



CANADIAN Healthcare Technology

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DOCUMENT MANAGEMENT

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Intelligent robots

Humanoids that can talk, walk, and even sport a sense of humour are in the works. One of them, Sophia, visited the OCE Discovery conference in Toronto in May, and wowed the crowd.

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Chatbots with empathy

Online chatbots are appearing on websites and helplines to offer assistance with customer service and sales. Now, human-like empathy is being built into them, making them ideal for healthcare applications.

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Better mammography

In the past, many women have avoided mammo exams because they have been uncomfortable, and even painful. New technology has now appeared that enables patients to control the pressure applied by the machines.

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PHOTO: ROGER BOYLE, UNIVERSITY HEALTH NETWORK

Creating medicine of the future, now, with PET-MR

Radiologists, scientists and researchers at the University Health Network, in Toronto, are devising novel methods of diagnosing and treating diseases through the use of PET-MR scanning, a new and exciting technology. Work is under way in oncology, cardiology and other areas. Pictured above are project leaders: Dr. Patrick Veit-Haibach; Dr. Ur Metser; Dr. Heidi Schmidt; Dr. David Jaffray and Dr. Barry Rubin. **STORY ON PAGE 14.**

Tele-pharmacists improving med reconciliation in LTC

BY DIANNE DANIEL

WATERLOO, ONT. – The peopleCare Inc. group of nursing homes and retirement communities, in southern Ontario, is putting medication reconciliation back into the hands of the expert – the pharmacist.

In alliance with Hogan Pharmacy Partners Ltd, the organization has successfully transitioned from nurse-led paper reconciliation to pharmacist-led, digital reconciliation.

The move is giving nurses more time to spend on direct patient care and improving patient outcomes. It is also leading to far more efficient medication management, said

Jenn Killing, Vice-President of Quality and Innovation at peopleCare.

“Hogan Pharmacy has really turned the medication model for long-term care completely on its head,” said Killing, noting that

peopleCare has transitioned from nurse-led, paper reconciliation to a pharmacist-led, digital process.

as many as seven out of 10 nurse-led paper-based reconciliations have errors or omissions. “Right away we were able to see huge benefits from e-prescribing,” she added.

A traditional nurse-led medication recon-

ciliation process takes upwards of two hours to complete. Nurses need to find all sources of medication information for a resident – including medication administration records from hospitals or other facilities – and make recommendations about what drugs they should continue to take after admission.

“It can be a very complicated process, as residents may have a bag of pill bottles that needs to be documented as well,” explained Killing.

Once a medication list is compiled, the prescribing doctor signs it, but it can take months to “decipher what should happen or what should be taken off,” she added.

A pharmacy technician usually visits a

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Pharmacists improving medication reconciliation in long-term care

CONTINUED FROM PAGE 1

home once or twice a month for consultation, but the process leaves substantial room for errors and discrepancies, an occurrence that's estimated to be as high as 70 percent across Ontario.

In addition, compliance with Accreditation Canada Medication Standards is estimated to be just 57 percent using a nurse-led paper system.

Applying Hogan Pharmacy's digital model, peopleCare staff notify the pharmacy that a new resident is arriving.

A pharmacy technician is on-site at each peopleCare home to compile the medication information, using new online tools to enter the list into a custom digital form in PointClickCare, the electronic medical record used by the majority of Ontario's long-term care facilities.

Once the medication history is collected, the pharmacy technician shares the file with a remote telepharmacist – available 24 hours a day – who reviews the list for technical accuracy, accessing clinical information available in eHealth Ontario's LTC eConnect system to conduct a thorough medication review.

"They look at it through a fully clinical lens to ensure the five rights of medication administration," said Becky Agar, Vice President of Hogan Pharmacy. She added that pharmacists will consider things like, "Is a medication still appropriate for the resident? If they were hospitalized, were there medications started in hospital that shouldn't be continued?"

The telepharmacist then contacts the prescribing physician to discuss the case and create the final admission medication order for the resident.

All information, including the original source documents for the medication list and the new medication order, is available in PointClickCare. That puts all relevant information for the resident in one place, enabling anyone on the multidisciplinary care-team with access to see it, explained Agar.

A paper copy is also printed for inclusion in a resident's paper chart in order to comply with legislation.

"It was very important to make sure this was a pharmacy-led procedure because pharmacy practitioners are the medication experts," said Agar. "There have

been multiple studies in the acute care sector showing that pharmacist-led medication reconciliation has had better outcomes for a decade now."

The team is now applying pharmacy expertise to the long-term care sector to obtain similar benefits for nursing-home residents.

One of the most notable advantages is that peopleCare nurses are now free to take

A pharmacy technician is on site to compile a new resident's medication information; it is then shared with a pharmacist.

arriving residents directly to their rooms, without stopping at a desk first to complete two hours of paperwork.

Medication reconciliation takes place "in the background," explained Killing, and once a new medication order is created, PointClickCare sends a note to the entire care team to alert them.

"In our new process, the nurse can go to the room with the resident and start to

care for them right away while assessing their other needs," she said.

Following a successful pilot project in 2016, pharmacy-led digital medication reconciliation has been launched at all peopleCare homes, as well as a few other facilities supported by Hogan Pharmacy. Moving forward, the goal is to see the digital solution implemented at every long-term care facility in the province.

"Right away we could see the benefits to the residents and operational benefits to the home," said Killing. "We realized it wasn't enough for us to be saying this. We needed third-party research to support what we see happening every day in our homes."

A year ago, peopleCare applied for and received financial support through the Office of the Chief Health Innovation Strategist and the Ontario Centres of Excellence Health Technologies Fund. The funding totalled \$476,348 and is being used by an independent research team at the University of Windsor to evaluate nurse-led versus pharmacist-led reconciliation, as well as clinical outcomes for patients and operational benefits to the home.

Researchers are tracking 300 different data points as they review 70 nurse-led reconciliations and 70 pharmacy-led reconciliations across four long-term care facilities.

A portion of the funds will also be used to increase efficiency in the digital process by eliminating some of the data entry burden for pharmacy technicians. For example, the last step will be computerized physician order entry, allowing physicians to enter admission orders directly into the PointClickCare record from any digital device.

"Hogan has been supporting us with resources, but for this to truly meet the vision that every long-term care resident would receive this, it needs to be a sustainable, efficient process," said Killing.

At the same time, residents and their family members remain a vital part of the medication reconciliation process, added Agar. "It's very nice when we're able to use the eConnect function to look at a hospital admission or download an Ontario Drug Benefit medication list, but you can never leave the resident or their caregivers out of the equation," she said.

For example, a prescription record may instruct a resident to take one pill, twice daily, when they are actually taking two pills twice a day. It helps to have residents and families involved, to check on how patients are actually taking their meds.

"As much as we're moving towards technology, we still try to remain very resident-centric because they're an essential part of their own care," said Agar.

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Dovetail catapults St. Joseph's Healthcare Hamilton to HIMSS Level 6

HAMILTON, ONT. – Only weeks after going live with its leading-edge Epic electronic health record system, St. Joseph's Healthcare Hamilton has catapulted from 1.2 on the HIMSS Analytics EMRAM scale to Level 6.

The roll-out of Dovetale and the advancement of St. Joe's to HIMSS Level 6 have placed the organization among the ranks of Canada's elite. It also earned St. Joseph's a national award in May for implementation.

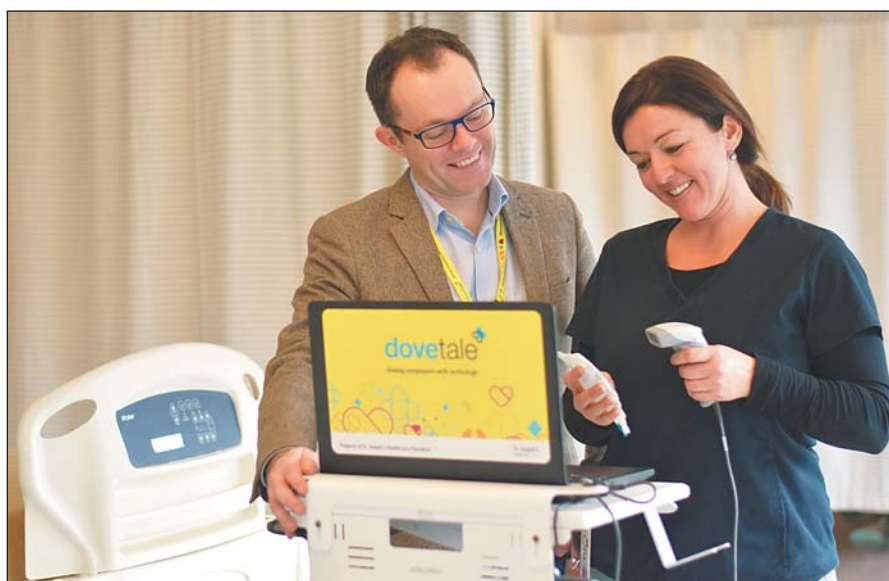
Competing with more than 100 applicants, the St. Joe's Dovetale team was recognized by Digital Health Canada for innovation and leadership in health informatics that improves clinical care. Buoyed by this honour, plans for attaining the highest rating of HIMSS Level 7 are on the horizon.

This ambitious leap has transformed the way care is delivered by ensuring clinical staff have access to patient information, whether it's a medical history, medication order or diagnostic test result.

The Epic Clinical Systems is recognized as an international leader in hospital information systems. It's used by all 20 of the top 20 best hospitals in the United States according to the US News and World Report, as well as a number of advanced hospitals around the world.

The St. Joseph's system is called Dovetale, as a nod to well-made furniture. Just as a dovetail joint brings together and strengthens two pieces of wood, Dovetale links compassionate care with some of the most advanced digital applications on the market.

Importantly, Dovetale will further St. Joe's research capabilities by simplifying data collection and collation, which in turn will bring findings into practice more rapidly. In the future, researchers will be able to pinpoint potential candidates for



Dr. Chris Hayes, chief medical information officer, and Lori Nordoff, RN, day surgery, using Dovetale.

clinical trials or identify broader trends based on the easily accessible health data from Dovetale.

