# Royal College Research Forum:
# The Intersection of Medicine and AI

Meet the panel



**Richard K. Reznick, MD, FRCSC, FACS, FRCSEd (hon), FRCSI (hon), FRCS (hon)**

Dean, Faculty of Health Sciences CEO, Southeastern Ontario Academic Medical Organization Queen's University

**Brian D. Hodges, MD, PhD, FRCPC**

Executive Vice-President Education and Chief Medical Officer, University Health Network, Professor, Faculty of Medicine, University of Toronto

**Daniel Hashimoto, MD MS**

General Surgery Resident and Associate Director of Research, Surgical Artificial Intelligence and Innovation Laboratory, Massachusetts General Hospital

**Alison Paprica, PhD**

Assistant Professor, Institute for Health Policy, Management and Evaluation, University of Toronto, Executive Advisor and Affiliate, Scientist Institute for Clinical Evaluative Sciences

**Jonathan Kanevsky MD, FRCSC**

Plastic and Reconstructive Surgeon; Head of Clinical Innovation, Imagia Cybernetic
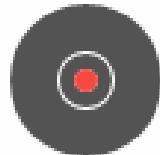
**Tanya Horsley, PhD, MBA**

Associate Director, Research Royal College of Physicians and Surgeons of Canada

# Housekeeping

- You have been automatically muted

- Your camera cannot be activated

- The session is being recorded

- Questions to the panel can be submitted in both English and French
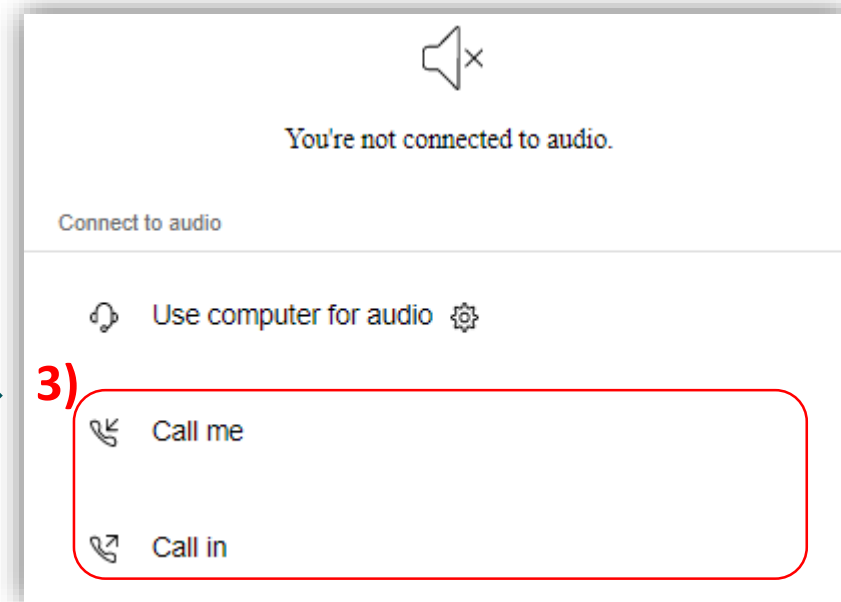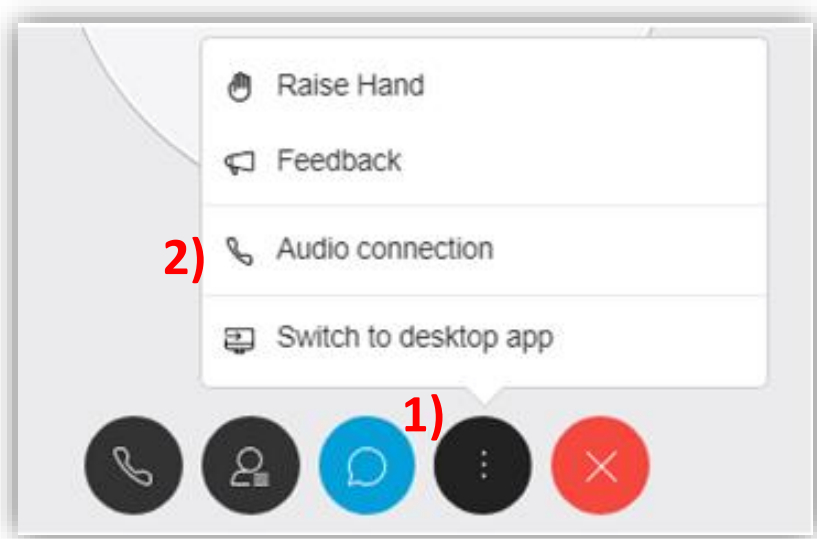
- For technical support:
  - Call 1-800-461-9598; 613-730-6243
  - Or email researchunit@royalcollege.ca

# Switching to Phone Audio

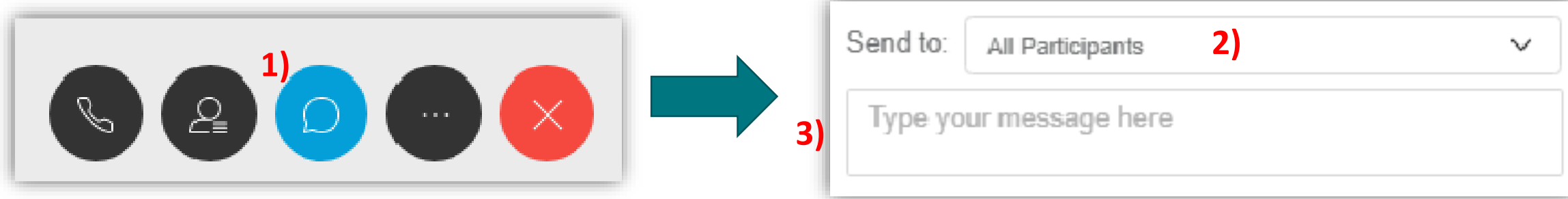- Experiencing issues with your computer audio? Here is how to connect via your phone:

  1) Click
  2) Select "**Audio connection**"
  3) Choose "**Call me**" or "**Call in**" option

# Send a question for the panelists

To submit:

1) Open the **Chat** panel by clicking 

2) Within the **Chat** panel, in the **Send to** or **To** drop-down list, please select "*All Participants*" only

