ADVANCING RESEARCH TOGETHER

Hamilton Health Sciences Research

2023-24 Research Impact Report

Welcome

More than ever, research is critical to advancing the range and quality of health care we provide to patients in our community and beyond.

Hamilton Health Sciences (HHS) is a leading academic health science institution, and the only hospital in Ontario that cares for all ages, from pre-birth to end-of-life. Our cadre of world-class researchers, clinician-scientists, research staff and learners work in labs and at patients' bedsides, collaborating with the wider community to improve health outcomes for patients locally, nationally and globally.

We are pleased to introduce HHS' 2023-24 Research Impact Report, a summary highlighting some of the remarkable discoveries and achievements by HHS researchers including those connected to the Escarpment Cancer Research Institute (ECRI), the Population Health Research Institute (PHRI), Offord Centre for Child Studies, the Thrombosis & Atherosclerosis Research Institute (TaARI) and Geras Centre for Aging Research.

This report provides insight into the direction HHS is taking to advance our research, so that even more people benefit from new, cutting-edge treatments and cures. In the year ahead, we will launch a renewed strategic plan and vision for HHS research aimed at advancing our position as a nationally-leading academic health sciences institution. The plan will build upon our existing strengths and relationships and outline the steps we'll take to advance our hospital's ultimate vision of providing the *Best Care for All.*

Tracey MacArthur
President & CEO

Dr. Marc Jeschke
Vice President, Research &
Chief Scientific Officer

1 of Canada's **Top 10 Research Hospitals** for over 10 years

RESEARCH SPENDING IN 2022

$133 million

RESEARCH PUBLICATIONS ANNUALLY

1,200 +

ACTIVE RESEARCH STUDIES

2,000 +

CLINICAL TRIAL PARTICIPANTS

10,541

TOTAL RESEARCH STAFF

2,243

RESEARCH SPACE

250,000 sq ft

GLOBAL HOST SITES CONDUCTING HHS RESEARCH TRIALS

1,600

CATALOGUED TISSUE SAMPLES IN CANADA'S LARGEST BIOBANK

3,200,000

HHS researcher leads uniquely Canadian blood cancer study

"This trial has the potential to change the standard-of-care treatment in older adults with multiple myeloma not only in Canada but around the world." – **Dr. Hira Mian**

Hamilton Health Sciences (HHS) hematology oncologist Dr. Hira Mian believes Canada has the potential to become an international leader in research into the treatment of multiple myeloma.

A large national clinical trial backed by $4 million in funding, which Mian is leading as the national study chair, could be the first step towards making this vision a reality. The MY13 trial is looking at whether monthly treatments of the medication daratumumab can be cut from five years to 18 months with the same medical benefits but improved quality of life and fewer side effects for older patients. Mian's study has the potential to both improve patients' quality of life and save the Canadian health-care system millions of dollars since daratumumab is a costly, publicly-funded drug. It's taking place at 30 sites across Canada, with 559 patients over the age of 70 taking part over the next four years. This will include 80 patients from HHS Juravinski Hospital and Cancer Centre (JHCC).

"This study positions Canada to become a major force in multiple myeloma research," says Dr. Marc Jeschke, vice president of research and chief scientific officer, HHS.

Mian received funding from the Canadian Institutes of Health Research (CIHR) grant competition and Myeloma Canada, a non-profit organization for people living with multiple myeloma. This trial will be conducted by the national Canadian Cancer Trials Group (CCTG).

"Multiple myeloma is a rare cancer, so it's wonderful to get this level of funding," says Mian, who is also a scientist with **The Escarpment Cancer Research Institute (ECRI)**, a joint institute of HHS and McMaster University.

Multiple myeloma patients receive constant treatment for the rest of their lives, and this can last for years. "It's a quality of life issue," says Mian, who divides her time between researching multiple myeloma and caring for patients at JHCC. "Throughout their whole disease course they're constantly being treated with IV or injections in a hospital setting."

Many other countries don't publicly fund the drug combination in this study, which puts Canada in a fairly unique position to run a large trial, adds Mian.

