Harmonizing AI Innovation in Public Health: A Canadian Approach

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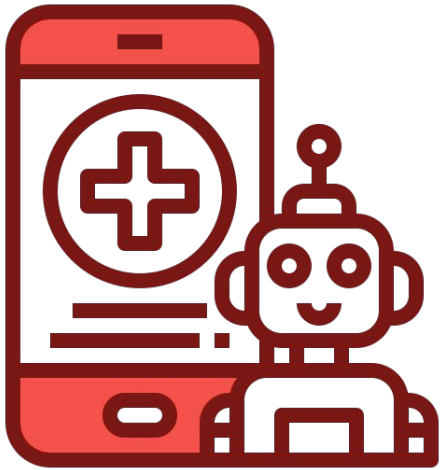


Issue Statement

How can Canadian governments effectively promote the responsible implementation of artificial intelligence (AI) in the public health sector, with a targeted focus on mitigating biases, addressing privacy concerns, managing public pushback, and engaging key stakeholders in the decision-making process?

Background

WHY AND WHY NOW?

CURRENT POLICY/GOVERNMENT COMMITMENTS ALREADY IN PLACE?

WHAT ARE THE CONTEXTUAL FACTORS THAT LED THE PROBLEM TO DEVELOPING?

Why & Why Now?

$330.00 Billion

Canada

Spends this much money on health care each year

12.2% GDP

This is equivalent to 12.2% of Canada's 2022 GDP

4.5-8.0%

Net Care Spendings

Efforts based on known AI applications could allow Canada to lower its net healthcare spending by this much

Current Policy Initiatives

Canada has been actively:

- Developing a **“made-in-Canada”** branding to Canada’s AI sector
- Integrating AI into the public health sector since the COVID-19 pandemic

POLICIES

Policies:

- The *Pan-Canadian Artificial Intelligence* (The *Global Innovation Clusters*)
- The *Digital Research Alliance of Canada*
- The *AI4Health Task Force*

What are the Contextual Problems?

