

Report on Automation in Healthcare

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Table of Contents

- Forward** 2
- Acknowledgements**..... 2
- Introduction** 3
 - What is Artificial Intelligence (AI) and automation? 4
 - What is the role of AI in healthcare? 6
 - Benefits of automation for patients, providers, and healthcare systems 7
- Automation addresses key challenges** 9
 - Areas where automation is currently addressing challenges..... 9
 - Areas where automation shows potential for future use 13
- Implementing Automation** 14
 - Challenges to implementing automation in healthcare 14
 - Lessons learned and best practices 17
- Call to action** 19

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Forward

In January 2022, Digital Health Canada hosted a unique event focused on automation in healthcare. The event delivered a day of workshop activities to members and leaders in healthcare and digital health. There were with three breakout working sessions each proceeded by a catalyst conversation featuring subject matter experts.

The purpose of this workshop event was to initiate a national discussion, report, and working group to identify practices, projects, and products that are changing health service delivery across the continuum of care in Canada.

This report builds upon the conversation started at the Automation in Healthcare Workshop.

In healthcare, automation initiatives are currently addressing challenges we face collectively in healthcare human resources, wound care management, diagnostic imaging, emergency department intake, and many other areas, with the potential for wider expansion.

Canadian healthcare organizations are seeing a growing opportunity to improve upon the patient and provider experience while addressing the challenges brought on by a shrinking workforce and growing stakeholder interest in engaging with more health information, with greater access, from their home and in community settings. The use of AI, chatbots, and innovation in automation is providing new opportunities for extending access to health resources while optimizing provider time and focus on front-line care delivery.

This report is intended as an information primer and current state snapshot for digital health professionals in Canada. Furthermore, it is a call to action and invitation to participate in a national Digital Health Canada Community of Action (CoA). The CoA will drive an agenda to improve automation in healthcare and exchange best practices, methodologies, and tools to help foster implementation in Canadian health delivery.

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Introduction

The COVID-19 pandemic has challenged our healthcare workforces and systems in extraordinary ways.

The pandemic has exposed weaknesses in our healthcare system and highlighted the issues around clinician burnout and the shortage of human resources at this critical time point. Now, the rapid spread of the Omicron variant has further strained our care systems and healthcare workers.

While healthcare is generally cautious about implementing new technology, pandemic-induced demands on how we deliver care have created opportunities for healthcare to modernize and digitize at leaps and bounds ahead of what could have been predicted pre-pandemic.

There is a growing need for improving how healthcare is delivered; automation technology can improve the experience for both patients and providers. These technologies can be used to automate repetitive and time-consuming tasks to allow professionals to focus on providing care and using their clinical decision-making skills. With healthcare automation, patients could have better access to care, through shorter response times, 24/7 access, the potential for remote and virtual healthcare, better diagnostic tools, and improved data sharing.

This report was created out of the “Automation in Healthcare” Workshop held by Digital Health Canada on January 11, 2022. This report aims to explore how automation and the use of bots can transform Canada’s healthcare systems and share best practices in healthcare automation. This includes references to details and evidence of impact. This report should act as both a call to action and a current snapshot of the state of healthcare in Canada while helping to point readers to other resources and catalyzing a community of action for further collaboration.

What is Artificial Intelligence (AI) and automation?

The Canadian Institute for Advanced Research (CIFAR) defines AI as “any current or future machine learning approach to predictive analytics, decision-support systems and/or automated decision making”.

AI allows computer systems to conduct data discovery and analysis at a rate exponentially faster than humans and to adapt when given new data.

Automation

Automation is the use of technology to complete a task with as little human interactions as possible. It’s a type of software that follows pre-programmed rules. Automation can use AI, but most automation uses traditional software. Automation works with data, while AI simulates human thinking, understanding data.

Automation can do work that is time-consuming for humans reliably and without fatigue, saving healthcare workers to focus their energy on providing healthcare.

Machine learning

Machine learning is a type of AI that allows software applications to make predictions or decisions without being explicitly programmed to do so. It starts without knowledge and becomes intelligent. Machine learning uses data and experiences to offer more sophisticated insights with new datasets.



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AI is already integrated into a variety of tools we use daily. Social media platforms, such as Facebook and Instagram, use artificial intelligence to determine what types of posts to show on a user's feed. Digital voice assistants, like Alexa, Siri, and Google Home, use machine learning and natural language processing to tailor answers to the user and their history.

