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Virtual home care visits

Maple and SE Health have teamed up to offer a unique service: virtual visits with physicians, for SE Health nurses and staff who are visiting clients in their homes.

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What OHTs will need

Technology and IT expertise are obviously required, but there are several other things that are burning issues: governance, updated privacy laws and funding are also moot points.

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Easier ICU data collection

The Montreal Heart Institute, as part of its “digital hospital” strategy, has automated the collection of vital signs from ventilators in the ICU. Nurses no longer need to copy and re-enter the data, as it’s electronically transferred to the EHR.

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PHOTO: COURTESY HUMBER RIVER HOSPITAL

Clinical apps added to Humber River’s Command Centre

Humber River Hospital, in Toronto, has launched the world’s first clinical analytic applications in a hospital command centre. The four new applications alert caregivers when patients show signs of needing help, and inform clinicians about the steps that should be taken. Alerts are sent directly to the relevant care-givers. Pictured (l to r): Jhanvi Solanki, Dr. Susan Tory and Jane Casey. **SEE STORY ON PAGE 4.**

Innovators bring AI into imaging skills development

BY JERRY ZEIDENBERG

Two Ontario hospital organizations – encompassing six sites – will soon deploy artificial intelligence to help with continuous learning and peer review in their imaging departments. By automatically detecting the types of cases being read by radiologists at St. Joseph’s Healthcare Hamilton and Hamilton Health Sciences, the system will deliver the latest journal findings, as well as personal pattern recognition and error avoidance, direct to their desktops.

While radiologists at all Canadian hospitals are experts in their field, with years of education and experience, our understanding of diseases and illnesses is rapidly expanding and new insights are constantly appearing. To ensure that they’re aware of the latest research and best practices, many radi-

ologists conduct journal and web searches while they’re reading cases at the hospital, or at night, from home.

“Our radiologists and physicians spend a lot of time reading and searching for literature,” said Shairoz Kherani, who until re-

The system will automatically bring research and new findings to the desktops of radiologists.

cently was Director of Diagnostic Services at HHS. (She has since moved to Halton Health Care, in nearby Oakville, Ont., where she is Director of Diagnostic Services and Laboratory.) “Finding the right information can be a daunting process. Now it will be readily available.”

“There are hundreds of new findings

every day,” said Ian Maynard, CEO of Real Time Medical, of Mississauga, Ont., the company that’s providing the AI-powered solution, called AICloudQA™.

“Radiologists can spend two or more hours a day searching independent medical data sources,” said Maynard. “Our solution saves radiologists a significant amount of time and effort by searching multiple data sources simultaneously, relative to the case at hand. We’re like a Google search on steroids for relevant medical data, helping radiologists apply the latest findings to their patient care.”

Indeed, Real Time Medical is collaborating with Google Cloud and Sightline Innovation to deliver its AI-fueled solutions. The project is also supported by the National Research Council of Canada’s Industrial Research Assistance Program (NRC IRAP), resulting in a

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Innovators bring artificial intelligence into imaging skills development

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collaboration between these organizations and the hospitals using the solution.

Not only does the automated searching save time and contribute to better medical outcomes for patients, but it helps reduce radiologist “burnout”, a serious issue today as radiologists feel overloaded by the demands placed on them, Maynard said.

St. Joseph’s Healthcare Hamilton and Hamilton Health Sciences will introduce AICloudQA for peer learning and skills development across their sites by the end of this year. The hospitals will probably start with one site, or one physician group across all sites, and then steadily roll out the solution.

The context-sensitive provision of journal articles and other sources of medical information is expected to be of great help to the radiologists, nuclear medicine physicians, cardiologists and other clinicians who use the system.

There are 70 to 80 radiologists and medical imaging experts at Hamilton Health Sciences and St. Joseph’s Healthcare Hamilton who will be the prime users of AICloudQA.

Real Time Medical’s Ian Maynard said the importance of timely and accurate information cannot be underestimated. As they’re reading cases, radiologists want the latest literature and personal pattern recognition notifications of what to be on the lookout for.

“What they don’t want are patients and

their families coming back to them later, asking why they didn’t know about the latest finding from Cleveland Clinic for example,” said Maynard.

Dr. Karen Finlay, radiologist and Interim Chief of Radiology at Hamilton Health Sciences, agreed that radiologists are currently taking “a lot of time for research”.

“If a radiologist steps off a case for five to 10 minutes to go to Google Scholar, that can really add up over the course of a day,” she said. Additionally, for those familiar with the impact of interruptions on the efficiency of the diagnostic process, that time impact can be significantly magnified to the detriment of diagnostic efficiency, which collectively impacts system-wide efficiency.

The feed from AICloudQA, by contrast, is instantaneous, meaning the radiologist doesn’t have to stop what they are doing.

Notably, the Real Time Medical system also uses AI to scan the readings done by radiologists, and to provide feedback on areas where they might want to focus on or look more closely in future. “It’s like the blind spot warning system in your car, only it’s anonymously helping you avoid possible gaps in your own reading patterns,” said Maynard.

“This is very valuable,” said Kherani. “The system can do intelligent sampling and note where a radiologist may want to improve. It can even spot patterns, time of day and other conditions when they may be more vulnerable.”

Dr. Finlay observed that AICloudQA will also transform the process of peer



Dr. Karen Finlay and Shairoz Kherani, key members of the team that implemented the peer learning system.

learning at Hamilton Health Sciences and St. Joseph’s Healthcare Hamilton.

It will do this, in one way, by increasing the pool of radiologists participating. One of the limitations of current peer review methods is that there’s often a limited number of potential reviewers, especially when a sub-specialty is involved – such as breast or neuro-imaging.

Real Time Medical’s cloud-based solution offers the potential to connect with other hospitals across the province and the country, creating a critical mass of peers with a cross-section of experiences in each sub-specialty. This will enable a level of peer learning and best practice sharing that’s simply not possible with site-based systems.

Increasing the number of radiologists in the peer learning pool also helps with the issue of anonymity. With site based solutions, it’s sometimes possible to guess the identity of the radiologist or clinician being assisted, as physicians are often familiar with the reporting styles of their peers.

Like all physicians – and people in general – radiologists don’t like to be judged. By making the system more anonymous, the Real Time Medical system makes peer learning more objective, valid and hence palatable for participants. This part of what is being called a “just culture” approach, that physicians are calling for in such solutions. AICloudQATM embraces the “just culture” principles that physicians want and deserve.

It is not punitive, and the information is not shared. Instead, it’s sent privately to the participating radiologist or clinicians, who can use it for self-improvement.

At Hamilton Health Sciences and St. Joseph’s Healthcare Hamilton, the peer reviewing will be prospective – that is, it’s done before the results are reported to the referring physician.

Of course, there are only so many cases that can be reviewed before the process becomes counter-productive. The need for continuous learning must be balanced with the extra burden that’s placed on reviewers.

“The trick is to make it a rich and rewarding learning experience, but not burdensome,” said Dr. Finlay.

Hamilton Health Sciences and St. Joseph’s Healthcare Hamilton currently aim to review 2 percent of the cases, which is in keeping with other Canadian programs.

Kherani noted there are other potential benefits to the AICloudQA platform. It has a workload balancing function, where it uses its intelligence to feed cases to the appropriate radiologist – based on availability and expertise.

That not only offers the organization advantages with workflow and wait times, but it also benefits patients, as they obtain the most expert radiologist available.

She said the system can eventually support different types of physicians involved in imaging, such as cardiologists, and not only radiologists. “It’s a multi-ology solution.”

Dr. Finlay noted the system also supports critical results reporting – so that urgent findings are quickly sent to referring doctors. It can also be tweaked to include notification of unexpected findings – flagging colleagues about problems that were unanticipated, but should be addressed.

Coming up in 2020

Issue Date	Feature Report	Focus Report
February	Medical Imaging	Interoperability
March	Analytics/AI	Surgical Systems
April	Mobile Solutions	Medication Management
May	EHR Trends	Precision Medicine
June/July	IT Resource Guide	Start-ups
September	LTC & Continuing Care	Cardiology
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Humber River launches new applications in its Command Centre

TORONTO – Humber River Hospital has launched the world's first clinical analytic applications in a hospital Command Centre. The new solutions use real-time clinical data, early warning algorithms and AI to identify issues and raise the quality of care. The hospital worked in partnership with GE Healthcare to develop the Command Centre and its new capabilities.

At the Command Centre, a team of trained staff continuously watches for alerts, logjams and trends, and takes actions to alleviate potential problems throughout the hospital.

The centre first began in the fall of 2017 with systems to track patient flow throughout the hospital, ensuring timely movement from admission to discharge. Humber River is now adding clinical monitoring and analytics to keep tabs on the health of vulnerable patients so they can be helped at the earliest possible stage.

Four clinical applications are being added to start. In September, the hospital switched-on two of them, "Mothers and Babies" and "Risk of Harm". Mothers and Babies tracks the health of mothers in labour and delivery, and alerts staff when there is an elevated risk, so that timely interventions can be taken.

Risk of Harm tracks patients throughout the hospital and ensures that tests, meds and precautions are all managed in a timely fashion. It also contains algorithms to detect the onset of sepsis, and protocols to manage patients with sepsis to reduce the chance of its progression.

The applications leverage early warning systems (EWS) developed in various centres of excellence around the world. But Humber River has enhanced these EWS by focusing on follow-up actions – the steps needed to alert the appropriate individuals and to deliver care in rapid response.

So, for example, its new "Mother and Baby" early warning system tracks vital signs like heart rate, blood pressure and oxygen levels, and accounts for factors like



Peter Bak, on the success of the Command Centre: "We have incredible engagement from our clinicians."

the fetal heart rate, patient history and physician orders.

When the system detects a mother or baby in distress, or with signs of possible future problems, it creates an alert – which can be seen both in the Command Centre and on monitors on the floor.

Moreover, it will send the alert directly to nurses on the Labour and Delivery Unit, and it also sends instructions on how the problem should be handled.

"The alert is pushed directly to the nurses' Ascom phones," said Jhanvi Solanki, Director of Inpatient Surgery and the Maternal and Child Programs. "And if action isn't taken in a certain amount of time, it rolls over to the resource nurse and obstetrician."

By detecting potential problems, and sending alerts and instructions to nurses, "we can intervene immediately, instead of the next hour or so," said Solanki.

This proactive follow-up adds a dimension that's missing from many early warning systems, where problems may be detected, but actions may not occur.

She noted that Humber River defined the algorithms used in the Mother and Baby system, identifying the factors that indicate the onset of various problems. The team worked with GE Healthcare to develop the analytics and rolled out procedures for Command Centre and nursing staff to follow when an alert is triggered.

"All of our metrics are aimed at driving down the rate of complications and providing comprehensive, patient and family centered care," said Solanki.

Two other early warning systems will soon be added – "Seniors Care" and "Clinical Deterioration".

The Seniors Care tile recognizes that seniors have vulnerabilities that require special attention to ensure the best possible outcomes, even if those vulnerabilities are not the primary reason for a senior patient's stay, noted Zahava Uddin, Managing Director of GE Healthcare Partners Canada.

"Patients with delirium, mobility risks or urinary incontinence, for instance, alert on the tile when recommended interven-

tions have not yet been carried out, thereby prompting Command Centre staff to work together with front line staff throughout the hospital to help reduce readmissions, shorten patient stays and most importantly improve the rate of patients discharged back home," said Uddin.

According to Humber River Hospital, since the launch of the Command Centre, the hospital has improved its efficiency, resulting in the equivalent of 35 additional beds. With the new clinical applications, the hospital expects to see increased outcomes which leads to even more benefit to the hospital and, more importantly, to the patient.

An upcoming phase of the Command Centre will see analytics added that further integrate the hospital with the community, so that more patients can receive care at home.