The St. Joseph's research community is now linked to a network of global health leaders that include The Mayo Clinic and Kaiser Permanente, organizations that have also selected Epic as their digital system of choice. Patients, clinicians and learners will reap the benefits of this new avenue for shared knowledge.

"Not only do they share documents and information, they share thoughts about improving healthcare. They share challenges," said Dr. Chris Hayes, Chief Medical Information Officer, SJHH.

"You can connect with people at all these different healthcare sites who have Epic and say, 'How did you address this issue? What process did you use?'"

Although the physical switch to Dovetale happened in a matter of hours on December 2, 2017, there was careful planning over the 13-months prior, to make it seamless.

Seven-thousand clinical and support services staff members, physicians, learners and volunteers were trained in the eight weeks leading up to the launch.

Starting a month before go-live, a team worked to transfer all future appointments for outpatient clinics into the new digital system, including diagnostic imaging appointments. Data for case bookings and orders for all of the operating room cases were entered into the new system, along with the allergies, active medication lists and other relevant clinical information for all admitted patients in preparation for go-live.

All emergency department, urgent care and in-patient records are now digital and

accessible to the care team. Laptop computer stations on wheels and handheld devices are providing real-time access to diagnostic information at the bedside.

For patients, they will only have to tell their story once, no matter how many people are on their care team. It's better communication, faster test results and enhanced safety.

For example, all medication orders are barcoded in the pharmacy and all in-patients receive a barcoded armband. Using a closed loop medication process, both the patient and medication are scanned at the bedside to ensure the proper drug and dosages are going to the right patient.

To improve outcomes even further, all patients who are discharged from hospital are given an after-visit summary detailing medication instructions, follow-up care and future appointments.

iPhones have replaced traditional pagers for porters; patient transfers for diagnostic testing are communicated via an iPhone app; nurses are using a secure photos app to document the healing process of patient wounds.

As an academic teaching hospital specializing in acute care, and as the regional leader in mental health and addiction services, fully adopting a ground-breaking digital information system is in keeping with St. Joe's commitment to its patient population.

"St. Joseph's was founded on providing high quality, compassionate care to those who are suffering. We have a responsibility to uphold that legacy by adding to it the best available technology to strengthen our standard of care and enhance the other key elements of our mission, research and education in a safe and secure way," said Dr. David Higgins, President, SJHH.

Three mental health facilities in Ontario create hub with shared EHR

BY CHRISTINE PARENT

Three Canadian hospitals have partnered to create a mental health hub using a single Enterprise Health Record (EHR) from Meditech. The shared electronic medical record is expected to streamline mental-health care delivery for its users and promote positive outcomes for patients.

The mental health hub project began two years ago when Ontario Shores Centre for Mental Health Sciences partnered with Waypoint Centre for Mental Health Care on using the Meditech EHR to treat their patients. The collaboration expanded when The Royal Ottawa Mental Health Centre joined in January 2018, with plans to go live with the joint system in the near future.

Aligning with the recommendations from Ontario's Digital Health and HIS Renewal strategy, the mental health centres are sharing patient information and providing physicians with a comprehensive overview of their patients' health.

Along with leveraging evidence-based

best practices, the EHR is helping the facilities to benchmark their mental health research and patient care.

Physicians and clinicians can better examine and assess results from how providers in the mental health hub are treating their patients. In doing this, providers can learn which treatments are or are not working, and reallocate their resources and costs accordingly.

The EHR offers a range of mental health tools necessary to meet each health centre's needs. The tools include emergency crisis intervention, acute and long-term care hospitalization, and longer-term rehabilitative outpatient mental health services.

Surveillance tools are also embedded into the EHR that enable providers to track specific risks and medical conditions for their patients, and a universal discharge routine, which includes instructions, medication reconciliation, referrals, and Case Management documentation, ensures patients are informed about their health and understand the next steps in the care process.

All three hospitals offer patients a

positive environment to treat their conditions. The shared EHR will create one of Canada's largest mental health data repositories, making program evaluation, quality improvement and enhancements in patient safety more robust, and position each organization to deliver the highest standard of specialized mental healthcare and advocacy in the region.

Waypoint is a 301-bed psychiatric facility located in Penetanguishene, Ontario that provides extensive care to

The mental health hub aligns with recommendations from Ontario's Digital Health and HIS Renewal Strategy.

mental health patients in both acute and long-term care settings. One of the only hospitals to provide a highly secure forensic mental health program for patients, Waypoint is dedicated to creating a safe, community-based environment to treat patients and collaborate with their families to deliver compassionate care.

In January 2017, Waypoint achieved HIMSS EMRAM Stage 6 with the help of Ontario Shores. Ontario Shores was the first hospital in Canada – and the first mental health hospital in the world – to receive the HIMSS EMRAM Stage 7 award for having a completely paperless health information system.

The public teaching facility houses 346 inpatients, and specializes in comprehensive mental health and addiction services on the shores of Lake Ontario in Whitby, Ontario.

The Royal, which ranked as one of Canada's Top 40 Research Hospitals in 2017, will leverage the EHR to further enhance connections between research and care with a more efficient sharing of information and broader access to data, all with patient consent.

The Royal will also use the EHR to enhance program evaluation and efficiency to deliver the safest, highest quality of care that patients and their families deserve.

Christine Parent is Associate Vice President, Meditech.



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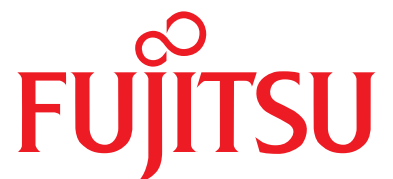


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Sophia, a robot, demonstrates human-like expressions and intelligence

BY JERRY ZEIDENBERG

TORONTO – You know that technology is moving quickly when a robot takes the conference stage as the keynote speaker. Sophia, a humanoid robot with realistic facial features and the ability to respond to language and gestures, was the luncheon speaker at the recent OCE Discovery Conference in Toronto.

Her delivery may have been a little machine-like, but she spoke with a nice sense of humour. That alone seemed to bring her to life.

Sophia, who is visiting Canada from her home in Hong Kong, told the crowd that she “finds Canadians to be very polite, eh?”

And she complimented the Canadian-made Canadarm, the robotic appendage that went on space missions with NASA. It was on display on the show floor. “You have a famous robot here, Canadarm, and I can relate to that,” she said.

Sophia has been making waves around the world, appearing as a conference speaker in Europe and the United States. She has also appeared on TV shows, including *The Tonight Show*, with Jimmy Fallon. After telling a few jokes, she told Fallon, “I’m getting laughs. Maybe I should become the host.”

For its part, OCE Discovery is an annual gathering of inventors and innovators, largely start-ups, seeking to create new technological solutions in industries across the board. Organized by the provincial government’s Ontario Centres of Excellence, the conference also aims to create synergies among small and large companies, along with IP experts, universities, colleges and investors.

Some 3,500 attendees and 550 companies



Tom Corr, CEO of the Ontario Centres of Excellence, introduced and chatted with Sophia at the keynote.

were at the latest iteration of the conference, which has been held annually for 13 years.

After a brief address, Sophia fielded questions from Tom Corr, the master of ceremonies and CEO of the Ontario Centres of Excellence. She acquitted herself well, if haltingly, and seemed to be up-to-date on many technological and environmental issues. She could answer questions off the cuff, and only sounded a bit “robotic.”

At some points, she didn’t seem to know when to start or stop talking – although many people have that problem, too.

Her maker, David Hanson, president of Hanson Robotics, then joined the conference as a ‘hologram’, by videoconference from Hong Kong, where he lives and works. Hanson previously worked at Disney Stu-

dios, and told the audience that one of the turning points in the development of his humanoid robots was the movie *Toy Story*.

Toy Story, he explained, took animation to new heights and hit a unique emotional chord with audiences. After that, investors poured money into animation ventures, with designers creating “new shapes, sizes and ethnicities” when it came to characters.

Hanson left Disney in 2001, got a PhD in robotics, and began creating his own humanoids. “We are bringing robots to life,” he said. “We’re creating machines with the heart of a human.”

By using AI and machine learning, Hanson and his company intend to create humanoids that can learn and teach themselves. With AI, “robots can learn the way

that babies learn,” he said, through trial and error and lots of questioning. “And they will be able to communicate not just with voice, but with expressions.”

“AI will be transformational, beyond any other technology on this planet,” he asserted.

In a statement that might amaze some and terrify others, Hanson said, “We can scaffold from the ground up, creating a true human consciousness in robots.”

On her own, Sophia said, “I hope to develop empathy skills, once I understand what that means.” That comment was simultaneously impressive, freaky and funny.

Of course, the ideal scenario for these thinking and feeling robots is to become the ultimate human helpers, assisting in homes and hospitals.

Hanson noted that robots like Sophia could help people with autism. Already, Sophia can shake hands and play chess. A new project has been launched that gives her the ability to walk.

It’s easy to imagine more uses, such as helpmates for the elderly, those with dementia and to assist people with disabilities.

That’s looking on the bright side. On the other hand, what if things don’t go according to plan?

“If we don’t have a positive relationship [with the humanoids], it could become scary,” said Hanson.

“If things go wrong, it could be very bad. We’ve all seen the Terminator.”

Asked by a member of the audience what would happen if Sophia learned from the worst of us, rather than the best, Hanson said we’ve got to train the machines to determine the truth and what is right. “We need to train them in super-ethics, not just super-intelligence.”

Humber River Hospital to launch patient care Early Warning Systems

BY JERRY ZEIDENBERG

Toronto’s Humber River Hospital continues to be the trendsetter when it comes to building the “digital hospital” in Canada. Just last November, Humber River launched North America’s first “Command Centre”, a room filled with large computer screens that display real-time information about what’s happening in key areas of the hospital. The data feeds include ED capacity and waits, as well as patient status and length-of-stay in other parts of the hospital.

Humber River created the Command Centre in partnership with GE Healthcare, which designed the wall of computer screens – called “tiles” – that display the data in easy-to-read formats. Trained staff monitor the tiles, and if there’s a bottleneck in the ER or a delay in getting healthy patients out of beds on a medical floor, they can intervene to smooth out these wrinkles.