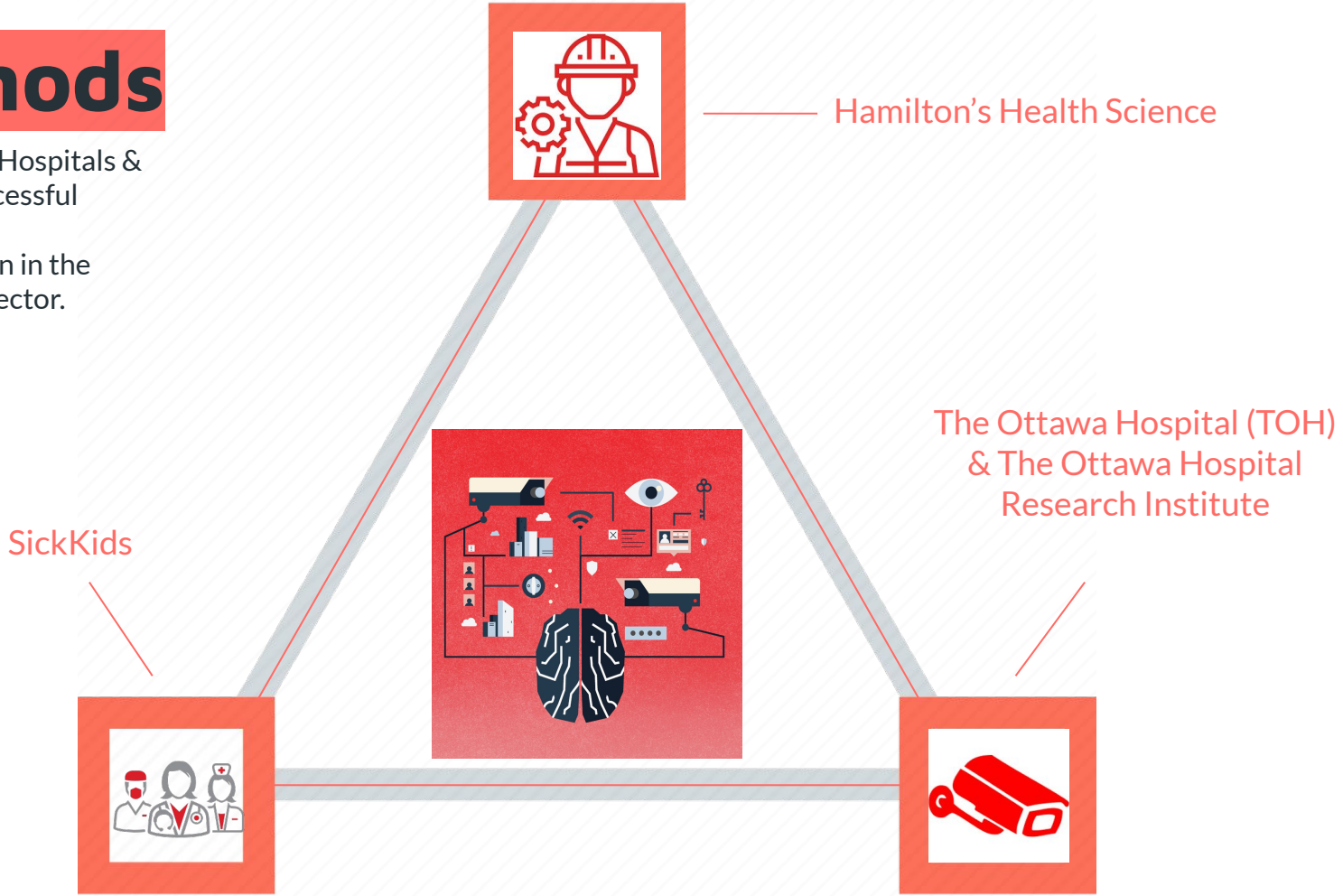
BIAS

PRIVACY & REGULATORY CHALLENGES

PUBLIC PERCEPTION & COMMUNICATION CHALLENGES

Methods

Research on 3 Hospitals & their most successful projects of AI implementation in the public health sector.

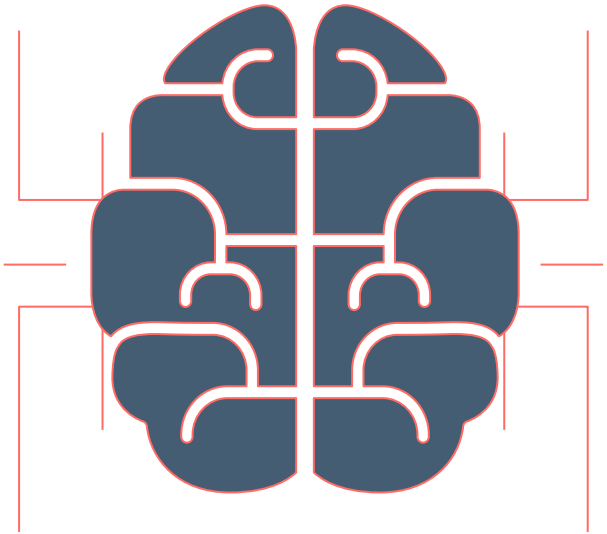


Key Considerations

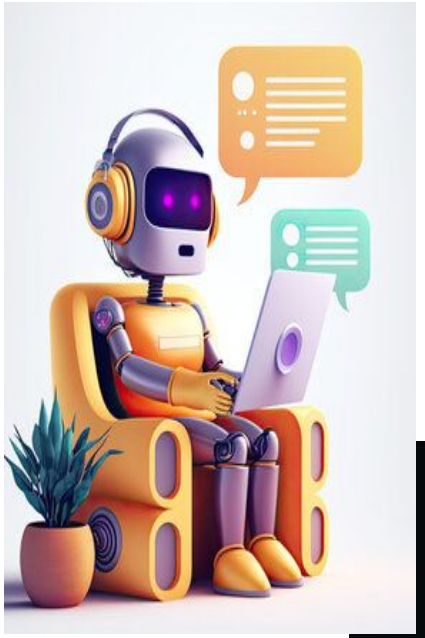
01 Biases

02 Privacy & Key Stakeholders

03 Public-Pushback



Policy Options & Recommendations



1. Integration of AI Engineers
2. A Human Doctor Devil Team
3. Privacy Protection

OPTION 1: Integration of Engineers into Clinical Departments

- Recruit engineers into a clinical department to enhance the research agenda
- Integrating advanced analytics techniques such as machine learning and AI, with existing robust team of clinical researchers

