THE COLLEGE OF FAMILY PHYSICIANS OF CANADA

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CFPC Statement on Artificial Intelligence for Family Medicine

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Artificial Intelligence for Family Medicine

Motivation

Artificial intelligence (AI) is a rapidly evolving phenomenon in today's world. There is a potential for AI research and development (R&D) to serve patients and populations in the context of high-quality primary care. AI may also serve those who work in primary care, including family physicians, other health professionals, administrators, researchers, and others. For example, AI might assist health workers in fulfilling their professional roles, improve health service delivery and experience, enhance physician well-being, and advance anti-racism and Indigenous health initiatives.

The CFPC supports AI R&D for family medicine and primary care, conducted according to the principles outlined in this statement considering practice environment, ethics, and social context. Further to these principles, AI R&D should be congruent with the Patient's Medical Home (PMH) vision,[1] the Family Medicine Professional Profile,[2] and the Quintuple Aim.[3]

Artificial intelligence (AI) refers to a collection of techniques loosely focused on getting computers to exhibit "human like" intelligence. A major subfield of AI is machine learning, whereby human decisions and mathematics are used to learn from existing data to be able to produce information or predictions (e.g., risk score, note summary) for new or previously unseen situations. Generative AI and large language models (LLMs) are also being rapidly developed and deployed. These technologies interpret complex questions and produce coherent responses in a variety of forms, such as images and text. AI technologies perform in ways that suggest contextual understanding and memory during human-machine interactions.

- Resources to learn more about AI include
  - *CFP* AI for primary care primer[4]
  - CFPCLearn CPD e-Course AI for Family Medicine[5]
  - *JAMA* article: Three Epochs of AI in Health Care[6]

AI-enabled tool refers to a piece of technology that relies on AI for some or all of its functionality and has all necessary components ready to be implemented in family medicine settings. For example, additional software and visualization strategies are likely to be needed to support integration of AI into an electronic medical record (EMR) system and to communicate AI outputs to end-users. AI-enabled tools may rely on one or more data sources; multimodal platforms which draw on multiple data sources are being developed rapidly.

Context

- Family practice is complex, varied, and demanding. In this context there is a need for continual innovation and scientific evidence generation to support and further the discipline of Family Medicine.
- There is a history of technology, such as electronic health record systems, not being properly developed with and for family physicians. This has contributed to undue burden and suboptimal benefits. There is an opportunity to learn from the past to improve the

trajectory of research, co-design, development, deployment, and use of AI for family medicine practice and delivery of care.

- There is more awareness and action happening both within and outside of the CFPC to support equity, diversity, inclusion, anti-racism, and anti-oppression than ever before. These important developments can be embedded in AI R&D.
- Machine learning, which uses large amounts of data to learn patterns and improve accuracy of predictions or recommendations, and particularly LLMs and multimodal platforms, are prominent subfields of AI today.[7] Unlike many other innovations, including medications where performance is static upon implementation, some AI-enabled tools can continually learn and improve performance over time. To allow these types of iterative improvements, de-identified patient and clinic data may need to be shared with AI vendors.
- AI design methodologies themselves may not be biased, but the data, guidelines, and/or criteria used for training AI could be. Poorly or naively developed AI may replicate or exacerbate existing biases and inequities. Furthermore, there may be bias in the ways that AI tools are or are not used for different patients or populations. AI tools can potentially further perpetuate the biases from the developers, society, guidelines, and/or criteria. However, careful AI research, participatory co-development, ongoing monitoring, and regulatory oversight may help to identify and mitigate these biases and build trust in the technology and/or in the provider using it, resulting in better and more equitable care.[8]

Gaps

In the broader AI for health field there has been an historical lack of focus on family medicine, with most examples of AI implemented in healthcare situated in other specialties and acute care settings. Targeted attention must be given to family medicine to fully realize the potential benefits of AI in promoting high-quality primary care delivery and health equity. Unique characteristics of family medicine have implications for 1) the types of tools that will be beneficial and 2) methodological decisions to achieve optimal performance.

