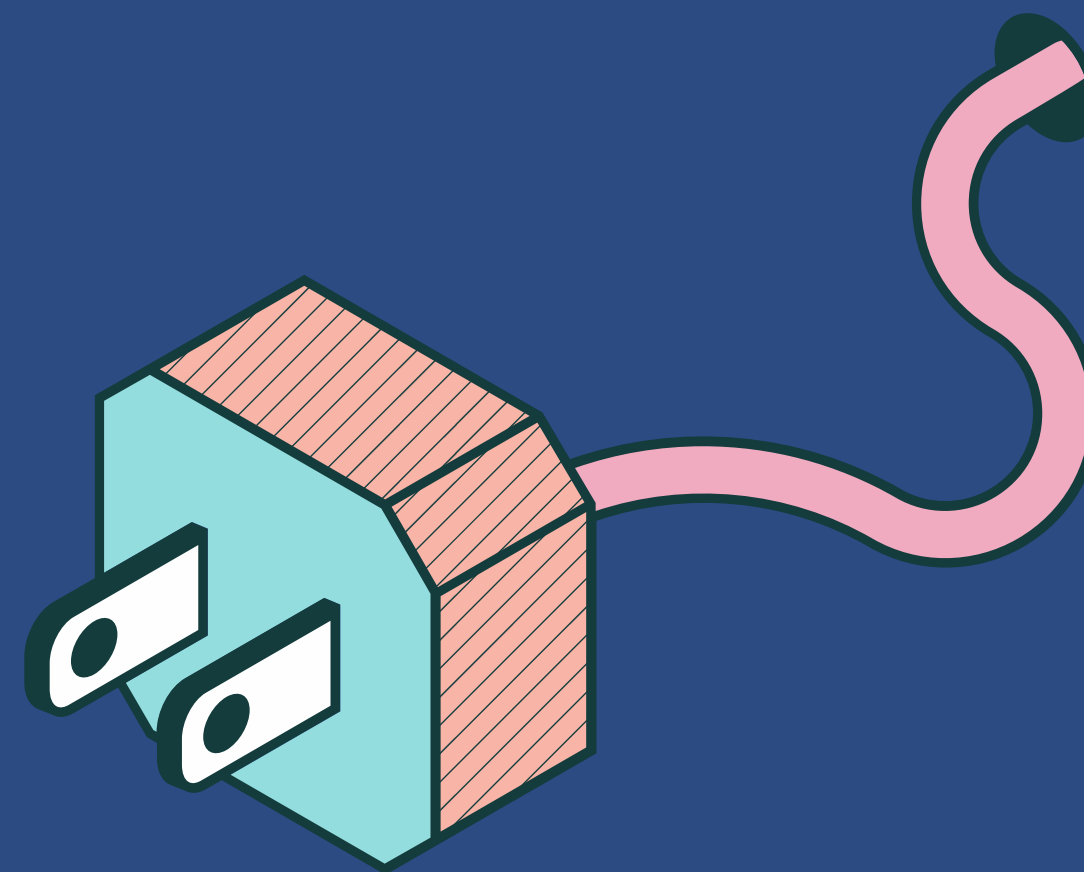


1. Time motion study
2. Develop AI tool using real-world EMR data
3. Pilot & evaluate tool in 3 FM clinics

TOP ROW: Frank Rudzicz, Noah Crampton, Andrew Pinto • BOTTOM ROW: Hanu Chaudhari, Omri Nachmani, Stephanie Garies, Jane Zhao, Christopher Meaney



# Implementing AI in Primary Care




# A Few Considerations



- AI & data science are team sports!
- Engage & co-design with clinicians, patients & communities early
- Think carefully about bias & fairness (e.g., consequences of FP / FN)
- “Move fast & break things” probably not appropriate for healthcare

Implementing artificial intelligence in Canadian primary care: Barriers and strategies identified through a national deliberative dialogue

Katrina Darcel, Tara Upshaw, Amy Craig-Neil, Jillian Macklin, Carolyn Steele Gray, Timothy C. Y. Chan, Jennifer Gibson, Andrew D. Pinto 



# Helpful Resources

## Canada Health Infoway Toolkit for AI Implementers in Healthcare



6 modules for healthcare organizations: key risks, regulation of AI, opportunities & investments, change management, governance

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## Implementing ML in medicine (Verma AA et al.) & Evaluation of ML solutions in medicine (Antoniou T & Mamdani M)



3 phase framework with implementation steps, team design & considerations; outline of a comprehensive, multifaceted evaluation plan

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## Upstream Lab Resources (upstreamlab.org)

AI in Family Medicine webinars

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# Questions?

[sgaries@ucalgary.ca](mailto:sgaries@ucalgary.ca)