Enhanced research capabilities, alleviating public pushback

Interdisciplinary collaboration for bias mitigation

OPTION 2: A Human Doctor Devil Team

Assemble a “devil” team consisted by human doctors & AI experts to review AI generated results and make final medical decisions

BENEFITS

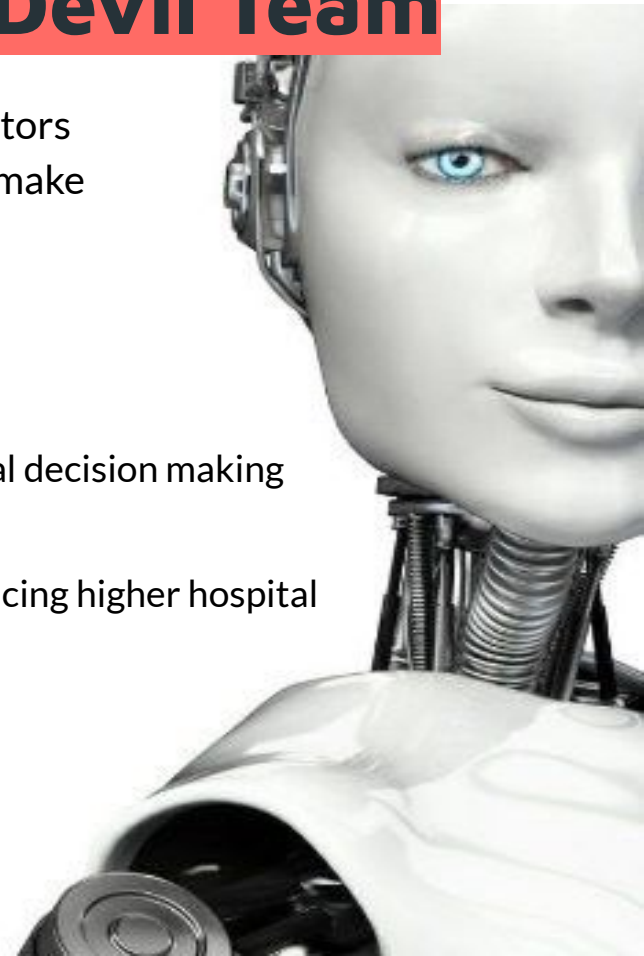
- Reduce biases and facilitate critical thinking
- Address ethical concerns of using AI in medical decision making

COSTS

- Time consuming: progress might be slow, inducing higher hospital burnout rate

MITIGATIONS

- Classify & prioritize cases that requires higher level of precision



Option 3: Lumenix Project AIMS

- Clinically validated by the Federal Government of Canada, AIMS predicts and prevents adverse events in healthcare settings

- Collaboration with The Ottawa Hospital and Research Institute AI networked system of 3D spatial sensors and predictive AI with an emphasis on **privacy**, **communication, and coordination**

