nova scotia health authority
Research Services

Research Focus

emergency medicine

Amid the high-intensity environment of emergency care in Nova Scotia, research is flourishing. “We face so many complex challenges, with high volumes of patients in acute situations of tremendous variety,” says Dr. Kirk Magee, interim head of the Department of Emergency Medicine. “Research allows us to develop, test and apply practical solutions—not only to improve patient care but also to advance the relatively new specialty of emergency medicine (EM).”

Researchers at NSHA and Dalhousie Medical School have led many unique initiatives in the design and delivery of superior emergency care—from developing assessment and decision tools that guide and streamline appropriate care, to expanding the role of paramedics who now provide care in hospitals and homes, to creating realistic simulation-training programs that ensure the highest levels of clinician proficiency and skill. As a result, patients are receiving better care—not just in the emergency department, but within their communities as well.

Conducting Research at the Crossroads of Care

Almost every medical specialty intersects in some way with emergency medicine—cardiology, critical care, orthopedics, oncology, infectious diseases, neurology, psychiatry, and pediatrics, to name a few. Emergency clinicians frequently refer patients to different levels of specialist care, but they also refer them back to their family practitioner or to services and supports in the community.

“Because we’re situated at such a crossroads, we’re in a perfect position to conduct system-level research to improve the delivery and quality of care, and to work with other disciplines on clinical research in their specific areas,” notes Dr. Magee. “Our work is also highly interprofessional, involving physicians, paramedics, academics, nurses, nurse practitioners, residents, and students—as well as patients and health-system decision-makers.”

NSHA researchers also collaborate with colleagues at the IWK Health Centre and—through the recently formed Dalhousie Department of Emergency Medicine Research Council—in New Brunswick and Prince Edward Island. Involving representatives from all three provinces, the council oversees resident research projects and seeks opportunities for interprovincial research collaboration, such as a recent Saint John-led, multi-site study evaluating the role of ultrasound in assessing patients who present to emergency with undifferentiated shock.

Paramedics play a uniquely pivotal role in emergency research at the QEII. “Paramedics in emergency departments not only help triage patients upon entry to the ED, they also keep an eye out for patients who meet the criteria for current studies,” says Pat Froese, a paramedic researcher at the QEII. “In addition to enrolling patients, paramedics are also involved in research that’s expanding their role in patient care—in the hospital and also in the community.”

Interprofessional collaboration: RN Debbie MacDonald, paramedic Pat Froese, ED chief Dr. Sam Campbell, district head Dr. Kirk Magee, affiliated scientist Dr. Stacy Ackroyd and Department of Emergency Medicine, director, Division of EMS Dr. Alix Carter

Streamlining the System for Better Emergency Care

Emergency Medicine is at the forefront of catalyzing system change through implementation science, quality improvement research and systems-level evaluation and integration.

Wait times in emergency departments are an ongoing concern to both health care providers and the public. Research to streamline the system for better care is a top priority for NSHA and the Department of Emergency Medicine.

"Our research is finding that a lot of assumptions about the causes of overcrowding are not actually true," says Dr. David Petrie, professor and former head of the department. "A high volume of low-acuity patients is not nearly as big an obstacle to smooth flow as having admitted patients waiting in the ED for an inpatient bed, for example. Other major problems are the relative scarcity of same- or next-day access to primary and specialist care and insufficient human resources to meet increasing demands."

The department is collaborating with Dalhousie's Faculty of Engineering to map emergency services and community needs across Nova Scotia, to optimize the distribution of ambulances, community emergency centres (CECs) and higher levels of emergency care. At the same time, they're expanding the role of paramedics to increase system capacity.

"Paramedics are now triaging patients, conducting certain assessments, and performing such procedures as casting and suturing in hospital emergency departments," notes Dr. Sam Campbell, site chief at Charles V. Keating Emergency and Trauma Centre at the QEII. "We're also leaders in training paramedics to provide procedural sedation to patients undergoing gastrointestinal scopes, cardioversion and other emergency interventions."

