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The new province-wide dictation and transcription service in Saskatchewan is transforming the way clinicians work, enabling them to create and finalize their documentation much faster than before. As well, the system has unified dictation solutions across the province. Pictured above, family physician Dr. Mark Brown has found the system allows him to chart on the spot, instead of playing catch-up at night.

New service transforms charting in Saskatchewan

BY DIANNE DANIEL

Emergency physicians in Saskatoon, as well as medical practitioners across the province, are getting used to speaking into microphones, and it's changing the way they work and care for patients.

As part of a province-wide rollout of a new, standardized dictation and transcription service, all three of Saskatoon's emergency departments are using real-time speech recognition software from M*Modal Canada. Instead of typing notes into the Allscripts Sunrise Clinical Manager electronic patient record – a time-consuming process doctors often left to the end of their shifts – they now dictate directly into patient records, reviewing, editing and signing their notes within minutes.

Each computer in the department is equipped with a microphone and doctors usually document directly in the EHR after seeing a patient.

"It's just one example of how the move to a provincial service model for front-end speech recognition and transcription is changing the way people work," said Julie Johnson, director, Provincial Dictation and Transcription Services at 3sHealth, the shared services organization supporting the newly integrated Saskatchewan Health Authority.

"It's a revolutionary change within acute care that we probably wouldn't have been

> **The innovative provincial service is supported by M*Modal Fluency for Transcription.**

able to predict five years ago," said Johnson. "It's transforming the way doctors are working and reducing frustration with a significant benefit to patients."

The move to a single provincial service coincides with Saskatchewan's journey towards a unified health system. Starting in

December 2017, the province's 12 separate regional health authorities began operating as one integrated organization. When the business case for a unified, speech-driven clinical documentation strategy was made two years prior, each regional authority had its own technology and process.

"It was all over the map, some were using cassettes, others had made a technology investment," explained Kendell Arndt, 3sHealth vice-president, Strategic Information & Corporate Services, noting that in some cases patient reports were backlogged for weeks.

The new provincial service is supported by M*Modal Fluency for Transcription. Some parts of the health authority are continuing to use transcriptionists and back-end speech recognition; others, like Saskatoon's three emergency departments, have transitioned to front-end speech recognition using M*Modal Fluency Direct and

AI-Powered M*Modal solutions transform clinical documentation

are dictating into desktop computers or smartphones.

Either way, each clinician has a single, cloud-hosted voice profile which enables them to easily move between devices, locations and workflows (mobile documentation, front-end speech recognition and/or transcription) as preferred.

Whether using front-end speech recognition or back-end transcription workflow, clinicians at the health system are supported by top-ranking, market-validated solutions: 2017 #1 Best in KLAS, Speech Recognition: Front-End EMR, M*Modal Fluency Direct, and 2017 #1 KLAS Category Leader, Speech Recognition: Back-End, M*Modal Fluency for Transcription.

Since completing its 18-month M*Modal implementation in November, 2016, the province has set a target of 24-hour turnaround for all reports. For those clinicians using front-end speech recognition to document directly into Sunrise Clinical Manager, reports are available immediately.

"The biggest change management piece we've tried to focus on is readiness," explained Johnson. "It's about fully understanding the current and desired workflow of the practitioner so that the technology supports what they need to do to ensure patient information is flowing."

3sHealth recently hired two full-time System Change and Adoption specialists whose focus is to help clinicians transition to the M*Modal solutions, including front-end speech recognition. The first step is understanding the current workflow so that the technology can enhance the individual and preferred workflows of clinicians and drive better quality clinical documentation. For those who want to self-report, the support is there to help them.

Family medicine physician Dr. Mark Brown decided to move to front-end speech recognition so that he could chart between patient visits. Not only does the new way of working allow him to include more meaningful information in his charting, such as negative findings and conversations with patients, he also has more time for his clinic now that he spends less time typing.