Peter Bak, Chief Information Officer at Humber River, has noted that AI, medical devices and remote monitoring can be combined to track the health of patients at home, intervening at an earlier stage than ever before. In this way, many patients can be helped before needing to visit the hospital, thereby reducing crowding and "hall-way medicine."

Bak said the hospital is continually using machine learning in its systems to predict which patients will need an intervention. And machine learning tweaks itself as it goes along, learning which factors are most important.

The goal, of course, is to produce better outcomes for patients – whether it's predicting and stopping the early onset of sepsis, assisting a mother in childbirth or ensuring an elderly patient has received the necessary consults before being discharged from hospital.

The analytics used at Humber River are helping to achieve these goals. Bak notes that it's being made possible by the support of the hospital's doctors, nurses and other healthcare professionals: "We have incredible engagement from our clinicians."

MedSafer helps reduce inappropriate medications prescribed to elderly

MONTREAL – The elderly are often prescribed multiple medications for different health conditions. While some medications are needed, polypharmacy and medication overload can be costly and even harmful. However, reducing the number of potentially inappropriate medications that seniors take on a daily basis is an ongoing challenge.

In one of the largest deprescribing studies that has ever taken place in the acute care setting in North America, a team of researchers from the Research Institute of the McGill University Health Centre (RI-MUHC) showed that MedSafer, an award-winning electronic decision-support tool, could help doctors and pharmacists reduce medication overload in an elderly population.

Their study was published in September 2019 in the Journal of the Amer-

ican Geriatrics Society, and the tool is already gaining popularity; soon it will be adopted in New Brunswick's long-term-care units and in several facilities in Ontario.

"A prescription check-up is a complex process for interprofessional teams and often involves complicated decision-making," said Dr. Emily McDonald, first author of the study, scientist at the RI-MUHC and physician in the Division of General Internal Medicine at the MUHC. "In addition, cross-referencing multiple medications and medical conditions for a large number of patients requires time and resources that are not always available."

MedSafer makes it easier for doctors and pharmacists to quickly review the drugs a hospitalized senior is taking and recommend the ones the medical team may want to consider reducing or stopping.

More precisely, it identifies potentially inappropriate medications and generates "deprescribing opportunity reports" for the treating teams. It can identify all the rules for deprescribing included in the lists of the American Geriatrics Society's

MedSafer makes it easier to quickly review the drugs a hospitalized senior is taking, and to recommend changes.

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"The tool is a timesaver for health professionals," said Dr. Todd Lee, co-lead author of the study, scientist at the RI-MUHC and associate professor of Medicine at McGill University. "Quick access

to up-to-date recommendations can help them replace or even stop certain inappropriate medications in a safe manner. It acts as a road map for the prescriber."

"Some medications cause memory problems and increase the risk of falls, hip fracture and trips to the emergency department," added Dr. McDonald, who is also an assistant professor of Medicine at McGill University. "Performing a prescription check-up and stopping medications that might be problematic is important for seniors so they can maintain their independence, mobility and cognition."

Susan Bartlett's mother participated in the study. She reflects on her experience: "When she entered the hospital after a fall, my mother was taking about 15 medications a day," says Bartlett. "I was worried about all these medications in an older person, and I often talked to her

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Maple gets ready for virtual-visit expansion in home care, hospital care

BY JERRY ZEIDENBERG

TORONTO – Maple, the provider of virtual visits for patients and physicians, was recently in the news after raising \$14.5 million in funding to help fuel its growth. A key part of the program for the near future involves a partnership with SE Health, formerly known as Saint Elizabeth Health, the national provider of home care and community services.

What the two organizations have in mind is to link Maple's online doctors with home care and community-based patients while they're being visited by SE Health's nurses, personal support workers and therapists.

"This will be the first solution of its kind in the world," said Dr. Brett Belchetz, co-founder and CEO of Maple. "Nobody else has combined home care and primary care the way we've done."

To be sure, nobody has done it on this scale, with a coast-to-coast technological system that connects doctors, nurses, PSWs and patients.

The plan is to make use of Maple's national platform for telehealth – including video visits and other forms of virtual care – to provide continuous physician services to nurses and PSWs as they're checking on patients in the community.

That's expected to dramatically improve the care of these patients, many of whom are too ill or are simply unable to leave the house to see a doctor in person. For example, palliative-care patients or

frail patients without enough help to get into a vehicle and to a physician practice.

It will also help keep many patients out of Emergency Departments, and reduce "hallway medicine", as home care patients are often sent to hospitals when they appear to be sick, and when family doctors are unavailable after hours or in rural regions.

"We're able to provide national, around the clock coverage," said Dr. Belchetz.

He commented that Maple and SE Health are natural partners, as in the past, SE Health has lacked the technological infrastructure to provide physician-supervised, virtual home-care visits, while on the other hand, Maple has needed the "boots on the ground", the nurses and PSWs who are physically present with patients.

The nurses further augment care, taking blood pressure readings or assisting with other medical equipment that virtual physicians may need to use during the encounters. They can even help with the computer equipment for patients who have trouble operating a laptop or smartphone, including patients with dementia.

Virtual visits could be used to examine patients with a host of ailments, including heart failure, COPD, and diabetes. Using the teamwork between online doctor and the physically present nurse or PSW, "We don't have to automatically send patients to the ER," said Dr. Belchetz.

Not only can this result in better, faster care for patients, but it also reduces overcrowding in emergency departments and curbs "hallway medicine".

"When Maple's virtual physician ser-



Dr. Brett Belchetz, co-founder and CEO of Maple.

vices are coupled with the care offered by SE Health nurses, personal support workers and therapists, a truly powerful combination is created that ensures patients can be triaged and treated in a responsive and cost-effective manner," said Michael Peters, senior vice president at SE Health. "Ultimately, we hope patients and their families will receive an exceptional care experience in their own home environment, while avoiding unnecessary hospitalization and emergency department visits."

Maple and SE Health plan to start pilot projects in the next few months, Dr. Belchetz said. Some of the momentum for

moving ahead will depend on government funding for virtual visits.

This seems to be only a matter of time, as many groups have been calling for an expansion of funding for virtual care. British Columbia now offers limited remuneration for doctors doing video visits, and Ontario has been funding some physicians through its Ontario Telemedicine Network (OTN).

Notably, the newly proposed Ontario Health Team strategy has been calling for an expansion of virtual care; Dr. Belchetz expects to see changes in the billing codes, or at least funding of virtual care projects on an ad hoc basis.

Maple also gained international attention this year with its hospital telemedicine project – it provided remote rounding of patients in a PEI hospital that faced a doctors' shortage. The Western Hospital, in Alberton, PEI, was able to stay open and care for patients by using telemedicine to connect with Maple's physicians.

Moreover, Dr. Belchetz said, "the outcomes were tremendous," and hospital performance actually improved when using virtual visits. "Length-of-stay was shorter, and readmission rates were reduced."

Now, the company is on the verge of expanding the virtual rounding program to other hospitals in Canada. While the hospital in PEI is a small one, very large hospitals have been contacting Maple to augment their delivery of medical services.

"We're speaking to very large, tertiary care centres," he said. "We're taking a gigantic step forward."

OHTs must address governance, privacy laws and funding

BY JERRY ZEIDENBERG

TORONTO – What are the main stumbling blocks as healthcare providers align themselves into Ontario Health Teams? A panel of CIOs commented on this question at the recent HIMSS Ontario conference, and they agreed the biggest hurdle isn't the technology.

"We're going to need a room full of lawyers," asserted Mark Farrow, CIO at Hamilton Health Sciences. "That's who I'm spending my time with now – lawyers and privacy specialists."

Indeed, the technology needed to connect the various levels of healthcare providers – acute, complex, long-term, and home care – is all available, he said.

What's more difficult is working out the governance agreements between the partner organizations, along with navigating the privacy regulations that may prevent the sharing of information.

As Rod Burns, CIO of the Alliance for Healthier Communities put it, "These are the elephants in the room. Governance, policy and privacy."

Shafique Shamji, CIO of the Ottawa Hospital, had some insights on this score. His hospital has already partnered with five other organizations in the eastern Ontario region, to share an Epic

health information system. The other medical centres are all much smaller, and include places in Barry's Bay, Hawkesbury and Renfrew, Ontario.

"What do you do when someone wants something, and the others don't want it," asked Shamji. "Does the biggest partner get to dictate? Unless you have thought about this beforehand, it won't work out."

He observed, as well, that Ontario's current privacy laws are an obstacle to the efficient sharing of patient data. "The legislation needs to change," he said. "The current legislation is not conducive to the sharing of information."

For his part, Burns added that the Alliance for Healthier Communities has some 80 agreements in place, holding members to service guarantees.

He said that alliances often start with enthusiasm, but then encounter rough patches – and that's when the agreements are really needed.

"When the honeymoon is over, you better have that pre-nup in place," he cautioned.

Dr. Sarah Muttitt, CIO at the Hospital for Sick Children, in Toronto, observed that her medical centre, too, faces some trials and tribulations in forging alliances.

It recently implemented an Epic information system, and partnered with the Children's Hospital of Eastern Ontario, which has similar aims.

However, not all organizations are on the same wavelength, nor do they share a similar culture.

For one thing, SickKids is a very large organization, with world-leading research and clinical practices.

"As we bring partners together, there



Pictured (l to r): Rod Burns, Tara Coxon, Shafique Shamji, Moderator Todd McCallum, Mark Farrow and Sarah Muttitt.

is often disparity. There may be some challenges, as different organizations' financing models vary according to their size and scope.

"They often have a different culture, values and business models," Dr. Muttitt asserted.

Another issue for SickKids: as an in-

ternationally renowned pediatric centre, 80 percent of its patients come from outside the Greater Toronto Area. For that reason, working only within a "local" health team doesn't make sense. "We could be in every OHT that provides pediatric care," she said.

Tara Coxon, CIO at St. Joseph's Healthcare, Hamilton, mentioned that funding will also be a challenge, as Ontario Health Teams are expected to build ties and resources without any additional financing.

She added that the current privacy laws are also out of whack with reality. As an example, she pointed to the virtual visit system that St. Joseph's recently rolled out, connecting surgeons with post-op patients at home.

In the project's early days, when a surgeon wanted to Skype a patient at home, to check on him, he was reprimanded by colleagues who complained about the privacy implications and who worried that the flow of patient data might not be secure.

"But the patient said, you saved me a 45-minute trip to the hospital," commented Coxon. St. Joseph's has since implemented a secure video platform as part of the solution, but this initial experience shows the difference between the needs of patients and current regulatory practices.



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Telus Health app provides virtual visits and medical info to patients

BY JERRY ZEIDENBERG

Just eight months after launching Babylon by Telus Health, a platform for virtual visits with doctors and an AI-powered symptom checker for patients, the app has been downloaded by “tens of thousands” of users across Canada. It’s especially popular in British Columbia, where the provincial government has given the go-ahead for patients to conduct video visits with participating primary care physicians.

Babylon by Telus Health runs on smartphones and enables B.C. patients to make an appointment and see a doctor – often in as little as 15 minutes. That’s an impressive feat, as many members of the public don’t have a GP, and those who do have difficulties getting to a doctor’s office if they’re housebound or in a rural location.

“There are 800,000 people without a family doctor in British Columbia,” noted Juggy Sihota, vice president of consumer health at Telus. There are 600,000 without a family physician in Alberta, and 5 million across Canada.” Virtual visits, like those provided through Babylon by Telus Health, can be an effective part of the solution to this problem, she said.

For its part, Telus Health is in discussions with other provincial governments about supporting virtual care. Telus Health sees this as an effective way to alleviate the challenges of access to primary care doctors and providing care to members of the public when they need it. “We think that [improving healthcare for Canadians] is the most significant social challenge of our generation,” said Sihota.



