

EMPOWERING
INNOVATION
IMPROVING
HEALTH

INNOVATION REPORT / JUNE 2023

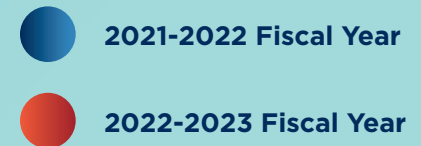
Embracing Innovation

At Hamilton Health Sciences, innovation has long been a pillar of our strategic plan and a key enabler of our vision to provide best care for all. Over the past three years, we've seen a groundswell of remarkable, innovative approaches to providing care. The pandemic pushed us forward faster and our teams responded by embracing change. We're harnessing this momentum to bring even more value to our local and regional health-care system as we grow and rebuild for the future. Through our commitment to innovation, and our national and global partnerships, we're advancing health care in our community and around the world.

**ROB MACISAAC,
PRESIDENT AND CEO,
HAMILTON HEALTH SCIENCES**



Innovation accomplishments in the 2022-2023 fiscal year



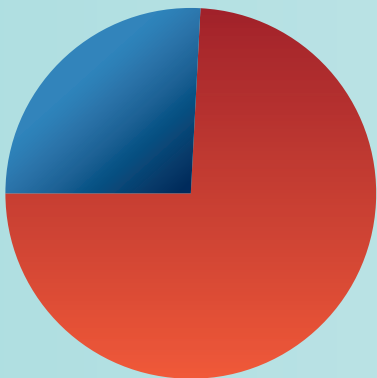
Innovation tools, products and projects

Almost double



Publications/press exposures

70% increase



Patient involvement

Increased by 2.8x



Revenue generated

\$33,000 increase

Giving our patients a “Voyce”

Accessing Canada’s health-care system can be a frightening and stressful experience for those with a language barrier. Patients and their families who are not proficient in English may struggle to express their concerns and symptoms and to understand medical terminology. This can lead to misunderstandings, frustration and even a lack of trust between patients and health-care providers.

As one of Ontario’s largest and most comprehensive health-care organizations, Hamilton Health Sciences (HHS) recognizes the importance of equity, diversity, and inclusion in delivering exceptional care to a diverse community of 2.3 million people. So, HHS is rolling out a new, real-time interpretation service to solve these issues.

For interpretive services, HHS previously relied on in-person translators or phone services. However, they were time-consuming and often unavailable in a timely manner.

“Improving communication is essential to us as an organization that’s on a mission to provide ‘best care for all,’” says Ted Scott, Ph.D., vice president innovation at HHS. “The Voyce system was identified as an opportunity to serve our community better.”

Ontario Bioscience Innovation Organization (OBIO®), a not-for-profit organization dedicated to advancing health technology innovation and commercialization, facilitated a partnership between HHS and Voyce Canada, a Toronto-based technology-driven company. Through this partnership, HHS is able to evaluate Voyce’s medical interpretation platform.

HHS has deployed Voyce in selected units representing a variety of settings including an emergency department, inpatient units and outpatient units to assess and address any adoption barriers for full implementation across our health-care organization.

Voyce works just like a Zoom call – the care team simply needs an internet connection and a tablet. It offers a network of more than 2,000 qualified interpreters who speak more than 240 languages and are trained in medical terminology. No matter what language is required, an interpreter is connected in an average of 30 seconds – no pre-booking required.

“Having Voyce really helps to promote inclusivity for a lot of our families who don’t speak English,” says Dr. Audry Lim, Pediatrician and Medical Lead of Complex Care at HHS’ McMaster Children’s Hospital. “Without the ability to interpret properly and timely, I find that it really impedes the care we can provide. But, by



pulling Voyce into the room I can communicate with the families in real-time without any translation issues.”

By providing real-time interpretation services, care teams can ensure that patients and families can fully understand their medical conditions, treatment options, and instructions for follow-up care.