Additional time is saved using an M*Modal Fluency Direct feature that automatically inserts blocks of standard text using key words.

"I used to stay late or take charting home with me," said Dr. Brown. "Now I take coffee breaks and lunch. I am home in time to have supper with my family and to be 'Dad taxi' for my kids."

Dr. Terry Zlipko, an ER physician in Saskatoon, echoes Dr. Brown's enthusiasm. "I love this new system. I know for sure that I'm now doing my charting in half the time it used to take me. That gives me more time to spend at the bedside. Instead of spending 23 minutes typing a report, I can now do that same dictation, edit it and send it on its way in about three or four minutes tops. It's been incredible."

Clinicians who prefer real-time documentation are further supported by M*Modal Fluency Direct's Computer-Assisted Physician Documentation (CAPD) functionality.

This real-time, fully-automated and AI-powered technology delivers high-value clinical insights to physicians as they dictate or type the clinical note in the EHR. This closed-loop documentation solution proactively suggests improvements in quality, coding and compliance, and reports on physician engagement with the system.

The system delivers physician feedback on ICD-10 codes, gender and laterality mismatch, gaps in documentation quality, variance in patient care, etc.

"Our mission is creating time to care and improving the patient-physician encounter. To that end, our real-time artificial intelligence (AI) and natural language understanding (NLU) technology continually analyzes the note, contextually understands the physician narrative, and provides in-workflow insights to physicians at the point-of-care.

"Our solutions are designed to significantly improve the speed, ease, efficiency and quality of clinical documentation so that doctors can focus on patient care," explained Carey Silverstein, Vice-President, Operations, M*Modal Canada.

As of now, the only groups not using the provincial speech recognition and transcription service are physicians operating fee-based private clinics and medical imaging.

All others, including laboratory, pathology and the provincial cancer agency, are on the M*Modal platform.

Carey Silverstein, VP Operations (l), and Paul Silverstein, VP Finance, lead M*Modal in Canada.

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Analytics and data access lead to quality improvements at Sick Kids

BY JERRY ZEIDENBERG

TORONTO – Quality and safety can be improved through the use of tools like business intelligence and analytics, but you need to "democratize" the data, so that everyone is on board across the organization.

That's the message delivered by the Hospital for Sick Children's CEO, Dr. Mike Apkon, at a session on analytics that was held last November during HealthAchieve, the Ontario Hospital Association's annual conference.

"We want to be the safest children's hospital," he said. "But 10,000 people have to work toward it," he added, referring to the 10,000 clinicians and employees of the organization.

As Dr. Apkon put it, "The key is transparency, so that someone who needs to know about their performance has access to the data."

He reflected on his past experience with a U.S. hospital, where information was collected on the performance of staff and clinicians, but they didn't have access to the data.

When the hospital finally shared the data, performance shot up. "And it happened without a single conversation," said Dr. Apkon, noting that people looked at the data about their units or themselves and from that alone, were inspired to improve.

"It shows the power of giving people access to their own information," he said.

David Grauer, senior vice president of Health Catalyst, and former CEO of Intermountain Medical Center, in Salt Lake City, Utah, added, "Most people are intrinsically motivated to do the right things, but they don't have the right information."

Grauer was on stage engaging in a conversation with Dr. Apkon about analytics, performance, quality and safety. Intermountain is itself a leader in the use of analytics and BI. Health Catalyst, a company

spun off from Intermountain, helps hospitals build data warehouses and improve their processes.

That being said, Dr. Apkon did note that transparency of data can also motivate people in a different way.

"When people know that I can see the information each day, it improves their performance. It has an immediate effect."

Indeed, with the democratization of performance data, everyone becomes more responsible for performance and quality.

Dr. Apkon commented that this kind of continual observation and monitoring requires "data literacy" by the leadership throughout an organization.