Juggy Sihota, VP of Consumer Health at Telus, is pictured announcing the launch of the service earlier this year.

Babylon by Telus Health also offers an AI-powered symptom checker that can help users get more healthcare support and information. Devised by the British company of the same name, Babylon, the solution is now being used by the National Health Service in the United Kingdom to offer video visits with GPs, 24/7 (when needed, patients are directed to local GPs for in-person appointments). The app also suggests possible treatments and therapies.

Babylon considers itself to be on the forefront of artificial intelligence and machine learning in healthcare globally. It makes use of its own knowledge base, drawn from inputs from medical professionals, cases, medical journals, and learns over time to improve its suggestions.

“It’s helpful if you’re not sure of what you’re dealing with, and you want to get a better idea,” said Sihota. “But it’s not a substitute for a doctor, especially for emergencies, or when a doctor has to palpate [touch] to discover what’s wrong.”

She added, “But it does prepare you and the doctor for a visit.”

The app can even transfer the notes of an interaction with the Babylon by Telus Health symptom checker to the physician, if the patient then sets up a virtual visit. That way, the doctor has details of the patient’s problem at his or her fingertips and has valuable information about the issue even before the medical encounter begins.

And if the patient does have a regular family doctor, notes of the virtual visit can

be sent electronically or by paper, if required, to ensure continuity of care. Half of all the virtual consultations conducted today through Babylon by Telus Health are being shared with a family doctor at the patient’s request.

That integration is helping to overcome another stumbling block in Canada’s health-care system – when patients go to an ER or a walk-in clinic for care, their regular doctor rarely receives a note about the visit. With the Babylon by Telus Health interaction, notes and video consultations can be provided. “We’re specifically trying to improve the continuity of care issue,” said Sihota.

She preferred not to discuss exactly how many patients and doctors are online and using Babylon by Telus Health in British Columbia, except to say that tens of thousands of patients have been using it and that thousands of consults have occurred in the past six months.

Most of the doctors have their own practices and conduct the virtual visits as part-time work, from home, their office and other locations. The province of British Columbia provides remuneration for video visits.

When the patient has a virtual visit using Babylon by Telus Health, and a prescription or lab test is needed, the doctor can electronically send the script or lab requisition to the patient’s preferred pharmacy, medical lab or diagnostic imaging centre.

Not everything can be treated via a virtual visit, but studies have shown that a wide range of ailments can be effectively handled, from skin rashes to colds and coughs, as well as prescription renewals and mental health issues.

AI-powered app uses photos to determine nutritional content of meals

BY ELIZABETH CHOI
AND JEFF ALFONSI, MD

Poor diet is one of the leading causes of chronic disease and premature death in the United States and Canada. Almost as concerning is the limited number of tools both patients and providers have to combat this endemic.

For healthcare providers, it is time-consuming and often challenging to accurately obtain a dietary history. In fact, many dietitians take 20-30 minutes, and some spend up to 90 minutes, trying to document a dietary assessment.

Yet, obtaining and documenting dietary history can improve outcomes and help deliver better medical nutrition therapy (MNT), which is recommended by most major chronic disease guidelines. For patients, it is frustrating to track their diets, and many find it overwhelming to understand what matters most for their health.

However, with the use of artificial intelligence, some of these limitations can be overcome. Inner Analytics Inc. uses artificial intelligence (AI) to provide new insights into what patients are eating. Inner Analytics has combined machine vi-

sion with contextual data to decipher relevant nutritional information from photographs. For patients, snapping a picture is far more enjoyable than searching through a database or recording paper logs. Real-time feedback can also be provided to the patient.

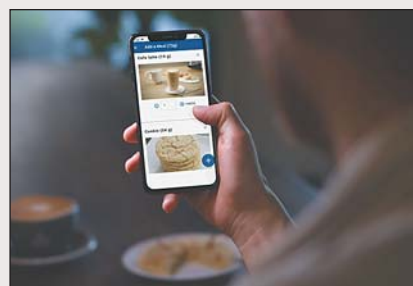
Inner Analytics launched its initial product in 2015 through a collaboration with the Hospital for Sick Children, in Toronto, to help children and adolescents with Type 1 diabetes manage their disease. This collaboration involved a multi-phase clinical research study to test the efficacy of Inner Analytics technology, which culminated in funding for a randomized control trial from the Physicians Services Incorporated Foundation, a physician-sponsored granting agency whose mission is to improve the health of Ontarians.

The objective of the randomized control trial is to see if the mobile application for carbohydrate estimation results in patients feeling more freedom to eat foods they want and enhanced ability to carbohydrate count. The team’s initial progress was presented at the 2018 Paediatric Academic Societies Meeting; the full trial is still in progress with results expected early in 2020.

Realizing that other patients can ben-

efit from the technology led to broader expansion. For example, the tool is being prepared to track sodium for those with hypertension and overall intake for those with obesity. A broader platform for cardiometabolic disease prevention is also being rolled out with one clinic at the end of 2019.

Indeed, although such tools have great promise, machine vision and artificial intelligence have their limitations. Machine



The app makes it easier to log your food intake.

vision can only recognize what is in the image. Hidden items – such as barbecue sauce under a bun or the coconut oil used to fry fish – cannot be detected.

Secondly, sizing foods automatically requires complex algorithms that currently have moderate accuracy. There-

fore, patients may still need to intervene to improve accuracy (for now).

Beyond artificial intelligence, patient behaviour – in terms of continuing to track and learn from their tracking – is necessary to achieve true benefits. How to best motivate patients is an area of active investigation by multiple researchers.

Finally, tracking food alone is not likely to ameliorate the epidemic of poor diet. The entire food supply chain needs to work together. Yet, the AI platform offers an important breakthrough in the battle.

Although machine vision and artificial intelligence are not able to perfectly and accurately identify all nutrients from a picture, they may offer a major improvement over how things are currently done.

They also offer new ways to store and analyze a dietary history and new opportunities for patients and providers to work closer together to try to achieve better health outcomes.

For instance, virtual models of care involving secure video or messaging can be added to the data generated from the AI platform to provide more frequent and personalized touchpoints.

Elizabeth Choi and Jeff Alfonsi, MD are co-founders of Inner Analytics Inc.



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Interior Health improves quality of the data collected for MedRec

BY DIANE JONES, PMP

The use of prescription medications in Canada, as in most of the western world, is widespread. Roughly 700 million prescriptions were written in 2018 alone. That's equivalent to roughly 20 pre-

scriptions for every man, woman, and child in Canada. As might be expected, senior Canadians tend to lead the way, with nearly 83 percent taking at least one medication and one in four having 10 or more prescriptions.

This heavy use of prescription medica-

tions presents huge challenges in the emergency department (ED). Obtaining the medication history of people who come to the ED prior to treatment is critical to ensuring patient safety as well as treatment efficacy.

Yet numerous studies have found that

medication histories are often incomplete within the clinical workflow. For example, a 2015 survey of Canadian hospitals with an ED and at least 50 acute care beds revealed that only 30 percent of ED managers believed their current processes were adequate to obtain a Best Possible Medical History (BPMH) for all admissions.

Issues with timely medication reconciliation (MedRec) in the ED place patients at risk for adverse drug events (ADEs). In fact, studies in the U.S. have shown that the ED is the third most common source of medication errors, and 30 percent of patients have at least one medical discrepancy after hospital discharge, which can lead to significant pain or clinical deterioration in the post-discharge period.

All of this demonstrates the importance of proper MedRec in the ED. Yet in Canada, MedRec is particularly challenging because only one province (British Columbia) has an online medication history database (PharmaNet) that encompasses more than 95 percent of prescriptions dispensed in the province, including community pharmacies.

Interior Health, a regional health authority with 22 hospitals in British Columbia, traditionally relied on manual MedRec processes in the ED that required clinicians to leave the EMR, enter log-on credentials to access PharmaNet via a portal, print or manually copy the relevant details, log off PharmaNet, and then return to the EMR to enter the medication history manually. This time-consuming process was prone to data entry errors that could compromise patient safety.

Recognizing the dangers of these issues, Interior Health joined the PharmaNet Integration Project, a collaborative effort between the British Columbia (BC) Ministry of Health (MoH) and Canada Health Infoway. The project's goal is to make medication profiles more readily available and visible to care providers within their EMRs and support the electronic capture of the BPMH.

Following rigorous due diligence, Interior Health purchased an electronic prescribing solution from its EMR vendor and a medication reconciliation solution from a third-party vendor that worked extensively with the EMR company. Implementation and testing began in 2015, and by 2018, Interior Health received approval from the Ministry of Health to launch a pilot site at South Okanagan General Hospital (SOGH).

The MedRec solution automated the population of medication histories from PharmaNet directly into Interior Health's EMR. Based on a discussion with the patient, the clinician then verifies a patient's current medications and makes necessary updates to create a current and correct eBPMH.

How it works: When a patient is registered in the ED, the system automatically requests and retrieves his or her PharmaNet



Diane Jones



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MHI automates vital sign collection in ICU and integrates with EHR

BY DAVE WEBB

A renowned Quebec cardiac hospital has implemented an automated, electronic solution to collect vital signs data from ventilators in its intensive care unit. It's another step towards Montreal Heart Institute's vision of a "Digital Hospital," says Leila El-Fehri, biomedical engineer with MHI.

Middleware from Marseille-based Enovacom helps automate the transcription of data from MHI's Maquet Servo-I mobile ventilators into the hospital's electronic health record and onto the nurses' hand-held tablets.

This saves time over writing the information down and re-entering it into the patients' electronic health records and other hospital systems. It also prevents transcription errors.

The Enovacom Suite was designed from the caregiver's perspective, says Jean Casini, Enovacom's North American business development director.

"What do caregivers do on a daily basis? How do we integrate it seamlessly?" Casini says. "It has to be transparent to the users."

Caregivers use the same applications that they have been using daily. As they make their rounds, the ventilators, connected to the hospital's TCP/IP network, update the applications.

"The project has achieved several objectives," says El-Fehri. Aside from eliminating transcription errors, the system allows regular logging of patient data, and allows clinicians

to quickly find vital parameters to speed medical decision-making, she says.

It also frees up caregiver time so they can focus on patients, she says.

The amount of time saved adds up, as more medical machinery is connected. At the Bordeaux-area Hospital Centre de Libourne, France, whose ICU is similar in size to MHI's 21-bed unit, as many as eight devices per bed are network-connected in this fashion, says Casini. It's saving the hospital two hours per caregiver per day.

The next step: extend the automation to the rest of the hospital: Enovacom – which was acquired by French telecom giant Orange Business Services in 2018 – has middleware libraries for a wide range of patient devices, including ECGs, pumps, ventilators, anesthesia stations, dialysis equipment, oxymeters and more.

Choosing the hospital's roadmap to more extensive automation is a matter for discussion, says Marius Tine, strategic advisor with Purkinje Inc. Services Informatiques, the Montreal-based integrator for the project.

"You can integrate pretty much all of the vital signs equipment," says Tine. The integrator and the hospital must first determine which integrations will add the most value, and what the cost and risk management implications are.

MHI put together a team about 18 months ago with a mission to drive innovation in "a responsible and human way," says Anne Nguyen, co-ordinator of the hospital's Digital Hospital Initiative. The



Anne Nguyen, Digital Hospital Initiative coordinator.

five-year vision for electronic health records revolves around real-time data collection and access, including telemedicine-based information from patients who aren't on site.

A better hospital for a better care: MHI is focusing on "avant garde," mobile-first technology, Nguyen says. The strategy is patient-centric and designed to combat the "digital fatigue" of learning new applications and technologies.

The Digital Hospital vision is supported

by four pillars:

- Care focused on patients' well-being. The initiative is to build technologies and processes around the patient experience. Technologies that are transparent to the user can help patients with treatment and compliance help make the patient part of the decision-making process.