HHS is working to expand Voyce into all areas of the organization, including research and education, to better understand the needs of our non-English speaking community.

“Voyce is game-changing,” says Scott. “By providing immediate interpretive services to our patients and families, we can empower our health-care providers and improve equity to accessing HHS services.”

PHOTO Aisha and Mahmoud Jomaa have been able to utilize Voyce translation services during their daughter’s regular medical appointments. Through a Voyce interpreter, Aisha says, “Whatever I’m saying, I’m sure that it’s being relayed in the same way.”



Voyce really helps to promote inclusivity for a lot of our families who don’t speak English.”

CREATE-ing health-care solutions

Hamilton Health Sciences' (HHS) Centre for Data Science and Digital Health (CREATE) team is a group of experts in software engineering, data science, AI and interoperability on the forefront of health-care innovation.

By partnering with clinician scientists and innovators, CREATE enhances research and development efforts with the latest technologies in digital health and data science. And, with collaborations within the broader health-care community, not just HHS, CREATE makes it possible to bring innovative solutions to market that address complex health care challenges.

The team brings deep knowledge of how to implement the health-care specific requirements around interoperability, security, privacy and machine learning. Combine their expertise with cutting-edge tools and they can transform data into solutions that can drive better clinical outcomes and patient experiences.

“It’s a huge journey to go from a clinician’s promising idea in the hospital and something that runs well on your laptop, to something that can be scaled into a product that brings value to the whole health-care

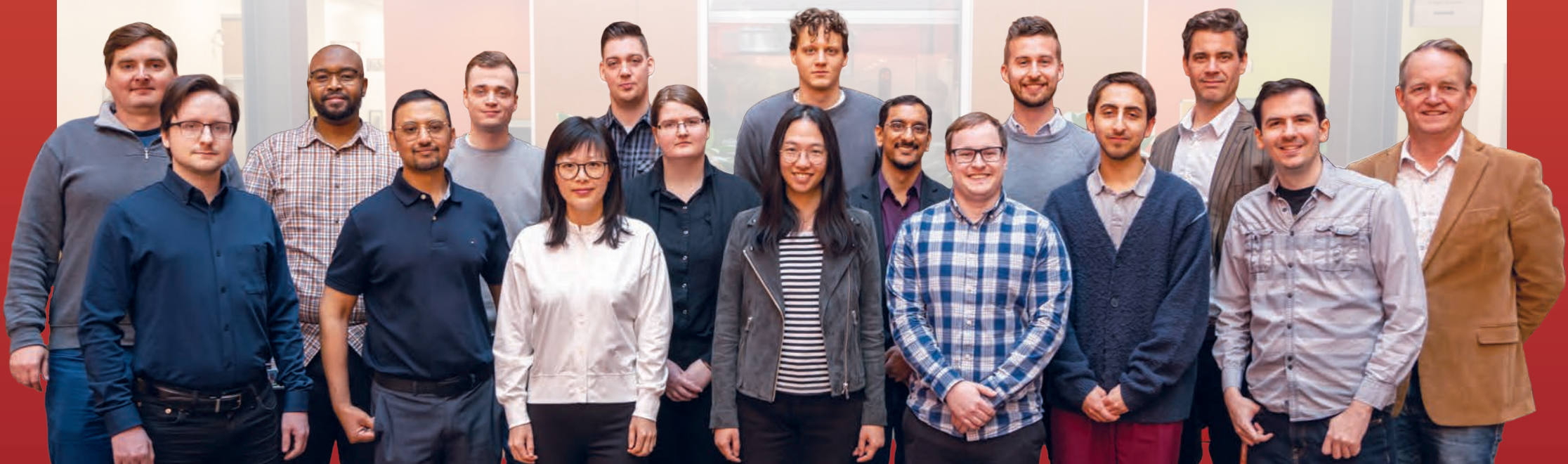
system,” says Jeremy Petch, Ph.D., CREATE’s director. “We make it possible to take health care innovation out of the hospital, broaden it to apply to wider communities and have an impact on population health. This is the secret sauce we bring to our partners.”