3) Enter your question, then press **Enter**

# Meet your panelists

Richard K. Reznick, MD, FRCSC, FACS,  FRCSEd (hon), FRCSI (hon), FRCS (hon)

Alison Paprica, PhD

Jonathan Kanevsky MD, FRCSC

Daniel Hashimoto, MD, MS

Brian D. Hodges, MD, PhD, FRCPC

# Task Force on AI & Emerging Digital Technologies

**Dr. Richard Reznick**
MD, FRCSC, FACS, FRCSEd (hon), FRCSI (hon), FRCS (hon)
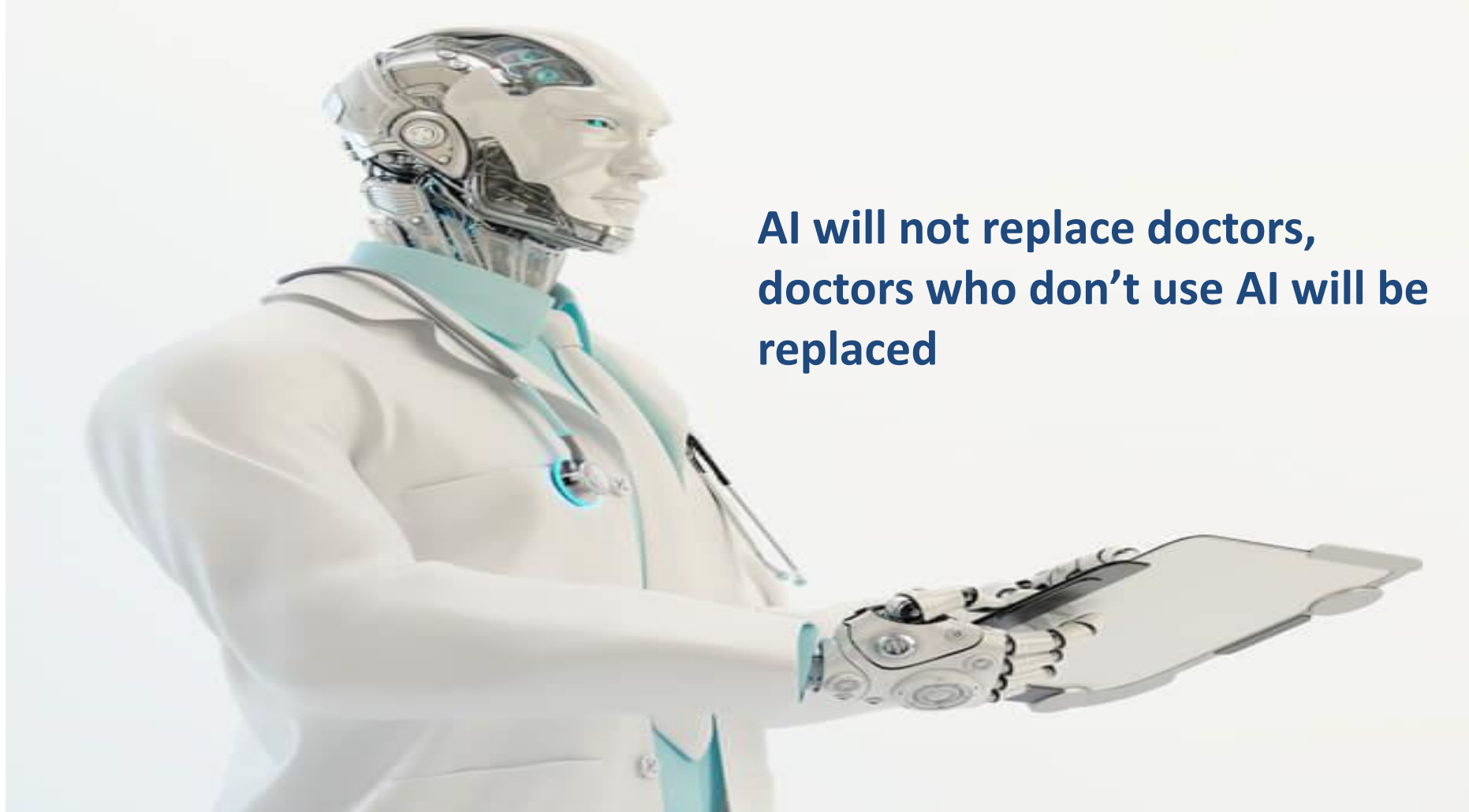Research Forum: Intersection of AI and Medicine
June 09, 2020

# Overview

- 14 member task force & RC Staff
- 12 Committee meetings (5 in-person + 7 teleconferences)
- 30+ Steering Committee meetings

- Annotated Bibliography 20+ reports
- Fellow & resident survey (4000+)
- 22 key Informant interviews
- Round table (Fellows, ethics committee)
- Scoping review

January 2018 – February 2020

**AI will not replace doctors, doctors who don't use AI will be replaced**

That at this time, the College not make alterations to the number and complement of specialists being trained, and monitor the impact of AI on individual disciplines

