RESPONSIBLE INNOVATION IN AI

eXplainable Artificial Intelligence in healthcare Management (xAIM)
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Marie-Pierre Gagnon , PhD
Faculty of Nursing Sciences,
Université Laval, Québec, Canada
VITAM Research Center in Sustainable Health, Québec, Canada

SYNOPSIS

- AI in Healthcare

- Responsible AI

- Responsible Research and Innovation

- The Responsible Innovation in Health (RIH) Framework

- Application of the RIH Framework to an AI solution

- Discussion

- Take home messages

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AI IN HEALTHCARE

- Artificial Intelligence is the imitation of human cognition by computers: reasoning, learning, adaptation, self-correction, sensory understanding, and interaction (Alami et al., 2020)

- However, the use of AI could result in decisions that have moral consequences, undermine ethical principles, and diminish people's rights and dignity (Trocin et al., 2021)

RESPONSIBLE AI

- Responsible AI refers to the design, implementation and use of ethical, transparent, and accountable AI technology in order to limit biases, promote fairness, and to help facilitate interpretability and explainability of outcomes (Trocin et al., 2021)

- Responsible use of AI in healthcare can positively contribute to health and wellbeing

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RESPONSIBLE AI

Ethical concerns related to AI in healthcare (Mittlestadt & Floridi, 2016)

- **Inconclusive evidence**: statistical inferences are not sufficient to prove causal relationships
- **Inscrutable evidence**: lack of transparency regarding how data is used in algorithms
- **Misguided evidence**: reliability of algorithms is dependent upon the quality of input data
- **Unfair outcomes**: actions can have a disproportionate impact on one group of people
- **Transformative effects**: algorithmic activities that generate new and unexpected ways of understanding
- **Traceability:** tries to detect the harm caused by algorithmic activity and its cause

AI DEVELOPMENT PUT ON HOLD

On March 22, a petition calling for an immediate pause to the development of more powerful AI systems is launched

More than 27,000 people have signed it, including Elon Musk and Steve Wozniak!
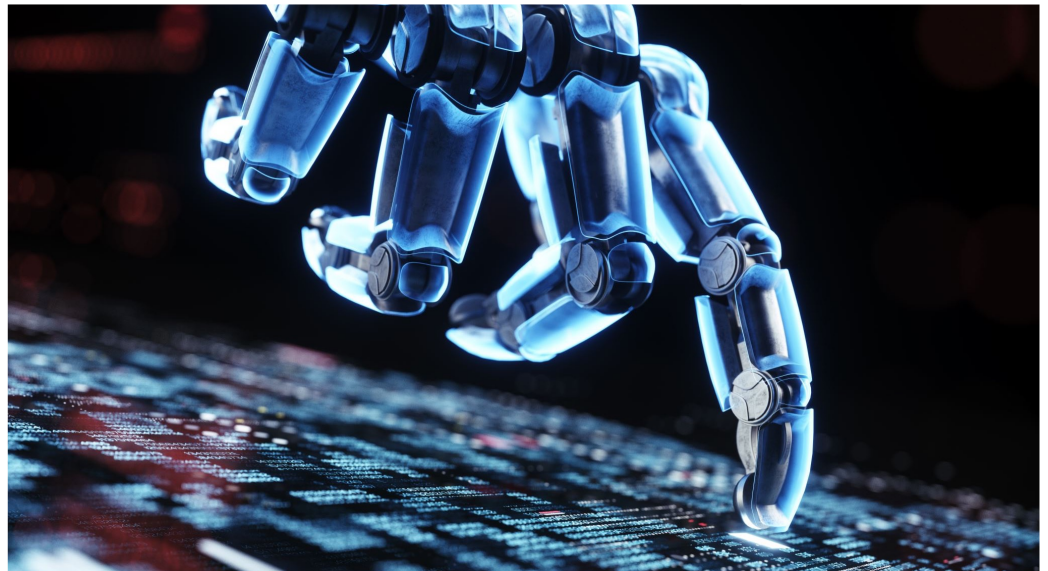
RESPONSIBLE RESEARCH AND INNOVATION

An approach that anticipates and assesses potential implications and societal expectations with regard to research and innovation, with the aim to foster the development of innovations that are ethically acceptable, sustainable and socially desirable (European Commission, 2013)

RESPONSIBLE RESEARCH AND INNOVATION

Focuses on 4 processes:

1- Anticipation of risks, impacts and unintended consequences

2- Reflexivity regarding value systems and social practices regarding innovation

3- Inclusiveness in innovation development processes

4- Alignment with economic, social or environmental priorities such as the United Nations Sustainable Development Goals

RESPONSIBLE INNOVATION IN HEALTH

Responsible innovation in health (RIH):

RIH consists of a collaborative endeavour wherein stakeholders are committed to clarify and meet a set of ethical, economic, social and environmental principles, values and requirements when they design, finance, produce, distribute, use and discard sociotechnical solutions to address the needs and challenges of health systems in a sustainable way. (Silva et al. 2020)

RESPONSIBLE INNOVATION IN HEALTH FRAMEWORK

RIH Framework (Silva et al. 2020)