Gone are the days when executives would wait for reports to be printed and delivered to their desks. "You can't just use a print-out," said Dr. Apkon, explaining that these boiler-plate printouts are often out-of-date by the time you see them, and often enough, they don't contain the information that's needed.

By working with an analytics system, moreover, you can formulate your own questions and find your own answers.

Of course, implementing such technologies is expensive, as is the training and education that goes along with it. But the change that analytics and BI can bring about is significant.

Dr. Apkon said the systems have been enablers of quality improvement at Sick Kids, where clinicians aren't just given reports and targets. They're also able to dive into the data for themselves, to check it and come up with their own analyses and interpretations.

"We've given a lot of our physician leaders access to the data," he said.

That's been a big help when it comes to issues like length of stay, which the hospital has been trying to optimize.

LOS can have many facets and questions surrounding the figures and definitions that are used. "There are a million reasons why someone might question the number we have come up with," said Dr. Apkon.

Dr. Michael Apkon, CEO, (right), speaks with pediatric surgeons at Toronto's Hospital for Sick Children.

Indeed, physicians in particular may question the official wisdom. "Tearing apart data is a sport for physicians. We're trained to have a critical eye."

But by letting doctors explore the data, Dr. Apkon said, engagement and utilization are fostered. So is understanding, as the doctors can see how various numbers were arrived at.

Dr. Apkon said it's important for the leadership to set goals and targets, but clinicians and staff have to be free to develop initiatives, as well. After all, the problems identified at the front-lines can have an impact on workflow, safety and quality, too. And giving teams control over their activities also contributes to morale and job satisfaction.

Linette Margallo, clinical director of ED at Sick Kids, commented that she has seen "a huge evolution in data over the past 10 years. "Having more data lets us really dig in." She and Kate Langrish, clinical director of paediatric medicine, gave real-world examples of how analytics and

parsing the data have helped improve the delivery of care at the hospital.

As one example, they described the incidence of supracondylar fractures in children. "Usually from falling from a jungle gym or tree," commented Margallo. Over a five-year period, they could see from the data that admissions were increasing, and so were wait times for admissions and treatment.

By further analyzing the data, they could see that most of the arrivals were in the afternoon – when orthopedic surgeons were in the operating rooms. This meant the surgeons weren't available to admit the patients from the ED to hospital.

The hospital then worked to change the admitting process, enabling young patients with fractures to get started sooner on pain management and other procedures. And the 10 to 12 hour wait time for admitting was reduced to an average of eight hours – a significant improvement.

"We used data to solve a problem and change a process," said Langrish.

Health Ecosphere holds showcase, demonstrates progress of innovators

TORONTO – "If innovations aren't being used, it's really just research." These words were spoken by Harvey Skinner, co-chairman of the Health Ecosphere Innovation Pipeline, at the projects first showcase, earlier this month. Dr. Skinner, a psychologist, is a professor at York University and was the Founding Dean of the school's Faculty of Health.

The sentiment is the driving force behind the Health Ecosphere Innovation Pipeline's core goal – taking health technologies from conception to commercialization. Since the project's launch in 2016, more than 40 health technologies and enterprise solutions have received support in their development stages.

Earlier this year, in January, lead partners York University and Southlake Regional Health Services, along with University Health Network, invited the public and stakeholders to learn exactly how

the project has benefited industry and research institutes to develop personalized health technologies, including healthcare apps, medical devices and big data platforms.

Held at Telus Tower in downtown Toronto, 12 of the 55 project partners had the opportunity to showcase their work through a "speed-geeking" exercise, with five minutes to explain to attendees exactly what their technology is and how the Ecosphere project has contributed to its development.

Technologies featured in the showcase included:

• DashMD, a mobile application designed to help patients track, manage and find the care they need after they've been discharged from the hospital. The app will soon be tested in the Emergency Department and Childbirth Centre of Markham Stouffville Hospital.