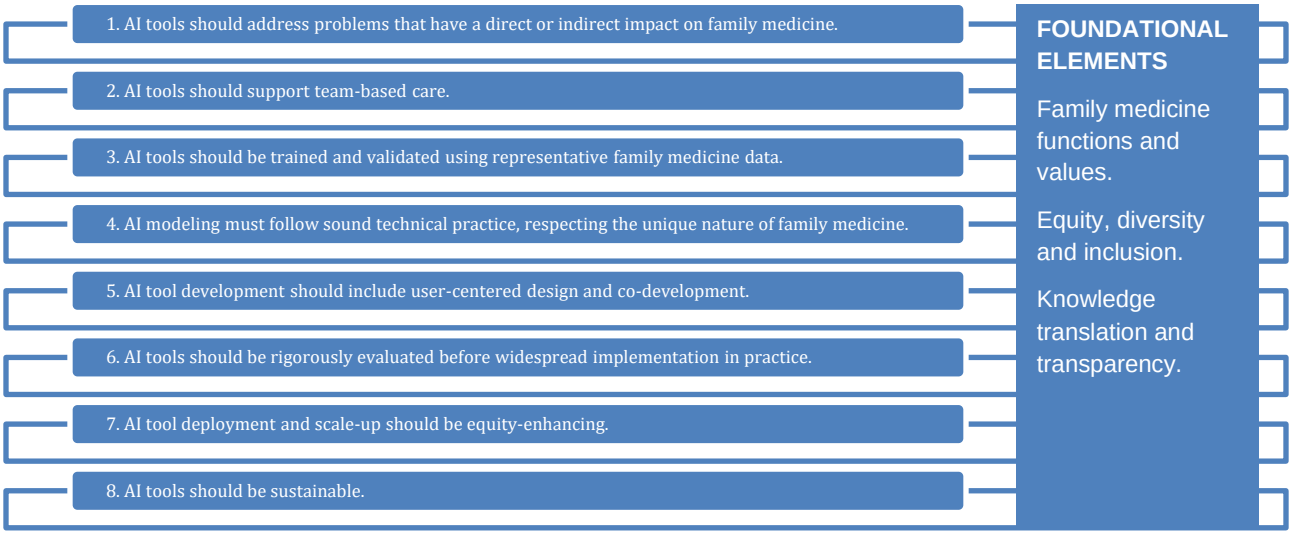
Family medicine's unique characteristics include:

- Comprehensive care and the associated variety and particularity of presenting patient concerns and care content;
- The undifferentiated nature of many presenting complaints;
- A broad scope of practice, including coordination of care from other sectors, and care models ranging from solo practice to large interprofessional teams.

Given its patient-centered, community-based nature, family medicine can be at the forefront of cutting-edge techniques for identifying and mitigating biases and systems of oppression. Through its active involvement in AI R&D, family medicine can marshal the evolution of AI-enabled tools such that they support family practice while promoting health equity.

The principles outlined in this statement are intended to guide AI R&D for family medicine, to support an increase in the number of high-quality, family practice relevant AI-driven tools available in Canada. This entails meaningful involvement of patients, interprofessional primary care providers, clinical administrative staff, health information technology (HIT) specialists, policy-makers, government stakeholders, and funders. Existing guidelines on AI for health are not specific to family medicine but do include relevant recommendations and information. For example, there is an existing framework for responsible machine learning for health care,[9] an outline of ethical considerations and governance,[10,11,12, 13] an approach for implementation using quality improvement methods,[14] insights for encouraging front-line adoption,[15] and guiding principles for machine learning in medical device development.[16] The principles herein are intended to supplement these and other general guidelines, emphasizing specific requirements and considerations for family medicine AI R&D and clinical practice.

Guiding Principles: Family Medicine AI R&D and clinical practice



Source: AI Working Group – Jacqueline K. Kueper, 2023.

