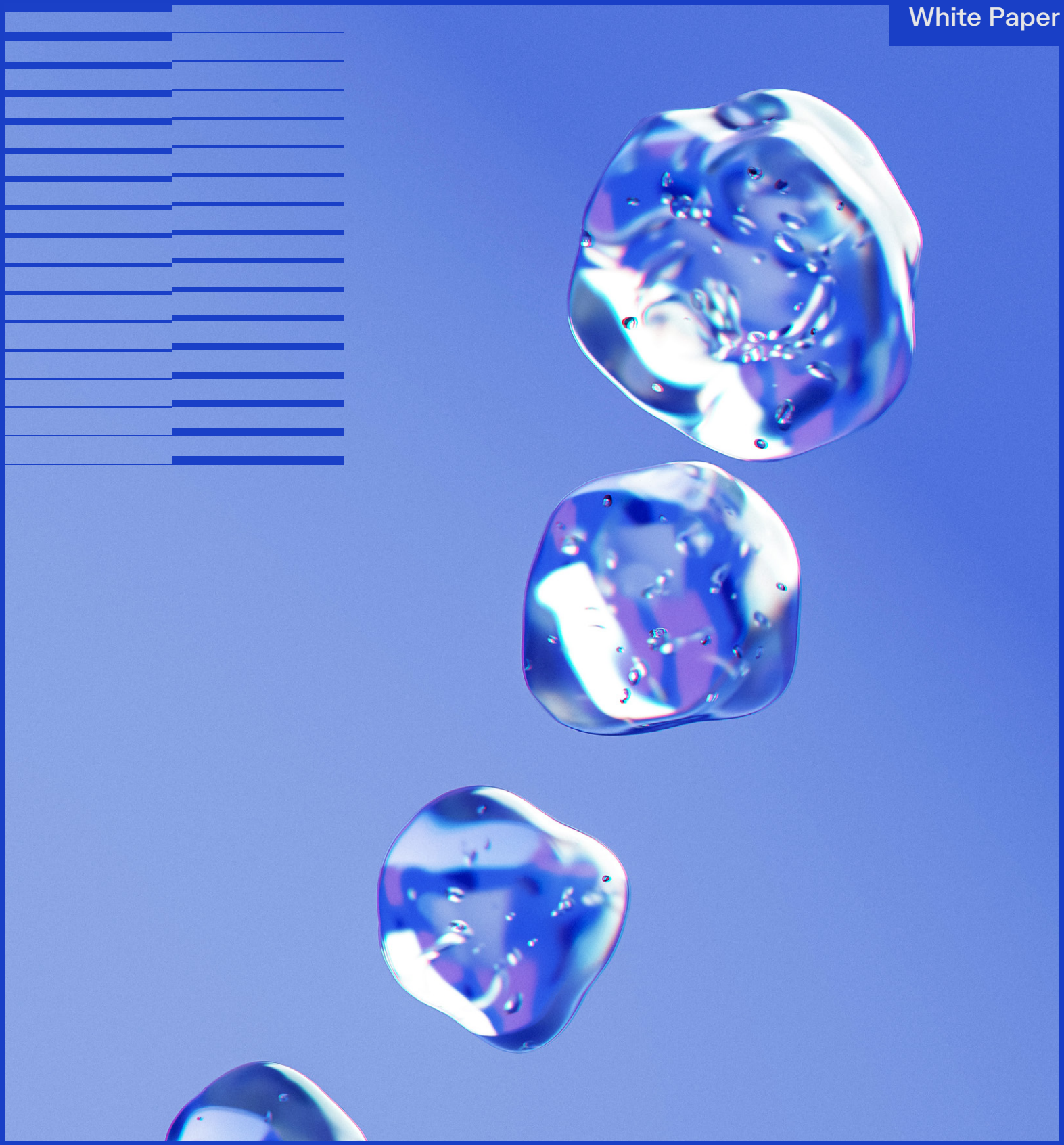
White Paper



AI for Healthcare

Leading Groundbreaking
AI Projects in the Healthcare Sector

SCALE AI

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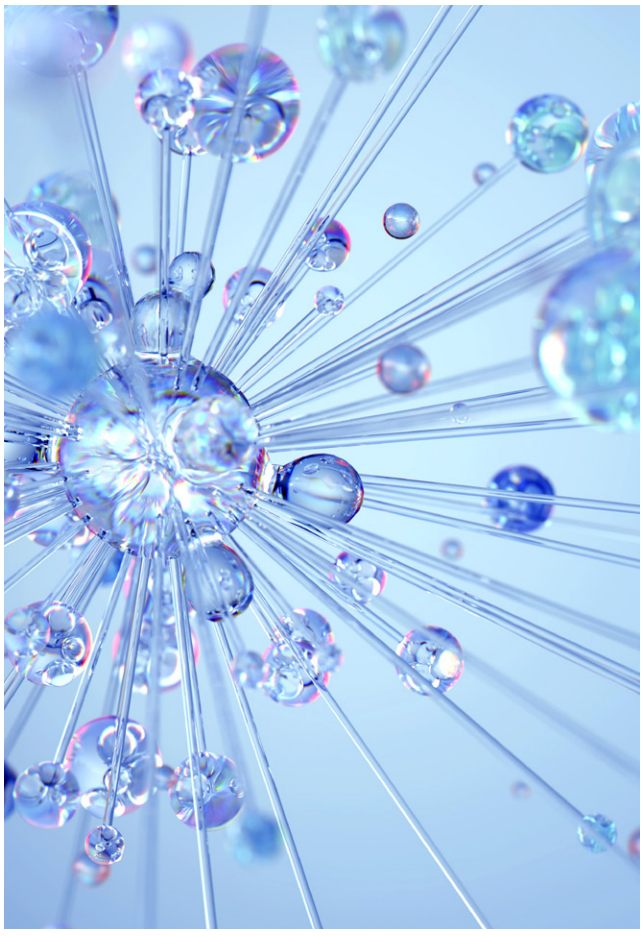
White paper written in collaboration with tech and business journalist Vawn Himmelsbach.

How AI is transforming healthcare in Canada

With support from Scale AI, Canada's AI Global Innovation Cluster, three Canadian healthcare providers are using artificial intelligence to optimize scheduling, reduce surgery backlogs and improve patient care.

The healthcare sector is facing a number of challenges, many of which have been exacerbated by the COVID-19 pandemic. Hospitals operate with tight budgets in Canada's publicly-funded provincial healthcare systems. But they're now facing capacity and labour shortages, at a time when they're also dealing with surgery backlogs created during the pandemic.



Scheduling the optimal type and number of surgeries based on hospital and ICU occupancy is critical, particularly given these limited resources. In some cases, ICU beds are left open due to inaccurate forecasting of bed use. In other cases, they're overbooked, and surgeons and hospital staff end up working overtime.

This isn't just an inconvenience. With cancer, a four-week delay in treatment can increase the risk of mortality by six to eight percent across seven types of cancer, according to research published in BMJ. For some radiotherapy and systemic indications, delaying treatment has even higher mortality rates, ranging from nine to 13 percent. For many diseases, like cancer, the earlier the diagnosis, the higher the chance that treatment will be effective.

The pandemic forced healthcare providers across Canada—and the world—to come up with solutions to maintain quality of care despite budgetary and staff constraints. One of those solutions is artificial intelligence. For example, AI models can take online scheduling to the next level with capacity planning and metrics forecasting, even giving hospitals the tools to prioritize patients at particularly high risk due to the progressive nature of their disease.