Research is guiding the expansion of the paramedic role, including their role in the community, where they now provide acute care at nursing homes and palliative care in patient's homes. As a result, there are fewer unnecessary transfers of frail and terminally ill people to the emergency department.

"Our research is finding that a lot of assumptions about the causes of overcrowding are not actually true."

Even so, a quarter of the patients presenting to emergency departments in the Central Zone are over the age of 65—and the number of patients over 85 is expected to quadruple in the next 20 years. "Research shows that improving patient experience improves safety and outcomes," notes Dr. Stacy Ackroyd, a PhD researcher with the department. New research is testing ways to assess patients' frailty early on in emergency—so they receive the most appropriate care—and to improve older patients' experience while they wait.

Preventing repeat visits is another way to streamline the system flow. PhD researcher, Dr. Janet Curran, is exploring how providing more in-depth education to patients and families prior to discharge can improve their ability to manage at home, so they can avoid another trip to emergency.

"It's a complicated scenario we're approaching from multiple angles," Dr. Petrie says. "We are seeing real improvements."

Special thanks to: research manager Corinne DeMone, the staff of the QEII Charles V. Keating Emergency & Trauma Centre and the Acute Research Unit. Additional photos by: BRIC NS & NSHRF

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Low Back Pain in Emergency? Researchers Developing Decision Tool

"The third most-common problem that sends adults to emergency departments across Canada is back pain." —Canadian Institute for Health Information (CIHI)

"We see people every day with low back pain, but only a small percentage have a serious pathological cause for their pain—such as a cancer, infection or fracture—that can be addressed or managed in the acute care system," says Dr. Kirk Magee, emergency physician and director of research for the Department of Emergency Medicine. "The crucial thing is to identify these patients so they can be directed to appropriate care."

Dr. Magee and emergency medicine colleagues are collaborating with Dr. Jill Hayden, a researcher in Dalhousie's Department of Community Health & Epidemiology, to develop an effective approach to back pain in the emergency department.

Thanks to preliminary evidence gathered with support from two TRIC (Translating Research into Care) grants (funded by the QEII Foundation), and a grant from the NSHA Research Fund, the Canadian Institutes of Health Research (CIHR) has awarded the research team $784,000. This is for a five-year project to develop and validate a clinical decision tool to help emergency physicians determine whether or not they should order x-rays for patients presenting with low back pain.

"Our TRIC grant-funded studies revealed that only 1000 of the 40,000 patients who reported to Nova Scotia emergency departments with low back pain over a seven-year period had a pathologic cause for their pain," notes Dr. Hayden. "Yet, x-rays were ordered for 30 per cent of the patients—that suggests a lot of unnecessary x-rays."