- Changing the current healthcare system. Mobile technologies like smartphones, mobile apps and smart objects increase patient engagement and allow different healthcare professionals to co-ordinate follow-ups.

- Better prevent, predict and cure cardiovascular disease. The massive amounts of data collected through the network will be centralized and integrated with other clinical data picked up from the network.

- Strengthening at-home healthcare. Mobile technologies will create a holistic, rather than episodic, approach to patient care. Data collected in real-time from the patient can extend care beyond the hospital.

The hospital's IP network is also to be fitted for navigation technology. The 60-year-old campus is undergoing a renovation and expansion, adding 15 percent in floor space, Nguyen says.

"There's a lot going on right now," Nguyen says. The site is becoming tricky to navigate, she said, particularly for older patients. The average age of an MHI patient is 67 years.

"When the patient is in MHI, it will be easier to get from Point A to Point B," Nguyen says.

OTN has moved its video-hosting platform to Amazon Web Services

BY REJEAN BOURGAULT

Virtual care – the practice of offering remote healthcare services through communications technology – offers a practical way for patients to access a healthcare team regardless of their location. And as technologies evolve, there are more options that allow virtual care to rival the effectiveness of traditional medicine – for example, through videoconferencing and the addition of remote instruments.

Modern virtual care could be transformative for Canada, allowing the country to overcome its geographical challenges and truly deliver on the promise of equitable public healthcare to all its citizens. Advocates hope that this service will help improve access to critically needed services, such as primary care and mental health services, to Canadians in rural and remote communities.

OTN is delivering on that vision, providing two-way videoconferencing for patients in hospitals and rural locations throughout Ontario. In much of the province, accessing specialized care can be inconvenient and time-consuming, with patients in remote locations traveling hours to regional healthcare hubs. Virtual care, provided through OTN, can minimize travel and wait times, making

the delivery of public healthcare in Ontario more cost-effective – and most importantly, more equitable.

The service has seen a spike in demand in recent years. It now offers care through 170,000 healthcare providers at more than 1,600 sites. Managing this increased demand through the network's legacy IT infrastructure proved challenging – adding additional capacity to their on-premise system required downtime, which could, at times, increase wait times for healthcare providers in need of technical support.

OTN made the strategic decision to move its video-hosting platform to the cloud so it could spend more time serving patients and less time managing infrastructure.

"We wanted to be able to focus our internal resources on technical improvements that would enhance our customer experience, rather than the day-to-day tasks related to scaling the platform to meet demand," said Alex Reidiboim, Lead Solutions Architect for OTN. "We wanted someone else to manage the scalability and operational infrastructure of our video environment for us, so we could deliver more value to customers."

After selecting Amazon Web Services (AWS) as its cloud provider, OTN has been able to mitigate compliance risk and access real-time metrics that allows it

to monitor the network, optimize capacity, and scale up and down as necessary.

"We considered all the top cloud providers, but AWS won because of its adaptability and flexibility," said Reidiboim. "We also loved the number of features that could be implemented."

Since moving to the cloud, OTN has been able to significantly reduce downtime and increase its functionality, without requiring the length of time that

would be needed to manage on-premise. For example, at OTN's launch mobile customers experienced connectivity problems, as some mobile providers required IPv6. In the on-premises environment, Reidiboim estimates



Rejean Bourgault

that testing, determining the cause, and fixing the issue would have taken six months. But after migration to AWS, fixing the issue required no more than a week – without any downtime or impact on customers.

Instead, "because of AWS, OTN engineers are spending their time helping customers troubleshoot videoconferencing issues and making sure we're provid-

ing the best healthcare experience," Reidiboim explains.

Ultimately, OTN's move to the cloud has enabled it to refocus on its core mission: delivering the best possible virtual care experience to the people of Ontario, especially those in remote, rural and underserved regions.

Under its old system, OTN video engineers had to split their time between serving customers and dealing with mundane tasks such as hardware failure and adding additional capacity.

Now that they can automatically provision their platform, and scale it up or down on demand, OTN is able to improve its core service, helping healthcare providers troubleshoot videoconferencing issues and improve the user experience. The move has been so successful that the organization is looking to use its new cloud infrastructure to provide metrics not just to OTN engineers and management, but to other healthcare stakeholders.

With a solid cloud foundation under its feet, OTN is focusing on improving its operations and making efficiencies. In the future, OTN will leverage its cloud services to create operational dashboards – making detailed metrics readily available to stakeholders.

Rejean Bourgault is Public Sector Lead for Amazon Web Services (AWS) in Canada.

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Improving documentation: eventually, the EMR will be writing itself

Electronic medical record (EMR) adoption among primary care has risen to 95 percent in the U.K., Australia and New Zealand; this rate has reached 85 percent for Canadian primary care physicians, with wide variances between provinces. The medical record is at the heart of good patient care. “Document, document, document!” the Canadian Medical Protective Association writes, adding that because medical records facilitate good care, providers should record patient encounters as soon as reasonably possible.

When it comes to timeliness, however, many might wonder what “reasonable” means. Some institutions have published on this topic, with one clearly asserting that documentation should be completed within 24-48 hours of the encounter. Anything longer than that would affect the provider’s ability to remember critical details of the encounter, potentially having a negative impact on patient care and outcomes, as well as the healthcare organization’s financials.

As EMRs have been gaining traction in recent years, providers are beginning to use them for more than simply reviewing transcribed reports. Despite these transitions, handwritten, scanned notes are still commonly found in Canadian patients’ medical records, and it can still take as much as six weeks for physicians’ dictations to come back from transcription.

“This type of documentation with these delays has a major impact on the ability to care for patients in real time. That is, a patient’s condition can change by the minute, and having accurate, up-to-date documentation is essential to appropriate and life-saving care,” says Dr. Robert Budman, a Chief Medical Information Officer in the U.S. He continues: “Consider a patient who has been discharged following a surgery but returns to the emergency department the next day with a high fever. Waiting 24 hours for the current medical records –

much less six weeks – is unreasonable.”

In addition to patient care implications, inaccurate, incomplete patient documentation has financial and physician reputation effects as well.

Documentation that does not properly capture the patient’s story, severity of illness, risk of mortality, and the resulting care the patient received means poor quality metrics, which in turn influences funding.

Further, because the documentation doesn’t match the reality of patient care, clinicians may be penalized with poor quality metrics, even when they are no less qualified than other providers.

Further driving these changes: physicians today are more mobile than ever and taking multi-disciplinary, integrated team approaches to patient care. As a result, they recognize the need for having accurate, robust, immediate patient information available in the EMR.

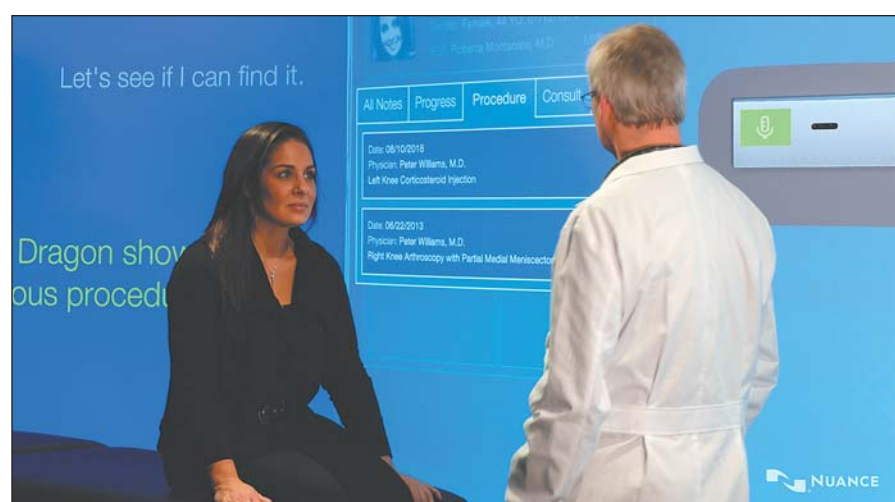
Thus, greater, more rapid adoption of EMRs and their enabling technologies, such as speech recognition and computer-assisted physician documentation or CAPD, which advises physicians while

In 2020, Nuance will bring Computer-Assisted Physician Documentation (CAPD) to Canada’s healthcare sector.

they’re documenting when important information is missing or needs clarification), is on the horizon.

Provider burnout is a concern as well, with alarming implications both for the providers and their patients. Recent research reveals that about one-third of Canadian physicians experience depression, and have the highest rate of suicide of any profession. Mental health support is one answer, but so is alleviating the administrative burdens that can contribute to burnout.

Speech recognition and CAPD can ad-



Nuance’s Computer-Assisted Physician Documentation charts the visit as the clinician focuses on the patient.

dress all of these concerns and challenges facing the healthcare industry, but the key to success lies in thoughtfully adopting healthcare technologies and implementing innovative approaches over time.

As just one example, British Columbia’s Northern Health understands these challenges acutely and has supported its EMR solution with Nuance Communication’s speech recognition platform, Dragon Medical One. The intent is to not only ease the burden of documentation on the organization’s 1,000 physicians, but also to enable near real-time patient documentation.

“Nuance’s speech recognition solution is HITRUST CSF certified and is hosted in a Microsoft Azure HITRUST CSF-certified data centre in Canada,” said Joe Petro, Executive Vice President and Chief Technology Officer at Nuance.

He added, “This infrastructure has allowed us to successfully roll out Dragon Medical One here in Canada, and it’s what enabled Northern Health’s successful program with the ability to meet British Columbia’s stringent privacy regulations.”

Petro also explained that because Nuance has established long-term, pre-exist-

ing partnerships with the major EMR vendors, their speech recognition platform is embedded in the EMRs, and other enabling technologies are easily integrated as well.

“Nuance is committed to making continued investments in these ways, such as the data centre, but also in terms of the next phase of technologies we’re bringing to Canada. In 2020, both CAPD and clinical documentation improvement (CDI) solutions are slated for Canadian availability,” he said.

Backed by artificial intelligence (AI), CAPD offers documentation guidance at the point-of-care, helping improve the effectiveness of patient documentation while avoiding rework. Likewise, AI can be applied to the CDI workflow to bring physicians and CDI teams together in a continuous documentation quality improvement effort.

Virtual assistance is also available today, and Nuance has made significant headway here, as well, to enable providers to use their voice to command and control the EMR, search the patient record, and order labs or prescriptions, and so on. In fact, Vanderbilt University Medical Center already has their virtual assistant up and running.

“These solutions are the next stop, if you will, on our journey to ambient clinical intelligence, or ACI. Soon, ACI will close the gap between the clinical conversation and patient documentation,” says Petro. “The exam room will ‘listen’ to the physician-patient encounter, capture key clinical facts, and initiate orders and prescriptions. Ultimately, the documentation will write itself, letting the provider focus their attention on the patient, not the computer,” he continues.

Incremental steps toward automation and augmented intelligence along the way will add up over time. Thoughtfully and purposefully adopting technologies at a pace that makes sense for each organization’s funding needs, quality initiatives, and physician readiness demands a technology roadmap to guide this journey.

Organizations can take advantage of increasing levels of automation that match the burdens they need to remove for providers while a phased approach will make it easier to learn from the best practices and lessons learned from other organizations – all while making critical clinical data available in real-time to help better care for patients.

Interior Health uses new solution to automate MedRec

CONTINUED FROM PAGE 10

profile. The MedRec solution further automates the eBPMH documentation process by analyzing and translating free-text prescription information, validating and normalizing the data. It then sends the cleaned details to the EMR to streamline the process and further prevent data entry errors when creating the eBPMH at the point of care.

This tight integration decreases the risks associated with transcription errors, improves clinician workflows and enhances prescribing decision-making by automatically transferring details on community-dispensed prescription medications and patient-reported drug allergies to the EMR.

