NORTHERN HEALTH RESEARCH

SEPTEMBER 2019

Detecting Northern Human Health Hazards

New Emergency Medicine Research Network

Building A Community Of Medical Education Research



Northern Ontario School of Medicine

École de médecine du Nord de l'Ontario

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WELCOME TO THE SCOPE

Scope can be defined as: the range of one's perceptions, thoughts, or actions; the geographical or perceived area covered by a given activity; or, a viewing instrument such as a microscope or telescope. In most modern usages of the word scope, there is a unifying theme of examination or investigation. In this case, Scope includes all of these ideas. Research at the Northern Ontario School of Medicine (NOSM) is reflective of the School's mandate to be socially accountable to the diversity of Northern Ontario.

For years, Canadian health research took place primarily in large cities. This meant that there were many health questions that were going unanswered in Northern Ontario, including questions about the incidence of chronic disease, outcomes for patients with mental illness and how work in industries such as mining or forestry affect one's health. Also left unanswered were specific questions about the health of Francophone and Indigenous communities in the North, two groups that have historically not been well-represented in health research.

The subjects being studied are as varied as the geographic area of NOSM's wider campus of Northern Ontario and as diverse as the researchers themselves: faculty members in the School's Human, Medical, and Clinical Sciences Divisions, residents, medical students, a broad range of health-professional learners and collaborators who conduct leading-edge health research not just in the lab, but in communities, hospitals, health clinics and administrative offices across the region. Since 2003, NOSM faculty members have published more than 2,340 scholarly articles which aim to answer questions that will have a positive impact on the health of Northern Ontarians.

Although this publication cannot provide the full scope of exciting research happening across Northern Ontario, we hope it provides a glimpse into some of the work being done with a view of improving the health of people in Northern Ontario and beyond.

The Scope Research Newsletter of the Northern Ontario School of Medicine

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WELCOME TO THE SCOPE

A Message from Dr. Sarita Verma, Dean, President and CEO, NOSM



True innovation is built on evidence-based, bestpractice research. It is what leads us to uniquely Northern solutions.

The Northern Ontario School of Medicine's (NOSM) research agenda has evolved as the School has grown

and is shaped by regional and affiliated researchers. Their collective focus is to conduct studies that are relevant and meaningful to partner communities in the North, informing front-line care.

This issue of The Scope marks an important milestone and a personal first for me since becoming the Dean, President and CEO of the Northern Ontario School of Medicine. In this issue, we highlight a few projects taking place across the region, specifically Dr. Greg Ross' research showcasing his exciting work focusing on blue-green algae and high-tech sensors that also track and predict wildfires and, we hear from two new up-and-coming research groups who are organizing themselves into dynamic collectives.

I'm personally looking forward to new opportunities to contribute, collaborate and connect to our growing research agenda at the Northern Health Research Conference. Let's put our heads together and be strategic about the healthy and strong future of Northern research.

Sincerely, Dr. Sarita Verma

A Message from Dr. Penny Moody-Corbett Associate Dean of Research



Dr. Penny Moody-Corbett

The very purpose of research is to drive change. We correct and refine our approaches based on new discoveries and big questions. The scientific truths we uncover lead us to better, evidencebased courses of action and treatment.

There would be no research at the School without the support and endorsement of School leaders, Dr. Sarita Verma, Dean, President and CEO, and pioneers like Founding Dean Emeritus Dr. Roger Strasser and former Associate Dean, Research, Dr. Greg Ross. Together, we have worked to advance NOSM's research agenda.

From the beginning, Dr. Strasser has always been a huge supporter of research. He valued its importance and initiated the graduate tracking study from the outset. We are the only medical school that I know of that has data on all of our medical students since the very first class. As well, Dr. Strasser has been a leader in the Northern Periphery and Arctic Programme, the Recruit and Retain Project - Making it Work - a seven-year project involving five countries and funded through the European Union. Also, he trained graduate students which led to an instrumental graduate program to provide MDs with the skills to conduct research. Dr. Strasser, we thank you for setting the pace.

With a new academic year upon us, I am happy to extend a warm welcome to Dr. Sarita Verma. She is a great supporter of research and leveraging new discoveries to transform frontline care. There is much opportunity ahead.

As my term as Senior Associate Dean and Associate Dean, Research wraps up, I wish to thank everyone for their impact and dedication to research across the North. I look forward to hearing about your ongoing discoveries.