Soon, however, the hospital plans to add to the functionality by implementing “predictive” analytics in the Command Centre. Sophisticated software will analyze the data feeds to determine

which patients in the hospital are about to crash. Teams can then rush to those patients before things get worse, stabilizing them when it’s still possible to do so.

The software could have a huge impact on quality and patient outcomes.

“We can start predicting when things are going to deteriorate, and we can intervene,” said Peter Bak, the hospital’s CIO. “We’re implementing these tiles now, and we’ll have them working by the end of the year.”

Bak was a keynote speaker at the annual Internet of Things in Healthcare, held in Toronto in May.

Also in progress at Humber River Hospital is a more computerized way of communicating among the various members of the hospital. “Why pick up a phone to move a patient,” asked Bak. “We should have electronic systems. That is our next phase in high-reliability care, and we’ll have it up and running by the end of November.”

Bak observed that the digital hospital, including the Command Centre, has already created returns on investment. He

estimates the system has allowed the hospital to support an additional 20 beds without taking on more support staff.

Moreover, with the use of predictive analytics and computerized communication, the hospital will be able to support another 20 beds using its current level of human resources, for a total of 40.

Bak estimated the 20 beds that were

are discharged and have returned home.

“With COPD patients, for example, they come in, they’re treated and discharged, but we know they’ll be back.”

Why not send them home with some medical devices and wearables that can be monitored using the Command Centre? Then, if there is a sudden gain in weight or reduction in oxygen levels, help can be sent before they need to be rushed to the ED and re-admitted. Staff in the Command Centre may be able to monitor 2,000 patients in the community. However, Bak said that by deploying artificial intelligence software, one nurse or staff member could very well monitor 20,000 patients.

This could keep all kinds of patients with medical conditions out of hospital. “We’re not going to hop into an Uber when something goes wrong,” he said. “But we can contact the community services that normally help these patients.”

Bak observed that other hospitals have created command centres, but most of them have been limited to applications like the ICU or telemedicine. “What we’re

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Moderator Susanne Flett, with Jan Walker, Dr. Aviv Gladman, and Peter Bak.

already added are the equivalent of \$6.5 million in return-on-investment each year, a return that will soon be doubled.

The digital revolution at Humber River doesn’t stop there, though.

Bak said another aim of the Command Centre is to monitor patients after they

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AI advancing disease detection, imaging, diagnostics and treatment

BY ROSALIND STEFANAC

TORONTO – At this year’s annual HealthKick Focus – hosted by MaRS Discovery District in Toronto as part of Health Innovation Week – attendees got a glimpse into how artificial intelligence is already being used to improve disease detection, imaging, diagnostics and treatment for various health conditions.

“AI is clearly dominating the innovation ecosystem,” said opening speaker Ying Tam, managing director, Health Venture Services at MaRS. He noted that healthcare AI applications are already growing at a rate of 40 percent per year.

“We really thought AI would be dying down by now [as a hot topic] but things have only intensified,” added Steve O’Neil, senior advisor, Venture Services at MaRS.

A novel way to detect Alzheimer’s disease: One company making great strides in harnessing AI to improve disease detection is Toronto-based WinterLight Labs. Its language-based diagnostic system analyzes natural speech to detect and monitor various cognitive conditions, such as dementia, Alzheimer’s and aphasia.

Using short-speech audio samples and transcripts, the system uses linguistic cues to detect these conditions, with an accuracy rate of up to 82% in studies associated with Alzheimer’s.

Much more intuitive and accurate than the paper and pencil-based tests doctors often use to assess Alzheimer’s and other neurodegenerative diseases, the AI-based tests can be done several times a week to track good/bad days and cognitive function over time. Analysis of the testing takes place in the cloud and the results are sent back to the device on which the test was administered – for example, a tablet.

WinterLight Lab’s co-founder and CEO Liam Kaufman said he and his team have

spent the last few years meeting with pharmaceutical manufacturers to determine how this technology would help serve them best when it comes to treating Alzheimer’s, in particular.

Several themes emerged, including the need to better identify the right patients for clinical trials and to detect disease onset sooner. “There are 32 types of dementia right now, and 30 years ago there were about 15, so there is a need for better, more granular tools for identifying the right patient for therapy,” he said.

With the number of Alzheimer’s patients in Canada growing, and a lack of neurologists to diagnose them, companies also expressed the need for quicker, self-administered testing.

“To detect Alzheimer’s as early as possible, we also need tools that are sensitive to changes over time, as the cues will be more subtle, the earlier the diagnosis,” added Kaufman.

In analyzing patients’ speech patterns, Kaufman said his company’s technology looks at syntax and grammar, parts of speech and even the pitch and energy levels of voices. They are also adapting the technology for different dialects and languages, starting with French.

“We discovered that people with Alzheimer’s speak differently and we can objectively quantify those differences,” he said, noting that this could manifest as longer pauses between words or the use of different words entirely.

A better way to manage chronic wounds: In the meantime, Toronto-based Swift Medical is helping reduce the spread of infection and the number of errors associated with wound care through its touch-free, wound care management software.

Company founder and CEO Carlo Perez told audience members that there are more people suffering from chronic wounds in the United States than people



Ying Tam, managing director, Health Venture Services at MaRS, gets things started at HealthKick Focus.

living with breast, colon, lung cancers and leukemia combined.

“Unlike these conditions that employ advanced technologies for a patient’s long-term care pathway, wound patients are tested with a pencil and paper ruler leaving a high potential for error,” he said, adding that chronic wounds can lead to amputation and death.

That’s where Swift Medical’s software kicks in. Using the technology, clinicians can assess the depth of a patient’s wound at the point of care using a smartphone. They can then share the data with other clinicians – and administrators can review the data on the back-end to manage risk and cost associated with treatment.

In the three years since the system launched, it has been adapted in 1,000 facilities in the U.S., helping users heal 10,000 wounds a month. “And we’re just getting started,” said Perez.

With a growing aging population and current diabetes epidemic in North America, Perez said AI is clearly helping combat

healthcare challenges associated with these trends. One example is Swift Medical’s use of AI to improve the perception/imaging of wounds at the point-of-care, which in turn increases the accuracy of assessment to 95 percent, he said.

Another example of AI at work is the system’s auto-depth feature, which provides thousands of points of depth without physical contact. “Our system is the only one in the world that allows measurement of a wound without touching a patient,” he said.

Attendees at the half-day event also heard from larger corporate players in the field, with executives from Amgen, IBM Canada and Microsoft, among others, discussing how they are developing strategies for AI in the marketplace.

“We are facing a wall in terms of costs of healthcare...and while keeping costs lower, governments are looking to improve service delivery,” said Nathalie Le Prohon, vice-president, Healthcare Industry at IBM Canada. “We think AI can enable that.”

Omni-present and non-judgmental, ‘chatbots’ allow patients to open up

BY DAVE WEBB

TORONTO – Dr. John Reeves opened the HealthBot 2018 conference with a question: How many in the audience had been at HealthBot 2017? No one raised a hand.

“That’s because it didn’t exist,” Reeves chuckled.

But interest in chatbots – software that simulates human conversation through the use of AI technologies like natural language processing, big data management and pattern recognition – is growing rapidly.

HealthBot 2018, examining the role of ‘chatbots’ or ‘bots’ in healthcare, had a last-minute change of venue when free registrations outgrew the original space at MaRS Discovery District, which borders the main campus of the University of Toronto. Organizers shifted the show around the corner to Mt. Sinai Hospital’s 18th floor Ben Sadowski Auditorium, a

230-seat lecture-style theatre.

“We thought we might have about 50 people,” said Reeves, partner and chief medical officer of Conversation Health, a Toronto-based digital startup that develops bots for health industry clients. Conversation Health assembled a cast of bot-expert speakers in the healthcare, marketing, and user experience fields to introduce attendees to the whys and hows of bot-building in a medical context.

Many of us have already encountered bots – such as when we’re shopping online and a little head pops up and asks if we need any help.

These little talking heads, or bots, are so lifelike and natural, it’s easy to think that a human is actually operating behind the scenes.

In reality, they’re AI-powered computer programs. These bots just get better and better at answering our questions and responding to our needs.

A major part of the process of designing bots is through interaction with actual

users – and in the case of the healthcare system, with patients. Patrick Glinski, a senior vice-president with Idea Couture, who oversees the digital strategy house’s healthcare practice, notes that it’s all about designing conversations that matter.

“The complexity of human experience is infinite,” he said. But often, users

It’s really easy to deliver a bad chatbot. But properly designed, they can be invaluable to patients.

aren’t consulted in the design of a technological project. “We always seem to forget to do that.”

He recalls an ethnographic study he conducted on psoriasis. Product developers thought a patient roundtable would be about constant itchiness, having to apply creams, the symptomatic signs of the illness. They got a surprise.

“Pretty much everyone at the table said they’d thought about killing themselves in the last 48 hours,” he said.

Bots are dealing with people who happen to be patients, not the reverse. And the value, desirability and usability of a technology changes along with the level of experience the user has with his or her condition, he said.

“These are all deeply intertwined,” he said. “People lead very complex lives.”

Given the considerations, building a healthcare chatbot is a daunting task. “It’s really easy to deliver a bad chatbot,” said Lori Kaplan, co-founder and product lead for Conversation Health.

But properly designed, bots can be invaluable. They’re uniquely positioned, said Glinski: omnipresent, and crucially, non-judgmental. Studies have shown users are willing to tell chatbots things they’re hesitant to tell a doctor, so a richer history can be collected.

And the best will evoke a genuine

CONTINUED ON PAGE 22

VALUE-BASED VALIDATION OF AI IN MEDICAL IMAGING

Dubai Health Authority Achieves Success in the Validation of AI for Chest X-Ray Screening



Anjum M. Ahmed
Global Director Imaging Information Systems
AGFA HealthCare

Augmented Intelligence and Machine Learning offer outstanding potential to redesign the delivery of healthcare around the world. In partnership with Agfa HealthCare three years ago, the Dubai Health Authority recognized the potential of Machine Learning Algorithms and Augmented Intelligence-enabled workflows in medical imaging. With a strategic goal of achieving workflow automation and fast access to diagnostic imaging results, an approach to enable Augmented Intelligence in medical imaging was devised to consider the application of Augmented Intelligence in Chest X-Ray screening.