AI is now integral to a range of industries, from banking to travel. Healthcare is traditionally slower to adopt new technology, yet the benefits of implementing automation can save time, money, and human effort while improving how care is delivered.

Examples of AI technology currently being used in healthcare include deep learning, reinforcement learning and robotics.

What is the role of AI in healthcare?

Healthcare automation can be a confusing space for providers. There are fears associated with adopting AI and automation, for both patients and providers. There is a perceived threat of job loss or a dissolution of the scope of practice (will they lose their job or be able to do their job better?). Ideally, automation tools support the work of humans.

The Dorothy Vaughan analogy

Dorothy Vaughan, depicted by Octavia Spencer in the film *Hidden Figures*, was a mathematician and human computer for NASA. Rather than have her job become obsolete when one of the first IBM computers was rolled in, Dorothy learned programming and became a computer analyst. She also taught programming languages and other computer concepts to the women she supervised to prepare for this big change in technology.

Following Vaughan's example, physicians and all healthcare providers need to be persuaded to spend more time on transforming for the future, rather than worrying about their jobs being replaced by computers. With adequate training and education, AI will supplement and support the work of healthcare delivery teams.

Tasks humans do better than machines and vice versa

There is a distinction, which is still in flux, between tasks and activities best performed by humans and those that machines can do better. There are human-only activities that even the smartest AI can't do as well, such as judgment, leadership, and compassion. Whereas machines are better at computational tasks, like transactions and dealing with data sets.

An important factor when considering AI in healthcare lies in recognizing the tasks that humans can do better with the assistance of machines or bots. The integration of humans and machines working together through healthcare workflows is key. For example, in some cases, patients can tell bots their story and may be open to sharing information they wouldn't share in a face-to-face clinical scenario.

What do we do with the extra time?

With more computation power and automation, there is effectively more time available for healthcare providers to do their important work. A leading question will be – what do we want tech to do for us? Do we want automation to let us see more patients or spend more time with each patient? Both.

With the help of automation, healthcare workers can focus on higher-value work, such as providing compassionate care to patients. Computer automation can help perform the mundane and time-consuming tasks that can be the source of clinician burnout.

Benefits of automation for patients, providers, and healthcare systems

Patients

Patients are becoming more complex – people are living longer, and age brings more conditions, complications, and medications. Furthermore, patients are likely to be seen by a variety of health professionals across primary, secondary, and tertiary care. Automation has the potential to contribute to a continuum of care, offering better information for decision making, and improving access.

Improving healthcare

Automation could be used to empower people to access healthcare outside of the system, such as for mental health, diabetes care, or home care. Citizens could have the ability to self-triage and know when they need to access care outside the home. Predictive algorithms could be used to monitor and follow-up with patients with comorbidities. Instant translation tools offer an increased ability to communicate with people speaking any language.

Improving access to care in remote areas

In remote areas of Canada, such as the Northwest Territories, there can be no access to a ground ambulance or plane in bad weather. Healthcare automation could be used to optimize the resources at remote sites for basic day-to-day tasks.

Providers

Workflow efficiencies and reducing strain on workforce

Automation can do the jobs that humans don't want to – often ones based on data where there is a high risk of human error. Machine learning, if trained and modeled properly, can adapt easily to new information and offer suggestions to support healthcare workers.



It [Watson] is still struggling with the basic step of learning about different forms of cancer. Only a few dozen hospitals have adopted the system, which is a long way from IBM's goal of establishing dominance in a multi-billion-dollar market. And at foreign hospitals, physicians complained its advice is biased toward American patients and methods of care.

Source: <https://www.statnews.com/2017/09/05/watson-ibm-cancer/>



Improved exchange of digital health information

Healthcare professionals, especially newer or inexperienced clinicians, could draw from the large data sets in the form of digital tools to enhance their clinical practice. AI could assist clinicians with constantly updating evidence for improved quality and safety. Though care should be taken that AI is not turned into mere automation, which can result in incorrect diagnoses and unsafe recommendations, as seen with the IBM Watson failure in cancer treatments.

Properly applied, automation could provide healthcare workers with a more complete history of information on a patient. Automation additionally can help with sharing of information between clinical systems in a manner that aligns with clinical workflows.