COMMUNICATION & COORDINATION

Privacy Policy Solutions

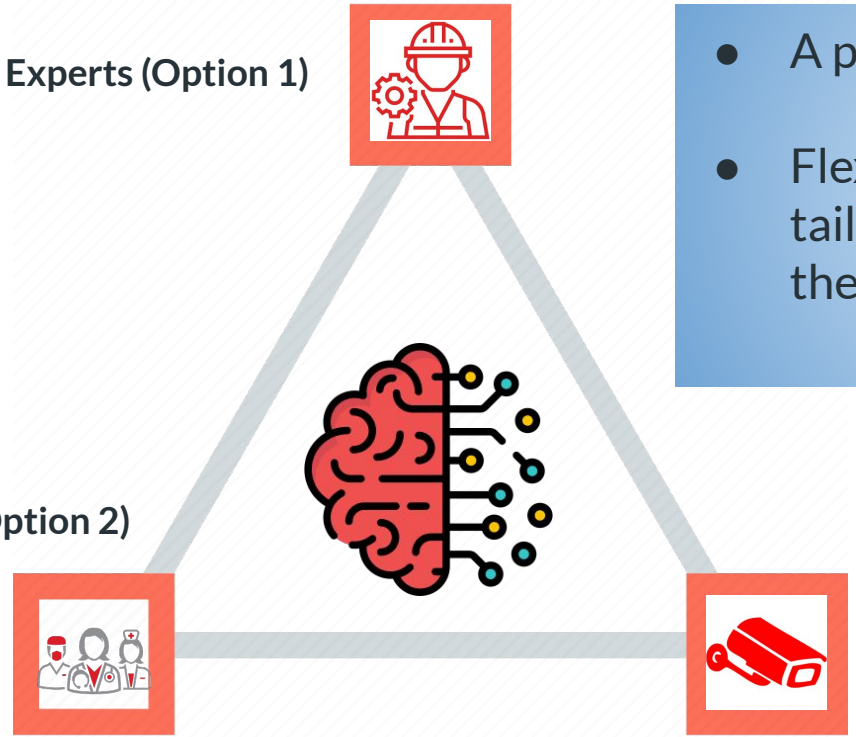
- Obtaining patient consent before AI participation
- Implementing robust security measures
- Training healthcare workers to recognize AI biases

PRIVACY ISSUES

Recommendation: a Holistic Approach

Support from AI Experts (Option 1)

A Human Devil Team (Option 2)



Privacy Measures (Option 3)

- A package deal
- Flexibility for hospitals: to tailor the actual criteria to their needs and capacities.

Thank You!

Questions?

Appendix 1: Risks & Mitigations (OPTION 1)

- Costs of Integration: Implementing this option may involve costs associated with training, resource allocation, and potential adjustments to existing workflows.

- Communication Challenges: Differing backgrounds between clinicians and engineers may pose communication challenges. It is important to establish clear communication channels, promote a shared understanding of goals, and foster a collaborative culture to address challenges in Canada's public health sector.

Appendix 2: Cost Analysis (OPTION 1)

Personnel Costs	Research & Development Costs	Infrastructure Costs	Regulatory Compliance Costs	Maintenance Costs

2.1 Personnel Costs:

- Estimated annual salaries and benefits for personnel:
  - AI specialists: $120,000 - $180,000 per year
  - Data scientists: $100,000 - $150,000 per year
  - Software engineers: $90,000 - $140,000 per year
  - Healthcare domain experts: $110,000 - $160,000 per year
- Recruitment, training, and retention costs: Approximately 25% of annual salaries.

2.2 Research and Development Costs:

- Data acquisition: $50,000 - $100,000
- Experimentation and prototyping: $100,000 - $200,000
- Algorithm development: $150,000 - $300,000
- Hardware, software, and third-party services: $200,000 - $400,000

2.3 Infrastructure Costs:

- Cloud computing resources: $50,000 - $100,000 annually
- Storage and networking infrastructure: $50,000 - $150,000 initially, with ongoing maintenance costs of $20,000 - $50,000 per year.

2.4 Regulatory Compliance Costs:

- Compliance consultations and audits: $20,000 - $50,000 annually
- Implementation of data privacy and security measures: $50,000 - $100,000 initially

2.5 Deployment and Maintenance Costs:

- Integration with existing systems: $100,000 - $200,000
- Ongoing maintenance and support: $50,000 - $100,000 annually
- Software updates: $20,000 - $50,000 per update cycle.