**Future doctors will require new skills**
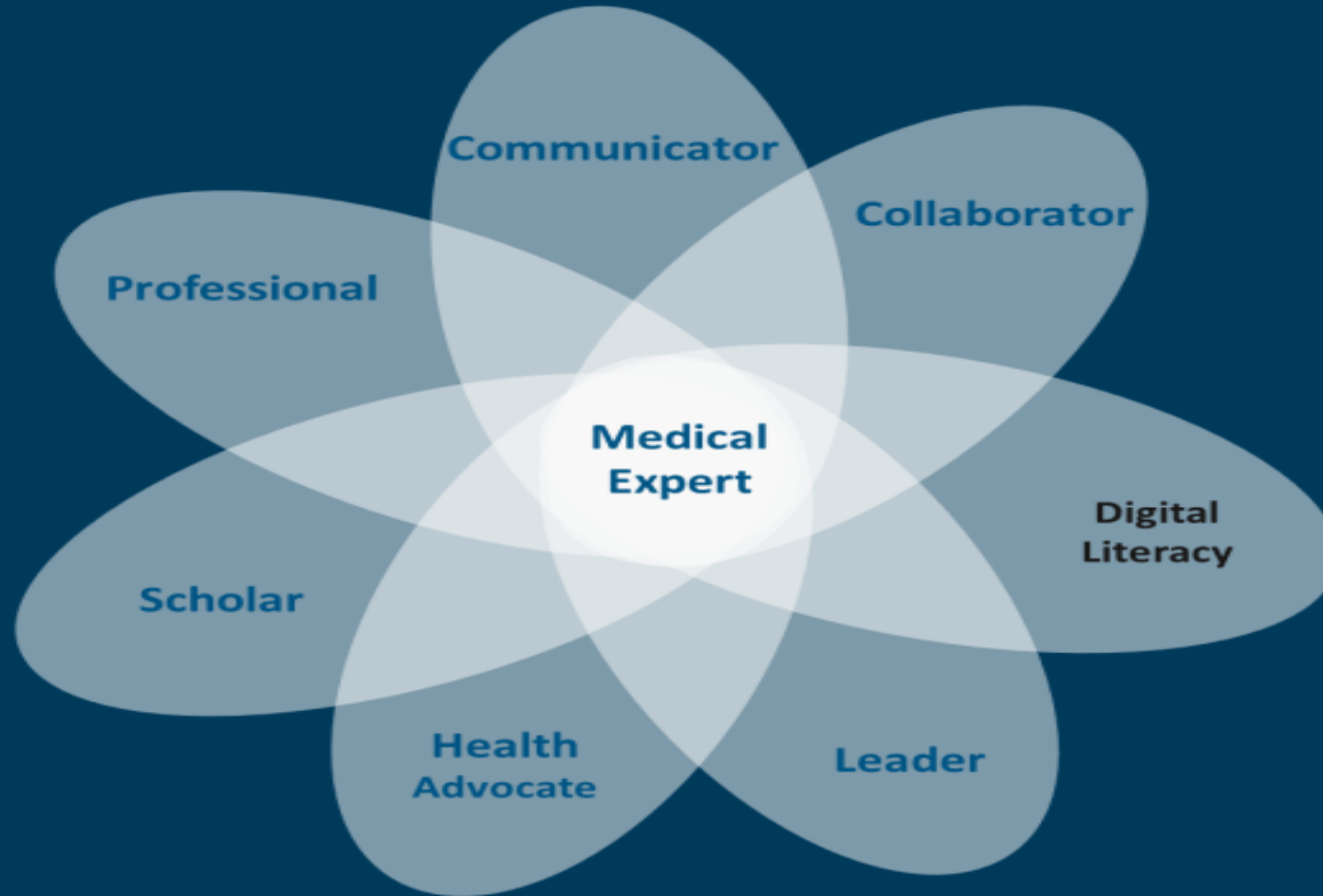
Digital health literacy competencies should be integrated into the CanMEDS framework

**A surgeon won't do gallbladders for 40 years ...Jobs will change**

The College needs to provide support in developing new competencies and in facilitating career transitions

**One third of Stanford Meds are not pursuing clinical medicine**

Consider introducing a new discipline in clinical informatics

**The best AI tools will not be developed by computer scientists, but by computer scientists and Fellows**



The College should play an active role in supporting Fellows to co-develop, refine, validate and spread AI-enabled technologies

# Machines and technologies will become a "member" of teams that are increasingly multidisciplinary
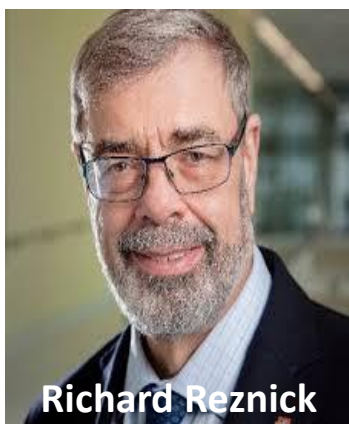
Responsibly promote collaborations between Fellows and innovators to co-develop, refine and validate AI

# AI Implementation can be torpedoed if we are not diligent about legal and ethical aspects

Collaborate to develop, tailor, curate and distribute materials related to privacy, discrimination, safety and other ethical and legal concerns relating to AI

**Richard Reznick** (Chair)
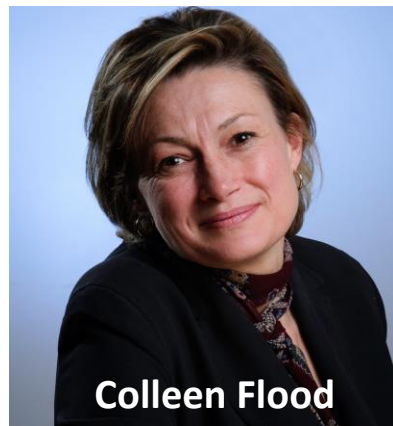
**Colleen Flood** (Ottawa)

**Jaron Chong** (McGill)

**Alison Paprica** (Toronto)

**Daniel Hashimoto** (Harvard)

**Brian Hodges** (UHN)

**Osmar Zaiane** (Alberta)

**Anna Goldenberg** (Toronto)

**Joon Lee** (Calgary)

**Khaled El Emam** (Ottawa)

**Frank Rudzicz** (Toronto)

**Ken Harris** (Royal College)

**Tanya Horsley** (Royal College)

**Mohsen Hassani** (Royal College)

**Tyler Victor** (Royal College)

# Health AI is Team Science

P. Alison Paprica
Health Data Research Network Canada
Institute for Clinical Evaluative Sciences (ICES)
University of Toronto

Réseau de recherche sur les données de santé du Canada
**Health Data Research Network Canada**

**ICES**

Institute of Health Policy, Management & Evaluation
UNIVERSITY OF TORONTO

# Health AI is Team Science

Main messages:

- Health AI applications are best co-designed by teams

- There are a range of roles for physicians in co-developing, refining and implementing health AI