Here's to good health and research, Dr. Penny Moody-Corbett



DETECTING HUMAN HEALTH HAZARDS IN THE NORTH

Imagine a hazardous blue-green algae is blooming in the lake at your favourite beach. The time it currently takes to test the water (and in some cases, close a beach) is several days, or up to a week.

Enter Dr. Greg Ross and his research team. They study when the conditions for blue-green algae are high, and they've created a sensor that is used in aerial photography that can detect the growth and movement of a harmful bloom. What's also impressive is that they can then transmit their lake analysis directly to health authorities in minutes, flagging potential health hazards with speed and accuracy.

"With this technology we've developed, you can be sitting at your computer in Thunder Bay and I can get this data to you only minutes after we've got onto the aircraft and are in the air capturing it," says Ross, MAG Aerospace Chair in Environment and Health Surveillance at NOSM, Professor, researcher and Vice-President, Academic and Research Impact at Health Sciences North in Sudbury.

The sensors can do the same to detect high-risk conditions for forest fires: "We can use the same technology to predict whether a forest fire is likely to happen, if the conditions are correct for a lightning strike to ignite it, and for tracking fires," Ross explains. "This way, we can tell crews on the ground where the fires are headed, what they're doing, and how intense they're burning in real-time."

He says the strength of his research is partly in the sensors, which offer high-quality analysis and accurately interpreted data, but also in the speed and technique they are using in partnership with MAG Aerospace to transmit the photos.



"THE HEALTH OF PEOPLE IS THE HEALTH OF THE ENVIRONMENT AND VICE VERSA."

Dr. Greg Ross, chair of Environment and Health Surveillance at the Northern Ontario School of Medicine, is excited about a new project with MAG Aerospace to document algae through aerial imagery. A mat of bluegreen algae is visible in a bay just north of Moonlight Beach on July 21, 2019. The image was captured by a sensor on a MAG Aerospace plane.

Social accountability mandate and water

"When I first joined NOSM as an environmental researcher, I would talk about my work in terms of studying the environment, as opposed to studying people's health; and it was very eye opening early on from talking to some of our Indigenous colleagues that, in fact, you can't separate health from the environment," says Ross.

"The health of people is the health of the environment and vice versa. It's been a complete change in my thinking," he explains. "Blue-green algae is only a part of our research program now, as the majority of my research is on wildfires."

"It's all the same issues, and we use the same technology," says Ross. "We had some big fires last year including Parry Sound 33 and this year Red Lake 39 and Red Lake 23. These events have an impact on people's health ... evacuations are usually the result of smoke inhalation and respiratory problems for communities."

Keeping track of both hazardous water and tracking forest fires are hot-button issues in the North. This summer alone, wildfires affected more than 20 communities in Ontario and 4,500 residents in two First Nations communities experienced full evacuations—Pikangikum and Keewaywin.

Water issues have caused flooding in Kashechewan, which led to the evacuation of 2,000 residents and three First Nations communities declared a state of emergency over unsafe water this summer, including Grassy Narrows, Eabematoong First Nation and Attawapiskat. Grassy Narrows has been under a boil water advisory for 18 years, Attiwapiskat First Nation has been under boil water advisory since 2001, and Neskantaga First Nation has been under a 25-year boil water advisory.



"Studying the quality of the water and the health impacts of the water is something that fundamentally we should be doing. I think it is absolutely critical," says Ross. "Water in Indigenous communities is sacred and water quality is so important for the health of everybody."

"It's an issue that is unique to Northern Ontario. If you're in Toronto, you're on municipal water which is treated to remove bacteria," he explains. "Whereas, in Northern Ontario a lot of people rely on and drink the lake water. They don't have access to municipal water treatment."

Symptoms from unsafe water can vary from diarrhea and nausea, to skin rashes. For wildlife, like fish, it is often fatal. Ross says his research team has seen blue-green algae blooms cause significant fish kills. "If fish were to die, they would just sink to the bottom of the lake or be distributed among the lake, and nobody would notice. But in the oceans, when you get a massive fish kill they wash up on shore and people notice; it's more obvious than in a local lake." He cautions people about eating fish from contaminated lakes.

The key to Ross' research is to determine quickly whether or not a human health risk exists. He says what has amped up his research in the past few years has been the speed of technology and his team's ability to integrate it quickly.

"Our success is a combination of having the information quickly; having the right to interpret that information, detecting when blue-green algae is there, and transmitting it back to the stakeholder's desk so they can take action."



"OUR SUCCESS IS A COMBINATION OF HAVING THE INFORMATION QUICKLY; HAVING THE RIGHT TO INTERPRET THAT INFORMATION, DETECTING WHEN BLUE-GREEN ALGAE IS THERE, AND TRANSMITTING IT BACK TO THE STAKEHOLDER'S DESK SO THEY CAN TAKE ACTION."