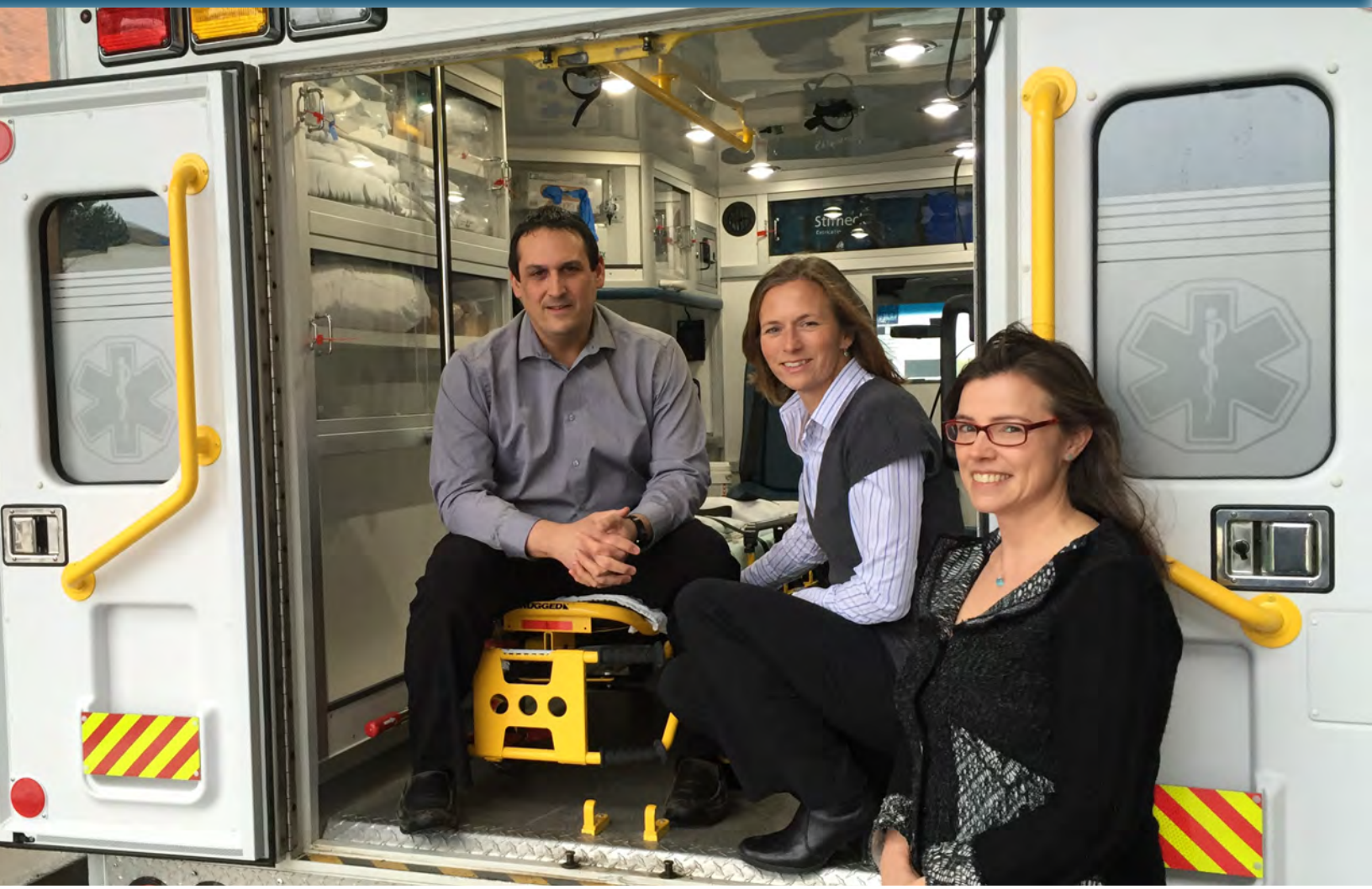
As Dr. Magee explains, unnecessary x-rays can do more harm than good. "Not only are patients exposed to radiation, but findings in the x-rays that are not actually related to their pain can trigger additional, more invasive tests that can lead to real problems," he says. "Plus, they end up with needless worry and may even develop a false sense that they're not fit and start to limit their physical activity."

Dr. Kirk Magee and Dr. Jill Hayden in the Acute Research Unit (ARU) adjacent to the Charles V. Keating Emergency & Trauma Centre, where they conduct some of the low back pain research.

The CIHR funding will allow the research team to enroll 4,000 patients presenting with low back to emergency departments in Nova Scotia and the Ottawa Hospital in Ontario. They will interview and assess patients while they're in emergency, survey them by phone three and twelve months later, and analyze the health administrative data to see what diagnoses, treatments and outcomes ensued.

"We want to create a profile of patient characteristics that reliably predicts a higher likelihood of a serious problem underlying their pain," Dr. Hayden explains. "We will use this to develop a decision tool to help clinicians make evidence-informed decisions about diagnostic imaging tests for low back pain."

Left: Dr. Mary-Lynn Watson, Director of the ARU. The ARU allows NSHA researchers to conduct urgent and acute care research with patients presenting to the emergency department, without impeding the overall flow of emergency patient care. It is designed to accomodate many types of studies such as the emergency management of stroke, heart attack, pneumonia, and back pain.



Division researchers: Dr. Judah Goldstein, EHS research coordinator; Jan Jensen, EHS performance manager; Dr. Alix Carter, EHS medical director of research. In addition to other projects, Judah, Jan and Alix are working to include Nova Scotia as a new site of the Canadian Resuscitation Outcomes Consortium (CanROC). CanROC began in December 2015 and research shows survival rates have doubled in study sites for patients who have a cardiac arrest at a place other than a hospital.