Visit www.createhealth.ai for more information.

Since its inception in 2019, the CREATE team has:

- Grown from 6 to 20 experts and staff
- Doubled its revenue
- Published twelve scientific papers
- Partnered repeatedly with world-leading organizations including the World Health Organization

PHOTO From left to right: Peter Sztur, Ryan Hull, Mohamed Ibrahim, Shihab Khan, Colin Kent-Shepperd, Zhiping Yu, Callum McKail, Daria Ostroushko, Shuang Di, Walter Nelson, Nityan Khanna, Jordan Webber, Jonathan Ranisau, Juan Pablo Tabja Bortesi, Jeremy Petch, David Melnyk, Ted Scott. Absent: Hajare Bencherifa, Krystal Mercer, Joel Kempainen, Hasnain Mamdani





Improving the doctor-patient connection

Visiting the family doctor used to be a personal experience: talking about your health concerns while the doctor really listened, and jotted notes down on paper. Now, technology advancements mean that patients are often talking to a doctor who is busy looking at a computer and typing relevant medical details into an electronic medical record (EMR).

Toronto-based family physician Dr. Noah Crampton recognized this critical gap. He sought to restore the natural flow of a two-way doctor-patient conversation, while maintaining accurate and efficient reporting in the EMR.

After some initial work, Crampton turned to CREATE to help bridge the gap between idea and reality to create Autoscribe, an artificial intelligence-powered digital scribe assistant.

Autoscribe not only transcribes conversations, but accurately fills out the EMR in seconds. Doctors can focus on having natural conversations with their patients without compromising eye contact or trust, while still having immediate access to a comprehensive and accurate medical record.

“Partnering with CREATE’s team of technical experts and health-care user design experts in the initial phase of brainstorming and designing made the process so much easier and seamless for us,” says Crampton.

The second phase of work with CREATE focused on privacy, security, legal aspects, cybersecurity and testing.

“Being part of an academic health sciences organization, CREATE has experience with what’s required in privacy and security. This knowledge is very valuable. It meant we could be more efficient, with fewer versions before getting to the final product,” said Crampton.

When it came to showcasing a live demo to other physicians, Crampton says jaws dropped as they saw the EMR being completed throughout the course of doctor-patient conversation.

Thanks to the knowledge and expertise of HHS’ CREATE, Autoscribe is now available for purchase online to any interested physician.

Diabetes study finds a wealth of information at your fingertips

Despite being separate health conditions, diabetes and heart disease are strongly connected. According to the Heart and Stroke Foundation, people with diabetes are more likely to develop heart disease at a younger age, and are three times more likely to die of heart disease.

Identifying a patient's risk of these complications due to diabetes, means preventative measures can be developed. While it has already been established that the capillaries in the retina of the eyes can assess the risk of retinal complications from diabetes, Hamilton Health Sciences' (HHS) Dr. Reema Shah wondered if the capillaries in nailbeds could be a novel method to providing more information about diabetes in a less invasive manner.

During her fellowship in 2016, she set out to find the answer in partnership with her supervisor Dr. Hertzell Gerstein, an HHS endocrinologist and recognized leader in diabetes research by the Canadian and American Diabetes Associations.

They developed a research study using images from the finger's nail fold. The nail fold attaches the nail to the rest of the skin through the protective cuticle. The image is captured through a simple, non-invasive, portable diagnostic test called a capillaroscopy.

Then, in 2020, Shah and Gerstein partnered with HHS' Centre for Data Science and Digital Health (CREATE) to use artificial intelligence to analyze the images.

"We had been seeking partnerships with various external groups to do the machine learning aspects of the projects for quite some time with no success. Finding the CREATE team's expertise in-house finally helped us move the project forward," says Shah.