Healthcare system

A fuller view of the healthcare system

Healthcare automation and data analysis can allow for a fuller view of the current state of the system, which can give patients more autonomy in making choices for their care. Wait times for different hospitals and urgent care clinics can be viewed online in many parts of Canada. Algorithms could be used to offer suggestions on the best place to receive care, for example, which emergency department has the shortest wait time while being near enough for the patient.

Better use of data and analytics

Implementing automation can allow for better analytic capability for healthcare data, meaning information like population-level data can become more relevant. Standardized data sets can be used in large research initiatives to help drive policy and clinical care pathways. Automation can also allow for large data sets to be combined to get a deeper understanding of the patient by looking at social determinants of health like employment, food, or housing insecurity.



Automation addresses key challenges

Areas where automation is currently addressing challenges

Areas where many computational and repetitive tasks are being performed, such as in human resources and finance departments, are traditionally strong candidates for automation. In fact, automation techniques for tasks such as payroll or vacation tracking are already embedded into many administrative and back-office processes. In healthcare, automation is currently addressing challenges in wound care, diagnostic imaging, emergency department intake, and many other areas, with the potential for wider expansion.

BC COVID-19 Digital Agent

The COVID-19 pandemic led to the development of the COVID-19 Digital Agent in British Columbia. The public needed information on the virus and the 8-1-1 free-of-charge provincial health information and advice phone line quickly became overwhelmed. The province needed a solution to help people quickly navigate rapidly evolving information. This Digital Agent is a new channel for helping people, but also provides a view into the public's current concerns and priorities about the pandemic.

The Digital Agent was designed to engage with people in several ways, including by asking questions, such as about the latest COVID-19 provincial restrictions, and suggesting topics, addressing issues like vaccine concerns. It is also able to dial or text important phone numbers and lead a patient through a self-assessment. The COVID-19 Digital Agent has engaged in eight million sessions to date and answered 20 million questions.

Ontario COVID-19 Immunization Bot

The rapid immunization of the Ontario patient population led to a need to update local electronic medical records with COVID-19 immunization data. The eHealth Centre of Excellence in Ontario developed a bot that automated the updating of patient charts. For one clinic alone this saved 87 hours of time for clinicians and staff.

Swift Michener AI wound care app

Amputations of lower limbs due to diabetic foot wounds are common, yet preventable. The Michener Institute of Education at UHN with Swift Medical developed a mobile app that uses artificial intelligence to help patients and physicians monitor the healing of wounds. The Swift Skin and Wound app works on a smartphone or tablet to capture a photo of a wound then immediately measures its dimensions. AI is used to improve the accuracy, consistency, and objectivity of wound measurements to guide clinician decision-making around assessment and treatment. Healthcare providers in rural and remote communities could potentially use this technology to help treat wounds based on previous data.

Nova Scotia Health Authority diagnostic imaging

The Nova Scotia Health Authority is using AI and machine learning with diagnostic learning to identify tumours and other growths in lung tissue, in parallel with clinicians. The province is building a health data repository and working with data scientists to create algorithms to run through the paces. They are looking to implement AI in other diagnostic imaging in the health authority.



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Emergency department intake

The Amazon healthcare team is working on automation in emergency departments for patient intake. People that enter the emergency department are often answering the same questions again and again. This can be done through voice or typing on a tablet. Information gathering and patient experience is improved with the ability for the app to translate instantly into other languages.

Google Chatbot use

In BC, the Google Chatbot tool and Google Cloud Dataflow were leveraged in response to COVID for citizens who needed to get information. It's an intuitive tool that was placed on the BC Centres for Disease Control website, partnered with the Ministry of Health and core government partners.

Now, two years later, they are expanding the technology for other health authorities and agency partners. The tool will also be used to support cancer patients and family members with key questions about their health journey, such as symptom management.

Telus My Health Symptom Checker

Telus has developed an app to guide patients to the most appropriate form of healthcare service based on their medical symptoms. Interactive questions are given to the user to determine the possible next steps for care. It can suggest an action, such as visiting a doctor, performing self-care, or seeking urgent care.

Chatbots in healthcare

In our modern, increasingly digital society, we expect many things to be instant, from social media to banking access. Chatbots are software applications that allow for online instant conversations with users. Many large organizations are now using these on their websites. Chatbots can also be installed on messaging platforms, mobile apps, and websites.