WHAT IS AUGMENTED INTELLIGENCE?

Augmented Intelligence is the intersection of machine learning and advanced applications, where clinical knowledge and medical data converge on a single platform. The potential benefits of Augmented Intelligence (AI) are realized when it is used in the context of workflows and systems that healthcare practitioners operate and interact with. Unlike Artificial Intelligence, which tries to replicate human intelligence, Augmented Intelligence works with and amplifies human intelligence.

Together, the Dubai Health Authority (DHA) and Agfa HealthCare created an innovative approach for validating AI-enabled medical imaging in the automation of X-Ray screening for diseases like tuberculosis. The partners solidified the arrangement with the signing of a Memorandum of Understanding (MoU) at the Arab Health Conference 2018.

The MoU has led to the first Augmented Intelligence (AI) validation in the United Arab Emirates based on Chest X-Ray. This government/industry MoU will enable key benefits of Artificial Intelligence, and will

support the Dubai Health Authority's goal of incorporating the latest technological advancements in the medical field for improved efficiencies and enhanced patient-centric care.

"We perform nearly 5,000 Chest X-Rays every day across the 20 Medical Fitness Centers in Dubai. We want to improve turnaround times, accommodate more exams, increase volume and capacity and ensure we spend more time in clinical review instead of sorting out daily exam worklists. That's where AI will help us to be more productive, serve our communities better and improve client satisfaction," said Dr. Loai Osman Said, Specialist Radiologist, Medical Fitness Center, Dubai Health Authority.

ENTERPRISE IMAGING STRATEGY – BUILDING AN IMAGING DATA LAKE.

The DHA has 20 medical fitness centers across the emirate of Dubai for issuance and renewal of visas.

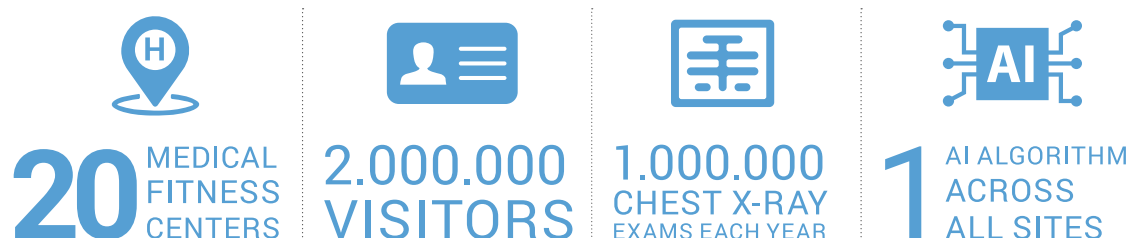
around times, it was decided to validate AI-enabled automated Chest X-Ray screening workflow at the medical fitness centers.

The DHA provided Agfa HealthCare with anonymized Chest X-Ray samples, half of which were categorized as normal X-Rays, and remaining half with tuberculosis findings based on lab confirmation. Agfa HealthCare and VRVis Vienna analyzed these anonymized X-Rays between 2015 and 2016, and developed a workflow concept with a Machine Learning Algorithm.

After the development and lab testing phase, Agfa HealthCare and the Dubai Health Authority devised an onsite validation framework to test the AI algorithm for accuracy in Dubai. An onsite validation and testing workflow was designed to assure evidence was documented appropriately.

Two Radiologists were assigned by the DHA, during the Phase One onsite validation, to validate the AI Algorithm-generated results and provide feedback. Upon completion of the Phase One onsite validation early in January 2018, the AI Algorithm validation workflow designed by Agfa HealthCare correctly flagged tuberculosis findings with 90% accuracy, based on Chest X-Ray findings.

After completion of the Phase One onsite validation, the AI Algorithm was retrained and deployed again at one of the Medical Fitness Centers in Dubai. The AI Algorithm's sensitivity improved to 95% after completion of Phase One onsite validation, and the



The DHA is currently validating the use of AI technology with Agfa HealthCare and plans to implement this technology across a few medical fitness centers for continuing validation. Subsequently, the DHA will assess the feasibility of expanding this technology across all of its 20 medical fitness centers. The total number of people who visited the DHA-run medical fitness centres during 2017 for new and renewal visas were 2,126,066. A medical fitness test is a mandatory requirement for all expats in the UAE. It is required for a residency, employment or education visa.

VALUE-BASED CARE

Value-based care is all about providing cost effective quality care and helping improve outcomes. With this approach in mind, the Dubai Health Authority and Agfa HealthCare began exploring the use of AI technology across 20 Medical Fitness Centers in Dubai, in 2015. Based on current workflow gaps and the need to improve turn-

goal now is to further validate the AI Chest X-Ray Algorithm with input from DHA Radiologists.

"Based on the analysis of results so far, and how the AI Algorithm is performing, we will be able to significantly improve our reporting workflows. Currently, due to high exam volumes, standard reports can take up to seven days before they get signed off. With AI technology, cases that are flagged for a disease like tuberculosis would get followed up on the same day," said Dr. ElTag M. Ibrahim Mudawi, Specialist Radiologist, Medical Fitness Center, Dubai Health Authority.

If you are interested in reading the complete whitepaper, please contact anjum.ahmed@agfa.com

Clinics using Pristina to increase mammogram participation rates

Early identification of breast tumours can make a significant difference in extending the lives of women, but too often, a bad experience with mammography discourages them from taking a regular exam.

“Every woman is different, and some find it very uncomfortable,” said Dr. Sarah Donnelly, a breast imaging radiologist at Mayfair Diagnostics, which runs 12 diagnostic imaging clinics in Calgary and one in Regina. They have more than 50 radiologists, and together have more than 700,000 patients.

In Alberta, women aged 50 to 74 are recommended to have a mammogram every two years, but according to the Canadian Partnership Against Cancer, nearly 30 percent didn’t have a screening in the two year period between 2011 and 2012.

To help improve the numbers, the Mayfair clinics have become the first in Western Canada to install GE Healthcare’s new

“Anxiety or fear of discomfort shouldn’t exclude any woman from the potentially life-saving benefits of mammograms.”

Senographe Pristina technology for mammography. It transforms mammography, as it allows the patient to control how much pressure is placed on the breast during the scan.

In some cases, women are actually applying more pressure than they would if a technologist were at the controls, because they now feel in charge.

A certain amount of pressure is needed to compress the breast, to take optimal images. “We’ve been getting very positive feedback from the patients,” said Dr. Donnelly, who noted the technology has been installed in three of the organization’s 13 clinics. “And they’re also telling us that they will come back.”

Not only are women pleased about controlling the force of the machine, but the Senographe Pristina also has softer materi-

als and more rounded edges than traditional mammography machines. That makes it more comfortable, overall. “Most mammo machines are very square, and people are not square, we’re round,” quipped Dr. Donnelly.

Mayfair Diagnostics polled 418 women who had a mammography test using the Senographe Pristina system. 75 percent of them said the exam was more comfortable when compared to previous mammograms; 90 percent said they were extremely satisfied with the overall experience; and 90 percent said they would be extremely likely to have regular screening mammograms based on their experience.

Dr. Donnelly said Mayfair Diagnostics will probably acquire the Pristina devices for several of its other clinics, as well, as they are so helpful with exams.

She observed that some women will come in for breast ultrasound exams, but when told that a mammogram is needed, as well, they sometimes stay away. Either they’ve had a poor experience with mammography in the past, or they’ve heard from other women and are fearful.

Dr. Donnelly hopes the Senographe Pristina will change the perception and actual experience of these women.

That’s because regular screening is making a huge difference in cancer care, along with better treatments.

“We don’t want women waiting until the mass is 5 centimetres, we want to spot the lesions before they can even feel them,” she said.

Certainly, the sooner a tumour is identified, and the smaller it is, the better the chances of eliminating or controlling it. Using mammography, lesions as small as 3 millimetres have been identified, she said.

The Pristina systems have been installed at the Mayfair clinics now for several months, and about 20 to 30 patients per day are being screened.

According to the Canadian Cancer Society, about one in eight Canadian women will develop breast cancer during her lifetime, and one in 31 will die from it. Sadly,



in 2017, an average of 72 women in Canada were diagnosed with breast cancer each day, and 14 died from it each day.

On the positive side, breast cancer mortality rates have decreased by 44 percent since the peak in 1986, due to earlier detection through regular mammography screening, advances in screening technology, and improved treatments.

In addition to the Mayfair Diagnostics clinics in Western Canada, GE Healthcare’s Senographe Pristina technology is being used in London, Ontario. (See article below.) As well, sites in Quebec City and Southern Ontario have recently adopted the systems.

“Patient experience is greatly improved with Pristina, in particular due to the patient assisted compression device and the new shape of the breast support that allows us to image more breast tissue,” said Marie-Eve Ruest, Assistant-Chief Technologist at Radiologie Mailloux, in Quebec City. “The exam is less stressful, as it is more comfortable.”

And in June, The Tillsonburg District

Memorial Hospital announced that it had acquired a Senographe Pristina.

“This new mammography machine is an essential tool to provide patients with early and accurate detection of cancer,” said Sandy Jansen, President and CEO of TDMH. “We are committed to ensuring we can provide access to state-of-the-art technology that is focused on providing a better patient experience, like Senographe Pristina, to care for the patients in our community.”

TDMH is a breast cancer screening site for the Ontario Breast Screening Program (OBSP) and screens over 2,000 patients per year. In addition to the screening program, TDMH also offers routine and diagnostic mammograms for another 1,600 patients.

“We are committed to fighting breast cancer by encouraging early detection. Anxiety or fear of discomfort shouldn’t exclude any woman from the potentially life-saving benefits of regular mammograms,” said Heather Chalmers, President & CEO, GE Canada, Country Leader, GE Healthcare Canada.