The study looked at the capillaries of 120 adult patients with and without type 1 or type 2 diabetes and with and without cardiovascular disease. CREATE's machine learning experts used a deep learning technique called convolutional neural networks to analyze a total of 5236 nail fold images, approximately 44 images per participant.

It resulted in accurately distinguishing between patients who did and did not have diabetes and could predict which patients are at greater risk for developing cardiovascular complications. These results were published in the Journal of Diabetes in February of 2023.

"This proof-of-concept study demonstrates the potential of machine learning for identifying people with microvascular capillary changes

from diabetes based on nail fold images, and for possibly identifying those most likely to have diabetes-related complications,” says Shah.

The team is now looking to expand to a larger number of patients and broaden the scope to see if the risk of other complications from diabetes can also be assessed. Eventually, this discovery could be used in low- and middle-income countries to help provide access to screening tools where there is limited access to health-care professionals.

“This world-first innovation could lead to better management of diabetes and its complications,” says Jeremy Petch, Ph.D., director of CREATE. “And, it’s happening right here in Hamilton thanks to our in-house team of data scientists and AI experts that are building relationships with clinicians who ask great questions and need support finding solutions.”

PHOTO *Our team, including Dr. Reema Shah, is able to determine if people have diabetes and predict their risk of its complications using images from a handheld microscope and artificial intelligence.*



This world-first innovation is happening right here in Hamilton.”

Transforming care for neurodevelopmental disorders with a learning health system

Navigating the Canadian health-care system can be daunting for families with children living with neurodevelopmental disorders like autism or ADHD.

As a caregiver and advocate for her child's needs, as well as a researcher, Karen Beattie knows this struggle all too well. Her journey began when her son Freddie was born prematurely at 29 weeks, weighing only 1.7 pounds. This was when he first became a patient of Hamilton Health Sciences' (HHS) McMaster Children's Hospital (MCH).

Now nine years old, Freddie has received ongoing care at MCH's Ron Joyce Children's Health Centre to support his needs related to Developmental Coordination Disorder and social skills.

"We often talk about lack of or miscommunication between teams, and sometimes between parents and teams," says Beattie. "Health-care providers do their own thing really well. But being aware of what each other is doing and how they can approach helping kids from all perspectives is also important."

To help solve this issue, MCH and HHS' Centre for Data Science and Digital Health (CREATE) are part of a Hamilton-based team creating a learning health system (LHS) for neurodevelopmental disorders. The team includes researchers, clinicians,

community leaders, as well as parents of children with neurodevelopmental disorders, like Beattie.

A learning health system is a digital framework that connects clinical care and research in health-care organizations. It uses routinely collected health data stored within multiple electronic record systems for research and quality improvement. And, through a type of artificial intelligence called natural language processing, it can collect data from clinical notes that would otherwise need to be manually reviewed. Having all this data accessible in one place is rarely achieved due to the siloed nature of health care.

"In Hamilton and across Canada, thousands of families use developmental, rehabilitation, behavioural, and mental health services separately or simultaneously. But instead of navigating one unified health-care system, families often have to deal with multiple micro-systems depending on their child's evolving needs and where the services are available," says Stelios Georgiades, Ph.D., Director of Offord Centre for Child Studies, a research institute of HHS and McMaster University, and MCH Chair in Autism and Neurodevelopment. "Clinicians want to work together, but our siloed systems do not foster interdisciplinary collaboration. CREATE experts will build the data infrastructure and real-time knowledge translation we need to integrate clinical care and streamline the family journey."

The goal of this LHS is to empower families, explore advancements in care, and translate evidence into policy and practice to ensure the best care for all Canadian children with neurodevelopmental disorders.

A \$1.5 million grant from the Azrieli Foundation supports phase one of the LHS. Evidence from MCH's first phase will inform the creation of a Pan-Canadian Learning Health System for Neurodevelopment.

“We believe that learning health systems can help move knowledge into practice and improve the experience for the millions of Canadian families living with neurodevelopment disorders,” says Georgiades. “Our goal is to ensure that every child gets the care they need in a timely and equitable manner.”