Frailty in the Emergency Environment

End-of-life care poses challenges in in the emergency environment—and so does frailty, an accumulation of health deficits that puts a person at high risk of a sudden downturn.

"Frailty is complex and not easy to assess in the context of a 911 call or emergency department visit," says Dr. Judah Goldstein, a PhD-trained paramedic and research coordinator for EHS. "But it's vitally important to know how frail someone is—this has an enormous impact on what interventions will be safe and helpful for them."

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Dr. Goldstein wants to know if patients or caregivers can accurately assess frailty. He and his colleagues from the University of Toronto have developed a tablet-based assessment tool that can be completed at home, en route, or in hospital.

"Their input will inform better medical decisions and provide an opening to discuss their health risks, preventive measures to take, and supports to line up in the community," he says. "It will be a powerful aid to discharge care."

Paramedics Play a New Role in Palliative Care

Symptom crises such as pain and breathlessness are common near the end of life, whether a person is dying of illness or old age. Paramedics are often called to intervene in these frightening situations, but the typical paramedic protocol—stabilize and transfer to hospital—is often not in the best interests of these patients.

Paramedics are now trained to provide palliative care in the home and can access a database containing the patient's goals of care.

"An ambulance ride and time in emergency is a stressful experience for anyone, even more so for patients approaching the end of life," says Dr. Alix Carter, director of the Division of Emergency Medical Services at Dalhousie/NSHA and medical director of research at Emergency Health Services (EHS) Nova Scotia. "We wanted to know if training paramedics to provide palliative care in the home would reduce transfers to hospital and allow more patients to die with dignity at home."

Funding from the Canadian Partnership Against Cancer enabled Dr. Carter and her team to work with Pallium Canada to develop a training course to teach paramedics the essentials of providing palliative and end-of-life care. They also enhanced the existing EHS Special Patient Program, which now allows palliative care patients to register the goals of their care—symptom control and comfort—in a database that paramedics can access.

Now Dr. Carter, project manager Michelle Harrison, and their team are evaluating the impact of these programs—launched province-wide in 2015—with funding from the NSHA Research Fund, a TRIC grant (funded by the QEII Foundation), CIHR (through BRIC NS), and support from the Canadian Foundation for Healthcare Improvement.

"Our evaluations show that paramedics, patients and families are enthusiastic," says Dr. Carter. "Paramedics feel well-prepared and confident to provide this care at home and patients and families are relieved to avoid unnecessary trips to hospital at such a vulnerable time."

The researchers are assessing key benchmarks of quality care—such as number of people who can spend the end-of-life period at home. At the same time, through the BRIC NS project, they're working with British Columbia to determine how such a program could be modified for rollout in other provinces.

Evidence to Practice in Pre-Hospital Care

EHS, NSHA and Dalhousie's Division of Emergency Medical Services are leading a cross-country effort to build the world's most comprehensive clearinghouse of evidence about best practices in pre-hospital care—the Pre-hospital Evidence-Based Practice (PEP) program, coordinated by paramedic Jen Greene.

"We and our collaborating paramedics and emergency physicians critically appraise the research literature in the field of pre-hospital care—essentially, the care that paramedics provide on the scene and en route to hospital," explains Jen Greene. "Each article is analyzed according to a matrix to determine its statistical and methodological soundness before it goes into the database. That way users can easily sift through the evidence and see at a glance how valid it is, and use that evidence to inform their practice."

To access PEP, visit: **https://emspep.cdha.nshealth.ca/**

In Case of Poison—Nova Scotia Antidote Program to the Rescue

"Prompt treatment with the appropriate antidote is crucial to saving lives and protecting against permanent organ damage."

Dr. Nancy Murphy sits with an antidote kit. Many community hospitals didn't think they needed many antidotes on hand—thanks to the N.S. Antidote Program's data collection and analysis, they now recognize the need to have the antidote kit on site.