- Patients (i.e., the intended beneficiaries) also need to be part of the team

# Implementing AI in Healthcare

October 2019 Vector-SickKids symposium – (to our knowledge) the first focused on health AI implementation vs. research
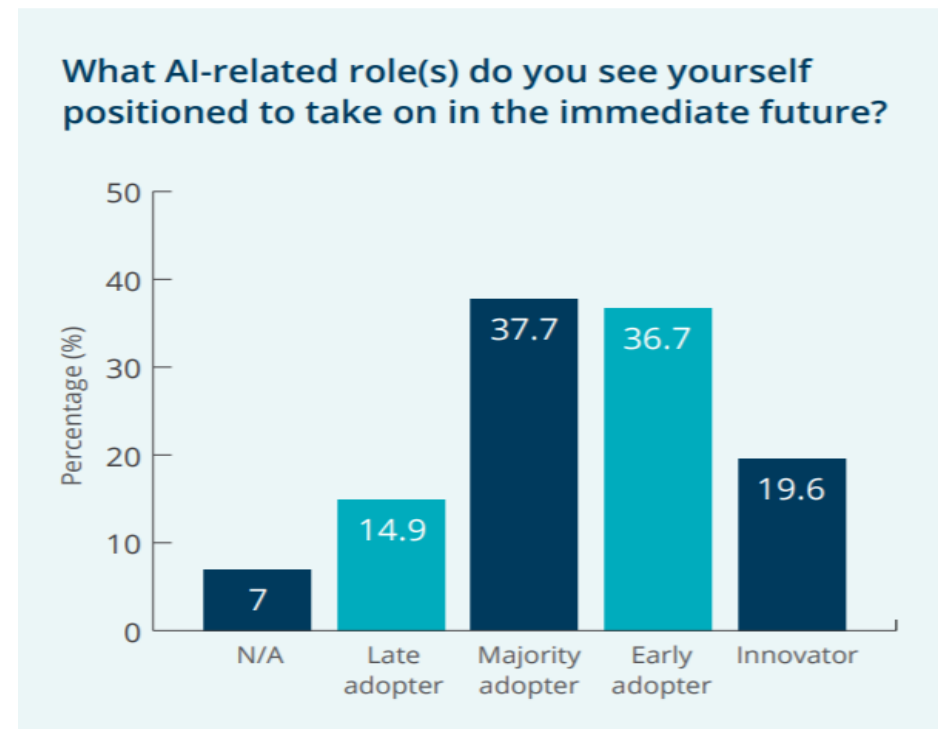
Resultant whitepaper highlighted three key interrelated themes that complement the RC Report recommendations

1. Contextualization: technology is deployed within existing norms and practices

2. Life-cycle planning: distinguishing the research/scientific stage, the technical/implementation stage, and the operational/maintenance stage

3. Stakeholder involvement: every successful project presented was enabled by the intersection of operational and research leadership along with a variety of clinical stakeholders

Drysdale, Erik, Elham Dolatabadi, Corey Chivers, Vincent Liu, Such Saria, Mark Sendak, Jenna Wiens et al. "Implementing AI in healthcare." (2019).

# There are many roles for physicians

Health AI = team science does NOT mean that all physicians need to learn how to code

Physicians have essential roles to play in the co-development, refinement, validation and spread of health AI technologies

**Figure 2.** Survey results indicating the roles Fellows see themselves fit to take on now and in the future



What AI-related role(s) do you see yourself positioned to take on NOW?

N/A: 7.6
Late adopter: 18.7
Majority adopter: 46.1
Early adopter: 27.8
Innovator: 12.5

What AI-related role(s) do you see yourself positioned to take on in the immediate future?

N/A: 7
Late adopter: 14.9
Majority adopter: 37.7
Early adopter: 36.7
Innovator: 19.6
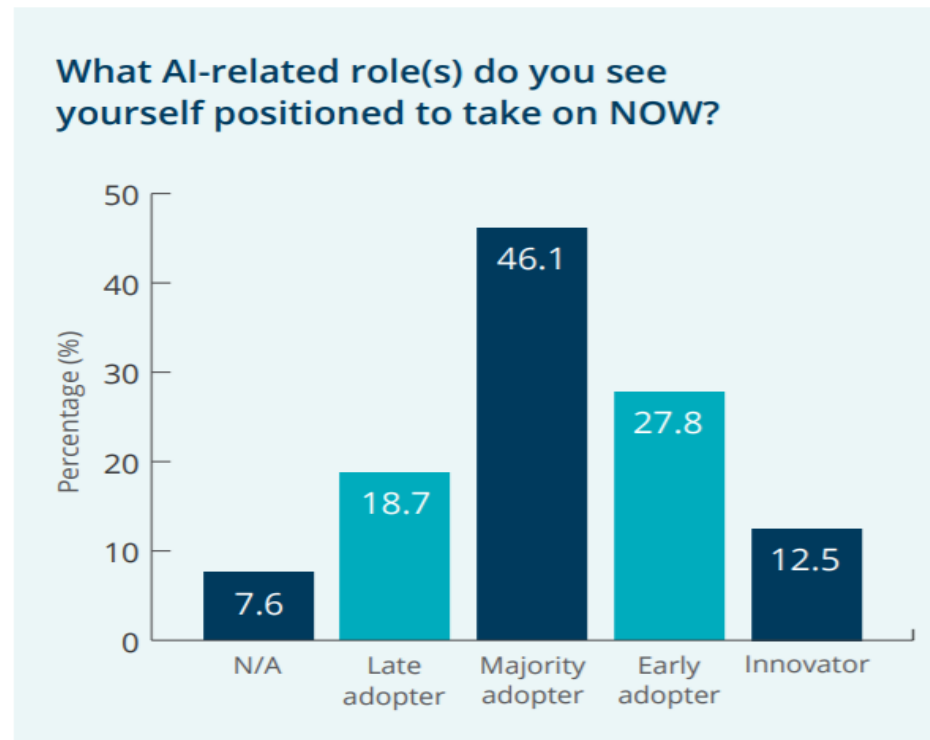
# Members of the public need to be involved too

A recent study with six (6) Ontario focus groups found:

- AI-specific hopes: e.g., potential for faster and more accurate analyses, ability to make use of more data

- AI-specific fears: e.g., loss of human touch, skill depreciation from over-reliance on machines

- Conditions: e.g., human in the loop, transparency

Deep patient involvement, which brings in these perspectives, is part of how we will ensure fulsome responses to report recommendations such as:

- AI as potential democratizer of health care that empowers the patient

- Ethical concerns such as patient privacy and how AI-based risk stratification that impact care decisions for individual patients

PREPRINT - MD McCradden, T Sarker, PA Paprica Conditionally positive: a qualitative study of public perceptions about using health data for artificial intelligence research, - medRxiv, 2020