• ForaHealthyMe Inc. a solution that

delivers a virtual clinic without walls by blending clinical protocols for prehabilitation and rehabilitation patient management with real time analytics, motion tracking, 3D avatars, video and gesture recognition technologies. The Fora-HealthyMe software and analytics engine

> **Project partners had the opportunity to showcase their work through a "speed-geeking" exercise.**

enables a provider to create custom care plans for patients. Using data related to range of motion and muscle strengthening exercises, a provider can prescribe specific activities to patients prior to and after a surgical procedure.

• Medly, a heart care system. Prescribed by clinicians, Medly enables patients liv-

ing with heart failure a platform to record physiological measurements and symptoms. A comprehensive algorithm uses these measurements to assess the patient and in turn provides actionable self-care feedback. Simultaneously, their clinician receives real time alerts in the event of any significant changes to the patient's condition. The system is developed by the eHealth Innovation team at University Health Network and is currently integrated into the standard of care for heart failure management at the Peter Munk Cardiac Centre.

The showcase event was clear evidence that the Health Ecosphere Innovation Pipeline is contributing to the vision of transforming health through continuous innovation and helping position Canada as a global leader in digital health. For more information on The Health Ecosphere Pipeline project and the technologies involved visit health-ecosphere.com.

Think Research's shareable order sets for best practices catching on

BY JERRY ZEIDENBERG

TORONTO – When Ontario's Ministry of Health and Long-Term Care asked St. Joseph's Health System (SJHS), Hamilton to lead the Provincial Digital Quality Based Procedures (QBP) Order Sets Program, SJHS publicly procured Think Research to create and implement digital order sets for the program.

With a recruitment goal of 75 provincial hospitals, the program turned out to be more successful than planned – to date, 82 hospitals representing 107 sites have made use of the provincially funded program.

"We currently have 62 percent of all Ontario eligible hospitals participating in the program, which has exceeded our goal of 50 percent," commented Donna Kline, Executive Lead, Project Management Office at SJHS, who added that the program has been extended for another year.

Order sets enable clinicians to quickly and effectively implement the latest, evidence-based practices for a wide range of diseases and conditions. They have many benefits, including producing better outcomes for patients, and reducing the variability that's found across the healthcare system,

And although hospitals have been tinkering with order sets for years, most of them have been working in isolation.

"Historically, hospitals using order sets would develop them on their own," said Dr. Chris O'Connor, president and founder of Think Research, who is also an ICU physician. "They're trying to re-invent the wheel."

Others have tried to adapt American order sets to the Canadian heathcare system. However, this can be expensive, involves customization work and does not connect the hospital to the healthcare system it operates in, noted Dr. O'Connor.

"It is puzzling why hospitals would want

The Clinical R&D Team at Think Research are driving evidence-based innovation in the company's order sets.

to use order sets developed for the high-cost, billing-driven, American healthcare system as a starting point for their own order set development in Canada," he said.

"It's much easier to be part of a group, to share knowledge through an order sets network," he said. "We connect hospitals with experts and the rest of the healthcare system. There are companies that will sell you order sets, like encyclopedia salesmen, but they won't connect you to the Canadian healthcare system."

Members of the network are able to share best practices and influence the tools through regular user meetings and clinical workshops, where various subject matter is discussed and refined. "We've just held clinical review sessions on palliative care, thrombosis, diabetes, wound care, and dementia," observed Kirsten Lewis, RN, Vice President of Clinical R&D.

Dr. O'Connor said that medical knowledge is growing at an ever-accelerating pace, and the regular meetings help keep clinicians and administrators in touch with the latest know-how. The peer-network, with support from Think Research, helps them incorporate the digitized order sets into their own systems and workflows.

"Not only is medical knowledge increasing, the medical system is becoming more complex as well. Care is now frequently delivered by large interprofessional teams across multiple institutions," said Dr. O'Connor. "Our advanced clinical systems integrate Canadian content into hospital information systems, regardless of what backend that might be."