"We're able to answer some of these bigger-picture research questions into multiple myeloma because of our health-care system and our population. The question posed in this study, about reducing daratumumab to 18 months, could likely only be answered in Canada."

Read more about Dr. Mian's work at hamiltonhealthsciences.ca/share

Research on genetic heart condition could save young lives

"If there was a drug that could prevent the onset of ARVC, then patients may not need the implantable cardiac defibrillator." **– Dr. Jason Roberts**

Leading-edge research by Dr. Jason Roberts, a Hamilton Health Sciences (HHS) cardiac electrophysiologist, has the potential to revolutionize care for patients impacted by arrhythmogenic right ventricular cardiomyopathy (ARVC), a potentially fatal genetic condition affecting the heart's muscle tissue.

ARVC often presents itself in young adults. It can cause dangerously fast heartbeats that can result in fainting and even sudden death, especially in young athletes since exercise worsens the condition.

Currently, the standard treatment is to insert an implantable cardiac defibrillator into the heart, which can deliver shocks when these dangerously fast heartbeats occur. These shocks can be quite frequent and painful, plus they don't prevent damage to muscle tissue caused by the disease.

As a result, people with ARVC must limit physical activity, which can cause other health issues, especially as they age. Through their research, Roberts and his team at the **Population Health Research Institute (PHRI)** of HHS and McMaster University are working to find a more effective treatment option. Patients may not need the implantable cardiac defibrillator if there was a drug that could prevent the onset of ARVC.

Research involving Roberts' team has found that a small molecule called tideglusib was successful at preventing dangerously fast heartbeats and heart muscle damage caused by ARVC in mice. This molecule has already been developed into a drug for another purpose. While it turned out not to be effective for that purpose, it was proven to be safe for human use and is now being tested for treating muscle disorders in people.

Roberts saw the opportunity to try this drug for ARVC patients.

"Since our team has found that the tideglusib molecule prevented ARVC in mice, it now makes sense to see if this drug can prevent ARVC in people," he says. Thanks to funding from the HHS Foundation and Canadian Institutes of Health Research, Roberts and his team are conducting a national clinical trial with this drug.

Read more about Dr. Roberts' work at hamiltonhealthsciences.ca/share

When blood thinners fail: Researching a new treatment for sepsis

"If the sickest patients are likely to have the most blood clots, and blood thinners aren't working at this stage, the drug we're testing might be the answer." **– Dr. Patricia Liaw**

"When it comes to sepsis, the ultimate goal is to select the right treatment, at the right time, for the right patient," says Dr. Patricia Liaw, a scientist at the **Thrombosis & Atherosclerosis Research Institute (TaARI)** of Hamilton Health Sciences (HHS) and McMaster University. "There is no one-size-fits all treatment so it's important to find alternative options that are effective for different types of sepsis patients."

Liaw focuses on immunothrombosis – the process by which immune cells contribute to blood clotting in the presence of a severe infection. She's exploring a new treatment for patients with sepsis and is working closely with Dr. Alison Fox-Robichaud, an HHS critical care physician and national sepsis expert to ensure her lab work translates well into a clinical setting.

Immune cells called neutrophils respond to severe infections by releasing DNA into the blood stream, forming sticky web-like structures that can help trap and kill microorganisms. But they can also attach to blood cells, forming clots. Since clots limit or block blood flow, this affects the supply of oxygen and nutrients to the body, resulting in tissue damage, organ failure and death.

Research by Liaw and her team has shown that some patients with severe sepsis have very high levels of circulating DNA in their blood, presumably released when the neutrophis encounter the infection. So the team conducted a multi-center study of 400 patients in the intensive care unit with sepsis and found that patients with high levels of DNA in their blood have the poorest outcomes.

Liaw wondered if stopping the DNA from creating blood clots could be a solution, and found a drug that can do just that.

"We're working on a Phase I clinical trial with a drug that breaks the connection between the sticky DNA structures and the blood cells, which essentially breaks down the blood clots," says Liaw.

In early testing, they found the DNA-digesting drug to be most effective when sepsis is in advanced stages. These preliminary findings are what make her clinical trial promising. If this Phase 1 study has a successful outcome, the team will move on to a larger-scale study to determine if the drug is effective.