Thanks to the Nova Scotia Antidote Program—launched as a pilot project in the Central Zone in 2005 and rolled out province-wide in 2009—people who ingest toxic doses of medications and other potentially dangerous substances can access an antidote no matter where in the province they live.

"We collaborate with all the emergency departments and hospital pharmacies in Nova Scotia to ensure every centre has timely access to the recommended antidotes," says Dr. Nancy Murphy, emergency physician and medical director of the provincial antidote program. "We track the use of the antidotes, so they can be re-stocked quickly, and analyze geographic usage patterns so we can pro-actively stock the optimal mix of antidotes for each centre, based on the most common poisonings in those areas."

The antidote for acetaminophen is the most heavily used. "Every two days, someone in Nova Scotia needs the acetaminophen antidote," notes Dr. Murphy. "Other antidotes we frequently need are those for opioids, blood pressure medications, and toxic alcohols."

According to Dr. Murphy, most of these poisonings are deliberate, and some are accidental. Prompt treatment with the appropriate antidote is crucial to saving lives and protecting against permanent organ damage.

"Our next step is to study the economics of antidotes," she says. "The average cost of a single dose of the antidote for toxic alcohols is $1,000, and a lot of hospital administrators will say, 'that's too expensive to have on hand!' But, when you compare the cost of the antidote to the cost of dialysis for kidney failure, it is likely more cost-effective."

Data collected through the antidote program has revealed that community hospitals account for 15 per cent of the antidotes used in the province, and that 16 per cent of those patients who either died or required intensive care presented initially at an emergency department in a community hospital.

"This is a very important finding—before we had this evidence, a lot of community hospitals didn't think they needed many antidotes on hand," Dr. Murphy says. "Now they recognize the need to have the antidote on site or readily accessible nearby."

If a hospital unexpectedly uses up its supply of a particular antidote, it can contact the provincial program to find the location of the nearest dose. This can be delivered, or the patient sent there.

"As far as we've been able to ascertain, ours is the only program of its kind in North America and quite possibly the world," says Dr. Murphy. "The data collection and analysis, ongoing monitoring and communication ensures virtually immediate access to antidotes. This is of particular importance if we start to see a fentanyl crisis in Nova Scotia."

Practice Makes Perfect in Airway Management

The ability to place a breathing tube quickly, safely and properly is an essential skill in emergency practice.

"Placing an airway is a priority intervention to save a life—as a clinician, you need to get it right," says Dr. George Kovacs, a QEII emergency physician and professor who's been leading airway training in the Department of Emergency Medicine for 20 years. "It requires the kind of proficiency you can only gain through repeated practice."

Because practicing on patients is not always safe or appropriate for patients—and the opportunity doesn't arise often enough to solidify learners' skills—Dr. Kovacs and his colleagues have helped develop simulation-training methods. Rather than working with mannequins, which are rigid plastic, they partnered with Dalhousie Medical School's 100-year-old Human Body Donation Program to develop a more realistic model.

"We've modified a method which preserves donated bodies without formaldehyde, so the tissues remain pliable," Dr. Kovacs says. "These 'clinical cadavers' provide the highest-fidelity simulation models you can use."

Increasingly, clinical cadavers are being used in research to develop new procedures and safe invasive approaches that would be too risky to learn and perform on live patients.

"Clinical cadavers have changed the way we teach our medical trainees from the historical approach of 'see one, do one, teach one,' to the contemporary approach of 'practice the skill until it becomes second nature,'" notes Dr. Kovacs. "Our training program has grown to the point that we now run 180 sessions a year with more than a thousand learners attending. This provides ample opportunity to conduct research to validate the effectiveness of these training methods."

Soon the department will be able to expand its simulation training programs, thanks to a $1.8 million donation from the QEII Foundation, announced in June 2017, to transform the current space (in a former ambulance bay)

Dr. George Kovacs demonstrates an airway procedure in the simulation bay. Trainees practice on 'clinical cadavers'—bodies preserved without formaldehyde.

at the QEII's Charles V. Keating Emergency & Trauma Centre into a high-tech, cadaver-capable simulation bay.