There are currently over 800 different reference order sets for acute care hospitals in the Think Research network, along with others for long-term care. The most commonly used order sets reflect the patterns of care in hospitals, with high demand for best

practices in COPD and coronary care, musculoskeletal surgeries, and normal deliveries.

Think Research is an active partner in the network; it monitors the use of order sets and receives feedback about them. "The data helps us to understand usability issues and clinical impact. We use that feedback to build better order sets," commented Dr. O'Connor.

The system created by Think Research has evolved into an online platform that can be used for more than order sets. Work is under way in many new knowledge-based applications, including of e-referrals, virtual care, and med rec to name a few.

To support this, Think Research recently announced a partnership with IBM Canada to make use of IBM's cloud infrastructure. The plan is to migrate Canadian users of Think Research order sets to the cloud, to make implementation, utilization, and analytics, even easier and more cost-effective.

"In terms of privacy and security, the IBM cloud infrastructure is light-years ahead of others on the market," commented Saurabh Mukhi, CTO. "It provides the kind of scalable, 24/7 availability global healthcare facilities and systems demand."

For its part, Think Research technology is deployed in almost every province across Canada. Moreover, it has expanded into Ireland, implementing its solutions in five hospitals as part of a planned EU and UK expansion.

The company is also gearing up in the U.S. market, where it initially will be focusing on the long-term care and smaller acute care hospital sector.

Overall, the company is quickly growing, with about 200 employees and many new projects on the horizon. "We're using the most advanced technologies and creating very exciting solutions for clinicians across the province and around the world," said Dr. O'Connor.

How to reduce SSIs in your operating rooms? A global expert weighs in

BY JERRY ZEIDENBERG

TORONTO – Surgeons who operate buck naked would likely have lower rates of patient infection, as without clothes rubbing their skin and shedding cells, there would be less spread of possibly infectious matter in the OR.

Dr. Patch Dellinger, a general surgeon and world authority on surgical site infections, made this light-hearted remark at Health Quality Ontario's annual conference on surgical quality, held here last November.

The audience of some 300 surgeons and OR staff thoroughly enjoyed this and many other quips made by Dr. Dellinger during his one-hour keynote address. But Dr. Dellinger, who works at the University of Washington Medical Center, in Seattle, had a number of more serious recommendations on how to reduce surgical site infections (SSIs), and to improve quality, all of which were tied to evidence, studies and his own experience.

He had the following advice:
• Keep your patients warm. ORs can be cold places, especially in the early morning. But it's been found that warmer patients have higher oxygen levels, which is important for discouraging infections in surgical sites. In a multicenter study in Germany and Austria, colorectal surgery patients were randomly assigned to be kept warm or to be allowed to get cold. It turned out the patients who were cold experienced a much higher incidence of SSIs. "Use a warming blanket prior to the operation and when the patients are in the OR, to get them warm," said Dr. Dellinger.

In addition to the improvement in clinical outcomes, there's also higher patient satisfaction. "What do patients hate about surgery?" he asked. "Pain, nausea and shivering in the OR. Warming the patient can reduce the shivering, and improve patient-reported quality outcomes."

• Use lots of antibiotics just prior to surgery and during the operation, but stop right after. "When I was younger and more foolish, I used to tell people

not to use prophylaxis for clean operations [such as joints, as opposed to procedures on internal organs, like the intestines.) But in fact, there is consistent data that no matter what your underlying infection risk is, you do reduce it

Dr. Patch Dellinger

with prophylaxis. And it's independent of the type of operation."

Dr. Dellinger said he is a strong supporter of antibiotic and antimicrobial stewardship, and he is aware of the costs of drugs. But it's clearly a case of being safe rather than sorry. "If you're going to do a hernia operation on me, and stick mesh in there, even though the underlying infection rate is low, I'd just as soon have one dose of prophylaxis."