"With AI, we can empower the people who are already making those decisions, and we can add an extra month of surgeries—or more, depending on how the technology is used—to the schedule throughout the year," says Jack Klejka, vice-president of product at IVADO Labs, an AI solution provider with a mission to take advanced AI technologies out of the lab and apply

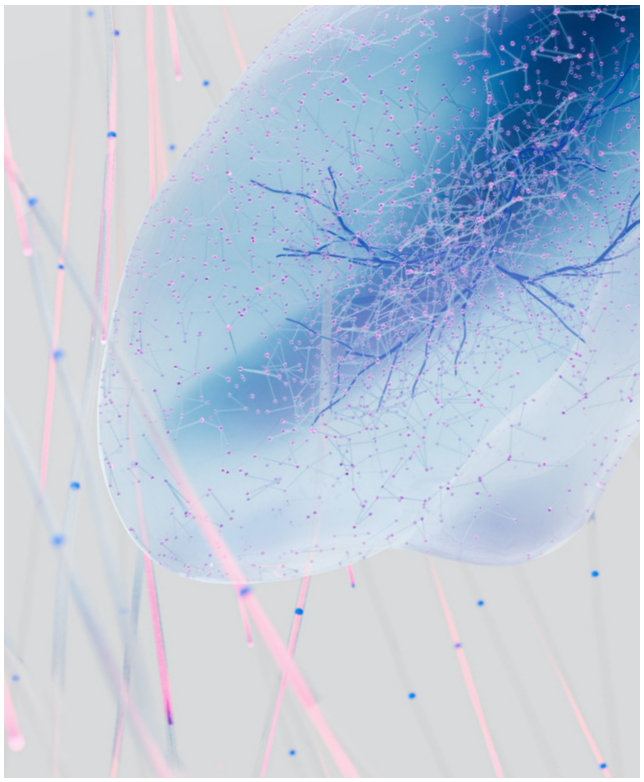
them in the real world. “But we need to get serious about it, invest the money in it, or we’re going to be buying products from companies that aren’t Canadian.”

Artificial intelligence, machine learning and natural language processing could all have a profound effect on the future of healthcare, from optimizing patient scheduling and automating manual tasks to reviewing medical records, reading radiology images, identifying medication errors, and even making clinical diagnoses. AI can also be used to detect diseases, including cancer, and help patients manage and monitor chronic conditions.

“AI has the potential to create new efficiencies in administrative processes and provide a precise and faster diagnosis and treatment plan for each patient, resulting in reduced length of stay, fewer subsequent readmissions, and reduced costs,” according to Deloitte Insights. It will also be a “critical engine behind analytics, insights, and the decision-making process.”

That’s why Scale AI, Canada’s AI Global Innovation Cluster, is working with dozens of partners like IVADO Labs to accelerate the rapid adoption and integration of AI in sectors like healthcare. These projects are helping to find efficiencies and optimize limited resources that can ultimately improve patient well-being and clinical outcomes.

Here’s how Scale AI and AI experts are helping three Canadian healthcare providers bring innovation to the forefront through AI.



“With AI, we can empower the people who are already making those decisions, and we can add an extra month of surgeries—or more, depending on how the technology is used—to the schedule throughout the year.”

→ Jack Klejka, Vice-President Product, IVADO Labs

CASE STUDY

Centre hospitalier de l'Université de Montréal (CHUM)

Project: AI-guided tool to maintain safety and quality of cancer treatment

At the CHUM, a decline in cancer screening during the pandemic lockdowns of 2020 created a surge of incoming diagnoses and, consequently, a treatment backlog. This situation further emphasized the need for scheduling efficiency—not only to deal with the backlog, but to be prepared for any similar scenarios in the future.

Because of the complexity of cancer trajectories, patients move through various disparate treatment silos. Aside from chemotherapy, treatment might also include radiation, surgery or other interventions. As a result of this complexity, the CHUM was seeking to augment its capabilities in forecasting to optimize chemotherapy schedules for all of its cancer care.

"Each of these individual silos is playing a very, very complicated game of Tetris—of assigning this resource to that resource to that patient—and making sure that ultimately we're using all resources as efficiently as we can and patients are treated as quickly as they can be," says André Diamant, CEO and founder of Gray Oncology Solutions, which optimizes oncology operations through AI-powered software.