PHOTO *Our learning health system will bring together all of a patient's health records to help connect clinical care and research with the goal of providing a better experience for patients and families, like Freddie and Karen.*



Our goal is to ensure that every child gets the care they need in a timely and equitable manner.”

Bringing health innovation to life

Hamilton Health Sciences' (HHS) culture of innovation is a vital aspect of advancing care for our growing and aging population. The HHS clinical innovation team plays a crucial role in achieving this goal by empowering clinicians with the latest technology and innovative approaches to help solve the challenges they face.

The clinical innovation team works with HHS staff and physicians to provide expertise in business development, project management, knowledge translation and stakeholder engagement. They also forge collaborative partnerships with other health-care providers and industry and community organizations to find, develop and implement new technologies and approaches to care. This includes partnerships with the Coordinated Accessible National (CAN) Health Network and Ontario Bioscience Innovation Organization (OBIO®) - two organizations dedicated to advancing health technology innovation and commercialization by pairing health-tech companies with health-care organizations.

"The breadth of in-house expertise and patient populations makes HHS an ideal partner for companies wanting on-the-ground experience and feedback from clinical experts and patients," says Prathiba Harsha, manager, clinical innovation at HHS. "Together, we can drive the development of innovative processes and new products to advance how we provide care to our patients."

The goal of HHS' innovation team is to support the implementation of innovative solutions that can improve patient outcomes, safety, and overall experiences.

The clinical innovation team and CREATE's team of experts in data science and artificial intelligence, make up Innovation at HHS. Together, offer a one-stop-shop approach to bringing health innovation to life.



PHOTO From left to right:
Ted Scott, Prathiba Harsha,
Sarah Jivani, Shewit Buzuayne



Innovative partnership reduces hospital-acquired infections

Hamilton Health Sciences (HHS) achieved a 60% reduction in venous catheter infections after a six-month pilot using SterileCare's KiteLock™ solution in select units at the Juravinski Hospital and Cancer Centre.

A venous catheter is a tube that's inserted into the bloodstream, typically in the chest or upper arm, which is used to provide medication to patients. While this is usually the best option and commonly used with cancer patients, it does require careful monitoring for infections and blockages.

KiteLock™ solution is a liquid solution used by health-care professionals to cleanse patients' venous catheters. It aims to reduce the number of infections, the frequency of replacing venous catheters, and the need for blood-thinning medications.

The partnership between HHS and SterileCare was developed through CAN Health Network's federally-funded program that helps health-tech companies meet the needs of health-care organizations with products that are ready for large scale use.

"In order to find new and innovative ways to benefit our patients it's vital for us to collaborate with organizations like CAN Health Network to ensure we develop partnerships with the right companies to make impactful change," says Ted Scott, Ph.D., vice president innovation at HHS.

This pilot not only reduced infections, but 88% of patients surveyed had a positive or neutral outlook on KiteLock™ solution, staff found it easy to use, and it resulted in cost savings due to fewer infections.

As a result, HHS has now ensured the product can be regularly used within the same units as in the pilot and will begin expanding its use to other units where patients require venous catheters.

"We're excited with the positive outcome of the KiteLock pilot and look forward to improving the care we provide to our patients with this innovative and evidence based product," says Ari Collerman, chief of interprofessional practice at HHS.

Creating health care software that's out of this world

The Hamilton Health Sciences (HHS) Centre for Data Science and Digital Health (CREATE) will develop software that will run a medical suite prototype for Lunar Medical Inc. as part of the Canadian Space Agency's Health Beyond initiative. The prototype is intended to address the health care challenges faced by astronauts in deep space and people living in remote communities across Canada.

"We have experience developing and deploying digital health solutions in low-resource environments in eastern Africa and Canada's north," says Jeremy Petch, Ph.D., director of CREATE. "So our skill set was a perfect fit for this project."

