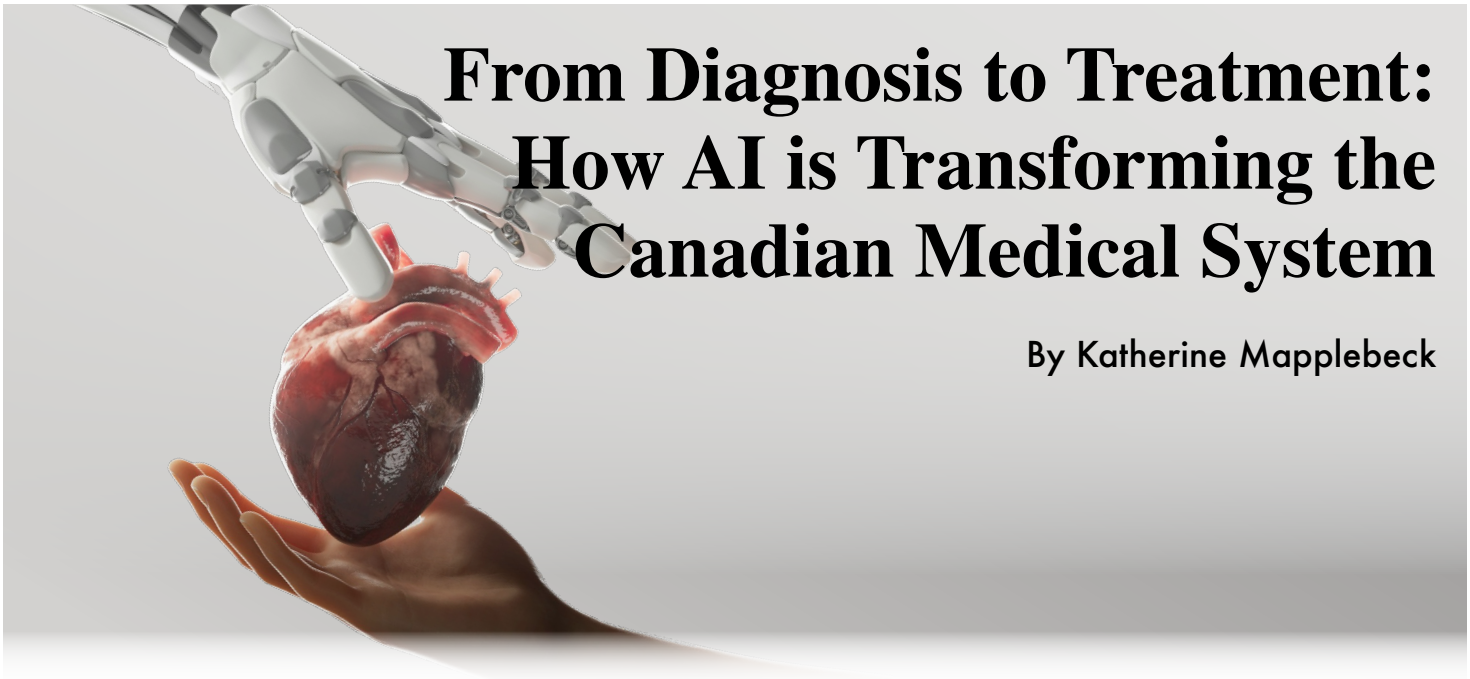

From Diagnosis to Treatment: How AI is Transforming the Canadian Medical System

By Katherine Mapplebeck

Artificial intelligence (AI) *was once confined to science fiction, popularized by futuristic films and mainstream media. Today, it is no longer a futuristic concept but an integral part of daily life. Defined as computer systems capable of performing tasks that are commonly associated with human intelligence, AI is now revolutionizing the Canadian medical system. From predictive analytics of patient data to advanced imaging and robotic-assisted surgery, AI is enhancing accuracy, efficiency, and patient outcomes across the country.*

Predictive Analytics

AI is helping to make significant strides in clinical decision-making through predictive analytics, which involves using patient data to predict health outcomes. A notable example is an AI initiative at Unity Health Toronto, which is reported to have reduced unexpected in-hospital deaths by 26%.[1] The algorithm identifies internal medicine and general surgery inpatients that are suspected to deteriorate, undergo transfer to the ICU, or die within 48 hours. The system runs every hour, analyzing over 150 variables (e.g., vitals, labs, demographics), and automatically pages medical teams when a high-risk threshold is reached.