Email responses can take 24 to 48 hours, optimistically, but chatbots are instant. Staff are not needed to answer requests for information at high volumes and at all times of the day. Patients ideally have access to the information they want when they need it. Chatbots are especially useful for repetitive tasks that are generally time-consuming for people to do. This can include scheduling appointments or completing COVID pre-screening questionnaires.

CASE STUDY: Nova Scotia Health Chatbot

Nova Scotia Health implemented a small bot for a simple IT task and measured the cost savings. This bot gave information as to when laptop leases were up for renewal – a question they were consistently asked. They estimated that the labour costs added up to around \$20,000 per year. Building the chatbot cost approximately \$5,000 with operations costing \$1,500 per year and cloud operations \$500 per year. From the second year forward, savings are estimated at \$18,000 per year.

Nova Scotia Health IT group is looking how these types of chatbots can be used for similar basic tasks like resetting passwords. Through a centralized group, they are looking at standardizing the user experience which can then be decentralized to other departments to build chatbots for tasks they determine are best to automate.

Guiding principles for chatbot implementation and use

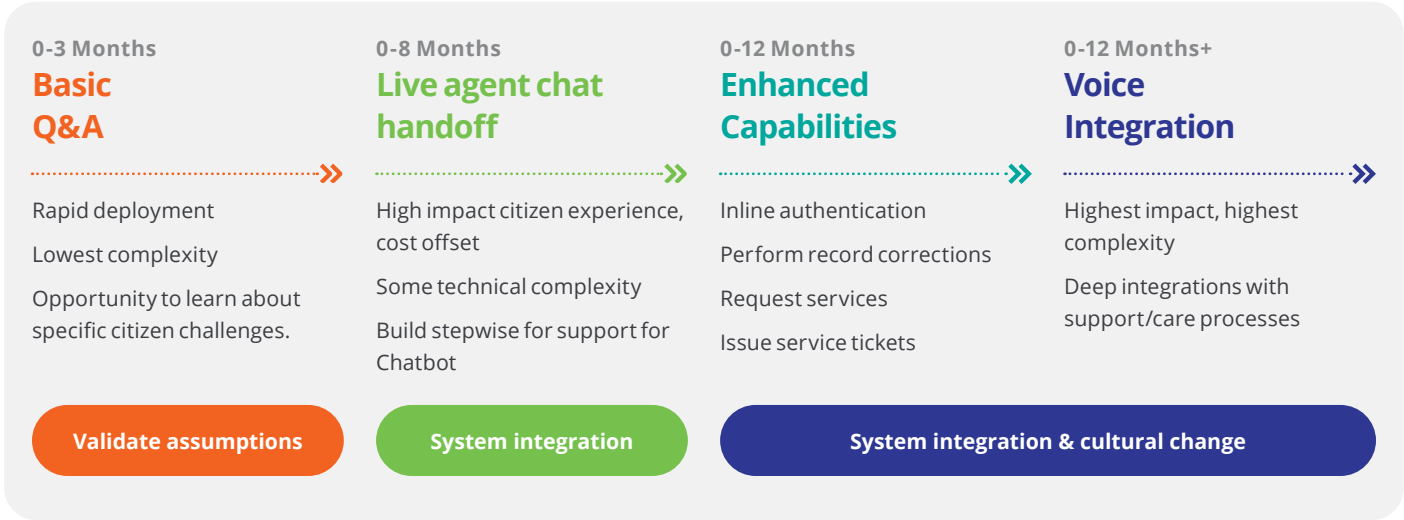
A guiding principle for the use of chatbots should be transparency – with both patients and staff aware of the fact that they are chatting with a bot and not a human. The chat should end with a direction for users to go for additional information and the next steps for care. Chatbots also must be reliable in terms of safety, security, and privacy. The focus should be on the customer experience, ensuring a good user experience.

COVID-19 Digital Agent implementation

The BC COVID-19 Digital Agent was first put into a test environment for numerous independent testing cycles, with people who had no knowledge of the project. The only direction for the subjects was to ask the agent about COVID-19. The results were reviewed and additional training was applied until the response accuracy was considered production ready.