# Consensus Statement on Public Involvement & Engagement with Data-Intensive Health Research

**in health sector Artificial Intelligence (AI)**

*Our key premise is that the public should not be characterised as a problem to be overcome but a key part of the solution to establish socially beneficial data-intensive health research for all.*
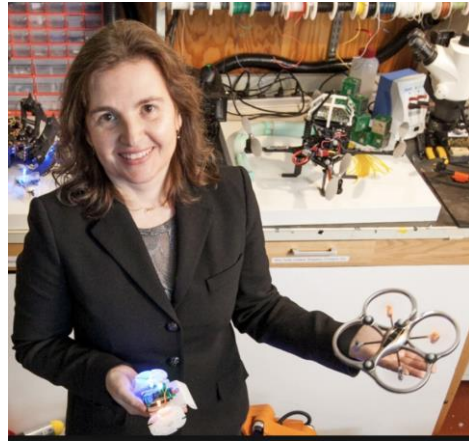
*health AI research & application*

Aitken M, Tully MP, Porteous C, Denegri S, Cunningham-Burley S, Banner N, Black C, Burgess M, Cross L, van Delden J, Ford E. Consensus Statement on Public Involvement and Engagement with Data-Intensive Health Research. International Journal of Population Data Science. 2019 Feb 12;4(1).

# MGH SAIIL Team



Oz Meireles, MD
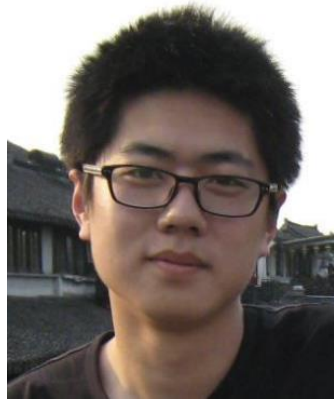Director, MGH SAIIL

Daniela Rus, PhD
Director, MIT CSAIL

Daniel Hashimoto, MD MS
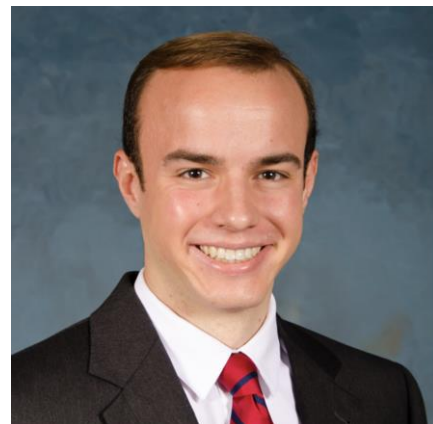Assoc Director, Research

Guy Rosman, PhD
Assoc Director, Engineering

Elan Witkowski, MD MPH
Surgical Faculty

Yutong Ban, PhD
Postdoctoral Fellow

Thomas Ward, MD
AI & Innovation Fellow

Caitlin Stafford, CCRP
Clinical Research Specialist

Allison Navarrete-Welton
Research Assistant

# Surgical AI & Innovation Fellowship

- 1-2 Year research fellowship for surgical residents
    - Background in computer science, mathematics, engineering, or related fields preferred but not required
- Paired with MGH-MIT postdoctoral research fellow
- Supervision from MGH Surgery and MIT CSAIL faculty

Also offer semester research assistantships for undergraduate and graduate students, including medical students

# Hands-On Experience

- Instruction on principles of data collection, management, and analysis with real-world data
    - Supplements classroom experience in statistics/data science

- Instruction on literature review and literature appraisal

- Graduated responsibility in projects

- Transfer of knowledge between clinical and engineering/data teams

# Thank you



Contact: dahashimoto@mgh.harvard.edu
Web:          www.saiil.org

@laparoscopes
@MGHSAiiL

# The Health in AI Healthcare

The physician and industry collaboration in developing AI

Dr. Jonathan Kanevsky, MD, FRCSC
Director Clinical Innovation,
Imagia

# Imagia
ABOUT US

" We're powering a collaboration ecosystem to scale the delivery of impactful *AI products* for personalized healthcare."

- **Founded in 2015**

- **60+ Team**: Healthcare, commercialization and regulatory expertise - researchers and PhDs in AI

- **Based in Montréal AI scene**: privileged relationship with Turing-award winner Yoshua Bengio (Advisor and Founding Investor) & the MILA, one of the largest global AI institutes

- **Corporate partnerships**: Olympus landmark deal in 2017 for co-development of AI modules in Endoscopic Devices (Real-Time Polyp Detection and Differentiation)
  - Several further large corporate partnerships underway (Undisclosed)

- **Academic Partnerships:** 12 academic clinical centers across Canada, US and Europe.

- **Awarded $49M:** Imagia and Terry Fox Research Institute from Canadian Federal Government to Accelerate AI-Driven Medical Breakthroughs

Challenges for implementing AI in healthcare are plenty...
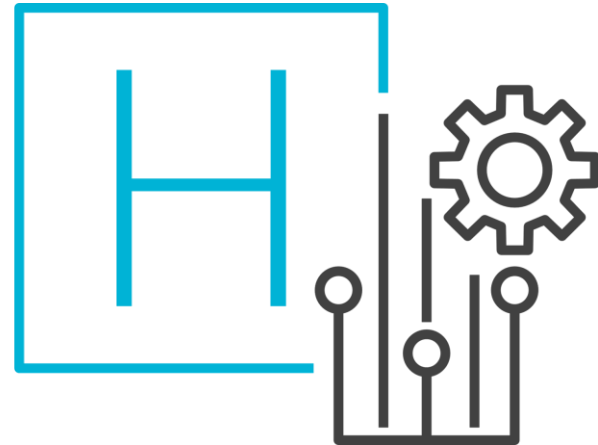
Privacy & security