Hanna Laverdiere, a member of Ross' research team, characterizing the spectra of a laboratory sample.

Although he doesn't link his research to the climate crisis theory, Ross says: "It's safe to say that the problems are going to get worse as temperatures increase. There's no doubt about it."

"Blue-green algae has always been in the water. What's making it worse is that humans are putting more nutrients in the water," he explains. "Wetlands absorb the nutrients and, the reality is, our wetlands are critical for reducing this problem in our waterways."

"It is a problem in Northern Ontario and in other places like Australia and Florida." Ross adds, "there is a huge opportunity for us to help develop and apply these technologies in other parts of the world." He says efforts to increase education and awareness around environmental research, like his, should be included in the curriculum for medical students.

"I'm looking forward to a time when medical schools formally incorporate these issues into education. It's important to understand the hazards of blue-green algae, but also what plastics are doing to the environment, carbon dioxide emissions, global warming and wildfires."

"All of it speaks to social accountability, and NOSM can't be a socially accountable organization without spending an appropriate amount of time talking about the importance of environmental impacts on human health."



of Emergency Researchers



Dr. David Savage, a founding member of NNER, is an emergency physician at Thunder Bay Regional Health Sciences Centre, NOSM Alumnus and an Assistant Professor.

EMERGENCY MEDICINE RESEARCHERS FORM NEW, NORTHERN RESEARCH NETWORK

A handful of emergency physicians are spearheading a new group called the Northern Network of Emergency Researchers (NNER), pronounced "niner." Their goal is to increase research participation and collaboration across Northern Ontario, including rural and remote communities.

Dr. David Savage, emergency physician at Thunder Bay Regional Health Sciences Centre; Dr. Robert Ohle, emergency physician at Health Sciences North in Sudbury; and, Dr. Sean Moore, emergency physician at Lake of the Woods District Hospital in Kenora are the founding members and Assistant Professors at NOSM.

"The goal is to increase research collaboration and support for our colleagues in the North. We want to develop a critical mass of emergency researchers in our region who work together as a team to produce quality research," says Savage. The group has identified major gaps and challenges to performing research in the North, which include a lack of formal research training and funding. They aim to bring physicians and other health professionals with a variety of research skills together to collaborate and support one another to achieve better clinical outcomes in the North.

Savage says the need for this research is critical, including infrastructure and meaningful opportunities to connect, plan, and coordinate their efforts.

"Supporting researchers across the North requires a focus on investigating and answering important questions related to northern health. Researchers who live and work in the North are best positioned to identify research questions that need to be answered."

Ohle echoes Savage's point: "The goal is to support researchers to address health problems that are relevant to



"THE GOAL IS TO SUPPORT RESEARCHERS TO ADDRESS HEALTH PROBLEMS THAT ARE RELEVANT TO THEIR COMMUNITIES."

Dr. Sean Moore, a founding member of NNER, is an emergency physician at Lake of the Woods District Hospital in Kenora, Alumnus and an Assistant Professor at NOSM.

their communities. Understanding the unique environment in which they live will allow practical solutions to local problems."

The group will also become a tool for distributing and sharing current research, to keep up with the academic side of medicine. They plan to leverage NOSM's social accountability mandate by connecting emergency providers who are furthest afield.

"Physician-researchers in Northern Ontario can be very isolated. This group will work to build a community of researchers who collaborate and support each other," says Moore. "Physicians in the North have many unique experiences; they understand the context in which health care is delivered and practiced in Northern Ontario and we hope to leverage that knowledge and strive to achieve our vision of the best care for the North."

How NNER is unique to NOSM and to research for the North:

- To foster community-based research, health care and education;
- To recruit, attract and retain academic researchminded professionals by establishing connections across northern communities;
- To deliver upon the core values and social accountability mandate of NOSM through the lens of research;
- To draw upon the local experience and knowledge of rural and remote physicians to better understand the context of healthcare in the north from both a northern clinical and health services perspective;
- To develop research that is relevant and meaningful to the North to benefit the lives of Northerners in Ontario and throughout Canada.



EYEING UP THE EFFECTS OF RADIATION

Anyone who is exposed to any level of radiation is on some level, made aware of the risks. Getting a CT scan? It's in the preamble on your patient form. Getting an x-ray? Here's the lead vest. Working as a technologist? Please step behind the barrier. However, how "low-dose" radiation affects us is still not entirely clear.