The results to date have been tremendous. SOGH clinicians save an average of 3.5 minutes per ED visit, or about 3 hours each day based on an average of 49 ED visits per day.

The MedRec tool translates each prescription to mapped discrete fields as the eBPMH details are entered, saving another

3.5 minutes for every inpatient admission, which comes out to 39 hours per year based on an average of 670 admissions per year.

Most importantly, the clinical accuracy of medication histories climbed from 99.184 percent in month three to 99.497 percent in month six, while the successful

As of July 2019, the solution had been rolled out to eight facilities, and it will be implemented in 15 more.

addition of fields omitted from the PharmaNet sig grew from 21,671 to 31,209 between months three and six.

Chart audits prior to implementation and at three and six months showed a 12 percent improvement in quality, while eBPMH verification increased from 87 percent to 90 percent. eBPMH completion within 24 hours also rose, from 87 percent to 98 percent, making more and better information avail-

able to clinicians, while eMedRec completion by physicians at admission jumped from 76 percent to 98 percent.

The PharmNet integration also improved follow-up times for abnormal laboratory reports and has given physicians the ability to request real-time medication history updates to verify if patients are taking their medications correctly.

As of July 2019, the solution has been rolled out to eight facilities, and Interior Health is in the process of implementing the solution across its remaining 15 sites.

While it is still too early to make a definitive statement about patient safety improvements, the expectation is that the availability of timely information and the elimination of manual processes will have a significant impact on reducing ADEs, as well as waste and duplication.

Diane Jones, PMP, is a team leader and project manager at the Interior Health’s Information Management and Information Technology department.



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New technology combines AI with brain implants to stave off illnesses

Neuralink has the potential to combat or cure diseases like Parkinson's, dystonia, and epilepsy.

BY DR. SUNNY MALHOTRA

Neuralink is a company dedicated to enhancing our health through the integration of artificial intelligence (AI), implants, and human neurologic functions. It was created as a means of understanding and treating neurological pathologies like Parkinson's, dystonia, and epilepsy with potential to treat conditions such as depression or chronic pain.

Neuralink is a neurological technology that is expected to require no hospital stay, can last decades once inserted into the brain, and is wireless – making it as simple and automated as LASIK.

Neuralink works using the basic principle of neurons, which represent how information in our brains is transmitted and controlled in our bodies. Neurons receive input from their dendritic limbs and in response, produce action potentials that travel down the axons and synapse with other neurons. These action potentials produce signals that are seen as spikes on EEG through the use of electrodes and provide information to localize the timing and activity rate of neuronal activity.

These electrodes can also be used to stimulate neurons in return, to produce action potentials and transmit information.

Current FDA-approved neurological technology used to treat brain diseases like Parkinson's are only able to stimulate a few neurons at a time, as electrodes are limited and confined to certain areas of the brain.

The placement of these electrodes requires invasive surgery with the potential risk of vascular trauma and unsightly scars.

In contrast, Neuralink uses threads to record from

and stimulate as many neurons as possible across various brain regions; it does so through chips containing 1,000 electrodes.

The threads can transfer a higher volume of data than previous technology, as there are thousands of electrodes placed in each thread. These threads are strategically placed by a surgical robot to avoid any trauma by bypassing vasculature and are also much

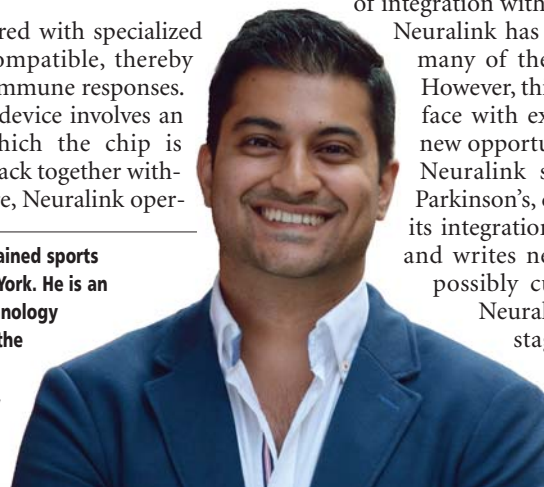
The robotically implanted "threads" are more flexible than previous solutions, decreasing the chances of damage to surrounding brain structures.

more flexible than previous forms of technology, decreasing the chances of damage to surrounding brain structures.

These chips are covered with specialized packaging that is biocompatible, thereby minimizing the risk of immune responses.

The insertion of the device involves an 8mm incision into which the chip is placed and then sealed back together without stitches. Furthermore, Neuralink oper-

Dr. Sunny Malhotra is a US trained sports cardiologist working in New York. He is an entrepreneur and health technology investor. He is the winner of the national Governor General's Caring Canadian Award 2015, NY Superdoctors Rising Stars 2018 and 2019. Twitter: @drsunnymalhotra



ates on a wireless brain-machine interface (BMI) that uses Bluetooth. Patients can control Neuralink through a mobile phone, making it the first patient-controlled neurological technology.

Through BMI, Neuralink gives patients the ability to control computers, keyboards, and mouse clicks by thinking about the movement they want the software program to elicit. Neuralink also has the ability to create visual feedback for the blind through stimulation of spatial maps in the visual cortex, or the sensations of touch through the stimulation of the somatosensory cortex.

This is done through the use of Neuralink's N1 chip that contains an analog pixel per electrode, which takes the neuronal signal and decodes it using a converter, allowing us to read what the signal is. A code is used to stimulate the neurons in the primary motor cortex and to perform the action with the use of integration with AI.

Neuralink has not started human trials and many of these functions are theoretical. However, this may enable patients to interface with external software, allowing for new opportunities to engage in the world. Neuralink strives to treat diseases like Parkinson's, dystonia, and epilepsy through its integration with AI. Amazingly, it reads and writes neuronal signals to control or possibly cure these diseases. Although

Neuralink is still in the preliminary stages of its development, the

mixture of AI and brain implants creates a whole new pathway in healthcare and the fight against illness and disease.

Fresh approaches to the aging crisis are available

BY DAVID STOLLER

In September, Greta Thunberg, 16, addressed the U.N.'s Climate Action Summit in New York City with a passionate speech that highlighted the critical nature of the world's global warming epidemic. When reading about her address, and then watching it online, I couldn't help but find common ground between her comments on climate change and the crisis of global aging.

You might consider it a leap to equate the challenges of a warming planet with those of an aging population. However, I suggest the urgency of the problem is quite similar.

Both scenarios require significant changes to the global infrastructure to support a new reality; both problems are already creating challenges for our population; and climate change, as well as the world's aging population, represent an economic challenge never-before

seen in the history of this planet.

From the perspective of the aging population, today we are at a crossroads that requires us to decide if 'business as usual' is going to be enough to support the new demographic reality. With some research, thought, and consideration to the science and facts, it's hard to avoid the conclusion that we must change our current 'business as usual' approach to better support the one in four Canadians that will be a part of our 65+ population.

Today, change is required.

To support the change, innovators, entrepreneurs, and business leaders are working together to develop new solutions and technologies that will allow us to help older adults age gracefully.

In some cases, this means allowing people to age in the setting of their choice; in other scenarios, it's about providing healthcare at the right time, in the right place,

and with the right advisor.

As well, solutions that empower not only older adults but their caregivers, will find significant use and value in our society as we tackle this problem. Here are a couple of technologies that exist today, are available on the market, and can make a difference – but do not represent doing 'business as usual' anymore.



David Stoller

Consider MySense.ai, a UK-based company with offices in Canada that describes itself as "compassionate technology that's changing lives for the better".

Leveraging the power of artificial intelligence (AI) and IoT devices, the team at MySense has developed a

well-being analytics platform that learns an individual's behavioural patterns to quickly identify declining health or immediate care needs.

Using eight fixed sensors and a wristband, MySense learns from 7,000 data points each day to understand what a person's normal behaviour looks like. If the system picks up a pattern of decline, an alert is sent to a dashboard and mobile app, allowing nominated responders to manage care needs before they escalate.

Impressively, MySense categorizes wellbeing alerts into five useful categories: hydration, nutrition, balance, independence, and alignment – allowing care providers to develop targeted care plans.

When deployed, MySense can keep people away from the doctor, out of the hospital, and avoiding significant healthcare emergencies. Thanks to the power of AI, MySense can see what many of us miss – subtle changes in

CONTINUED ON PAGE 22

How 5G wireless is ushering in a Golden Age for remote healthcare

BY RYAN WEBBER

With speeds 100 times faster than 4G and bandwidth that can drastically improve access to densely populated areas and reach remote regions, fifth generation (5G) cellular wireless is poised to usher in the next era in healthcare transformation around the globe. 5G won't be available to the Canadian public until 2020, but preparation for its rollout is already under way.

5G in healthcare: 5G will result in improved remote patient care, and reduced network latency. Not only will video run more smoothly on smartphones and other devices, but medical instruments can be deployed and used more effectively.

5G will enable quicker downloads of patient data, including large files such as MRIs, and will create more reliable telemedicine by reducing video lag and expanding internet access – two of the biggest factors impeding remote care on slower networks. Healthcare providers will be able to collaborate from different locations using augmented reality and view 2D and 3D content together without any detectable delay.



Ryan Webber

At the same time, there are security challenges that need to be assessed with 5G. Due to the fast download speeds, private data that is not secured can be shared very quickly on a 5G network.

As well, the faster data rates of devices – and the networks that support these – could increase the risk of large-scale, debilitating Distributed Denial of Service (DDoS) attacks.

DDoS attacks direct data towards a targeted piece of IT infrastructure through connecting and using several devices, inundating the IT infrastructure to the point that it fails. These attacks can be devastating for healthcare providers and can result in mobile health workers being shut out of critical systems necessary for delivering high-quality patient care on time.

Managing mobile devices and IoT endpoints: To minimize these risks and issues, healthcare providers need a mobility and IoT solution that integrates digital platforms and devices, ensures they run reliably and are secure. They also need the ability to be managed remotely. This will ensure high-quality care, while reassuring patients that their personal information is being kept safe.

Implementing an integrated enterprise mobility management (EMM) solution will simplify the security and management of mobile devices and IoT endpoints for business-critical mobility.

For example, an EMM solution can remotely wipe data from compromised devices and shut them down, along with preventing any sensitive information from being sent to unauthorized persons or even allowing a screenshot to be taken.

How Healthcare organizations can pre-

pare: Healthcare organizations and those adjacent to the industry need to take a 360-degree approach in advance of 5G integration to make full use of 5G and adapt as new technologies are introduced.

They should:

- Ensure that a wireless infrastructure net-

work, preferably cloud infrastructure, has been developed and implemented securely;

- Incorporate security measures and privacy compliance from the beginning;

- Apply edge computing to reduce the friction of data movement delays between the end user and the centralized hub. This

will allow for easier access to insights and intelligence, which will enable users to make faster decisions and apply responsive actions.

Ryan Webber is Vice President of Enterprise Mobility, SOTI.

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From AI to IA: Artificial intelligence makes strides as an intelligent assistant

Two notable projects are focusing on radiology and dermatology.

BY DIANNE DANIEL

Canadian researchers are digging deep to help solve an age-old problem: diagnostic error. By applying recent advances in artificial intelligence (AI) – including machine learning, deep networks and cutting-edge computer vision algorithms – they are working to automate the process of arriving at medical consensus, training machines to recognize thousands upon thousands of digital images so they can quickly and accurately serve as intelligent assistants.

“I would never have dreamed of saying this three or four years ago, but we have the historic opportunity to eliminate diagnostic error,” said Hamid Tizhoosh, director of the University of Waterloo Knowledge Inference in Medical Image Analysis Lab (KIMIA Lab) in Waterloo, Ontario.