Clinical adoption

AI-friendly data

Combined insights

Siloed data

# EVIDENS PLATFORM

**"Unlock" healthcare
data sets** for clinical researchers

**Use AI** to rapidly **structure and
organize data** for a discovery
process

**Automatically build an AI model**
that is optimized for the clinicians
question at hand

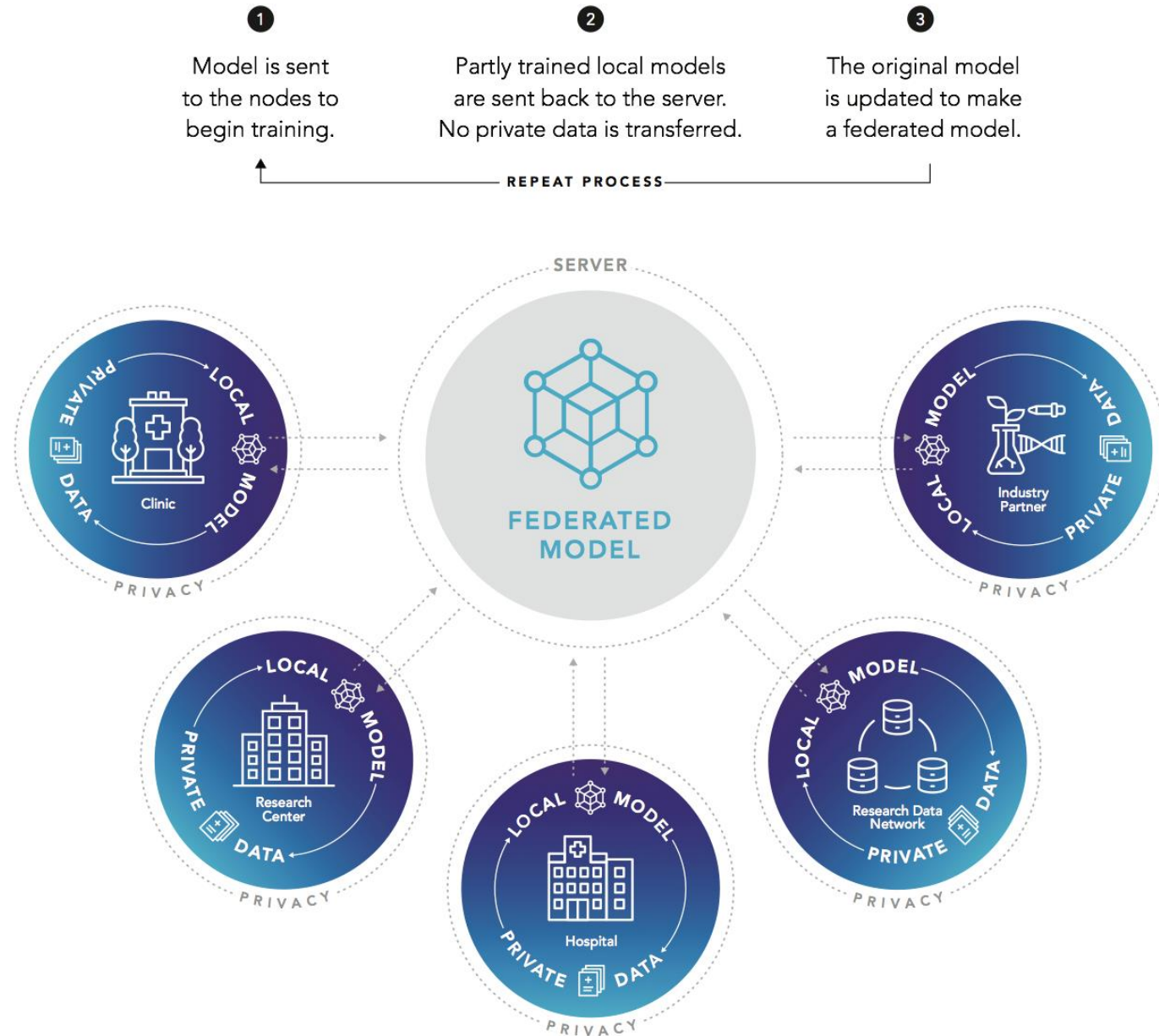Enable researchers to answer the
**specific question using new
insights**