TOTAL COSTS

To calculate the total cost for the first option, let's sum up the costs for each factor:

2.1 Personnel Costs:

- AI specialists: ($120,000 + $180,000) / 2 = $150,000 per year
- Data scientists: ($100,000 + $150,000) / 2 = $125,000 per year
- Software engineers: ($90,000 + $140,000) / 2 = $115,000 per year
- Healthcare domain experts: ($110,000 + $160,000) / 2 = $135,000 per year

Recruitment, training, and retention costs: 25% of annual salaries. So, for each category:

- AI specialists: 25% * $150,000 = $37,500
- Data scientists: 25% * $125,000 = $31,250
- Software engineers: 25% * $115,000 = $28,750
- Healthcare domain experts: 25% * $135,000 = $33,750

Total Personnel Costs = Sum of annual salaries + Recruitment, training, and retention costs
= $150,000 + $125,000 + $115,000 + $135,000 + $37,500 + $31,250 + $28,750 + $33,750
= **$656,250**

**(the recruitment, training, and retention costs are 25% of the annual salaries, which means that in addition to the base salaries, there are also additional costs associated with recruiting, training, and retaining personnel → which typically amount to around 25% of their annual salaries)

- Therefore, to calculate these additional costs, we must multiply each category's annual salary by 25% to find the costs
- Then sum these additional costs with the base salaries to get the total personnel costs

2.2 Research and Development Costs:

- Data acquisition: ($50,000 + $100,000) / 2 = $75,000
- Experimentation and prototyping: ($100,000 + $200,000) / 2 = $150,000
- Algorithm development: ($150,000 + $300,000) / 2 = $225,000
- Hardware, software, and third-party services: ($200,000 + $400,000) / 2 = $300,000

Total Research and Development Costs = Sum of all costs
= $75,000 + $150,000 + $225,000 + $300,000
= **$750,000**

2.3 Infrastructure Costs:

- Cloud computing resources: ($50,000 + $100,000) / 2 = $75,000 annually
- Storage and networking infrastructure initial cost: ($50,000 + $150,000) / 2 = $100,000
- Ongoing maintenance costs: ($20,000 + $50,000) / 2 = $35,000 per year

Total Infrastructure Costs = Sum of all costs
= $75,000 + $100,000 + $35,000
= **$210,000**

2.4 Regulatory Compliance Costs:

- Compliance consultations and audits: ($20,000 + $50,000) / 2 = $35,000 annually
- Implementation of data privacy and security measures: ($50,000 + $100,000) / 2 = $75,000 initially

Total Regulatory Compliance Costs = Sum of all costs
= $35,000 + $75,000
= **$110,000**

2.5 Maintenance Costs:

- Integration with existing systems: ($100,000 + $200,000) / 2 = $150,000
- Ongoing maintenance and support: ($50,000 + $100,000) / 2 = $75,000 annually
- Software updates: ($20,000 + $50,000) / 2 = $35,000 per update cycle

Total Deployment and Maintenance Costs = Sum of all costs
= $150,000 + $75,000 + $35,000
= **$260,000**

Sum of All Costs:

Total Cost = Personnel Costs + Research and Development Costs + Infrastructure Costs + Regulatory Compliance Costs + Deployment and Maintenance Costs
= $656,250 + $750,000 + $210,000 + $110,000 + $260,000
= $1,986,250
So, the total cost for the first option is **$1,986,250.**

Appendix 3: Types of biases

- Automated Biases: AI users tend to favour AI generated results, even when they have contrary evidence that are from non-automated sources.

- Confirmation biases: AI generated results can reinforce the AI users' preconceptions especially when prompts are written in a way that reflects the users' assumptions and beliefs, causing a decline in critical thinking.

Appendix 4: AIMS Budget

March 1, 2022

$2-million donation from **TD Bank Group (TD)**, The Ottawa Hospital will create the new TD Artificial Intelligence in Medicine (AIM) Hub.

They have research funds, but they don't have research funds often for the infrastructure for the consultation side, for what is called the data pipeline.

January 1, 2023 to December 31, 2023

Ernst & Young: Original Procurement Value **$150,000.00**

Consulting services to develop a Digital Transformation Roadmap for several back office functions for the next 5 years leveraging Oracle ERP and other tools like Robotic Process Automation, machine learning, and AI.