Established in 2013, the lab is at the forefront of medical image search. The goal is to extract information that not only supports speedy and accurate diagnosis of disease, but also establishes “new quality assurance based on the mining of collective knowledge and wisdom.”

Whereas other AI solutions in healthcare are pursuing prediction, segmentation, visualization or classification, the KIMIA Lab team is focused solely on using AI for image search. As Tizhoosh explained, the process involves taking current diagnostic images and searching for similar past cases in large databases of digital images.

“What doctors do, is they try to get a second opinion, which is not easy, which is expensive, which is time-consuming, and not every hospital can do it for every case,” said Tizhoosh. “What we want to do with image search is to do provide second opinions computationally, virtually; the pathologist shows us an image and we go in and find the top five, 10 or 20 similar cases and bring them back with corresponding metadata, such as radiology reports.”

The main rationale behind the work is that in medicine, nothing can be better than the collective wisdom, he added. If the majority of images matched by the computer suggest a biopsy is indicating adenocarcinoma, for example, a treating physician can be confident it is.

They can also access historical reports for each case that is matched, using the information to validate their own knowledge and arrive at a confident decision about diagnosis and treatment. “And the beauty here is that AI is just an assistant,” stated Tizhoosh.

Funded in part by an Ontario Research Fund: Research Excellence grant, a federal innovation fund grant and several public and private sponsors, the 20-member lab is intent on achieving computational consensus for histopathology. The overarching vision is to create a machine for biopsy samples that works in a similar fashion to current blood analysis machines: a sample goes in and after a minute, a full diagnostic report comes out.

For now, research goals are more humble, said Tizhoosh. After purchasing the necessary equipment to download and store 30,000 publicly available biopsy samples from the U.S. National Cancer Institute (equivalent to more than 20 million ordinary

images), KIMIA researchers and their ORF partner Huron Digital Pathology recently completed a major validation report establishing that if enough images per disease category are available – roughly 5,000 patients – they can achieve close to 100 percent accuracy in image search.

Access to publicly available data sets or bio repositories is key to advancing their work. In addition to cancer, the lab’s findings can be applied to more than 6,000 diseases and multiple diagnostic imaging modalities, including X-ray, MRI, CT-scan and ultrasound.

Earlier this year, the KIMIA Lab partnered with University Health Network (UHN) and Toronto-based Vector Institute, an independent, not-for-profit research institute focused on leading-edge machine learning, to use AI to enhance radiology diagnoses.

The second project to be announced as a Vector Institute Pathfinder Project – one that can demon-

ance process for all cases”, said Leon Goonaratne, Senior Director at UHN Digital.

As a starting point, three KIMIA Lab researchers are working with Leon’s team as well as radiologists from JDMI (Joint Department of Medical Imaging – UHN, Sinai Health System, and Women’s College Hospital) – to detect the occurrence of a pneumothorax (collapsed lung) in chest X-ray images. The condition represents a technical challenge because some cases are difficult to see, meaning doctors can miss small collapses.

“We felt that the detection of pneumothorax was a great place to start for our AI project with the Vector Institute. It allows us to focus on a very specific image type, on an indication or diagnosis that we see frequently, but can also be missed,” said Goonaratne, noting that the intent is to enhance the interpretation of the human eye, since unlike humans, “the computer can detect very subtle differences at the pixel level, very easily.”

UHN will be supplying anonymized medical images and reports required by the researchers. A subset of these images will also be annotated by JDMI radiologists. Once the detection tool is integrated into Coral Review, the JDMI radiologists will play an integral role in helping to further train the computer algorithm by providing feedback.

Working with publicly available data, researchers are already achieving 85 percent accuracy and intend to push it closer to 100 percent once they start to work with the well-curated data sets provided by UHN.

Laurent Moreno, Vector Institute Director of Health AI Applications, called the project ground-breaking. “What is amazing about this project, is that AI enables radiologists and clinicians to receive a second opinion based on thousands of additional diagnoses,” he said. “It will be a game-changer in the field because the technology is at the service of the clinician and could speed up the time a radiologist spends, enabling people

to be treated faster. It will be particularly useful in unusual cases, with the potential of confirming diagnostics and showing which treatments are likely to produce the best outcomes.”

The Pathfinder Projects are part of Vector’s overall health strategy. The aim is to support and enable health AI research with a focus on three streams: world class research, widespread application and analysis-ready data. Moreno said organizations at both the provincial and national level are getting better at providing data health assets, and the institute is working to facilitate appropriate access to them.

A second Pathfinder Project is under way at St. Michael’s hospital in Toronto in conjunction with the Li Ka Shing Centre for Healthcare Analytics Research and Training (LKS-CHART). LKS-CHART researchers are working to develop an early warning system for general internal medicine.

The system will use AI to process regular feeds of health data and predict when a patient needs to be transferred to the Intensive Care Unit. Accurately

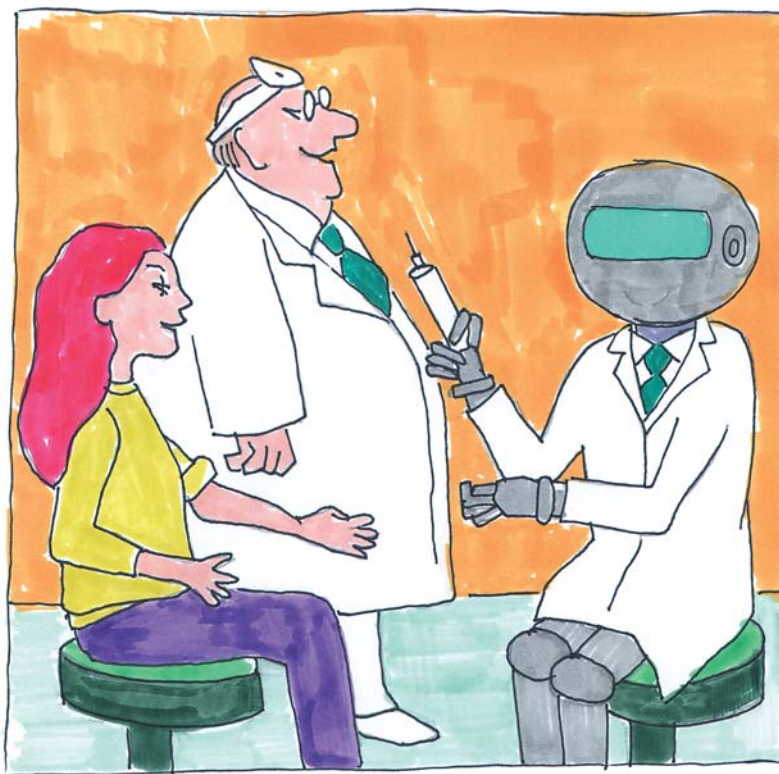


ILLUSTRATION: LINDA WEISS

strate the positive impact of a specific health AI application within 12 to 18 months – the UHN project is aimed at adding an AI-enabled detection feature to Coral Review, a quality and educational tool created by UHN for performing peer review and peer learning for imaging-based medical departments such as Radiology, Cardiology, and Pathology.

Coral Review is currently in use at 20 hospitals in Ontario and is also the chosen peer review software for the Hospital Diagnostic Imaging Repository Services (HDIRS), an independent, not-for-profit corporation responsible for operating two of the province’s four diagnostic imaging repositories.

Hospitals and imaging centres that connect to HDIRS can use the peer review service. In its current form, the software facilitates the retrospective, random, anonymous and structured review of cases.

Since the current process is manual, sites typically configure the scope of their reviews to between 2-4 percent of all cases. “By applying AI technologies, our goal is to make it possible to apply a quality assur-

predicting when patients need to be transferred 12 to 24 hours earlier may allow more time for potentially life-saving early-intervention care, decreasing rates of cardiac arrest and mortality.

A third project, in partnership with Public Health Ontario, is using computer vision to automatically identify blacklegged ticks that may carry bacteria causing Lyme Disease. This project has a longer-term goal of developing an app anyone can use to take a photo of a tick with their smartphone in order to obtain a rapid medical assessment of high risk tick bites.

"I think we are reaching the stage where people are getting a better understanding of the potential of machine learning. When they understand the potential can be very positive for the field of healthcare and for patients, in general it's well received," said Moreno. "AI should not be viewed as a way to replace humans. Instead, it provides cutting edge tools to the clinicians, to make them beneficiaries of the technology."

Maryam Sadeghi, CEO and co-founder of Vancouver-based start-up MetaOptima Technology Inc., said implementing AI in real-life clinical settings comes with challenges but agrees there is room today for machines to serve as intelligent assistants. She cautions early adopters to be "fair to the machine."

"Part of being fair to the machine is we all make difficult decisions every day and we make mistakes; actually, in medicine we learn from mistakes," said Sadeghi, pointing out that human accuracy is not 100 percent. "So many cancers are missed every day in a clinical setting, but if the machine misses one, it's going to end up the top story on the national news," she said.

The company she founded with husband, Majid Razmara, is working to develop an intelligent dermatology solution called DermEngine and a mobile dermatoscope called MoleScope. DermEngine is intelligent software for the imaging, documentation and diagnosis of skin conditions, including cancer. MoleScope is a skin magnifier that easily attaches to a smartphone to capture high-quality skin images.

According to MetaOptima, DermEngine should be thought of as a "smart assistant – a silicon-made colleague capable of providing educated insight on a given case based upon the collective knowledge obtained from a large number of diverse clinical cases." As an imaging and analytics system for capturing and analyzing images of the skin, hair and nails, it helps to manage a busy dermatology office. The AI component is intended as an evidence-based assistant to support clinical decisions.

Recently, DermEngine was found to have the power to classify skin lesion images with a higher accuracy than experienced human professionals. However, initial product implementations aren't focused on diagnoses. Instead the company is focusing on what Sadeghi calls intelligent e-triage, using the machine as a smart assistant to filter urgent and non-urgent cases so that urgent cases such as melanoma rise to the top.

"You'll have a human expert who is going to review everything, but this is expediting appointments for patients who need to be seen first," she explained.

The company has an office in Australia and is about to open in the United States,

as well. Here in Canada, MetaOptima is one of several partners working with Change Healthcare to develop a cloud-based Dermatology Point-of-Care Intelligent Network, one of the first cohort of projects to be announced by Canada's Digital Technology SuperCluster.

The \$9.7-million project is not only aimed at expediting urgent cases through e-triage, but will also create algorithms for

clinical decision support, using real-life clinical data.

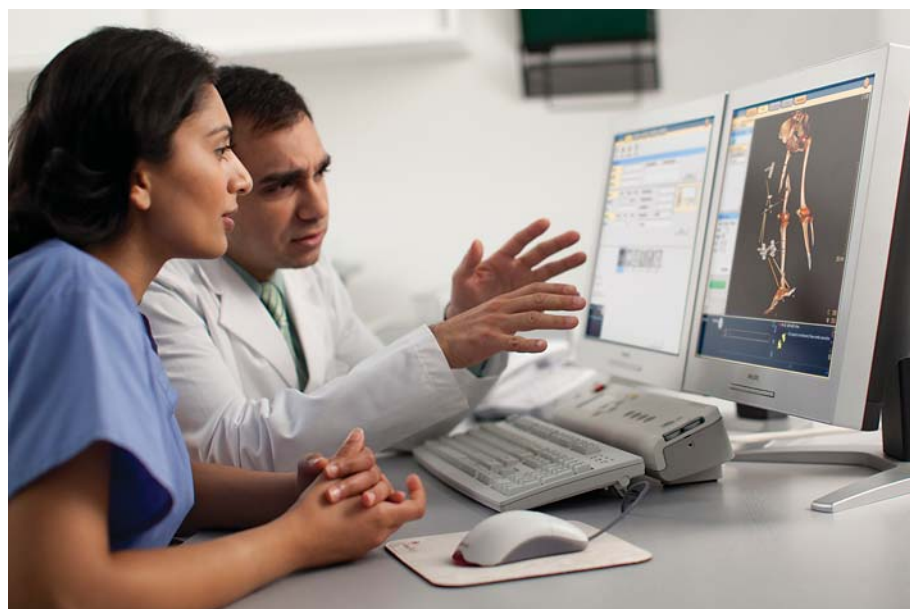
According to the project overview, one in six Canadians will develop skin cancer during their lifetimes at a cost to the healthcare system of more than \$500 million. Due to a severe shortage of dermatologists, Canadian wait times can be six months or more, but melanoma can progress in as little as six weeks, with sur-

vival rates declining from 98 per cent to 15 per cent if treatment is delayed.