THE SOLUTION

The CHUM, in partnership with Gray Oncology Solutions—supported by Scale AI—developed a solution that provides capacity planning, online scheduling and metrics forecasting, as well as an AI-guided action plan to help maintain the standard of patient care. The platform, called GrayOS, is directly integrated with the CHUM's existing software, allowing for the automated and optimized treatment scheduling of cancer patients.

"Deploying an AI project in the healthcare sector requires first to co-define the need with the industry partner, and internally with all stakeholders, and to seek support from the executive and transversal teams (project management, change management). Collaboration is key in using AI to transform the healthcare network."

→ Kathy Malas, Pôle Innovation & intelligence artificielle santé - Associate CEO, Executive Office, CHUM

The solution includes a patient flow simulator, which allows for the prediction of future patient flow based on historical data from the CHUM. From this, simulations can be performed that project how the clinic's operations would be affected by a change in capacity, and alternative scenarios can be simulated to discover the best strategy to handle various situations.

The platform also includes an AI-optimized "master schedule" for each treatment machine. Through a classification-and-regression tree algorithm, patient treatment times can be predicted prior to treatment, helping to ensure an optimal appointment assignment.

An online patient scheduling tool constantly assesses patient flow and finds the optimal starting date for each new arrival. This tool leverages the previous two components in order to model future patient flow and ensure that each patient's treatment time is accurately predicted.

Building on this success with the CHUM, the GrayOS solution has also been deployed in several hospitals in Quebec and Ontario following this project.

Key benefits:

- → A five percent increase in efficiency in the infusion clinic, which translates to about 11 hours of extra capacity per day to treat patients—without additional resources.
- → 5,000+ extra appointments facilitated by the optimization engine during the second wave of COVID-19, translating into $250K in saved costs.
- → An 80 percent reduction in administrative burden and higher staff satisfaction due to a reduction in mundane tasks, helping with staff burnout and turnover.

"We're starting in oncology, but the technology is by no means limited to oncology. The goal is to build these different modules for each sub-discipline, and then connect them all—so that all needs could be managed by one system. That's the 10-year plan on transforming how healthcare logistics are managed nationally; that's when we'll truly see transformative efficiency gains across the entire system."

→ André Diamant, CEO & Founder, Gray Oncology Solutions

CASE STUDY

Princess Margaret Cancer Centre (University Health Network)

Project: Optimization of radiation patients scheduling post-COVID-19 peak

The Princess Margaret Radiation Medicine Program (RMP) is Canada's largest radiation treatment (RT) provider and one of the world's leading radiation oncology departments. But the COVID-19 pandemic significantly reduced the number of patient referrals, leaving cancer centre with a massive patient backlog.

The timely delivery of radiation therapy is critical to cancer care, since delays are associated with detrimental oncological outcomes, psychological distress for patients and an increased economic burden (as a result of higher costs due to additional treatment required for more advanced stages). Because of the backlog, demand greatly exceeded capacity for this crucial cancer treatment.

At the Princess Margaret Cancer Centre, RT scheduling has traditionally been a complex task performed manually by a team of patient flow coordinators. They work with multiple systems that don't interact with each other or provide automated decision support. This reduces the efficiency of the scheduling process and its capacity to handle surges. The increase in complex, advanced-stage cancers was placing significant stress on resources and increasing the probability of bottlenecks for treatment.

"Even before the pandemic, one of our long-term goals was to automate this process. Our overall goal was to see if artificial intelligence could be used to automatically schedule patients and improve efficiency in the department—but to do it in a way that is best for patients and prioritizes the most urgent cases," says Dr. Srinivas Raman, radiation oncologist with the Princess Margaret Cancer Centre, who has an academic interest in applying AI to clinical workflows.