Developed through an iterative process:
- Literature review
- Horizon scanning for empirical examples of responsible innovations
- Expert consensus through a Delphi exercise

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RESPONSIBLE INNOVATION IN HEALTH FRAMEWORK

The *In Fieri* RIH Tool (Silva et al. 2020)

Underlying assumptions:
- The RIH Tool adopts a population health perspective, i.e. values the collective good
- The degree of responsibility of a given innovation is intimately linked to its context of use
- The RIH Tool should be applied when an innovation is ready for use, i.e. when effectiveness and safety studies have been conducted
- The overall responsibility score may be used to compare the respective value of different innovations
- The RIH Tool must be applied by people who can retrieve and critically read scientific literature

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RIH TOOL VALUE DOMAINS AND ATTRIBUTES

Population health value:
1- Health relevance: Importance of the health needs addressed by the innovation within the overall burden of disease in the region where the intended users are located.
2- Ethical, legal and social issues (ELSI): The innovation is developed by seeking to mitigate ethical, legal or social issues.
3- Health equity: The innovation promotes health equity.

Health system value:
Inclusiveness: The innovation development processes are inclusive.
Responsiveness: The innovation provides a dynamic solution to a health system need or challenge.
Level of care: The level of care required by the innovation is compatible with health system sustainability.

RIH VALUE DOMAINS AND ATTRIBUTES

Economic value:
Frugality: Provision of greater value to more people by using fewer resources, which may entail: (i) affordability; (ii) focus on core functionalities and ease of use; and (iii) optimized performance.

Organizational value:
Business model: The organisation that produces the innovation seeks to provide more value to users, purchasers and society.

Environmental value:
Eco-responsibility: The innovation limits its negative environmental impacts throughout its lifecycle as much possible.

SMALL GROUP EXERCISE

Objective:

Apply the Responsible Innovation in Health framework to a real case of AI in healthcare.

Methods:

Individual assessment; Small group discussion; Large group presentation

Material:

Description of the case, RIH assessment grid

Duration:

30 minutes

PRACTICAL CASE

The digital twin in healthcare

The concept of digital twin is already used by many industries. Its application to healthcare is recent. Using *multiomics* and clinical data, the digital twin links drug treatment to patient characteristics, enabling the simulation of disease progression and drug response at an individual patient level. It can also simulate entire clinical trials to better select patients, and rapidly generate evidence for comparative effectiveness of different drugs.

Important savings for clinical trials are expected, but a digital twin needs to be created for each individual. A huge amount of data is needed and must be handled by healthcare facilities. Extensive training is required to ensure patient safety.

The EPINOV project developed a digital twin of the brain for epilepsy research for a cost of about 6 millions euros.
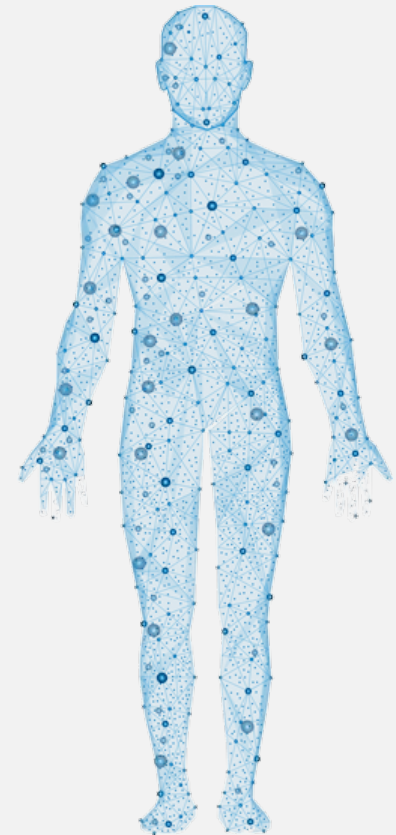
RIH VALUES AND ATTRIBUTES

Values and attributes	No	Yes	Comments
1- Health relevance, ELSI, Equity			• ... • ...
2- Health System: Inclusiveness, Responsiveness, Level of care			• ... • ...
3- Frugality			• ... • ...
4- Business model			• ... • ...
5- Eco-responsibility			• ... • ...

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Adapted from the In Fieri Assessment Tool for Responsible Innovation in Health, Silva et al., 2020

DISCUSSION

- The RIH framework can be used to assess the underlying values of responsible innovations

- For AI-based innovations, some of the attributes are more difficult to assess

- Other aspects related to Responsible AI could be integrated to the RIH framework:

  - Consent and privacy

  - Explainability

  - Traceability

  - Fairness

TAKE HOME MESSAGES

- The RIH framework can inform the development of innovations that support more equitable and sustainable healthcare

- It takes into consideration several attributes, including health inequalities, inclusiveness, frugality and eco-responsibility

- The RIH tool can be used upstream to ensure that AI innovations in healthcare are developed responsively

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THANK YOU!

MARIE-PIERRE GAGNON
Professor, Faculty of Nursing Sciences, Université Laval

marie-pierre.gagnon@fsi.ulaval.ca