Liaw strongly believes in ensuring there's a two-way bridge connecting lab-based research with applications that benefit patients. If this drug proves to be effective, she and her research team will continue to work to make it available to clinical teams at HHS. She's hopeful that this treatment can help patients with life-threatening cases of sepsis locally and globally.

Read more about Dr. Liaw's work at hamiltonhealthsciences.ca/share

Study aims to help older adults age in place

"Through exercise programs like the one developed for this study, we may be able to help older adults live safely at home instead of entering long-term care."
– Dr. George Ioannidis

Pam and Dave Edgcumbe's plans for their golden years include living independently in their Binbrook home for as long as possible.

Staying healthy is key to making that goal a reality, says Pam, 73. For Dave, also in his 70s, this includes morning workouts seven days a week at the YMCA. For Pam, it means improving her fitness level and finding more time for regular exercise. So when Pam learned about the OPTIMAL Fitness study, developed by the **Geras Centre for Aging Research**, in partnership with the YMCA and Upper James Physio, she was quick to sign up. Geras is a part of Hamilton Health Sciences (HHS) and is affiliated with McMaster University.

The study is funded by the Canadian Institutes of Health Research and Hamilton Academic Health Sciences Organization, and consists of 10 four-month sessions taking place over the next two years.

As older adults age, they may notice that it's harder to do everyday tasks like getting dressed, climbing stairs or picking up laundry baskets, says Dr. Alexandra Papaioannou, the study's lead, and executive director of Geras. "But frailty and mobility challenges are often reversible, which is why this study is so potentially impactful for supporting older adults who want to age in place."

In Canada, 1.2 million people are over the age of 65 and living with frailty or mobility challenges, adds Dr. George Ioannidis, deputy director for Geras. "It's never too late to start making positive changes."

Study participants are divided into three groups: a control group and two other groups receiving different levels of additional exercise and nutritional support.

"We're comparing these three groups to see which one does the best in terms of improving mobility and reducing frailty," says Ioannidis. When the study wraps up in two years, it will have involved 324 people in total.

Pam was concerned about falls before joining the study but feels much more confident now. "The classes really helped me to improve my balance," she says. "My energy level is much higher too."

Read more about Dr. Ioannidis's work at hamiltonhealthsciences.ca/share

Social work research benefits both children and parents

"Our goal as researchers is to improve the lives of children and adolescents who experience mental health challenges and violence, as well as the lives of the people that love them and those that care for them." – **Dr. Melissa Kimber**

Dr. Melissa Kimber's research focuses on children, youth and families in relation to mental health and family violence. The Hamilton Health Sciences (HHS) researcher received HHS New Investigator Funding in support of the Fostering Child and Adolescent Resilience through Emotion (CARE) Project.

This two-year study is looking at the feasibility of introducing emotion-focused family therapy for caregivers of children who are experiencing emotional and behavioural challenges, who are in contact with a child welfare agency. Kimber is the study's principal investigator, an assistant professor at McMaster University and a lead researcher at the **Offord Centre for Child Studies**, which is affiliated with HHS' McMaster Children's Hospital (MCH) and McMaster University.

Emotion-focused family therapy, offered at MCH, provides group and one-on-one training to parents and caregivers so they can process their own emotions about their child's challenges or illnesses, and also learn skills to help their child cope.

Kimber's work also includes the RISE (Researching the Impact of Service Provider Education) research project, which she co-leads. Funded by the Public Health Agency of Canada, RISE researchers look at ways to improve the encounters between health-care and social-service providers and the children, youth and families they serve, including MCH patients and their families.

"We're developing guidance around how to address family violence concerns safely and effectively with children, youth and families," says Kimber. This work also includes evaluating resources for health-care and social-service providers to see if they're having an impact on children and youth and their families by improving outcomes and helping them feel more respected and safe in their encounters in the health-care and social services systems.

Looking ahead, Kimber welcomes opportunities to collaborate further with the wider research community. "This includes hearing from even more children, youth and families who receive care at MCH and in the community," she says.

Hospitals, including MCH, have advisory councils where patients and their families provide input into their hospital experience, with the goal of improving patient care. "Their input is extremely important, and involving even more children, youth, parents and caregivers will help improve research," she says.