THE SOLUTION

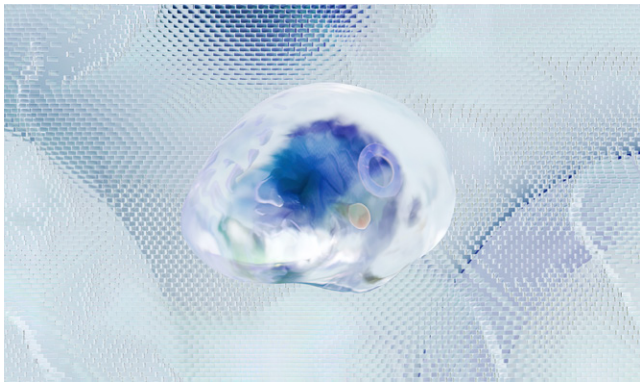
Thanks to funding from Scale AI, the Princess Margaret Cancer Centre worked in collaboration with IVADO Labs to develop an automated RT scheduling and prioritization platform that automatically assigns patients to CT-simulator and treatment appointments, incorporating patient preferences into scheduling for compassionate care. For example, some late-stage cancers may require immediate intervention.

The project spurred the creation of Princess Margaret's Advanced Analytics and Automation Working Group, which aims to facilitate and strategize the development and integration of AI solutions—which, in this case, involved facilitating the management of patient backlogs and treatment delays caused by the pandemic.

The solution provides recommendations to clinicians and prioritizes patients for immediate treatment in settings with a limited treatment capacity. The solution is also able to more easily accommodate patients' preferred schedules, which are factored into the optimization algorithm. This feature can help reduce the stress of cancer treatment to some extent. The improved process will enable a more personalized approach to decision-making based on data rather than consensus opinion. The plan is to fully roll out the solution by the end of the year.

Key benefits:

- → Decrease the mortality rate from delayed radiotherapy by up to 13 percent.
- → Improve capacity to account for patient schedule preferences.
- → Reduce scheduling time to seconds, providing more time for coordinators to support patients and complete complex tasks.
- → Equip the management team with a bird's eye view of patient needs and resource allocation to optimize the system's throughput.



"If we have a better, more efficient system of triaging patients and we're able to manage the workforce issue with AI, we can still deliver the same care even when there's increased demand. We need to build buffer capacity within healthcare to handle the next crisis or upsurge. This is a lesson that we learned from the COVID-19 pandemic and that we should be ready for."

→ Dr. Philip Wong, Radiation Oncologist, Princess Margaret Cancer Centre

CASE STUDY

McGill University Health Centre (MUHC)

Project: Adaptive optimization of surgery schedules post-COVID-19 peaks

The MUHC is one of two university health centres in Montréal, with five major hospital sites. Collectively, the MUHC has 36,000 patient admissions each year and performs more than 20,000 surgeries across the hospital network. Similar to other healthcare providers, the MUHC experienced a major disruption to its surgery scheduling during the pandemic, resulting in longer waiting lists for urgent, semi-urgent and elective surgeries.

The MUHC has three major surgery sites with one centralized scheduling centre. Beyond challenges caused by the pandemic, the previous manual allocation of patients had several shortcomings. Most notably, the manual approach did not account for uncertainty in the prediction of surgery duration or quantitatively assess the risk of cases and operating rooms running overtime, resulting in underbooked operating rooms, cancelled surgeries and overtime for surgeons and staff. The short horizon scheduling process also made it challenging to account for potential opportunities to optimize patient throughput.

The health centre was looking to increase patient throughput, tackle the large surgery backlog problem and maximize the utility of its operating rooms on a day-to-day basis. It was also looking to reduce the number of cancellations as a result of bed unavailability, reduce the number of patients in the ‘critical’ window for surgery, and reduce surgeon and staff overtime.

“We’re a tertiary and quaternary care hospital, which means we focus on specialized, highly complex surgeries and emergency interventions. This variation in the types of surgeries and surges in demand increase the uncertainty in the planning process. With current backlogs, we don’t want to leave the OR empty, but we don’t want to cancel surgeries and have staff work overtime,” says Dr David Buckeridge, Chief Digital Health Officer at MUHC.