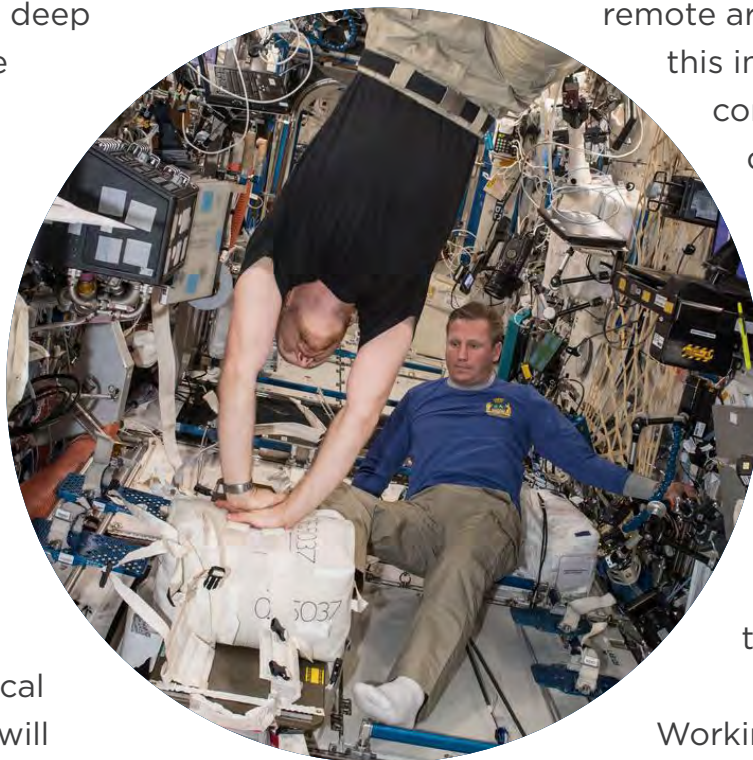
Named the Connected Care Medical Module (C²M²), the medical suite will take a transformative approach to increase on-site medical capacity and autonomy that is predictive and proactive. According to the Canadian Space Agency, a C²M² is "a scalable integrated system of state-of-the-art medical technologies and methodologies contained in a deployable unit." And the purpose of C²M² is to "increase a


user's capacity to independently detect, diagnose, treat, and/or monitor health conditions on site."

Ultimately, this module will help users receive timely and quality care while reducing risks and costs associated with transporting patients from remote areas to urban hospitals. For this initial prototype, a shipping container will be used for research, development, and easy module placement across Canada.

CREATE's involvement in the project is the result of a collaboration with Hamilton-based company Lunar Medical Inc., one of five organizations selected by the Canadian Space Agency to produce their own version of the C²M².

Working with Lunar Medical, CREATE will develop software that will integrate data from medical devices, like a point-of-care laboratory, and develop a novel artificial intelligence powered system that will provide step-by-step guidance on how to respond to a medical emergency.





“It’s exciting to simultaneously be developing an innovation that could improve health care delivery in Canada’s north while also laying some of the foundations for the next stage of space exploration,” says Petch.

The C²M² suite will be implemented on earth with a plan to eventually apply the module on deep space missions.

This project has brought together some of the brightest minds in the world to create accessible health care on earth and in space. HHS’ CREATE is part of a leading-edge group inventing the future of health care.

“This project has sparked our creativity and enthusiasm, and we feel like we’re just starting. We’d love to continue contributing to this important work,” says Petch.

PHOTO *HHS’ CREATE team is contributing to a project designed to provide health care to remote areas of Canada as well as astronauts in deep space.*

It’s exciting to be developing an innovation that could improve health care delivery in Canada’s north and for the next stage of space exploration.”

**TO LEARN MORE ABOUT COLLABORATIVE OPPORTUNITIES
WITH THE HAMILTON HEALTH SCIENCES INNOVATION TEAM,
CONTACT INNOVATION@HHSC.CA.**

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