Read more about Dr. Kimber's work at hamiltonhealthsciences.ca/share

A passion for research addressing unmet social needs

"Childhood obesity can lead to significant complications into adulthood, such as developing diabetes or high blood pressure, which may increase risk for heart disease or stroke." **– Dr. Gita Wahi**

The risk of obesity is one of the greatest public health concerns regarding young people, says Dr. Gita Wahi, a Hamilton Health Sciences (HHS) pediatrician and researcher at our **McMaster Children's Hospital** (MCH) Children's Exercise & Nutrition Centre (CENC). Wahi is also the associate chair of research in the department of pediatrics at McMaster University.

"We know that children from lower socio-economic neighbourhoods often have a higher risk of obesity," says Wahi, whose research focuses on health promotion and health equity, including identifying and addressing unmet social needs of children and families.

Challenges faced by many families include access to healthy food, and having enough of it, says Wahi, pointing to two recent MCH pilot studies she was involved in that supported patients and their families facing socio-economic challenges. Both studies were funded by the HHS Foundation.

One of the studies focused on patients and families visiting MCH's emergency department (ED). These families were invited to complete a survey screening for food insecurity, along with health and demographic information. A startling 26 per cent identified as experiencing food insecurity.

This informed the creation of a food pantry program at the hospital. This food bank-type program is available for patients and their families visiting the Pediatric ED and CENC.

The second study, which Wahi leads, involved 80 families from CENC who took part in screening to identify socio-economic factors affecting them, such as low income levels, housing challenges and food insecurity.

This study found that 50 per cent of participants had unmet social needs, mostly involving food insecurity and low income. Families were offered the services of a navigator to connect them to community supports aimed at meeting their needs.

Participants were invited to provide feedback about their experiences with the study, including whether they found the navigator support helpful. So far, feedback has been positive, says Wahi, adding that findings could lead to a larger-scale study.

Read more about Dr. Wahi's work at hamiltonhealthsciences.ca/share

Pregnant bellies: A crystal ball for long-term health outcomes

"Everything is interconnected, so a child's health into adulthood starts with the pregnant person." – **Dr. Jon Barrett**

Did you know that the cause of diabetes in a middle-aged person probably originated while they were inside their mother's womb? Research shows that if a pregnant person has gestational diabetes, their child is five times more likely to be diagnosed with diabetes decades later, at age 40 or older.

And what about the pregnant person who gets high blood pressure while carrying? That parent is four times more likely to experience a heart attack at age 50.

These are just two examples of why it's vital for researchers specializing in pregnancy, childbirth, and children's health to consider the whole patient across their lifespan, says Dr. Jon Barrett, a Hamilton Health Sciences (HHS) obstetrician and researcher, and a world-leading expert in high-risk pregnancies.

It's a major shift from the current practice in Canada and worldwide of focusing on ages and stages without a broad and in-depth look into how they're all connected, and the long-term impacts that those connections may have on a person's health over their lifetime.

"The health of the pregnant person affects the child after they're born and has a significant impact on that child's lifelong health," says Barrett, the head of McMaster University's department of obstetrics and gynecology, and the F.L. Johnson Chair in women's reproductive health research. He also cares for high-risk pregnant patients directly, as an obstetrician at HHS' **McMaster University Medical Centre** and St. Joseph's Healthcare Hamilton. "Yet worldwide, research into what makes healthy children isn't integrated with what makes healthy mothers."

Improved collaboration among the research community could help change this for the better, says Barrett, adding that Hamilton's research community is already extremely supportive of each other and welcomes opportunities to work even more closely together.

Read more about Dr. Barrett's work at hamiltonhealthsciences.ca/share

Finding ways to help older adults recover from burn injuries

"This is the beginning of a new era for care in Hamilton and an opportunity to conduct state-of-the-art research and science to improve the lives of patients." **– Dr. Marc Jeschke**

While significant advancements in burn care have occurred across North America over the past decade, there is still one patient population that hasn't experienced improvements –older adults.

Hamilton Health Sciences' (HHS) new burn research lab is working to understand why older adult burn patients continue to experience poor outcomes.