The CFPC supports AI R&D for family medicine practice and delivery according to the guiding principles herein, and in alignment with the World Health Organization (WHO)'s **core ethical principles** to appropriate the use of AI for health. The CFPC is also mindful that many AI services have significant ecological footprints. Social and environmental determinants of health must be considered when designing AI to lessen bias and address planetary health challenges, towards ensuring a sustainable primary care system. AI should help to reduce human impact on the earth's environment, ecosystems, and climate, not add to it by potentially increasing energy consumption and carbon emissions.[12,17]

WHO key ethical principles for use of AI for health:

- Protect human autonomy
- Promote human well-being, human safety and the public interest
- Ensure transparency, explainability and intelligibility
- Foster responsibility and accountability
- Ensure inclusiveness and equity
- Promote AI that is responsive and sustainable.[12]

1. AI tools should address problems that have a direct or indirect impact on family medicine.

Technologies, including AI, are typically meant to ease administrative burden, improve efficiency, and solve problems. When applying AI to problems in family medicine:

- **AI should support family practice and delivery of care**, including continuity, comprehensiveness, coordination, patient-centeredness, access, and health equity while **not producing additional administrative burdens**.
- **AI should support the key knowledge and roles of family physicians and health teams** associated with delivery of patient care. AI may not replace or fully simulate human perception, emotional intelligence, reasoning, judgement, and action. Humans should remain in full control of health care systems and medical decisions to **protect the quality of care** and ensure valid informed patient consent.[12]
- **Individuals, teams, populations, and settings that could be impacted by AI should be identified early on**.
    - Consider healthcare system special considerations, capacity, and culture with respect to adoption readiness.
    - Identify implications for cultural sensitivity, humility, and safety.
    - Consider risks and mitigating measures.

2. AI tools should support team-based care.

Primary health care teams in Canada are increasingly multidisciplinary, in alignment with the CFPC's PMH vision. For application in this context, **AI R&D and use in clinical practice must:**

- **Meaningfully involve interdisciplinary teams** that include family physicians, other clinical and non-clinical team members, and AI experts who effectively bridge the technology with practice contexts.
- **Consider AI as a tool that provides support to the primary care team**. AI tools may increasingly provide information to supplement care delivery and decision making of the health care team, however it should not supplant the role of human care providers, nor replace their clinical judgement.[18]
- **Engage administrators, patients, caregivers, families**, and other end-users and beneficiaries of AI-driven tools who are expected to be impacted by end-products early on.

- As needed, **include intersectoral partnerships and transparent information sharing** between academia, government, health care, industry, and the public to ensure AI initiatives are responsive, timely, feasible, accessible, and scalable.

3. AI tools should be trained and validated using representative family medicine data.

When conducting AI R&D for family medicine:

- **What is considered "representative data" depends** on the problem and intended application. Example considerations include race and other sociodemographic characteristics, and clinical complexity profiles.
- **Data governance, privacy, consent, access, use and security** policies and procedures should be considered during AI development. For example, when working with Indigenous communities, Indigenous data sovereignty and OCAP principles (ownership, control, access, and possession) must be recognized.[19] Data governance committees can provide oversight, advice, invite engagement, and build trust.
- **The CFPC supports access to data in EMRs for research and opposes excessive monetary barriers to EMR data access**.[20] EMRs are expected to be a major data source for AI R&D, and as with any dataset, need to be carefully assessed for quality and appropriateness by development and evaluation teams.

4. AI modeling must follow sound technical practice, respecting the unique nature of family medicine.

- **Developers, auditors, and regulators** collectively share responsibility in ensuring AI technologies are **fair, accessible, and relevant across potential user subpopulations**.[12,21]
- Choice of candidate algorithm(s), loss function(s), hyperparameters, and technical performance measures should consider the types of patterns that are most valuable to capture for a given problem.
- **Ensure transparency in AI development and use.** To ensure transparency, WHO specifies that "health care institutions, health systems and public health agencies should regularly publish information about how decisions have been made for adoption of an AI technology and how the technology will be evaluated periodically, its uses, its known limitations and the role of decision-making, which can facilitate external auditing and oversight."[12] Model development and evaluation studies should also be **transparent**. The use of reporting checklists such as MI-CLAIM[22] are encouraged.
- **Develop AI that is explainable and interpretable to support trust and safety, to the extent possible and meaningful for a given tool and intended use**. Improving the transparency of AI technology and making it explainable are two broad approaches to ensure that AI technologies are intelligible or understandable to developers, medical professionals, patients, users, and regulators, i.e., to the extent possible given methods available to perform a task and according to the capacity of who is receiving the educational information (e.g. tailoring for marginalized populations).