Under the SuperCluster project, B.C. primary care doctors will send dermatology e-referrals to Providence Health Care for e-triage. "So, this is not about diagnostics, it's not going to read these images and say: 'This is melanoma, this is not melanoma,'" explained Sadeghi. "It's going

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Medical Imaging News Canada is being sent to radiologists and DI department managers across the country, as well as to technologists, radiation therapists, IT directors, health region managers and government health officials.

Healthcare Technology

Working with government and industry groups, radiologists tackle AI

BY NATALIE ST. PIERRE

OTTAWA — Artificial Intelligence (AI) will be part of medicine. It appears that AI will have a major impact on the practice of radiology, and many questions are now being asked about how it will do so, and when? These are questions that the Canadian Association of Radiologists' AI Working Group is currently tackling and providing guidance on.

In May 2017, the CAR established an AI working group led by Dr. An Tang, a radiologist and researcher based at the University of Montreal. Under Dr. Tang's leadership, the AI working group is educating the medical community about the role of AI in radiology. It has also brought structural issues to light by publishing two related White Papers.

The potential opportunities to enhance patient care offered by AI are why the CAR is committed to doing everything it can to help in the responsible adoption of AI technologies.

The initial CAR White Paper on AI in Radiology was recognized as one of the top papers in the Imaging Informatics Year in Review 2018, with a record number of downloads.

This paper not only received traction on the Canadian front, but also globally, and has been cited at international radiology events.

The most recent paper, entitled "Ethical and Legal Issues related to AI in Radiology", was published in April 2019 and thus far has received considerable attention not only from radiologists but also from government officials, as well as from the broader medical community.

On June 6th, Dr. Tang represented the CAR at the Federal Standing Committee on Access to Information, Privacy and Ethics, to discuss recommendations for ethical and privacy considerations in the implementation of AI.

A focal point of the discussion occurred when Dr. Tang was asked about the future of radiologists, given the potential of AI in medical imaging. Dr. Tang responded by paraphrasing Mark Twain, saying "The rumours of our demise are vastly exaggerated". The Radiology community knows that the appropriate adoption of AI will be complementary to their work in caring for patients.

"AI development and implementation is occurring at a rapid pace globally. We must think beyond borders and continue our discussions with our international counterparts," said Dr. Tang.

Members of the CAR AI Working Group have contributed to a Joint European and North American Multi-Society statement on the ethics of AI in radiology. The electronic version of the statement is set for simultaneous publication in November 2019 in the CAR Journal, Radiology, Insights into Imaging and the Journal of the American College of Radiology. Stay tuned for the release of this statement.

The most recent and exciting initiative is the government of Canada's Strategic Innovation Fund. Earlier this spring Minister Bains announced a \$49 million investment in the development and implementation in AI.

This grant was awarded to a consortium led by the Terry Fox Research Institute and Imagia focused on accelerating medical breakthroughs. The consortium partners have committed to an additional \$108 million plus \$165 million in-kind contribu-



Dr. An Tang, a radiologist and AI expert

tions to help achieve this important work.

This is a record amount of investment for AI in diagnostic imaging research in Canada. The CAR is pleased to be part of this consortium, which is composed of industry and academic partners, including the Canadian Heads of Academic Radiology. The partners are looking forward to exciting home-grown research discoveries in the future.

The current membership of the AI working group is comprised of 66 individuals. They include radiologists and technology experts, such as physicists, computer scientists, and engineers, as well as legal and ethical representatives. The CAR views advancement in AI in medical imaging as a collaborative effort and will continue to

work with leading subject matter experts.

The next initiatives on the horizon for the CAR AI working group will include examining how AI software will be implemented in clinical practice and to provide guidance to radiologists on how to select and deploy software in their departments.

"The AI Working Group has made great progress. However, there are still unanswered questions that need to be addressed. The CAR will continue to be part of the development and implementation of AI in radiology, but we need federal leadership to realize the full potential in Canada. We believe that the federal government can help to fulfill this role," said Dr. Mike Barry, CAR President."

In the CAR's 2020 pre-budget submission, we asked the federal government to make a \$10.5 million investment over three years to establish federal frameworks to regulate the implementation of AI tools in radiology and healthcare.

Canada is in a unique position to assist with the collection of data given the framework of our universal healthcare system. With the government playing a pivotal role in privacy, we can ensure the data is clean and free from identifying information, thereby respecting the anonymity of patients.

With the right ethical and regulatory framework, we believe that AI in radiology can vastly improve the delivery of healthcare. Discussions with the federal government have begun and we are hopeful to see movement over the next few years in this area.

Natalie St. Pierre is Director of Marketing and Communications, Canadian Association of Radiologists.

Edmonton gains ground as worldwide centre for AI and machine learning

While Montreal, Toronto and Vancouver have received a lot of attention as leading-edge centres for the development of artificial intelligence, Edmonton has been building its own strengths in AI and machine learning. What's more, Edmonton's AI researchers have some advanced projects under way in healthcare.

At the heart of things is the Alberta Machine Intelligence Institute (Amii), which is part of the University of Alberta. It's one of three Canadian AI centres of excellence established through the Pan-Canadian AI Strategy. Moreover, Edmonton is the home of Google's first DeepMind office outside of the United Kingdom – DeepMind was drawn to the city by the strength of its AI researchers.

Some highlights of the work being done at the University of Alberta:

- An autonomous intelligence system is helping seniors stay safe both at home and in care facilities, thanks to a collaboration between University of Alberta computing scientists and software technology company Spixtrm AI.

The new tool uses a deep-learning computer vision system and motion-

classification algorithms to capture events such as falls in real time, alert caregivers, and give health-care professionals the information they need for immediate triage. The system was developed in part by the Multimedia Research Centre, led by Irene Cheng in the Department of Computing Science.

"Just-in-time action is needed for falls and other accidents in order to save lives, and only accurate and time-efficient algorithms can deliver real-time solutions," explained Cheng. "Videos are captured continuously, at all hours, and at high resolution. It is impossible for humans to monitor these systems and detect the relevant information in real time as effectively as this autonomous system can."

The system transfers real-time video to an autonomous computer vision lock-box. If an event, such as a fall, is detected, the system alerts a specified caregiver and provides a redacted video of the event. The system maintains the privacy of the user, while providing the caregiver with important triage information, including the moment of impact after the fall.

"Privacy is a major concern for most seniors," said Cheng. "Our algorithms

are able to extract the necessary information on the fall for analysis without disclosing their physical appearance to human operators and caregivers."

The research was funded by a multi-year Mitacs grant, supporting graduate students and researchers in their research and development of the project.

- A new tool developed by University of Alberta researchers diagnoses schizo-

Google's Deep Mind has set up shop in Edmonton, attracted by the depth of the city's AI talent.

phrenia from patient brain scans – a diagnosis that has historically relied on subjective data of patient experiences, rather than read from scans.

The study brought together campus expertise in two key areas: machine learning and psychiatry. Sunil Kalmady, lead author on the study and a postdoctoral fellow at the University of Alberta, explains the traditional difficulty in diagnosing the disease, and how machine

learning was able to present a solution.

"Schizophrenia is characterized by constellation of symptoms that might co-occur in patients. Two individuals with the same diagnosis might still present different symptoms," said Kalmady. "This often leads to misdiagnosis. Machine learning, in this case, is able to drive an evidence-based approach that looks at thousands of features in a brain scan to lead to an optimal prediction."

The result is EMPaSchiz (Ensemble algorithm with Multiple Parcellations for Schizophrenia prediction), a model that has been trained on scans from many patients diagnosed with schizophrenia.

Kalmady worked on the tool under the supervision of both Russ Greiner, professor in the Department of Computing Science, and Andrew Greenshaw, professor and associate chair in the Faculty of Medicine & Dentistry, Department of Psychiatry.

"Machine learning provides a set of tools that can use that existing scan information to produce the classifier we want: a tool that, given a scan of a person's brain, can predict whether that

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St. Mike's AI reduces time needed to schedule nursing and resident shifts

BY JENNIFER STRANGES

TORONTO — Ray Howald, the clinical leader manager of the Emergency Department (ED) at St. Michael's Hospital in downtown Toronto, remembers the frustration felt by team leaders, nurses and administrators alike less than a year ago. It's a frustration shared by healthcare teams in EDs across the country.

Team leaders were spending an hour-and-a-half each day assigning nurses, while administrators spent four hours manually recording the information. On a related note, the duplication rate of assignments was high — at about 20 percent.

Aside from being time-consuming, Howald had concerns that his staff were not receiving a variety of assignments in their shifts. His goal was to ensure that nurses had exposure to working in different zones, with different colleagues, and that there was objectivity in their assignments.

"I thought out loud, 'Would it be possible to create a system that does this for us?'" said Howald.

This simple question led to a journey of collaboration and an AI-powered solution which addresses scheduling and assignment challenges.

Howald, along with two ED nurses who championed the project, worked closely with Muhammad Mamdani, director of The Li Ka Shing Centre for Healthcare Analytics Research & Training (LKS-CHART), and his team to develop a system that automates the assignments for nurses while taking into account an extensive set of rules and conditions.

"We needed the system to take into account multiple considerations," said Howald.

"It had to remember previous assignments so that nurses weren't duplicating the zones they worked in; we needed a mix of experience and skill-sets so that each zone has the appropriate pairing of senior and junior nurses; and we needed the flexibility to make manual entries in the event there was a change in the schedule, like someone calling in sick."

Over the course of eight months and multiple iterations, Mamdani and the LKS-CHART team worked with Howald and ED nursing staff to develop and design a system that met their requirements, was user-friendly and was "intelligent" enough to understand all of the conditions.

The system was tested by "super-users" in the ED, so it could be evaluated and tweaked. It was initially designed to remember the previous three days of assignments, which created a blind spot in the scheduling of part-time staff who worked less frequently.

The LKS-CHART team adjusted the algorithm to remember the past 10 days of shifts, creating more accuracy in the assignments and fewer duplications.

The end-product is one that Mamdani says has radically changed the RN ED assignments.

"What previously consumed four hours of admin staffs' day, now takes 15 minutes," he said. "The assigning that took team leaders an hour and a half is now generated by the system in 15 to 20 seconds. And the du-

plication rate has decreased from 20 percent to about five percent. "This has been an exciting optimization problem from an engineering perspective. It's helping people do their jobs more efficiently and effectively," said Mamdani.

Mamdani notes that a benefit of the system — affectionately dubbed "The Robot" by ED staff — is that it has created opportunities for better patient care.

Mamdani and his team have also used data intelligence to help assigning resident physicians to their shifts at St. Michael's.

"Historically, residents were assigned very structurally. It was very rigid, and the assignments weren't reactive to actual patient volumes and their needs," he said.

Mamdani's team worked with Dr. Ophyr Mourad, a general internist at St. Michael's, to review patterns that should be considered in scheduling residents — including flow of patients on weekdays versus weekends, patterns in emergency codes within the hospital, and the intensity levels of cases. The collection of these patterns served as data points for informing resident assignments, and the LKS-CHART team created a data-driven solution that has fundamentally changed the way residents are assigned to shifts.