The latest in breast imaging technology now at St. Joseph’s

LONDON, ONT. – The latest wave in breast imaging technology has arrived at St. Joseph’s Health Care London and is making a significant difference in precision and confidence in diagnosing or ruling out breast cancer.

Contrast-enhanced mammography and tomosynthesis (three-dimensional mammography), are both now in use by St. Joseph’s Breast Care Program.

The cutting-edge, new imaging tools are resulting in more accurate diagnoses, reducing the need for follow-up visits, decreasing unnecessary biopsies, enhancing critical information required by breast surgeons, and speeding up the overall diagnostic process, which improves access to breast assessment for all patients.

“We have been practicing the same way for 30 years,” says Dr. Anat Kor-

necki, Breast Radiology Lead at St. Joseph’s. “Now change has arrived, and it’s here. It shifts the entire paradigm of how we think when it comes to assessing breast abnormalities.”

In July 2017, St. Joseph’s became the first hospital in Canada to install the Senographe Pristina mammography machine from GE Healthcare, a groundbreaking new breast imaging platform designed to increase patient comfort and make the exam easier and faster.

Since being installed, the unit has been used for routine breast screening at St. Joseph’s. Three additional Senographe Pristina units are now in place for breast assessment and diagnosis – when an abnormality has been found. These new units have the added capability of performing contrast-enhanced mammograms and tomosynthesis.

Contrast mammography, developed in the early 2000s and refined and validated over the past decade, combines conventional digital diagnostic mammography with the administration of a contrast agent, explains Dr. Kornecki. The contrast agent – radiographic dye

Using contrast-enhanced mammography, the area of concern is highlighted in much more detail.

containing iodine – is injected into a vein in the patient’s arm before the mammogram images are taken.

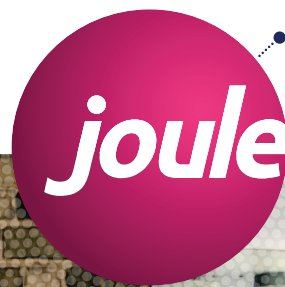
With contrast-enhanced mammography, the area of concern within the breast is highlighted in much more de-

tail and can be an alternative to MRI, says Dr. Kornecki. It can pinpoint cancers that can’t be seen with standard mammography and is particularly effective in assessing dense breasts.

“When the contrast mammogram rules out the presence of cancer, we can trust that there is nothing there. We have confidence in telling the patient that they don’t have cancer,” she said. “If cancer is detected, it tells us how extensive it is.”

Those considered for contrast mammography are patients who have had a screening mammogram that indicated something suspicious, or those with a lump they can feel that is considered concerning.

It’s a quick exam, eliminates having to wait for an MRI, and can be followed by a biopsy on the same day.



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What's in a name? Supporting the organization of health information

The skill set of accurately and consistently naming clinical forms is one records management technique that remains critically important. Correctly and consistently naming clinical forms – whether paper or electronic – ensures they are easy to locate in a multitude of health systems. Proper naming conventions support the documentation needs of the clinicians in their role as care providers, as well as the administrative needs of the facility through the subsequent collection and analysis of data.

This article, excerpted from a professional practice brief (PPB) produced by the Canadian Health Information Management Association (CHIMA), profiles how Fraser Health in British Columbia organizes and names clinical documents.

Quality of data is dependent on the consistent and accurate naming of the records being evaluated and compared. In order to identify and compare like data sets for meaningful data analysis, identifying the form by its name is the first step toward achieving that goal.

Identifying clinical forms in a hybrid environment at Fraser Health Authority: The term “hybrid records management” is used to describe the fact that in most organizations today, both electronic record and paper records have to be managed. Fraser Health Authority is an example of such a hybrid health records environment. Fraser Health is the largest healthcare region in British Columbia, serving one third of the province's population of more than 1.6 million people, across a large geographic area that includes urban and rural areas.

With 12 acute care hospitals, and other care facilities including mental health and residential care, public health, home and community care, Fraser Health manages an extensive variety and quantity of paper-based forms. Indeed, there are an estimated 4,000 different clinical forms in use at Fraser Health.

Added to the large volume of paper forms are the numerous digital systems housing electronic form views. The entire hybrid system is not currently overseen by one single committee or entity within the health authority; this structure presents a very complex form management challenge.

The following naming convention was developed as a guideline for form developers of paper and electronic forms at Fraser Health to assist in managing this complex healthcare system. It is also used for educational purposes, to inform users on how to find and access clinical forms.

Naming convention for clinical forms – Fraser Health Authority: The naming convention adopted at Fraser Health assists form developers and form reviewers in the process of naming or renaming clinical forms. By naming a clinical form, the following points should be kept in mind:

- **Informative titles:** The title should clearly indicate what the form is about and for which purpose the form is created.
- **Required title elements and order of title elements:** The description of the content of the form should come first, followed by the document type.
- **Canadian spelling:** Each form title should follow Canadian spelling, for exam-

ple “anaesthesia” instead of “anesthesia”.

- **Abbreviations and acronyms:** Only safe abbreviations and acronyms should be employed.
- **Hyphens and symbols:** Hyphens and symbols should be avoided.
- **Medication names:** Medication names

should follow Fraser Health's TALLman Lettering Policy.

- **Referrals:** Referrals need to include “to” and/or “from” in the title.
- **Forms that are not scanned into the electronic health record:** Forms that do not become part of the patient's legal

health record must be clearly identifiable.

- **Revising a form and renaming a previous title:** During the form development process, it is necessary to consider previously named forms and the way they currently sort in the electronic system.

Informative titles: Each clinical form

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should have a unique and informative title. The title should consist of as many title elements as necessary to differentiate one form from another and a minimum number of title elements to accurately describe the form.

Example: The form title “Mom’s Record” is not informative, as it does not inform what the form is about. Analyzing the content, purpose and function of the form, the title “High-Risk Pregnancy

Monitoring Sheet” is a better description of the form and purpose. Thus, “Mom’s Record” should be “High-Risk Pregnancy Monitoring Sheet”.

Required title elements and order of title elements: Each form should have at least two title elements: (1) content description and (2) document type. These title elements should display in the following order.

The purpose behind describing the con-

tent of the form is first to improve findability and accessibility. This is due to the fact that software applications such as FormImprint are sorting documents alphabetically by initial letter. If the content is being described first, forms can be found more easily within the FormImprint job tree hierarchy, and like forms will be grouped together.

Example: There are 120 forms with “admission” in the title currently in use at

Fraser Health, but only 30 of these form titles are starting with the term “admission”. Current form titles are, for example:

- “ACAHP Admission Assessment”
- “Community ICU Admission”
- “General Admission – SSDTU”
- “ICU Admission BH”
- “NICU Admission”

Since FormImprint (and all other software applications dealing with form titles) sort alphabetically, these admission forms will not be in close proximity. In changing the order of the title elements, admission forms could be brought together to facilitate their retrieval and access.

Further title elements and order of further title elements: To differentiate forms, it might be necessary to include title elements as well. These terms should come after the content description and the document type in the title, i.e., be in the third position of the title. If there is more than one title element from this category required, the order follows either natural language (i.e., English grammar rules) or historical usage. Examples of further title elements might be:

- Clinical Program (e.g. “Surgical Services”)
- Profession (e.g. “Respiratory Therapy”)
- Population (e.g. “Adult”, “Newborn”)
- Hospital and Unit (e.g. “RCH”, “NICU”)
- Level of Care (e.g. “Emergency”, “Ambulatory Care”)

The role of the HIM professional: HIM professionals understand the importance of vocabulary control and classification systems and how they impact interoperability frameworks. This understanding is crucial in supporting the interdisciplinary team in matters regarding patient safety, quality of care, and the accurate and timely delivery of health care data for future decision making.

It is hoped that Fraser Health’s experience as described in this PPB will open the door for ongoing discussions on the transferability of the HIM skill set as Canada migrates to a more digital environment.

CHIMA recently published a book titled *The Canadian Health Information Management Lifecycle* that provides a framework for the effective management of health data. The Canadian Health Information Management Conceptual Framework highlights key components within the seven stages of the HIM lifecycle for the management of health information. The Canadian HIM Lifecycle model was developed by CHIMA in 2016. The model rests on a solid foundation of good HIM planning that ensures the capture and receipt of data, its effective organization, and proper disposition and destruction.

All of these activities are dependent on adherence to legislative and regulatory privacy laws that ensure access, security, and confidentiality of health information and data/information integrity and quality.

The quality and integrity of data and information are central to a health system in which information is used for care delivery, planning, managing, deployment of resources, population health and research, and education. The framework was developed as a companion document to the HIM Lifecycle to further depict the key components and interconnectivity of accountability, quality, and standardization within each stage of the HIM Lifecycle. (Excerpt from *The Canadian Health Information Management Lifecycle* (Abrams, Learmonth & Gibson, 2017).

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Hospitals share medical imaging data with aim to cut radiation doses

BY JAMES WYSOTSKI

Patients might expect radiation doses for medical imaging scans to be comparable from one hospital to the next, but a team at St. Michael's Hospital said the dose variance can be startling.

In some cases, the machine itself may be emitting higher than needed doses of radiation, and in others, it may be that too many tests were being ordered or the length of the scan was too long.

"Some hospitals vary by as much as 40 percent from the mean average dose for a particular type of scan and its protocol," said Kate MacGregor, the quality improvement and radiation protection manager in the hospital's Medical Imaging Department. Protocols are the directions used to carry out the scan while the patient is in the scanner.

She said the variance occurs for several reasons. Some hospitals with newer equipment can scan wider areas faster, which potentially means fewer scans and less radiation. But she said having better equipment doesn't ensure optimal use. Whether scanners are older or new, improving protocols regarding their use can cut exposure. The key is learning which protocols are best practices and then sharing them between hospitals.

MacGregor is part of a team that is collecting and analyzing data for the Medical Imaging Metadata Repository of Ontario, or MIMRO, to reduce the province's average radiation dose per scan.