- Explainability should not necessarily be a requirement for clinically deployed AI tool for patient-level decision support, noting that explanations produced for complex AI systems can be confusing or even misleading.
- Explanation and interpretation can be useful to the **AI R&D team** during development and after deployment to better understand performance and to identify bias or fairness concerns due to the tool and/or data.
- Explanation and interpretation can be useful to **end-users** and foster trust and safety in an AI-enabled tool. For example, end-users should see the rationale for a given prediction and be able to check whether the input data represent the current situation of a patient, albeit acknowledging this may not be possible and is subject to circumstance.
- Expectations of explainability relate both the technical performance of AI tools, as well as the information outputs they produce. Technical explanations report on model performance, such as features with largest impact on predicted risk. Explanations related to information outputs relate to clinical actions, such as identifying "true" or "causal" relationships between AI inputs and outputs for the purpose of guiding interventions. Of note, AI's current ability to support causal inference and prediction is debatable. Advancement is needed for AI to differentiate between correlation and causation.[23]

5. AI tool development should include user-centered design and co-development.

- Health care is multidisciplinary and team based, so **diverse types of end-users and beneficiaries, including patients and caregivers, should be considered**.
- AI-enabled tools to support clinical decision making, including their functionality and user interface, should **support the primacy of the relationship between patients and their human health care team and do no harm**.
- Accessibility, digital literacy needs, and cultural sensitivity and safety need to be considered.
- Measures of quality control in the use of AI in clinical practice and quality improvement over time should be available to **promote human well-being, human safety, and the public interest**.[12]
    - Funders, developers, users, government, regulators, and the health care system broadly should ensure that AI technologies work as designed and assess whether they have any detrimental impact on individual patients or groups.

6. AI tools should be rigorously evaluated before widespread implementation in practice.

- **Neutral, scientific evaluation** is needed to rigorously test and generate evidence about impacts on practice delivery and patient health. Tools developed by commercial entities should undergo independent evaluation that manages conflicts of interest.
- **All evaluation findings should be made publicly available**, adhering to clinical trial standards and covering the most important and generalizable outcomes. Reporting

guidelines for clinical trial protocols (e.g., SPIRIT-AI)[24] and intervention reports (e.g., CONSORT-AI)[25] are available through the EQUATOR network.

- The evaluation of AI-enabled tools needs to **foster responsibility and accountability** and be presented in language that end users and beneficiaries, including family physicians, can understand.
    - Inequities or biases identified at any point through the development and evaluation process, whether to do with the AI-driven tool itself or the problem it addresses, should be reported and acted upon.
    - Responsible implementation can be assured by application of “human warranty”, which implies evaluation by patients and clinicians in the development and deployment of AI technologies. Appropriate mechanisms should be available for questioning to ensure accountability if something goes wrong and for redress for individuals and groups that are adversely affected by decisions based on AI.
    - All agents involved in the development and deployment of AI technologies should ensure that they can perform the specific tasks intended and are used under appropriate conditions. A “collective responsibility” model can encourage all actors, i.e., designers, healthcare providers, patients, regulatory agencies, or other supervisory authorities, to act with integrity and minimize harm.[12]