"As the fastest growing population it's concerning that effects of burn injury and even death as a result of burns has remained the same in older adults for the past three decades," says Dalia Barayan, a post-doctoral fellow working in the burn research lab at HHS. "On top of that, survival rates for older adults with large burns are much lower than other age demographics."

Factors related to aging make older adults more susceptible to burn injuries such as thinning skin, decreased sensation and deterioration of judgement and coordination. However, it's currently unknown why older adults haven't benefited from the ongoing improvements in burn care.

"If we can find out why older adult burn patients continue to have poor outcomes, then we can start working on new treatments to help these patients," she says.

One research project Barayan is working on, under the guidance of Dr. Marc Jeschke, HHS medical director of burns, is a newly launched three-year clinical trial to determine if the hypoglycemic drug metformin can safely and effectively improve outcomes in older adult burn patients.

In summer 2022, Jeschke moved his lab and team from Toronto to Hamilton to help rebuild the burn program at HHS. The regional burn program is located at HHS' Hamilton General Hospital.

Hyperglycemia, or high blood sugar, commonly occurs in patients suffering from major burns and other trauma or major medical events. It's identified as stress-induced hyperglycemia and can contribute to complications during recovery and even death. To maintain proper blood sugar levels, the standard of care is to provide the patient with insulin infusions, before they become hyperglycemic.

Metformin is a drug that works similarly to insulin. It has been proven to be one of the safest treatments for those with type 2 diabetes, as their bodies don't regulate blood sugar levels properly and they're also susceptible to hyperglycemia. It has become the most prescribed diabetes medication in North America.

Barayan and the burn research team previously conducted a preliminary trial showing that metformin was safe and effective at treating hyperglycemia in older adult burn patients. Since older adult burn patients have a greater occurrence of pre-existing diabetes, which leads to worse outcomes after a trauma, the team is optimistic about the continued investigation of the drug in this patient population.

Col. Chris Hadfield
25 March at 07:45 • Hamilton

These good people saved my Dad's life, his legs, and his quality of living. He's now healthy and whole, about to celebrate his 90th birthday. Enormous eternal thanks for your world class skills, professionalism and kindness, everyone at the Hamilton Health Sciences Burn Unit.

Read more about burn research at hamiltonhealthsciences.ca/share

DRIVE's Spark grants support HHS research and innovation

"I had always been interested in surgery so it really excited me to have the opportunity to watch a surgery remotely." **– Amna Ismaili, McMaster medical student**

Vivo Surgery is a cloud-based platform offering a live, interactive, high-definition, multi-view video display from Hamilton Health Sciences (HHS) operating rooms to more than 30 remote locations worldwide, delivering a secure livestream experience with no lag time.

The concept was developed at the beginning of the pandemic by HHS neurosurgeon Dr. Aleksa Cenic to give McMaster University medical students opportunities to view HHS surgeries in real time because they weren't permitted in operating rooms. Today, Vivo Surgery is used internationally to demonstrate leading-edge techniques by HHS surgeons.

Cenic and Vivo Surgery received a 2023 DRIVE Spark funding grant to support and promote innovation and commercialization efforts within our hospital community. Also receiving a 2023 grant was Dr. Catherine Demers, founder of Corlibra, which aims to empower people living with heart failure by revolutionizing in-home disease management. Demers is an HHS cardiologist and a McMaster University professor.

HHS DRIVE/Spark funding

DRIVE – which stands for Dare, Research, Innovate, VenturE – was launched in 2023 to cultivate the development of HHS' research and innovation into medical technologies and solutions. Two Spark winners are chosen annually.

Read more about DRIVE/Spark funding at hamiltonhealthsciences.ca/share

HHS Foundation supports leading-edge research

"Our donors believe in the power of discovery to transform lives."
– Anissa Hilborn, HHS Foundation CEO

The Hamilton Health Sciences (HHS) Foundation recognized three junior researchers and three intermediate researchers at the HHS Foundation Gala on March 2, 2024 with $25,000 each to take their innovative research projects to the next level:

Dr. Jenna Dowhaniuk is leading a project aimed at transforming the tracking and management of pediatric celiac disease.