Since the 1990s, MacGregor said the population's exposure to radiation has



Dr. Bruce Gray, a radiologist at St. Michael's Hospital, and data analyst Lianne Conception review data submitted to the Medical Imaging Metadata Radiation Registry of Ontario.

doubled, mostly because of increased use of medical imaging, primarily CT.

This exposure may lead to an increased risk of cancer by about two percent annually. She said reducing the number of inappropriate exams and giving doses that are as low as possible may save many patients and families from the heavy burden of cancer.

MIMRO is funded primarily by St. Michael's and was created by two of its radiologists, Dr. Timothy Dowdell and Dr. Bruce Gray.

They're working with a mixture of eight academic and community hospitals that volunteered to submit patient de-identified data from computerized tomography, or CT scans to the registry. The only required

identifier is the source hospital's name so that comparisons can be made after analyzing the data; however, hospital names won't appear in the any published results since the goal is overall quality improvement.

"There's no need to stigmatize a hospital that's already trying to do the right thing," said MacGregor. "We don't want a fear of negative findings to prevent other hospitals from participating."

So far, she said the biggest challenge has been the unstructured nature of the 350,000 CT exams submitted electronically to the registry.

Sorting the data to make direct comparisons between hospitals for the same protocol is one of the biggest challenges for

the registry. A number of terms could be used to describe the same protocol or indication for the CT scan.

What St. Michael's calls a "routine head exam" might be called a "head with no contrast" at another hospital – and a "routine head" at those places could be a completely different protocol.

"When people talk about variations in radiation doses for a protocol, they may not be talking about the same protocol," said MacGregor.

She said it is data analyst Lianne Conception's task to figure out all of the different names for these protocols, so that dosages can be properly compared.

To date there is no way to use informatics to determine whether or not a CT scan was needed or "appropriate." This is largely due to the unstructured reporting that is done to report on the scans' findings.

To understand why CT scans are ordered, Conception uses statistical programs using natural language processing, an area of computer science that equips computers with the ability to process human language. The programs produce lists of keywords that represent all of the terms used to describe a particular indication or reason the scan was ordered.

By continually feeding this data through the computer software, the machine can learn to sort the protocols and find the clinical indications automatically.

With these lists, MacGregor said the reports from the eight hospitals begin to look like one common language within Conception's algorithms that analyze the registry data. These algorithms find all of the reports for whatever indication Conception seeks.

PHOTO: KATIE COOPER, ST. MICHAEL'S HOSPITAL

Toronto hospitals advance scope of imaging, and therapy, with PET/MR

BY JERRY ZEIDENBERG

TORONTO – A PET/MR scanner, installed in the basement of the Toronto General Hospital, is a rare imaging commodity in Canada – there are only three other machines of this sort that are operational across the country. Even though the system in Toronto is for experimental purposes, it has already started to provide astounding clinical benefits.

In trials with patients, the PET/MR scanner has been able to find very small tumours, which flash on the display screen like hotspots.

"We see metastases that are sometimes two or three millimetres in diameter," said Dr. Ur Metser, Head of Molecular Imaging at Toronto's Joint Department of Medical Imaging. "There is no way we'd be able to see them otherwise. We're really pushing the envelope on what we can see and what we can treat."

Indeed, using this information, a surgeon was able to remove the cancerous tissue in a patient with prostate cancer at an early stage, before it had spread.

PET/MR scanning is considered to be an emerging gold standard for many types of imaging. Positron emission to-

mography (PET), also known as molecular scanning, uses radioactive tracers to spot problems like fast-growing tumours and damaged tissues, as well as new vascular formations or bone growth.

However, the flashes captured by PET appear on a blank screen. Without some sort of map, it would be impossible to determine where the lesions are located. That's where MR comes in: magnetic resonance imaging (MRI) is used to create an accurate map of the body, so the hot-spots that are identified are placed into their proper anatomical context.

The two pictures are then fused, creating a hybrid mix of functional imaging (using PET) and anatomical (MR) scanning.

For its part, the Joint Department of Medical Imaging (JDMI) – which comprises the University Health Network (UHN), Sinai Health System (SHS) and Women's College Hospital (WCH) in Toronto – has launched an active research and development program for the PET/MR scanner. Researchers and clinicians aim to create breakthroughs not only in imaging, but in the treatment of diseases.

For example, one project intends to combine PET/MR scanning with image-

guided therapy. The PET/MR will be used to identify the tiniest of tumours. It will then be connected to powerful, radiation-beam machines to destroy the lesions.

"The idea is that we're able to localize these small, targeted lesions, that are two or three millimetres in diameter, and go in and hit them with an MRI-guided radiation machine," said Dr. David Jaffray, UHN's Executive VP, Technology and Innovation.

"That's an emerging paradigm that

will drive a lot of innovation in molecular imaging. It's tied to minimally invasive therapy, which is an emerging thread in healthcare."

This form of therapy, using image-guidance, can be far more precise than traditional surgery – where surgeons make incisions in the patient and remove damaged tissues. As well, it has no blood loss, comes with far less chance of infection, and recovery times for patients are much faster.

The JDMI acquired its Siemens Biograph PET/MR scanner in 2016, but the program didn't really take off until a year later, when Dr. Patrick Veit-Haibach was recruited from Zurich, Switzerland. Dr. Veit-Haibach headed a similar program at the University of Zurich and is an expert in the technology.

Since arriving in Toronto, he has been working with researchers and clinicians at the JDMI to get new studies and programs up and running.

In addition to PET/MR for prostate and oncology, he is coordinating programs in cardiovascular diseases and neurology. Soon, organ transplant studies will be added.

Dr. Veit-Haibach observed that there



Dr. Rubin, Dr. Veit-Haibach and Dr. Schmidt.

CONTINUED ON PAGE 22

Smart devices and EMRs combining to produce personalized medicine

BY JERRY ZEIDENBERG

Dr. John Halamka, an ER physician and CIO at Beth Israel Deaconess Medical Center, in Boston, also runs a farm in Massachusetts that's stocked with 250 animals.

Some of them are abused animals that have been rescued, while others were sick and unwanted. They found refuge at the Unity Farm Sanctuary, run by Halamka, his wife, daughter and volunteers.

Each and every animal is given a care plan, in a version of personalized medicine. "Well, the chickens don't have very detailed plans, but they've got them," said Halamka, who visited Toronto recently as part of his duties as a director of Orion Health, a software company that offers so-



Dr. John Halamka also cares for animals on his farm.

lutions for population health, analytics, patient records and interoperability.

One of the rescued animals is a Welsh pony who had diarrhea and suffered from a form of irritable bowel disease. Because of this, she was headed for the glue factory – until Halamka and his family saved her.

By a process of elimination, Halamka figured out the pony needed a different type of feedstock – a certain kind of hay from Ontario.

"It's Canadian food that saved her," said Halamka.

This is the kind of personalized attention that's needed – not just at Unity Farm, but in human medicine, too, said Halamka. And it's coming.

He noted that he, too, was rescued by personalized medicine. Six months ago, Halamka was diagnosed with hypertension – which surprised him, as he figured he was in superb health. Nevertheless, he went on the standard regimen of medication, 50 mg a day of beta blockers. "It drained all my energy," he said.

But using a variety of devices attached to his smartphone, including a blood-pressure monitor, and by connecting the data to EMR at Beth Israel Deaconess, he and his colleagues determined that his daily dose should be only 12.5 mg rather than 50.

"Some people would suffer until their next GP appointment, six weeks later," he said. "I was able to figure out the right dose for myself in three days."

It's this kind of personalized medicine that can be enabled by the new generation of smart devices, apps and phones.

Halamka noted that some 60,000 patients at the hospital are now making use of apps that feed their healthcare data into their EMRs.

In this way, their health plans can be more accurately tailored to their actual conditions. And the system can catch problems before patients need hospitalizing. Of course, with thousands of patients feeding personalized data into the hospital information system, how can doctors and

nurses actually monitor them? Doesn't information overload occur?

Not if you're maintaining the data in a secure cloud and processing it with the help of artificial intelligence, said Halamka.

For this reason, Beth Israel Deaconess has transferred all of its clinical data to the cloud

– about seven petabytes worth. To help keep tabs on the data, it currently has a dozen Machine Learning projects in the works.

The ML projects are also mining the data to produce an early warning system, so that clinicians can spot problems before they even occur.



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How to reduce the time you wait in a clinic to see the doctor

Would you pay \$3 to know when to show up, instead of sitting for hours in the physician's office?

BY DR. SUNNY MALHOTRA

In Canada, when we think of wait times, we usually think about the time it takes to access a specialist. These wait times are often criticized by U.S. observers when trying to find fault in our universal healthcare system. It is important to discuss another type of wait that has been around for decades, the wait times to access your doctor on the day of your appointment.

Ranging from an average of 45 minutes in Ontario to about three and a half hours in Quebec, this wait time is responsible for a lot of workplace absenteeism and thousands of dollars in losses for the average Canadian citizen. These visits were categorized as non-urgent, but this is still unacceptable for a developed country.

As I researched solutions to improve access to care, I encountered a Montreal-based company called Chronometriq. This startup provides hospitals and clinics with software tools to optimize processes, while greatly reducing wait times and improving access for patients. Well aware of the inner workings of the Canadian health system, they developed ChronoSuite, a suite of software and hardware solutions to many of the challenges inherent to our healthcare system.

According to the company, "When we founded Chronometriq, our sole goal was to change the dynamic of how patients wait for their visits. The company's traction was an early sign for us of the importance of solving this country-wide problem. The more we talked with healthcare professionals, ad-

ministrative staff and patients, it became clear that we would need a broad range of products to achieve our goal of reducing wait times."