7. AI tool deployment and scale-up should enhance equity.

- AI developers and vendors, industry, and governments need to ensure equitable use and access to AI in health care. Patients, healthcare providers, and health systems should all be able to benefit from AI technology. To **ensure inclusiveness and equity**, AI for health should support the widest possible appropriate, equitable use and access, irrespective of age, sex, gender, income, race, ethnicity, sexual orientation, ability, or other characteristics protected under human rights codes.[12]
- Potential end-users should have access to all necessary information, including potential risks, to make an **evidence-informed decision about whether or not to adopt a given AI-driven tool.**
- **AI tools should be made available where there is evidence of benefit**. Potential end-users and beneficiaries should not be excluded based on socio- economic and demographic factors, geographic and practice settings, nor health conditions as noted above. When roll out is expected to happen over an extended period, short-term priority access should be based on need, with equitable access across subpopulations achieved in the longer-term. Equitable access applies to AI tools themselves, as well as the necessary technologies required to use them.
- **Commercialization may be useful** to achieve adequate scale-up, however, this should not be done in a way that prioritizes financial gain, exacerbates inequities, or is contradictory to principles outlined in this statement.
    - Diversity of backgrounds, cultures, disciplines, abilities, languages, and forms of communication should be considered in AI to minimize inevitable disparities in power that may arise, i.e., between providers and patients, policymakers and people, and companies and governments that create and deploy AI technologies and those that use or rely on them.

    - Potential or unintended biases must be addressed to avoid introducing or exacerbating health care disparities, particularly for already disadvantaged or vulnerable populations.
- **Thorough training or instructions on when and how to use an AI-driven tool** should be provided. This education should serve people along a range of digital literacy levels to enable their appropriate and successful use of the tool.
- AI-driven tools must abide by relevant regulatory policies and not sustain or worsen any existing forms of bias and discrimination.

8. AI tools should be sustainable.

- **Promote AI that is responsive and sustainable. Designers, developers, and users should**:
    - Continuously, systematically, and transparently assess AI applications during actual use to determine whether they are responding adequately, appropriately, and according to communicated expectations and requirements in the context in which they are used.
    - Integrate systems that allow adjustment of AI functionality based on the results of the assessment.
    - Ensure AI technologies are consistent with wider efforts to promote health system equity and environmental and workplace sustainability. AI systems should be designed to be carbon neutral, with the onus on developers to meet that bar through innovation. Sustainability also requires government support to provide training for health care workers to adapt to the use of AI systems.[12]
- Deployment of AI tools should contribute to, rather than detract from, interoperability of Electronic Health Records, not being limited to a specific subset of solutions and being easily transferable between existing systems across jurisdictions.

Surveillance on Real-world Impact of AI Technology

While the principles outlined in this statement and existing guidelines on uses of AI for health include relevant recommendations and information, there is currently no regulatory framework in Canada specific to AI systems. The proposed Artificial Intelligence and Data Act aims to ensure that AI systems deployed in Canada are safe and non-discriminatory and hold businesses accountable for how they develop and use these technologies.

The Medical Regulatory Authorities of Canada remain committed to their statutory obligation to ensure safe and competent care by physicians, in the best interests of the public, including the use of AI.[18]

Critical appraisal i.e., sober and systematic evaluation of the utility, benefits and harms, as well as costs of implementation of AI into clinical practice,[26] along with impact assessments[12] are essential to marshal the evolution of AI-enabled tools such that they support family practice while promoting health equity. The impacts of AI integration and deployment on family medicine practice and delivery, providers (individual and teams), and patients and communities must be

carefully considered and measured. Training residents and providing professional development opportunities to maximize digital literacy in family practice will also be key for application of AI technologies in primary care.[27]

Establishing close partnerships and collaborations between AI experts, family medicine experts, and all other actors in the AI ecosystem will be essential towards instituting and maintaining a regulatory framework specific to AI systems in Canada. The goal is to ensure that future AI for family medicine initiatives across teams and sectors result in positive impact on clinical processes and patient outcomes, rather than potentially exacerbating inequities. Anticipated areas of improvement include better efficiency, workflow, patient care, diagnostic accuracy, therapeutic decision making, and work-life balance for physicians. With enhanced funding, a focus on family medicine values and functions, teamwork, and data, AI can improve family practice and care delivery.[27]

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