Dr. Chris Thome, NOSM Assistant Professor, has devoted his research career to understanding the biological effects of ionizing radiation exposure. He says he is studying and measuring low-doses of radiation, similar to amounts that are emitted in healthcare occupational settings like hospitals, and other workplaces such as nuclear power plants.

Currently, his main area of study is on the effects of radiation exposure on the lens of the eye. "The concern was that lowdose exposure could lead to cataracts. There's some recent data that has come out of epidemiological data from human exposure cohorts suggesting that maybe the lens of the eye is more sensitive than we initially thought," says Thome.

"I'm starting a research program to really understand what happens in the lens of the eye after exposure to radiation. I'm interested in determining what the level of risk is, if any, and the mechanisms behind it."

Earlier this year, his team started by looking at human health data, based on health records. They accessed 16 million anonymized health records in Ontario over a 22-year period. They narrowed it down to a population who had multiple head CT scans, cross-checking those records against a specific cohort who had developed cataracts and cataract surgery.

"Around 3 million people had multiple head CT scans, and we measured it against the 1 million people who developed "WE BELIEVE THAT LOW DOSE-RATE CHRONIC EXPOSURES WILL RESULT IN A LOWER LEVEL OF RISK COMPARED TO WHEN RADIATION IS DELIVERED ACUTELY."

cataracts," Thome explains. "We then did a co-relation study to determine if the people who had CT scans were more likely to develop cataracts, and essentially we didn't see any correlation or increase in risk."

However, this was only one part of the epidemiological study. He's also doing biological laboratory testing. Thome says the next step is to study how more chronic exposure, like occupational exposure to low-dose radiation, may affect the lens of the eye.

"There's a lot of debate around acute exposure—so just one time—versus if it's an occupational exposure that is spread out over multiple years or decades. If chronic exposure poses different risks, what are the risks between those different dose rates," Thome explains. "We believe that low dose-rate chronic exposures will result in a lower level of risk compared to when radiation is delivered acutely." "And we'll be looking at things like DNA damage, how cells function, divide, and proliferate, and then use that data to look specifically at a cell line that's derived from a human eye lens. We will then use that data to study how that more frequent exposure to radiation can potentially lead to effects on the lens of the eye."

He's teamed up with researcher Dr. Sujeenthar Tharmalingam who is focusing on the molecular side of radiation biology. Tharmalingam is researching what happens with radiation in relation to cancer risk and carcinogenesis.

Results are expected to be published in peer-reviewed journals, and contribute to the body of evidence that is used to inform provincial standards around low-dose radiation.



NOVEL BENEFITS OF LOW-DOSE RADIATION

Academic researchers are studying the theory that low doses of radiation may actually stimulate the immune system.

Dr. Sujeenthar Tharmalingam holds a PhD in Cancer Biology and is an Assistant Professor of Molecular Radiobiology at the Northern Ontario School of Medicine. He's studying how the body responds to low-dose radiation at the molecular and genetic level. By low-dose, Tharmalingam says he's referring to the levels of radiation one might experience during a standard diagnostic test, such as a CT scan.

"The way I personally feel is that the treatment for cancer is actually within ourselves, within the immune system. The immune system is constantly fighting to prevent cancer formation. So when we have cancer, I think one of the best ways to fight it is to stimulate the immune system," says Tharmalingam.

"There is a growing body of literature which supports that low-dose radiation does indeed help with boosting the immune system and this seems to help prevent cancer formation or control tumor growth. It's a very novel concept in cancer biology." "If we find that the molecular mechanisms involved in radiation mediates stimulation of the immune system, the beauty is that we might not have to use radiation at all," he explains. "Instead, we will be able to replicate how it works using pharmacology and other therapies."

Tharmalingam is part of a group researchers that are currently performing a clinical trial to test whether low-dose radiation can help with prostate cancer.

"We're working in collaboration with McMaster University and the Juravinski Cancer Centre in Hamilton. We're giving low doses of radiation to prostate cancer patients," Tharmalingam explains. "We're trying to see if using lowdose radiation will stimulate the immune system in these patients to decrease the progression of prostate cancer."

He is also working to understand the effects low-dose radiation has on adult stem cells: "Adult stem cells possess the ability to either self-renew or differentiate into mature cells to replenish dying cells. These stem cells reside within our bodies for long periods of time, thus preservation of their function is vital for the longevity of the human body.



ACADEMIC RESEARCHERS ARE STUDYING THE THEORY THAT LOW DOSES OF RADIATION MAY ACTUALLY STIMULATE THE IMMUNE SYSTEM.