# Applied to multi-hospitals **at scale** using **federated learning**
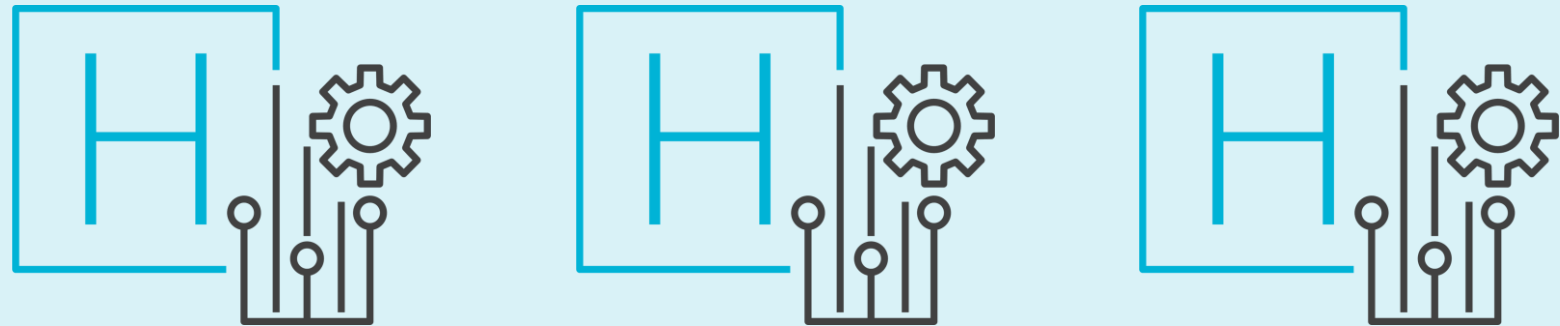


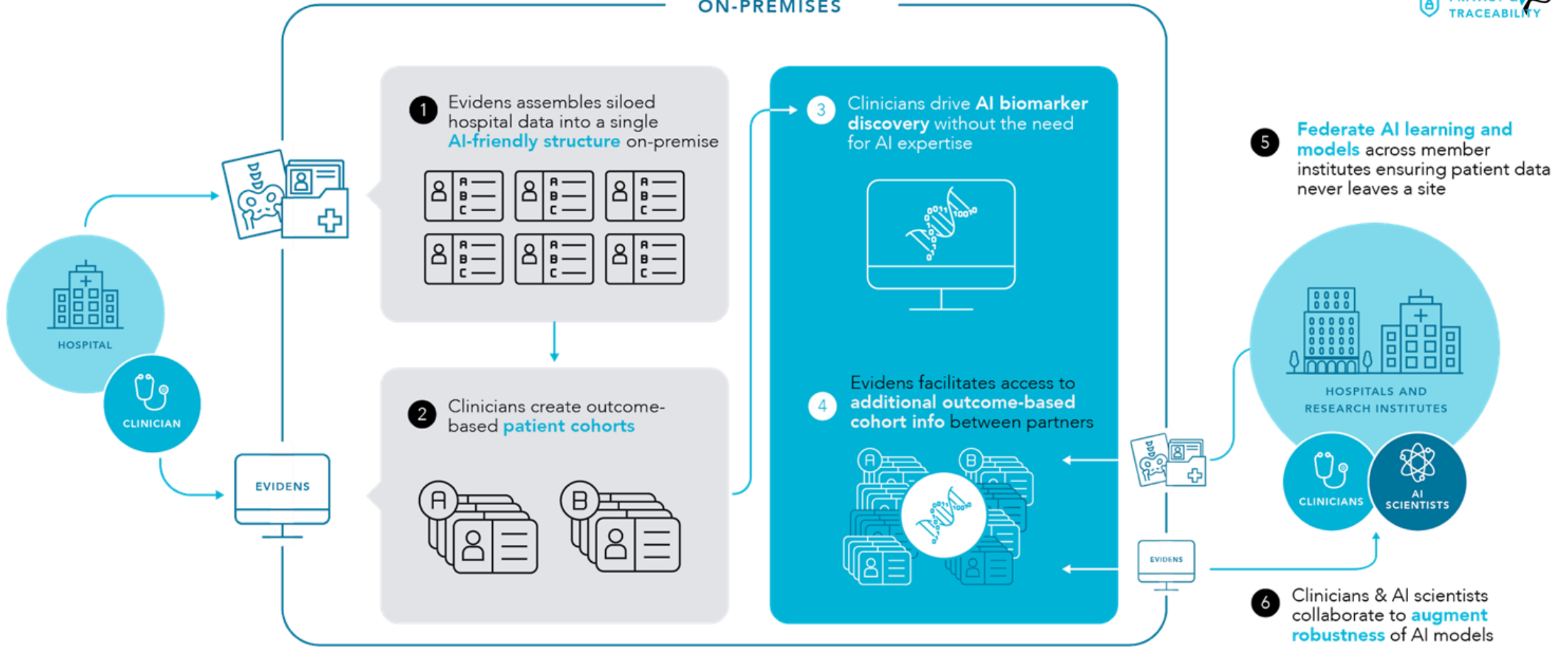**AI "travels"** — No need to move the data outside of the institutions.
**Data protection is ensured**

# Collaborative and transfer learning across institutions

**1** Model is sent to the nodes to begin training.

**2** Partly trained local models are sent back to the server. No private data is transferred.

**3** The original model is updated to make a federated model.

REPEAT PROCESS

# EVIDENS: enabling hospitals and research institutions to learn from distributed healthcare data

**4+**
Countries
(Canada, US, EU)

**10+**
Institutions

**20+**
Projects
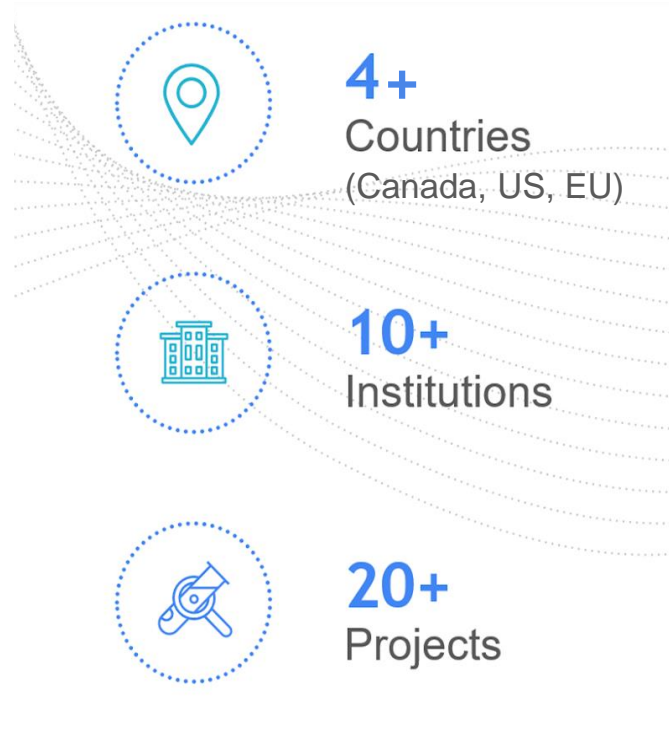
Imagia's **EVIDENS designed to federate learning across hospital data** to power discovery at scale.

EVIDENS is a purpose-designed platform for clinical researchers and healthcare partners **to use AI and validate clinical insights.**
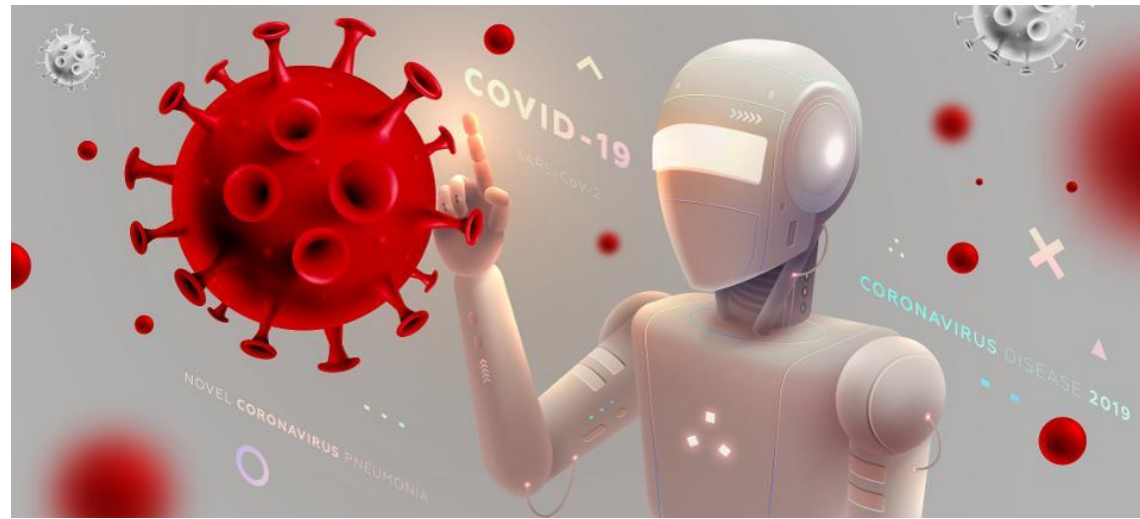
**Institutional data ownership and patient privacy are preserved - No need to move the data outside of the institutions.**