The project focused first on the small-scale transactions of the least complexity that can have a large impact on experience and quality. A guiding principle was rapid delivery – delivering something quickly rather than everything later. With each new step, technical complexity of tasks increased with system integrations and cultural change.

Agent Capabilities: Typical Maturity Model



Source: Provincial Health Services Authority, AI in BC Healthcare presentation, Agent Capabilities: Typical Maturity Model

Areas where automation shows potential for future use

Medication Management	In Nova Scotia, clinicians are focusing on the pharmacy department. With approximately 40 chatbots built, they will be looking at sharing information such as what drugs are available, which are covered under medical insurance, and who is on call.
Chronic disease management	People living with chronic diseases, like diabetes or COPD, could use AI technology to guide their management of symptoms.
Streamlining scheduling	Scheduling, rescheduling, reminders, and the like are time consuming and taxing for humans to do. Automation can be used to ensure appointments are more efficiently booked, with fewer no-shows or accidental multiple appointments.
Better access to healthcare services	With AI, such as with a chatbot, a patient could have better access to care by making it easier to navigate through services. A chatbot can narrow down and identify a person's needs before transferring to a human.
Rote knowledge	For looking up basic information that's not necessary to remember, such as normal body temperature, relying on a computer can make more sense.
Bypassing language barriers	Healthcare automation has the potential to improve care for people from varied cultural backgrounds speaking multiple languages. Doctors may wish to speak with their patient in one language, then transcribe their notes into another language.
Sharing meaningful data between systems	Interoperability remains a challenge in the health system. Bots can be used to synchronize data between different systems and across sectors. This has been successfully attempted in Ontario between primary care and home care.



Implementing Automation

Challenges to implementing automation in healthcare

The COVID-19 pandemic has rapidly changed how healthcare is delivered in Canada and around the world. Most Canadians started receiving healthcare services outside of physical clinics, offices, and hospitals, with the rise of appointments being held online and over the phone. Canada is now seen as a leader in AI, with tremendous talent in our systems. But several challenges are standing in the way of full implementation in healthcare:

Tech challenges and accessibility concerns

Virtual care options like phone and video conferencing offer several benefits, including the ability to provide healthcare services to patients in remote areas. But virtual care can be messy – calls dropped, WIFI cutting out, or additional technical challenges.

Patients and providers both need access to broadband services that offer robust support for multi-channel communication. Accessibility for people with disabilities or lower rates of technical literacy should also be taken into consideration.

Shifting mindsets

Healthcare is naturally very cautious about innovation. Input from all levels and stakeholders who may be affected by automation must be considered in planning and implementation.

Creating more of a culture of risk taking, willing to make mistakes and learn from them, but in a controlled, safe way will allow for innovations.

Educating providers and patients

It is a daunting task to educate an entire organization or health authority. People need to be educated to prepare for automation, with providers needing to be informed of differences in clinical workflow processes. It's important to grow capacity within healthcare teams through awareness, education, and skills building. Time and resources must be allocated for staff to learn how to use the tools properly. Tools must also be designed to minimize complexity.

It's important to consider patients' knowledge of what is being automated and what decisions related to their care are out of their hands. There is also the current comfort level around a new technology. While many people are currently not comfortable with being in a self-driving car, it will likely become the norm in the future. Focusing on improvements in quality of care can motivate both providers and patients to accept change.

Privacy and ethical considerations

Ethical and privacy concerns arise around healthcare records and the sharing of personal data, with healthcare data systems vulnerable to cyber-attacks. There are additional ethical concerns when using machine learning to give treatment options. Privacy legislation is one constraint to the growth of AI benefits, given the need for masses of training data. Algorithms can also come to conclusions without providing rationale and may be biased.

Financial contributions

It will likely be difficult to get the necessary funding for healthcare automation. Healthcare systems may need to rely on donors and third-party funding to support AI and automation. Private and public systems in Canada are not well connected, so there is an opportunity to leverage private companies to support public sector innovation.



Time and resources must be allocated for staff to learn how to use the tools properly. Tools must also be designed to minimize complexity.



Providing feasibility is necessary for getting support from donors, yet Canada is behind in having the evidence base to support AI. What about all the private companies that are already creating automation and AI – can we give them better access to anonymized data to create their products which then can be sold to hospitals? The private sector has proven to be better at developing products than the public sector; perhaps governments should provide the data they need for training purposes.