Dr. Mathew Leonardi is pioneering a transformative approach to diagnosing endometriosis, a condition traditionally confirmed only through invasive surgery.

Dr. Amanda Sim is at the forefront of addressing the critical mental health needs of newcomer children and families in Canada.

Dr. Rahul Chanclani leads groundbreaking research addressing the underdiagnosis of pediatric hypertension in Canada.

Dr. Michael Livingston spearheads vital research on acute appendicitis, the leading cause of emergency surgery in children.

Dr. Deborah Sloboda is heading up a research project exploring the changes in the gut microbiome during pregnancy and its potential impacts on maternal and infant health.

"Their innovative, leading-edge work exemplifies the top-tier talent in our research community," says Dr. Marc Jeschke, vice president of research and chief scientific officer, HHS.

Read more about the Foundation's gala at hamiltonhealthsciences.ca/share

Building Bridges: Celebrating leading-edge research and innovation

"We're a strong academic health sciences centre and research is an absolute cornerstone of what we do." **– Tracey MacArthur, HHS President and CEO**

Research, innovation and collaboration were celebrated by over 360 members of the Hamilton Health Sciences (HHS) research community at the 2024 HHS Research Building Bridges Symposium. This was the event's second year, with the number of attendees almost doubling from 2023.

Participants ran the gamut, from world-renowned HHS researchers to students intending to launch careers in the field.

Anissa Hilborn, chief executive officer of the HHS Foundation, shared the essential role that fundraising plays in helping to advance HHS research. "Our donors believe in the power of discovery to transform lives," said Hilborn, adding that the HHS Foundation has contributed millions of dollars to HHS research and is "incredibly proud" to support research as a hospital priority. "Research is not just about discovery. It's about translating knowledge into tangible benefits for patients and communities."

Read more about Building Bridges at hamiltonhealthsciences.ca/share

Discovery Days: Inspiring the next generation

"The doctors doing this work have so much knowledge. It's so inspiring."
– Addison Hrstic, high school student

Close to 200 students from 43 Ontario high schools attended the annual Canadian Medical Hall of Fame's Discovery Days symposium at the Hamilton Health Sciences (HHS)' McMaster University Medical Centre to learn more about potential career paths in medicine, health sciences and research.

The London-based Canadian Medical Hall of Fame honours excellence in health sciences and medicine, and its Discovery Days are one-day events held across Canada to give secondary school students opportunities to explore career options. This program is delivered in partnership with universities, hospitals and research institutions, and the Hamilton event was hosted by our HHS research team and McMaster University.

The symposium was open to students in Grades 10 to 12, who were selected by their schools based on their interest in medicine, health sciences and research careers. It featured 14 workshops led by researchers, doctors, staff, instructors and learners from HHS and McMaster, and included interactive experiences for participants.

Read more about Discovery Days at hamiltonhealthsciences.ca/share

HHS Research Leadership

Dr. Marc Jeschke,
Vice President, Research and Chief Scientific Officer

Dr. Ted Scott,
Vice President, Innovation and Partnerships

Dr. Hertzel Gerstein,
Deputy Director, Population Health Research Institute (PHRI)

Dr. Greg Pond,
Director, Escarpment Cancer Research Institute (ECRI)

Dr. Jeffrey Weitz,
Executive Director, Thrombosis & Atherosclerosis Research Institute (TaARI)

Dr. Stelios Georgiades,
Director, OFFORD Centre for Child Studies (Offord)

Dr. Alexandra Papaioannou,
Executive Director, GERAS Research Institute (GERAS)

Dr. Guillaume Pare,
Director, Clinical Research Laboratory and Biobank (CRLB)

Dr. Sheila Singh,
Director, Centre for Discovery in Cancer Research (CDCR)

Dr. Angelo Mikrogianakis,
Chief and Chair, Pediatrics

Dr. Jon Barrett,
Chair, Department of Obstetrics and Gynecology, McMaster University

Katie Porter,
Director, Research Administration

Anthony Scandinavo,
Director, Research Finance

Hamilton Health Sciences Research

hamiltonhealthsciences.ca/research