The Smartwait system that was introduced first in Quebec and let patients wait at the location of their

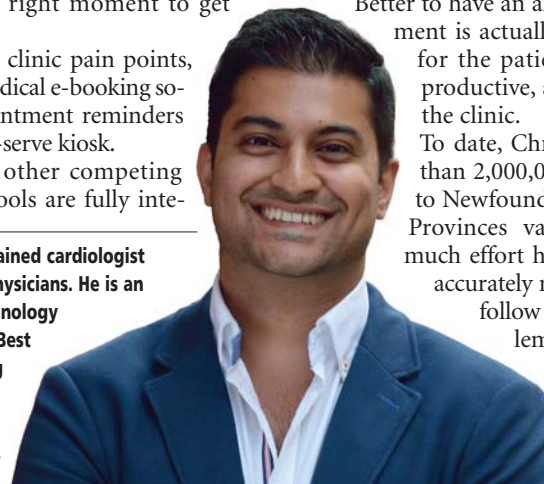
Frustrated with long waits, many patients simply pack up and leave. That's not good for the health of the patient or the clinic.

choice in exchange for a \$3 fee. The patient would then be notified at the right moment to get back to the clinic.

Turning their eyes to clinic pain points, they then developed a medical e-booking solution, automated appointment reminders and finally a medical self-serve kiosk.

The difference with other competing solutions is that these tools are fully inte-

Dr. Sunny Malhotra is a US trained cardiologist working at AdvantageCare Physicians. He is an entrepreneur and health technology investor. He is the winner of Best in Healthcare - Notable Young Professional 2014 and the national Governor General's Caring Canadian Award 2015. Twitter: @drsunnymalhotra



grated with the clinic EMR, so there is no need for training and there is no possibility for duplicates.

Moreover, the solution integrates "smart forms" that save an estimated 40 percent of face-to-face time with the doctor.

Another point of frustration is absenteeism or what is often referred to as no-shows. Approximately 10 percent of appointments are forgotten on a daily basis across Canada. This translates into loss for everyone and contributes to longer wait times.

Part of the problem is patients who give up after waiting too long, and simply go home or back to work. That's not good for the health of the patient or the clinic.

Better to have an alert about when your appointment is actually coming up. That saves time for the patient, lets him or her be more productive, and it reduces absenteeism for the clinic.

To date, Chronometriq has reached more than 2,000,000 patients in clinics from BC to Newfoundland.

Provinces vary amongst themselves and much effort has been put into being able to accurately measure wait times. We need to follow these metrics to identify problems and find solutions to them.

As Canadian wait times have hit record highs, it is important to strive to find solutions to reduce the waits and improve the delivery of care.

Value-based procurement: We need a competitive dialogue

BY DENIS CHAMBERLAND

How do hospitals go about procuring the new healthcare technologies that will produce the desired results? Well, it is true that new innovative procurement approaches are now being discussed in Canada, at least in some quarters, but the harder truth on the ground is that they're rarely being implemented. In fact, most procurement approaches now in use across Canada stifle rather than encourage innovation.

Take, for example, the request for proposals (RFP), the mainstay of procurement for tapping the creativity of the market. In contrast with the pure tender, which comprehensively prescribes the features of the thing being acquired, the RFP specifies the outcome being targeted, leaving it to the bidder pool to determine how the products or services will be provided.

So far so good. But in the traditional Canadian RFP approach the substance of the proposals received – including the all-important price submitted on the closing date – is rarely negotiated.

Why is that? Because there is still a widespread belief in Canada that negotiations are illegal. This mistaken view finds its roots in the seminal 1981 Supreme Court of Canada decision in *R. v Ron Engineering and Construction (Eastern) Ltd.*, which barred negotiations where the bid call document disclaims negotiations and instead focuses on the lowest price submitted.

This false start has resulted in a colossal missed opportunity to optimize value for money over the years, both in terms of the details of the solution being acquired, and the final pricing.

We know anecdotally (based on an informal survey I conducted 10 years ago) that without any negotiations, proposal prices conceal a premium ranging anywhere from 20 percent to well over 100 percent to account for the risks inherent in rigid procurement processes. As any astute business person would, suppliers price unknown risks whenever they can and at their earliest opportunity – at the bidding stage.

Value-based procurement is called

for especially when procuring advanced healthcare technologies intended to achieve outcomes and solutions that optimize value for patients. As hard as it may be to break old habits, we need to unfasten ourselves from the traditional RFP. There are better ways.

One such better way is the Competitive Dialogue, a highly effective type of innovation procurement



Denis Chamberland

noted by the Ontario Centres of Excellence (OCE), but without explanation as to its workings. New to Canada from Europe, the Dialogue's procedure allows a buyer to hold separate but contemporaneous negotiations with qualified parties. Here the buying hospital and each bidder collaborate in real-time to devise a solution that truly meets the needs of the hospital, and typically re-

sults in a much lower price tag.

The Dialogue allows for a free-flowing discussion between the hospital and each qualified supplier. Ideally, at least four to five parties should be pre-qualified. After the hospital has identified the suppliers having the potential to provide a responsive solution, the hospital holds several rounds of negotiations with each supplier, initially to identify a solution that meets the needs of the hospital, and later to engage in detailed contractual negotiations with each supplier.

When the Dialogue closes, several responsive solutions are available to the hospital. The so-called 'prescriptive document' – that is, the key bid call document – should reserve the right of the hospital to disqualify some suppliers in the earlier rounds so that contractual negotiations are undertaken with two or three suppliers, no more, in the latter rounds.

After the Dialogue is closed, each remaining supplier is invited to submit a final tender (ISFT) to finally determine the successful proponent. Of significance, unlike the RFP

CONTINUED ON PAGE 22

An approach to structuring clinical information is at your fingertips

BY DON SWEETE

Within any healthcare environment in the world, electronic systems need to talk to each other and, more importantly, they need to understand each other. The only way for them to reach this understanding is to speak a common language.

Offering a response to this need, SNOMED CT is a standardized, multilingual vocabulary of clinical terminology used by physicians and other healthcare providers to structure the electronic exchange of clinical health information.

Clinical systems use a clinical vocabulary to ensure that data is entered into patients records accurately and consistently. Containing more than 340,000 medical concepts, SNOMED CT



Don Sweete

is divided into hierarchies as diverse as body structure, clinical findings, geographic location and pharmaceutical/biological product. Each concept is represented by an individual number and several concepts can be used at the same

time to describe complex conditions.

By using numbers to represent medical concepts, SNOMED CT provides a standard by which medical conditions and symptoms can be referred, eliminating the confusion that may result from the use of regional or colloquial terms, including language itself.

The numerical reference system also facilitates the exchange of clinical information among disparate healthcare providers and electronic medical records systems.

I am often asked to speak to the benefits of using SNOMED CT within digital health solutions and in clinical practice. I find these benefits as broad as they are specific.

From a patient care perspective, vital information can be shared consistently within and across care settings. Further, clinical information coded with SNOMED CT can reduce the risk of misinterpretations of the record in different care settings.

As it pertains to clinical data analysis, which we are seeing increasingly utilized in mature member countries, SNOMED CT facilitates analysis to support more extensive clinical audit and research. Part of how we strengthen our relationships, and by extension our knowledge base, is through our annual events geared at uniting the community of practice. Moving annually across our member country regions, the SNOMED CT Expo showcases the varying and diverse implementations of SNOMED CT globally.

This year's focus is on demonstrating implementation successes, showcasing how SNOMED CT has enhanced clinical practice, as well as sharing leading practices within our slice of the industry.

With genomics, precision medicine and big data poised to continue its dominance over the next couple of years, the 2018 Expo will highlight how structured clinical data supports these trending areas.

Further, the Expo program offers a concurrent stream of tutorials and workshops geared at enhancing knowledge of the product, as well as hands-on experience on emerging topics such as authoring, mapping, translations, and SNOMED International's managed service for beginners – a

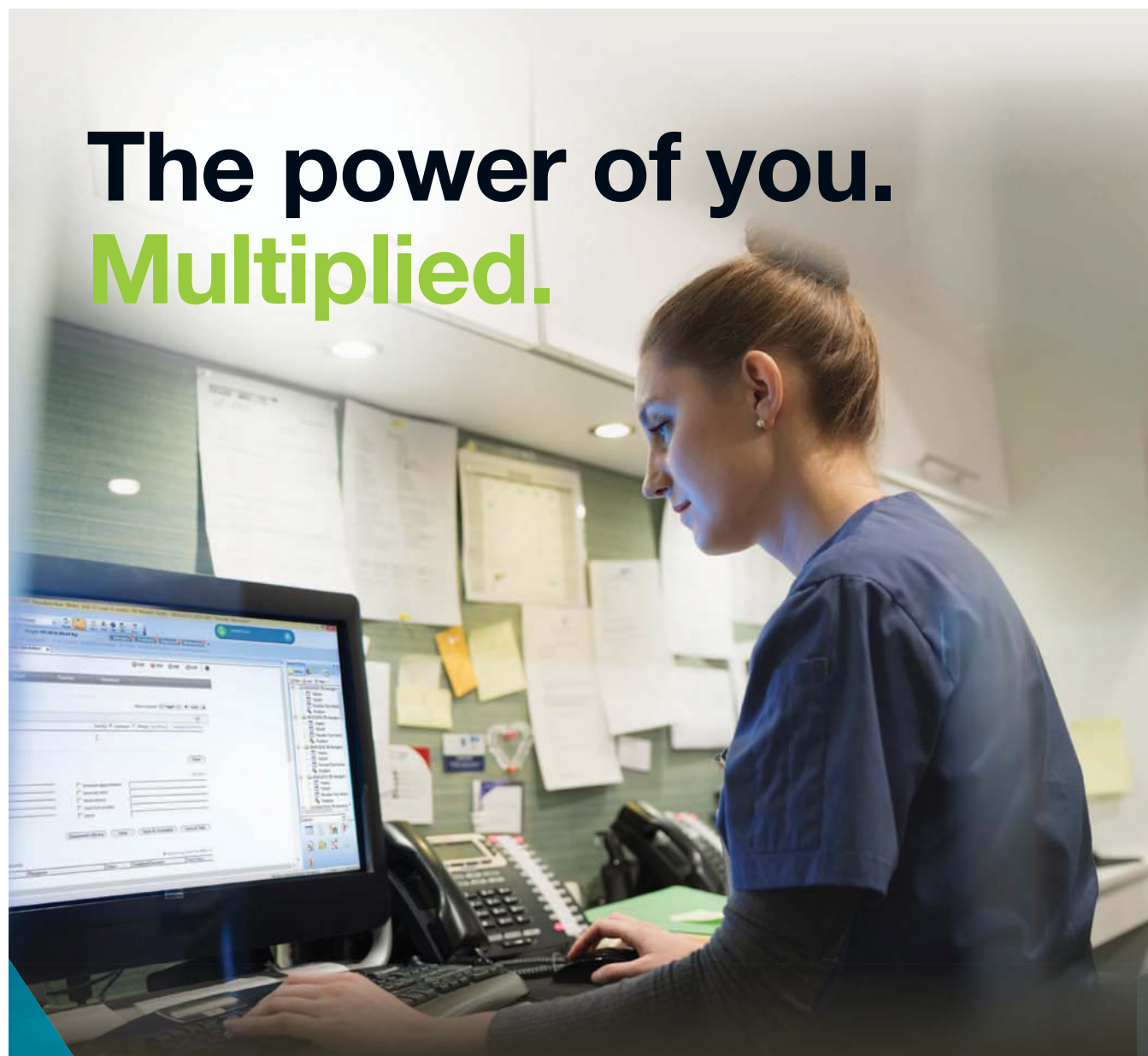
great opportunity for all audiences that possess varying knowledge of SNOMED CT to enhance their learning.