THE SOLUTION

In addition to accurately predicting surgery duration, accounting for the uncertainty of, or variance in, surgery duration and the availability of post-operative hospital beds are important to optimize the throughput of operating rooms while minimizing the risk of overtime. With support from Scale AI, the MUHC collaborated with IVADO Labs to develop a predictive and prescriptive decision-support solution for the central operating room booking (CORB) team.

This scheduling system recommends a joint optimized schedule for all MUHC surgeons while leveraging statistical models to account for constraints, such as the availability of post-operative ward beds. The solution aims to go beyond planning a unique schedule for each surgeon in isolation for a set time period, and instead optimizes across all surgeons and services simultaneously, while accounting for shared resources, constraints and longer time horizons.

Initial implementations demonstrated that by accounting for the uncertainty in surgery duration, the joint scheduler could increase throughput by identifying opportunities to add more patients to existing schedules. This gain could result in hundreds of additional surgeries each year at the MUHC, and the evaluation of benefits continues. MUHC is also expecting higher staff satisfaction and mental health as a result of decreased overtime and better resource management.

Key benefits:

- → Joint scheduling identifies opportunities to perform hundreds of additional surgeries each year.
- → Awareness of uncertainty across multiple stages of surgical scheduling and operations allows the coordination of staff and other resources.
- → Prediction of post-operative ward bed availability supports discharge planning and enables patient flow modelling.
- → In the long term, it will systematically and sustainably increase the surgery output of the MUHC, while decreasing the health and economic burden of later-stage cancer patients as a result of delayed surgeries.

"We had never done a project like this before. We don't have expertise in AI or machine learning, or optimization. So it was really helpful to work with partners who could bring that expertise to the table—and also bring a perspective outside of healthcare."

→ Dr. David Buckeridge, Chief Digital Health Officer, MUHC

6 key insights for successful AI projects

These three projects serve as a starting point for further AI innovation—and other clinics and hospitals can adopt similar methodologies to overcome similar challenges.

Here are key insights for healthcare providers looking to roll out a successful AI project:

01

Build a foundation

Build a solid, high-quality dataset and data infrastructure to ensure there is a solid groundwork to build the AI solution.

02

Start small and scale

AI projects are often derailed when they're too broad in scope or not seen as addressing real problems. Start with a specific use case or 'low-hanging fruit' to earn quick wins and generate quick value for patients, workers and the organization to gain support from business leaders and stakeholders.

03

Access the AI ecosystem

The success of an AI project is dependent on access to technology and talent. Most organizations don't have in-house AI expertise, but partners and networks can help to fill in the gaps.

04

Solicit input

It's critical to engage clinical and non-clinical staff when building out solutions to understand—from the perspective of multiple types of users—the problem and underlying process you're attempting to improve with AI. Broad engagement is needed prior to and throughout the project, and underinvesting in this type of engagement increases risks for the entire project.

05

Train super users

Create 'champions' who will get excited about the technology, aren't afraid of change and see the value in what you're doing. They will be the ones who will talk to their co-workers on coffee breaks and inspire them to embrace change. Facilitators within the organization that enhance interdisciplinary and intersectoral interactions also play an important role in AI projects for the healthcare sector.

06

Seek external funding

AI projects are expensive, particularly given the current economic climate. A partner like Scale AI can provide financial and peer support for R&D and innovative projects reliant on specialized AI talent and computing resources. Working with a partner can also make procurement possible in a matter of months as opposed to years.

Scale AI's Role in Supporting AI Projects for the Transformation of Canadian Healthcare

In addition to helping to fund your AI project to derisk it, Scale AI also has the crucial in-house expertise needed to help your organization navigate and accelerate AI adoption.

Scale AI can help your organization to:

- → Build strong relationships with partners experienced in the areas that interest you
- → Leverage its experience from past projects to help scope and structure your project to ensure the best chance for success
- → Fast-track the adoption of your AI solution

About Scale AI

Scale AI is a Global Innovation Cluster created to advance the Canadian AI innovation ecosystem. Acting as an investment and innovation hub across Canada, Scale AI accelerates the rapid adoption and integration of artificial intelligence and contributes to developing a world-class Canadian AI ecosystem.