Dr. Kovacs has a long history of leadership in procedural skill learning, an area of interest he developed while completing his masters in health professional education at the University of Illinois. He is internationally recognized for his interest in emergency airway management and has co-authored two editions of the textbook, *Airway*

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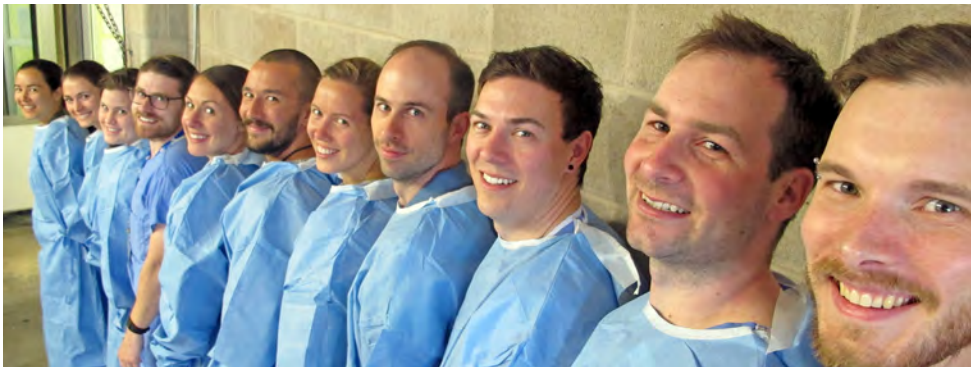
Management in Emergencies, with Dr. Adam Law, an NSHA-Dalhousie anesthetist. His collaboration with the Department of Anesthesia includes participating in the Maritime Airway Research and Teaching Investigators' Initiative (MARTini) and contributing—as the only non-anesthetist—to the creation of new Canadian airway management guidelines.

Thinking & Learning

Trainees Play a Vital Role in EM Research

To ensure they have the knowledge and skills to conduct top-notch research, first-year Royal College residents must complete Creo™ (Comprehensive Research Education Online)—and courses in evidence-based medicine and the ethical conduct of research.



A group of residents ready for training in the simulation bay.

Resident research projects cover the gamut from system-flow (minimizing delays, reducing return visits, using resources efficiently), to clinical (diagnostic imaging decisions, procedural sedation protocols, emergency management of a variety of conditions), to educational (development and evaluation of simulation programs, especially in airway management). Between 2012 and 2017, 22 residents in the department published more than 65 papers in peer-reviewed journals.

With the advent of Dalhousie Medical School's Research In Medicine (RIM) program, medical students play a larger role in research than ever before. As many as 25 medical students work with the department at any given time. Their participation is accelerating progress in such areas as the impact of CECs (Collaborative Emergency Centres) on non-urgent visits to emergency, discharge communications and education (particularly to parents of children presenting to emergency centres across the province), clinicians' test-ordering patterns, the management of low back pain in emergency, and patterns of emergency-service use by homeless people.

Preventing Diagnostic Failure

NSHA emergency physicians are leading experts in research and education to develop clinicians' critical thinking abilities so they hit the diagnostic mark.

"Research shows doctors fail to diagnose patients correctly 10 to 15 per cent of the time—with sometimes fatal consequences," says Dr. Pat Croskerry, professor in Emergency Medicine and director of Dalhousie Medical School's Critical Thinking (CT) Program. "Some of this failure is due to stress, fatigue, and mistakes 'in the system,' but much of it is due to errors in the thought process that led to the diagnosis."

Risk of diagnostic error is high in the emergency-department environment, where the pace is fast and the number and variety of cases is high. Critical thinking strategies appear to mitigate this risk. Several members of the Department of Emergency Medicine are involved with Dalhousie's Critical Thinking Advisory Group, which oversees and advises the CT Program to ensure both trainees and practicing clinicians are exposed to the essentials of critical thinking.

"Clinicians must be aware of biases and stressors that could influence their thinking, and know how to shift away from intuitive reacting to analytical reasoning," Dr. Croskerry says. He is a lead researcher in a Canada-U.S. collaboration to identify the best methods of teaching the thinking skills necessary for accurate diagnosis.

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