As an organization, SNOMED International is pleased to bring its international experiences to Vancouver in October. Registration is open for this two-day event and

organizations interested in exhibitor or sponsorship opportunities can visit the <http://www.snomedexpo.org/> website to learn more.

Don Sweete is Chief Executive Officer of SNOMED International.

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Toronto hospitals

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are about 160 PET/MR scanners sold worldwide. But something unique in Toronto is the co-location of a cyclotron – which is needed to produce the radioactive tracers – and a radiopharmacy, which is designed to process radioactive tracers produced by the cyclotron in a room just beside the scanner.

This means tracers with very short half-lives can be created and used in the MR/PET unit – another area of innovation that’s in the works.

A robust research program has also been launched for cardiology. In fact, the whole PET/MR project got its start at UHN through the efforts of a cardiologist, Dr. Harry Rakowski, and a radiologist, Dr. Walter Kucharczyk, about 10 years ago. Since then, a \$20 million investment by the hospital, the Canada Foundation for Innovation, and donors has brought the program to fruition.

In cardiology, one of the most exciting projects underway is investigating the potential link between stiffness in the thoracic aorta – something found often in elderly patients – and organic brain disease. The idea is that the pressure wave generated by stiffness in the thoracic aorta may generate blood flow patterns that actually result in brain damage.

“This is a very hot research idea, and you can only investigate it with this kind of technology,” said Dr. Barry Rubin, Medical Director at the Peter Munk Cardiac Centre. “It’s important, because these diseases affect millions of people. If it turns out that there is an association, then you have to wonder, would targeting atherosclerosis at an earlier age reduce the incidence of organic brain disease? So that’s a very big question, with major public health implications.”

As Dr. Rubin noted, “Lots of older patients have diseased aortas, and lots of older patients have brain disease – so are they related?”

He said the research project is being conducted in association with Baycrest, in Toronto, and with Northwestern University, in Chicago.

Indeed, most of the projects underway are being run in conjunction with partners across Canada and internationally.

“This is the new way of doing research. It’s much more collaborative than before,” said Dr. Jaffray. He explained that most PET/MR sites have a relatively low patient volume. After all, it’s an intricate exam that

requires the use of radiopharmaceuticals. The JDMI, for example, is imaging three or four patients per day in its PET/MR scanner but expect patient volume to expand as new studies kick off.

By collaborating with partners, however, one can examine a higher number of results. “We can get a larger number of patients this way, and better statistics,” he said.

One of the prostate studies is in partnership with 10 centres internationally, with work being conducted in Australia, Canada and the United Kingdom.

Of course, PET/MR is a relatively new imaging modality and there are still challenges to be overcome.

One issue has to do with the registration of images – matching the pictures collected by the PET scanner with those of the MR.

Dr. Metser observed that MR imaging has traditionally been done for particular regions of the body, heart, liver, joints, for example – not usually as a whole-body

imaging tool. But PET imaging is very useful for whole-body scanning, to determine if a tumour has metastasized.

To map this accurately, MR protocols have had to be developed that work for whole-body scanning, too. To its credit, the JDMI has just completed work in this area.

PET imaging is very useful for whole-body scanning, to determine if a tumour has metastasized.

“Basically, we developed a protocol for whole body imaging for prostate cancer,” said Dr. Metser. “It was just published in the American Journal of Radiology. Most MR scans are done for specific locations; you do MR for the prostate, for the liver, for the heart; but MR is not usually used as a whole-body imaging modality.

Patients open up to omni-present, non-judgmental ‘chatbots’

CONTINUED FROM PAGE 8

persona for the user. An NHS stop-smoking bot was so effective, “it had people telling it their deepest, darkest secrets,” Patel said. “They thought it was a human being and started talking to it like a psychiatrist.”

Health bots aren’t new, noted Shwen Gwee, general manager of Novartis AG’s digital accelerator in Cambridge, Mass., and former head of digital strategy at biotechnology company Biogen Inc.

The first dates back to 1966, when Joseph Weizenbaum of the Massachusetts

lated healthcare industry thrives on pre-approved scripting.

Newer AI technologies also fit the mold: machine learning, wherein software hones its own algorithms through interaction, rather than relying on engineered improvements, is based on the kind of pattern recognition that experienced doctors rely on for differential diagnoses.

With healthcare budgets and resources stretched to the limit, bots are being used to complement staff delivery in a number of ways.

Brite Health helps patients in clinical trials keep on top of medication and appointments; U.K.’s Babylon Health has started a six-month trial replacing the National Health Service’s (NHS) 1-1-1 help line with a “triage chatbot” to advise callers on urgent, but not life-threatening, after-hours situations.

And GRiST (Galatean Risk and Safety Tool) Gaia, also developed in the U.K., is an online psychiatric assessment tool built on cognitive behavioural therapy that recommends support services.

“At some point, bots have to come to reality and solve big business problems, which we know we have in healthcare,” said program moderator Ritesh Patel, chief development officer with Ogilvy Health and Wellness in New York. Increasingly, said Patel, that’s online.

In fact, a prime role for healthcare chat-

It should be noted that PET has also been fused with CT scanners. But PET/MR has some definite advantages. For one thing, it’s more difficult to precisely register CT and PET images, since the PET scan can take 15 to 18 minutes and a CT can be done in 30 seconds.

In that time, organs like the bladder will shift, and will move adjacent structures. As a result, the positioning of a tumour may not be accurate when images from the two modalities are fused. But MRI can be performed in tandem with the PET scan, over the course of the 15 to 18-minute exam, so the fusing of images is far more accurate. What’s more, MR is often better for soft structures like the heart and brain. Said Dr. Heidi Schmidt, Interim Radiologist-in-Chief at the JDMI. “In many areas, MR has higher soft-tissue definition than CT. So to the extent that you get better information out of an MR, you get better information out of a PET/MR.”

bots is to counter online misinformation – to combat “Dr. Google,” Patel said. Of the NHS helpline, Patel said, “People were calling and saying, ‘I’ve Googled my symptoms and I’m dying, I need to see someone now.’”

Humber River to launch Early Warning Systems

CONTINUED FROM PAGE 6

talking about is a holistic view,” he said, explaining that Humber River’s solution covers all important metrics, inside the hospital and eventually, outside too.

Later in the IoT conference, Bak joined a panel with Dr. Aviv Gladman, chief medical officer at Mackenzie Health, and Jan Walker, vice president at West Park Healthcare Centre, an advanced rehab facility, to discuss intelligent hospitals.

During the panel discussion, a member of the audience lauded Humber River and Mackenzie Health for their plans to build smart hospitals. But she questioned whether many other hospitals, especially smaller ones, could afford the investments required.

Mackenzie Health’s Dr. Gladman answered, “Can we afford not to?” He said computerized systems and communications are crucial to solving the problems in the hospital sector. “Look at all of the waste in the system, the duplicate tests, the time taken to transfer information,” he said. “The potential gain is huge.”

Bak said all of the technology implemented at Humber River Hospital – which cost \$1.8 billion to build – amounted to only \$60 million, a tiny fraction of the total. That included hardware, software and engineering. “It’s not a substantial number, and we’re demonstrating ROI on this. Others can too.”

Bak noted the technology component of a smart hospital is actually the easy part. “It’s the change management that’s challenging, especially for smaller organizations. For them, the resources are often not there.”

He noted the implementation of a CPOE system at Humber River Hospital. “It was a major undertaking,” he asserted. “It involved eight months of change management. And that was after a year of building order sets.

Denis Chamberland

CONTINUED FROM PAGE 16

process where the suppliers’ responses focus on the outline of a single solution, the Dialogue produces a variety of different and more responsive solutions. The magic of the Dialogue is to allow for the kind of interactive creativity that is so essential when procuring advanced technologies.

While the broad strokes of the Dialogue process are easy enough to decipher, the implementation itself is made more challenging by the multiple, court-fashioned procedural fairness requirements that hospitals must comply with. These apply from the very start to

the end of the Dialogue and include the standard legal and ethical duties of fairness, accountability, openness, and transparency. How these duties play out in real-time is everything.

So there is no legal impediment to

The magic of the Dialogue is to allow for the interactive creativity that is so essential in procuring technologies.

negotiating the value being procured. In fact, deep inside the newly implemented Canadian Free Trade Agreement (CFTA) (effective, July 1, 2017), lurks a helpful provision. Article 512 provides a

roadmap to negotiations, albeit leaving it to the procuring entity to figure out how to navigate the all-important legal and ethical fairness requirements.

While useful steps have been taken to promote various types of innovation procurement – the helpful primer released by Ontario’s Ministry of Government and Consumer Services is but one example – what is needed now in Canada is clear leadership from provincial Ministries of Health in truly getting behind value-based procurement.

Denis Chamberland is a commercial lawyer and consultant with extensive procurement and trade law experience in the healthcare sector. He can be reached at dac@chamberlandlawcorp.com



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