Appendix 5: AIMS Cost & Benefits

Benefits:

a) Privacy and Ethical AI Practices: Utilizing a 3D scanning IR laser and specialized neural networks, AIMS demonstrates a commitment to advanced, secure, and privacy-respecting technologies. Ensuring anonymity and unobtrusive data collection in clinical spaces, covering over 20,000 sq ft., AIMS employs deep learning analysis, prioritizing patterns and trends for unbiased and reliable data. Its commercial availability and deployment in Canada and the U.S. emphasize Lumenix's dedication to adhering to global privacy standards and regulations.

b) Communication and Coordination: AIMS supports patient-centric care, fostering communication, collaboration, and real-time data for enhanced decision-making and operational efficiencies. The hospital partnerships exemplify an ethical commitment to driving advancements and incorporating diverse perspectives, building trust among healthcare workers, patients, and stakeholders.

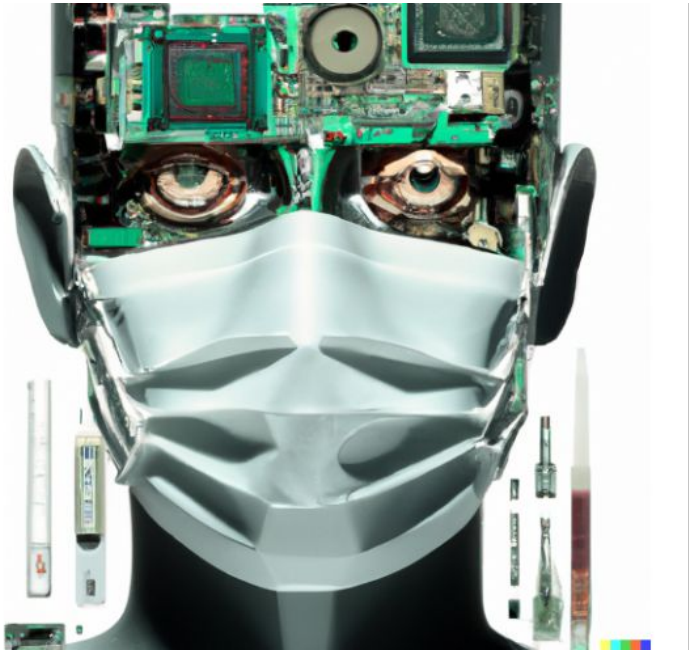
Costs/Risks and Mitigations:

a) Operational Adjustments, Scalability, and Data Security: Integrating AIMS requires proactive planning, communication, and training for workflow changes. Simultaneously, addressing scalability involves measures like scalable infrastructure and collaboration with IT. Data security concerns necessitate compliance with privacy regulations, encryption protocols, and access controls to safeguard sensitive patient data and prevent breaches.

Appendix 6: Key Consideration: Biases

Biases induced by AI will lead erode creativity and workforce capability.

- Automated bias
- Confirmation bias



Appendix 7: Key Considerations: Privacy Concerns & Key Stakeholders

Addressing privacy concerns in AI implementation for healthcare and public services involves:

- Anonymization
- Informed consent
- Robust security measures
- User control
- Legal compliance with ethical practices
- Continuous monitoring
- Cross-functional collaboration

- Ensuring successful AI implementation requires prioritizing considerations such as privacy, ethical use, and system reliability
- Effective communication and coordination among stakeholders are pivotal to navigate these potential challenges and foster collaboration.

Appendix 8: Key Considerations: Social Considerations (Public-Pushback)

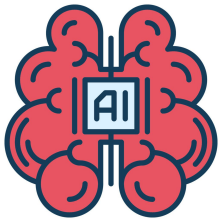
1 **Fear:** Job Displacement

2 **Uncertainty:** Reliability & Safety of AI-driven healthcare decisions

3 **Concerns:** Ethical Implications of AI sensitive health contexts

Policy Options & Recommendations

01 Integration of AI Engineers



02 A Human Doctor Devil Team

03 Privacy Protection