HIPAA COMPLIANT

GDPR COMPLIANT

PIPEDA Compliant
Personal Information Protection and Electronic Documents Act

# AI and COVID:
# Lessons from the pandemic

Brian D. Hodges MD, PhD, FRCPC

Chief Medical Officer & EVP Education, UHN

Israeli Innovators Harness Artificial Intelligence Technologies
To Curb The Global COVID-19 Pandemic, W Singer, Forbes 2020

**Dr Heather Ross**

Peter Munk Cardiac Centre, UHN

**Mary O'Sullivan**

MEDLY Coordinator

TORONTO STAR

Toronto-based heart health app Medly helps patients monitor symptom changes at home

By Theresa Boyle Health Reporter
Mon., Jan. 27, 2020 | 6 min. read

# Pre COVID there was a flurry of attention to AI use @ UHN

- Ray Station AI for radiation therapy treatment planning (from 4 hours to 4 minutes per patient)
- Medley remote cardiac monitoring
- Swift Medical consortium for foot and wound care
- AI prediction for Critical Care

- AI *should* have helped us with pandemic related issues

Lessons learned...

# Dr. Bo Wang

AI Lead at PMCC, UHN
CIFAR AI Chair, Vector
Assistant Professor, UofT

# There have been successes:

## Whole-genome sequencing to track SARS-CoV-2 viral genome evolution

Genotyping research sheds light on two aspects to help combat COVI19:

1) Vaccine development depends on viral mutations. The WGT AI tool detects on novel mutations of the SARS-CoV-2

2) Public Health Policy. The WGT AI tool provides a global view of viral transmissions to detect hubs of viral outbreaks by comparing data collected all over the world

Wang et al, coming to *Lancet*

## Dr. David Wiljer

Executive Director Digital Education, UHN

## But There are Many Limitations:

"The promise of AI has not been significantly fulfilled in the fight against COVID-19, from an epidemiological, diagnostic and pharmaceutical perspective, due to the challenge of readiness in leveraging these tools

Leveraging AI-driven tools requires data science (development and validation) and delivery science (education, operational leadership and clinician support)"

Wiljer et al 2020

# AI was not yet ready @ UHN

- While outbreaks & occupational health tracing are patterns amenable to AI, <u>lack of databases and identity management</u> rendered that impossible

- While predications of demand beyond ICU by AI is possible, there was <u>no history with COVID</u>, algorithms were not built

- While UHN underwent massive virtual scale up (80% of clinics went virtual clinics in 3 weeks), <u>lack of sensors for remote biophysical data collection</u> and <u>systems for remote work</u> such prescribing were a brake

*"The data wasn't ready, the people weren't ready, the system wasn't ready"*

# What's next?

"The Road to Readiness:

Education to maximize AI's capabilities for clinical decision making, health systems planning and facilitating virtual care"

David Wiljer, Rebecca Charow, Lydia Sequeira, Katerina Gapanenko, Wanda Peteanu, Caitlin Gillan, Patrik Rogalla, Mohammad Salhia, Brian Hodges
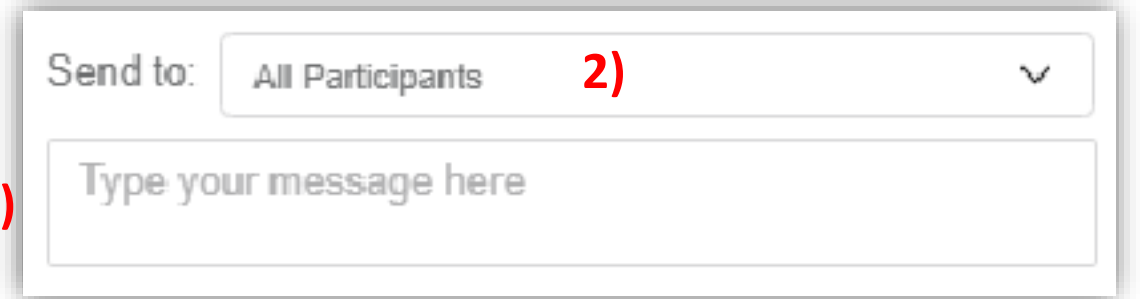
# Citations

- Singer W, Israeli Innovators Harness Artificial Intelligence Technologies To Curb The Global COVID-19 Pandemic, Wendy Singer, Forbes April 13, 2020 on line, https://www.forbes.com/sites/startupnationcentral/2020/04/13/israeli-startups-artificial-intelligence-covid19-coronavirus/#2343b5ca4567, accessed June 7, 2020

# Submitting questions

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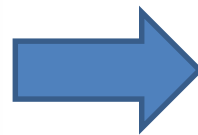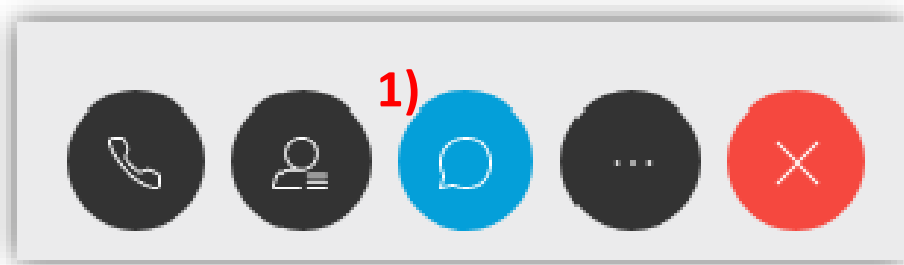
# Thank You



Richard K. Reznick, MD, FRCSC, FACS, FRCSEd (hon), FRCSI (hon), FRCS (hon)

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