Based in Montréal and funded by the federal government, Scale AI works with more than 500 industry partners, research institutes and other players in the field of AI.

Scale AI supports investments in companies—including hospitals—across Canada to implement real-world applications of AI to encourage the emergence of future Canadian flagships in the AI sector, all while facilitating the development of a highly skilled workforce.

$500M	**Investments committed**
100	**Projects supported**
520	**Partners Involved**
$5.2G	**Direct value generated**

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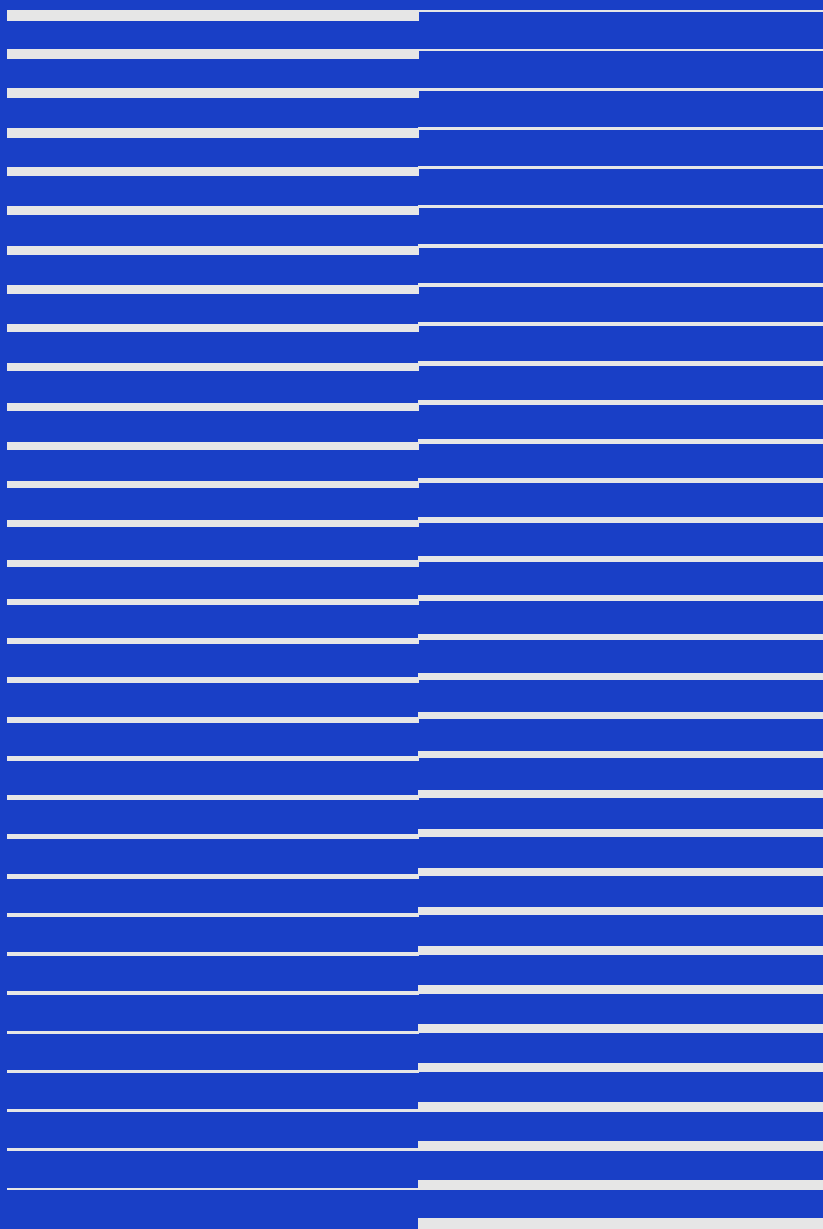

Reach Out ↓

For any question regarding project submissions: info@scaleai.ca

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