Dr. Muhammad Mamdani, co- author of the study and Vice President of Data Science and Advanced Analytics at Unity Health Toronto, explained that their team trained the algorithm on data from over 20 000 patients. "When a physician predicted whether a patient would die or go to the ICU, they were right less than one-third of the time," says Dr. Mamdani. When their algorithm was trained on the same variables, it correctly predicted outcomes 70% of the time.[1]

The algorithm, called CHARTWatch, trained on data from over 20 000 patients, includes a diverse range of patient demographics to improve its accuracy and mitigate bias. Initial challenges associated with implementing CHARTWatch included skepticism from clinicians, alarm fatigue (a desensitization to frequent alerts), and technical issues such as sodium levels being misinterpreted as missing data. Endorsement from a highly respected physician at Unity Health Toronto helped drive acceptance of CHARTWatch into clinical practice at St. Michael's Hospital.

While the system is not yet widespread across Canada, its promising results suggest it could become a model for hospitals nationwide. Internationally, similar systems like the UK's National Early Warning Score (NEWS) algorithm are being adopted, demonstrating global momentum toward AI-assisted monitoring.[2] "Healthcare is pretty slow to adopt, so I don't see things radically changing overnight. I think it will take some time. But as we become more comfortable with AI and the benefits it can provide us, the more value that it can give us," says Dr. Mamdani.

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Imaging for Lung Transplant Evaluation

AI is also a promising tool for diagnostic measures and imaging. Researchers at the University Health Network in Toronto have spearheaded a study that uses machine learning – an AI subset where systems learn from data without explicit programming – trained on Ex Vivo Lung Perfusion (EVLP) imaging data.[3] EVLP assesses lungs that are isolated outside of the body for potential transplantation.[4]

The machine learning model, InsighTx, analyzes over 1300 EVLP X-rays to identify patterns associated with lung injury and transplant success.[3] This allows clinicians to better assess donor lung viability, complementing human interpretation and reducing reliance on subjective judgment. While complete diagnostic accuracy statistics (e.g., sensitivity and specificity) are still under evaluation, early results suggest the model improves detection of subtle lung damage that might be overlooked by clinicians.[3] Challenges include the need for larger datasets and external validation to ensure results are generalizable.[3]

Robotic Surgery

AI also helps surgeons in robotic-assisted procedures. The da Vinci Surgical System was introduced into Canadian hospitals in 2008 and has increased precision in minimally invasive procedures.[5] AI integration has enabled the system to assist with intraoperative decision-making, enhancing dexterity and reducing complication rates. Studies have shown that robotic-assisted surgeries using da Vinci systems are associated with shorter hospital stays and lower post-operative complication rates compared to traditional surgery.[5] However, costs remain high, and surgical teams require extensive training. Ongoing research focuses on refining AI algorithms to further improve surgical outcomes and expand access.[5]

The Future of Artificial Intelligence in Canadian Healthcare

The progress made by AI is promising, however, major ethical considerations still arise in the discussion of AI in healthcare. Potential benefits of AI initiatives should not be outweighed by breaches to ethical guidelines in medicine. Bias assessments of AI systems may also be limited by a lack of race and ethnicity data in Canadian hospitals.[6] Furthermore, maintaining patient confidentiality and informed consent is paramount, especially since AI systems operate using sensitive health data. CHARTWatch, for example, functions within hospital firewalls and allows for patients to opt-out of the program. Finally, broader trust-building with the public is essential, which includes transparent communication about AI's role in patient care coupled with robust privacy safeguards to foster greater acceptance. Additionally, there is one key component missing from AI: empathy. Empathy will always be a vital component of providing the best standard of care, as patients and family members encountering the healthcare system are experiencing some of the most distressing moments of their lives.

Looking ahead, AI in Canadian healthcare will continue to evolve across prognostic, diagnostic, and therapeutic domains. Areas for future research include improving algorithm transparency, integrating more diverse patient data to reduce bias, and evaluating cost-effectiveness to ensure equitable access. Importantly, experts emphasize that AI should not replace healthcare professionals but instead optimize and improve what they already do.[7]

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