St. Michael's Ray Howald discusses the AI-optimized scheduler with Pamela Lovell and Kerri Lynn Penney.

"There were times where residents were underutilized because they were over-staffed, and there were times where residents would feel pressure because there wasn't enough support and there were too many patients," said Mamdani.

AI-powered tools such as the RN assignment system and data-driven insights into

resident staffing are optimizing hospital resources — a challenge that hospitals aim to address globally. For Mamdani, creating cost efficiencies and better experiences for hospital staff and patients through AI is largely about monitoring patterns.

"A lot of the solutions are about learning what happens when."

RetiSpec offers novel way to detect Alzheimer's

BY REBECCA IHILCHIK

An estimated 564,000 Canadians are currently living with dementia. As of 2016, the combined healthcare system and out-of-pocket caregiver costs each year related to Alzheimer's are estimated at \$10.4 billion per year. And by 2031, this figure is expected to increase by 60 percent, to \$16.6 billion annually.

Alzheimer's is the most common form of dementia among the elderly — yet there's no standard screening system for the disease. It's difficult to diagnose Alzheimer's early, which means treatment often occurs after the brain has suffered irreversible damage. Not only is this devastating for families, but as our population ages the heavy impact of Alzheimer's on the healthcare system increases.

Ontario-based start-up RetiSpec is looking to change that. Recent scientific evidence has demonstrated that the signs

(or 'biomarkers') of Alzheimer's normally found in the brain can also be found in the retina. What's more, these biomarkers identify those at risk of developing the disease years before symptoms appear.

RetiSpec has developed a non-invasive eye scanner that uses artificial intelligence to detect these biomarkers and identify people at risk of developing the disease. The technology is designed to connect to standard ophthalmological equipment that's available at most clinics, making it accessible and easy to implement.

"Current detection methods are expensive and invasive, and not suited to routine testing. Our goal is to identify the people that are at risk for Alzheimer's so they can be treated at the right time, before it's too late," says Eliav Shaked, CEO of RetiSpec.

"It is crucial to understand that if you detect Alzheimer's disease before signs of cognitive decline, it provides an

important window of opportunity for timely therapeutic interventions, so the progression of the disease can be slowed or even prevented."

The Centre for Aging + Brain Health Innovation (CABHI), powered by Baycrest, is working with RetiSpec to accelerate its technology in Ontario and Canada. Through the Industry Innovation Partnership Program, CABHI matched RetiSpec with the Toronto Memory Program, a medical facility with one of the largest clinical trial programs for Alzheimer's in the country.

The CABHI-funded RetiSpec trial will determine the safety and effectiveness of the technology through human clinical testing and help spur commercialization of the technology in Ontario and Canada — to get it into the hands of those who need it most.

"CABHI's support has enabled us to do a lot more than we expected in a short time," Shaked says. "It's enabled us to move faster to market with this project that's pivotal to our research and development, to our business development, and to our commercialization process."

Though the company has global ties — RetiSpec is conducting a concurrent study with Israeli hospital Sheba Medical Center — Shaked says it was important to start locally.

Not only does the technology have the potential to drastically improve the lives of aging Canadians, it could decrease Alzheimer's patients' long-term medical needs — thereby saving the healthcare system money and resources. With CABHI's support, RetiSpec is hopeful its technology will make a positive health and economic difference.



Eliav Shaked (r), CEO of RetiSpec: the goal is to identify people at risk of Alzheimer's at an earlier stage.

Edmonton gains

CONTINUED FROM PAGE 20

person has schizophrenia,” said Greiner. “Moreover, there are ways to estimate how accurate this tool will be and how often it will provide the correct diagnosis.”

When put to the test, EMPaSchiz was able to identify the disease in new scans with 87 percent accuracy, outperforming existing AI models in identifying the disease.

EMPaSchiz is also one of the first machine learning tools trained exclusively on data from patients who aren’t yet undergoing drug treatment – which could make it more valuable in the early stages of diagnosing the illness.

• University of Alberta computing scientists are aiming to create machines that can carry a conversation with seniors. “Chat bots like Siri or Alexa are primarily used to look up information or do a task for you – answering questions in the shortest time possible,” said Osmar Zaiane, professor in the Department of Computing Science, co-author of the study and director at the Alberta Machine Intelligence Institute (AMII). “We envision a device that’s emotionally intelligent. Where an elderly per-

son can say ‘I’m tired,’ or ‘it’s beautiful outside,’ or tell a story about their day – and receive a response that carries on the conversation and keeps them engaged.”

And the results are promising. The team’s model was able to express responses that matched requested emotions in most cases – though Zaiane noted that some emotions, like surprise and love, were easier to express than others, and that this is just one of several steps in turning the vision of a digital companion into a reality.

“In this study, we coached the program by telling it which emotion to express in its response. Our next study will focus on having the program independently decide on what emotion to express, depending on the persona it’s talking to.”

As Canada’s population continues to age, there are ever greater numbers of elderly Canadians wanting to continue living at home. But loneliness poses a very real concern for health and quality of life.

“Loneliness leads to boredom and depression, which causes an overall deterioration in health,” explained Zaiane. “Studies show that companionship – a cat, a dog, other people – helps tremendously. The advantage for caregivers of a digital companion like this is it can also collect in-

formation on the emotional state of the person, noting if they are frequently feeling sad, for example.”

But as one might imagine, developing an artificial intelligence capable of understanding when humans are expressing emotion and responding in an appropriate way is no small challenge.

“When an elderly person tells you something that’s sad, it’s important to respond with empathy,” said Zaiane. “That

AI-powered devices are being devised at the U of A that can carry on conversations with seniors, reducing loneliness.

requires that the device first understand the emotion that is expressed. We can do that by converting the speech to text and looking at the words that are used. In this study, we looked at the next step: having the program express emotions – like surprise, sadness, happiness – in its response.”

• In a related development, in partnership with online learning platform Coursera – the University of Alberta launched a new Specialization in reinforcement learning to help learners around the world stay current with the rapidly shifting artificial intelligence (AI) landscape.

With the new specialization, it’s now not just UAlberta students who can access the expert minds behind the boundary-pushing AI research at the University of

Alberta, which ranks third in the world for artificial intelligence and machine learning over the last 25 years, according to the industry standard CS Rankings.

“Reinforcement learning is the future of AI,” said Martha White, Amii fellow and assistant professor in the Department of Computing Science. “More and more, it’s becoming a key tool for anyone wanting to improve control strategies and create autonomous decision-making systems. But you can’t just use it out of the box. By giving our learners an in-depth understanding of RL, we can help them more effectively use this powerful tool.”

An area of machine learning, reinforcement learning research at UAlberta seeks to create new methods that remove some of the limitations on its widespread application and to develop reinforcement learning as a model of intelligence that could approach human abilities.

“From customer service to home automation, the future of numerous industries lies in the hands of experienced AI engineers,” said Dil Sidhu, Chief Content Officer at Coursera.

“With this new specialization, academics, industry practitioners and computer scientists alike can gain the knowledge needed for more advanced AI education and the necessary tools to apply reinforcement learning across a variety of sectors. We’re proud to partner with such a highly regarded institution like the University of Alberta to help more learners succeed in a rapidly evolving AI landscape.”

AI makes strides as an intelligent assistant

CONTINUED FROM PAGE 19

to say, “Dr. X, you may want to look at these 200 cases before these 10,000 cases.” When the system can save billions of dollars in the workflow, why should we jump to diagnostics?” she added.

In Waterloo, Tizhoosh and his team remain optimistic about the potential for in-

The dermatology app can triage patients, and separate urgent cases, possibly those with cancer, from less urgent ones.

telligent image search to improve diagnoses. After working on the problem since 1993 with limited results in medical imaging, Tizhoosh is buoyed by recent breakthroughs in AI, including deep networks, and the rapid progress researchers are now making.

“We have been able to close the so-called semantic gap – the difference between what humans find similar and what computers find similar,” he said. “That’s why now, with audacity, I saw we can eliminate diagnostic error. Not today, but one day after we have access to a large enough archive of data to process it.”

His journey to solve the complex problem is a personal one that started following the passing of his beloved grandpa, who died from lung cancer. At the time, Tizhoosh left his engineering career to pursue PhD opportunities related to improving medical imaging as it relates to diagnosis and hasn’t looked back.

“This most likely will be the last big project of my career,” he said of his work with KIMIA Lab to provide computational consensus for the diagnoses of cancer and other diseases. “It’s quite personal when you work on this type of thing. It’s additional motivation to do your best.”

MedSafer helps reduce meds overload

CONTINUED FROM PAGE 4

doctors about it. But they seemed reluctant to make changes in case it would create new issues. Being part of this study, her doctors were able to immediately see medications she could potentially reduce or stop taking. We were both delighted to learn this.”

This before-and-after pilot study took place on four internal medicine clinical teaching units in Montreal, Ottawa and Toronto, between September 2016 and May 2017, with 1,066 patients aged 65 years and older. Patients had an expected prognosis of at least three months and were taking five or more usual home medications at the time

of admission. Of all participants, 82 percent had at least one potentially inappropriate or harmful medication identified by MedSafer.

The results: In the intervention phase, researchers observed an increased proportion (8.3 %) of patients who had one or

The research team is now developing a version for patients, and is working on a larger study in 11 hospitals.

more PIMs deprescribed at hospital discharge. Researchers also looked at a secondary outcome – the occurrence of adverse events and adverse drug events within 30 days of hospital discharge.

Four hundred and ten patients were interviewed after a month, and within that group there was no increase in adverse events from having stopped medications identified by MedSafer.

“My mother and I had been hoping to safely reduce the number of medications she was taking for more than a decade,” says Susan Bartlett.

“I’m really excited to know there is something that can help doctors everywhere. We need tools that make it easier for physicians to know when and how to reduce medications, especially in the elderly. This is an essential but overlooked part of seniors’ care.”

The future of MedSafer: The research team is now developing a version for patients and is working on a larger study of 6,000 patients in 11 hospitals across Canada, with the goal of investigating the impact of the tool on the prevention of adverse drug events.

The aging crisis

CONTINUED FROM PAGE 16

daily patterns of activity that are hard to detect, but often represent the development of a more concerning health issue.

The result is a technology that allows older adults to maintain independence by living at home, while at the same time empowering formal and informal caregivers to offer improved care, thanks to the insights, data, and alerts delivered through this technology. MySense is a solution making a difference in a way that is not ‘business as usual’.

Or, what about a solution that is interactive enough to ask you about your symptoms and offer a diagnosis to you – and you never have to leave your home?

This type of solution is fantastic at reducing unnecessary trips to the emergency room and the doctor’s office. It

also helps alleviate the stress and pressures that come with the unknown, especially for informal caregivers.

Buoy, an AI-driven solution, is doing this very thing. This innovation is an interactive website that helps make sense of health concerns by providing suggestions regarding what’s wrong.

What about a solution that is interactive enough to ask you about your symptoms and offer a diagnosis?

Moreover, once the system has identified what might be the problem, it offers a plan to guide people on what to do next. Does the system think you have bacterial pneumonia? A recommendation for an in-person doctor’s visit is given. Is viral gastroenteritis the issue?

Self-treatment is suggested, along with some basic recommendations such as hydration, nutrition, and things to avoid.

Buoy, along with MySense.ai, are two solutions that are far from ‘business as usual’. These two innovations represent products on the market today that can help ease some of the social, economic, and infrastructure challenges facing our society, and its aging population. And, these two products represent only two innovations of the many that are on the market.

Sadly, the challenge in today’s climate is not a lack of good ideas or valuable products. Instead, the challenge is getting people to adopt these new technologies so that we’re not rooted in a “business as usual” approach”. New times, such as these, require new approaches.

David Stoller is Managing Director, MySense Canada Ltd.



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