We are trying to gain ideas about how these adult stem cells respond to radiation."

"We are also developing a functional genomics screening technology to identify genes responsible for radiation and chemotherapy resistant cancers. The end goal is to try and find ways to treat or control the gene expression that leads to the growth of cancer cells, which could help with cancers that are resistant to traditional therapies," explains Tharmalingam.

What is unique to the North however is his research team's focus on genomic variation within Northern communities.

"Different populations will have different genomes," he says. "So, one of the things that we would like to do here is sequence the northern population in particular, and find genetic variations such as single nucleotide polymorphisms [most common form of genetic variation] in the northern population to see how the genomes of the northern population are different." The discovery could lead to better treatment, personalized medicine and therapeutic breakthroughs. Tharmalingam predicts, with the fast-pace of technology, there will be significant breakthroughs in cancer treatment on the near horizon.

"For example, sequencing of the first human genome cost about \$1 billion and took over 10 years to complete, but today I can sequence an entire human genome in a day for \$2,000," says Tharmalingam.

"A lot of new things are coming out, and it's exponentially growing. Even the things that we are discovering now in the field, within the one year, are happening for a lot less money and a lot less time."

"It gives me happiness to know that something you found - you discovered - can be carried all the way to the clinical setting and help people."



Dr. Erin Cameron, Assistant Professor of Medical Education and Curriculum Development at NOSM

COLLABORATION, COMMUNITY, AND CAPACITY: BUILDING A COMMUNITY OF ACADEMIC AND CLINICIAN RESEARCHERS IN MEDICAL EDUCATION

"We're at an exciting time where we are building research capacity and collaboration within the Northern Ontario School of Medicine to help us to better understand and advance educational approaches and answer contemporary issues and questions in medical education," says Dr. Erin Cameron, Assistant Professor of Medical Education and Curriculum Development at NOSM.

In the fall of 2017, academic and clinical medical education researchers at the School began to gather as a group. They collectively noted that there were some gaps and a need for a central space to discuss, develop and support their work. This was the beginning of the Medical Education Research Lab in the North (MERLIN). It's a group of individuals with research interests and expertise in medical education and the collective vision to foster research that advances medical education in and for Northern and rural settings at NOSM. "MERLIN is creating opportunities for learning and dialogue around promising and emerging evidence-based practices in medical education with a focus on innovation. It also provides peer support and mentorship to those across our widespread geography who are engaging in, or perhaps new to, research," says Cameron.

Over the last year, the group held monthly virtual MedEd Cafés—a community forum for NOSM faculty, staff, and students to discuss and debate hot topics in medical education of local, national and international interest with invited speakers or guests. As well, MERLIN hosts a monthly research lab, which is a whole-school resource for collaborating and consulting on medical education research ideas, grant proposals, papers, conference presentations and specific research topics and activities. MERLIN IS SERVING AS A TREASURE TROVE FOR BRINGING TOGETHER EXPERTISE AND INDIVIDUALS WHO ARE PASSIONATE ABOUT ADVANCING MEDICAL EDUCATION.

"MERLIN is serving as a treasure trove for bringing together expertise and individuals who are passionate about advancing medical education," says Cameron. "It uses an open-innovation living lab approach defined by purpose, scope, and context."

In 2019-2020, MERLIN is well situated to have an even greater impact than the previous year, having recently welcomed two new staff members. Hafsa Siddiqui is an Intern, who will be helping to support and coordinate MERLIN activities, including the MedEd Cafés and research labs. Holly Fleming is the Research Assistant and she will be supporting MERLIN members with funded research projects. MERLIN's growing team will support NOSM faculty and staff, and strengthen the vision of promoting a healthier North through research in medical and health professional education.

To learn more about MERLIN or to get involved, please contact Hafsa Siddiqui at hafsiddiqui@nosm.ca or Holly Fleming at hofleming@nosm.ca nosm.ca/merlin

Orange Shirt Day

This September, join NOSM in recognizing Orange Shirt Day—a day that encourages Canadians to work together toward reconciliation and to hear the truths that come from the survivors sharing their stories. September 30 is a symbolic date that signifies when Indigenous children were historically sent to residential school. It is also the start of a new school year; a good time to set the stage for anti-racism/anti-bullying in our communities.

Visit **nosm.ca/orangeshirtday** to purchase a limited edition NOSM orange shirt for \$20.00. Funds generated from the sale of the shirts will be donated to NOSM's Indigenous Student Bursary.



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