Long-term sustainability

It takes a lot of effort to get automation and AI tools going and working to benefit an organization. It will be an important measure to ensure implemented automation tools are being used and will remain sustainable. Automation projects need support and funding in the long term.

Accessing data

Barriers to data for training purposes, without compromising protected health information, is currently an issue in Canada. Other industries, such as in the finance sector, have trillions of transactions to be analyzed. Currently people working within hospitals or inside a hospital network can access the data. But people outside these systems, such as researchers, developers, and policy makers, often don't have access to this data. Access is guarded by the ethics committee of each jurisdiction or organization and permission is needed to access aggregated data.

Lessons learned and best practices

Start small with simpler problems

There is a natural inclination to start building automation into the large “pain points” of the organization. Choosing the most complex problem to solve can be a recipe for disaster. Starting with a small, simple problem is better for large organizations. This automation should be based on clear rules without requiring extensive human judgment and oversight.

Focus on healthcare providers and staff satisfaction

Alberta Health Services found that there was much resistance to automation in the beginning of their journey. The team worked with executive sponsors to communicate the benefits and help ensure there wasn't fear of job loss. Once live, true excitement was seen in staff at not having to do the most mundane tasks anymore. The process has allowed staff to feel a lot more satisfied with how they were doing their jobs. Clinical champions are needed for successful implementations.

Share information and automation

Nova Scotia Health and Alberta Health Services are collaborating to share information and best practices for healthcare automation. Data flow between health authorities and other organizations can improve how healthcare is delivered, with a coordinated effort to improve quality of care.

The importance of interoperability

Interoperability, the ability of different information systems to exchange and access data, remains a major barrier across Canada. While health authorities are starting to better share data at the organizational level, it's still not available at the provincial and federal levels. There is aggregated data available, but none shared between provinces and no open data sources.

Transparency between humans and bots

Patients and providers should know from the outset whether they are talking with a chatbot. Setting a standard for expectations needs constant evaluation and user feedback.

Monitoring

Healthcare is currently monitored top to bottom for safety compliance and this must continue with any new automation developments. When implementing automation, monitoring must be considered, including monitoring use, who has access to which systems, outcomes, decisions made, and results. Clinicians and physicians are needed to ensure that AI is making the correct decisions.



Ensuring the proper data is collected and shared

Healthcare providers' notes must be careful and articulate, with the correct data being collected. Transcription and increased data collection are particularly useful for healthcare for auditing and safety purposes. The correct data must also be selected for training purposes.

Sharing of data also needs to be a big factor. There are many areas where the data is lacking to be able to train models. Fostering relationships between organization scan increase the availability of data for training AI.

Developing trust in automation and organizations

Create a structured process to determine what tasks to automate, start small and build trust in the technology. Methods must be put in place to examine the training data to ensure it is trustworthy. Starting with quick wins, then iterating over time will develop momentum and trust in the process. Constantly reviewing what is working and what is not.

Dedicated support team

Ensure there is a dedicated and centralized support team and robust processes to support automation. Companies or developers could be hired to set up automation and train internal staff to help implement.

Stakeholder consultation

Automation tools must be developed in tandem with clinicians and patients, while partnering with researchers and industry. Staff members and populations must be aware of the available systems and know how to use them. Ensure people on the frontline can partner with industry to make these tools meaningful and automated to optimize the user experience.



Methods must be put in place to examine the training data to ensure it is trustworthy.

Call to Action

This report is intended as an information primer and current state snapshot for digital health professionals in Canada.

Next, Digital Health Canada is inviting members to participate in a national Healthcare Automation Community of Action (CoA). The CoA will drive an agenda to improve automation in healthcare and exchange best practices, methodologies, and tools to help foster implementation in Canadian health delivery.

Please contact volunteer@digitalhealthcanada.com to indicate your interest and receive an invitation to join the national Healthcare Automation Community of Action.



Digital Health Canada connects, inspires, and empowers the digital health professionals creating the future of health in Canada. Our members are a diverse community of accomplished, influential professionals working to make a difference in advancing healthcare through information technology. Digital Health Canada fosters network growth and connection; brings together ideas from multiple segments for incubation and advocacy; supports members through professional development at the individual and organizational level; and advocates for the Canadian digital health industry.

For more information, visit [**digitalhealthcanada.com**](https://digitalhealthcanada.com).