• Sugar levels in surgical patients were a major topic of his discussion. He noted,

"There is a strong correlation between blood sugar and infection risk [in surgical sites], and said it's well-known that diabetics have a higher risk of infections. But he stressed that non-diabetics with high blood glucose levels also experience much higher rates of surgical site infections. "Hyperglycemia doubles the risk of SSI."

And while high blood glucose was at one time thought to be a risk only for cardiac surgeries, it has been established that the risk is there for all types of surgery. "White cells bathed in glucose do not ingest and kill bacteria efficiently. And most white cells probably don't know if they're in a laparotomy incision or a vascular incision," said Dr. Dellinger.

He cited a study of non-diabetics at the Cleveland Clinic who were in for colectomies and had high blood sugar counts in the OR or post-op (above 125). "They had increased mortality, increased sepsis, increased SSIs, increased re-operation. It was across the board in non-diabetics."

That's why it's important to monitor

Stepping It Up:
HIMSS® Health IT Value STEPS™

Looked at through the eyes of the value optimization framework called HIMSS STEPS, healthcare systems can benefit from insights in: Satisfaction, treatment/clinical, electronic secure data, patient engagement and population management, and savings.

As we face the pandemic of issues with medical imaging and IT, we must build solutions to solve the fragmentation of care delivery, design security and data management, improve delivery of patient care and efficiency, reduce waste, rein in lost revenue and reduce overall costs. We need to organize and present comprehensive patient information intuitively for each caregiver. We need to evolve from being data-rich but actionable-poor to a knowledge-based/information-driven care delivery approach. To achieve value-based care, we need to maintain secure custody of medical images within the enterprise and leverage them as strategic assets of the entire organization. Clinical, operational and financial goals will all be best-served with a patient-centered, longitudinal imaging record that completes the EHR strategy.

S SATISFACTION

Patient satisfaction increases when physicians share images with patients and families. Research studies show that engaged and educated patients take better ownership of their care. Care providers are more satisfied too, having easy access to information and tools to communicate and collaborate with peers. Administrators are more satisfied with better continuity of care and reductions in cost.

T TREATMENT/CLINICAL

When reviewing new imaging exams, clinicians can conveniently and quickly access a patient's historical imaging record in a single, use-to-use user interface to enable informed decision-making and swift initiation of treatment. Enterprise Imaging empowers care teams to collaborate and enhances continuity of care as transitions become smoother, more informed and purposeful. The hope is what follows are fewer hospital readmissions, fewer ED visits, increased patient safety and better chronic disease management.

E ELECTRONIC SECURE DATA

With a complete EHR comes one means of electronic secure data storage. Format is no longer a foible, with Enterprise Imaging managing studies from any device or format, including DICOM, DICOM SR and non-DICOM images such as MPEG, AVI, WMV, MP3, JPEG, TIFF, BMP, CINE, WMA and PDF. Text files such as DOC and TXT are imported too. Images from mobile devices such as CR, point-of-care ultrasound or digital cameras can be added securely.

P PATIENT ENGAGEMENT & POPULATION MANAGEMENT

With current and prior images available at the bedside at point of care, physician can engage patients with a clear understanding of their diagnoses and treatment course. Physicians also can engage each other or patients remotely using mobile devices. This helps to drive patient education, awareness and compliance, often supporting population management initiatives.

S SAVINGS

Savings is always top of mind in healthcare. Enterprise Imaging can lead to savings in time and costs. Consolidating images from a variety of specialties offers economies of scale in cost and improved accessibility. Integrated image access drives clinical best practices. Immediate and easy access to images and reports can mean faster and more productive appointments and rounds throughout the hospital, improving workflows, increasing patient volume and enhancing the overall patient-provider experience. Ready access to images can help maximize revenue entitlements and avoid penalties, and maximize bonuses available under the government payer programs. Easy image access also eliminates the need for retakes and speeds timely patient discharge and thus reduces the amount of resources needed to address risk minimization efforts.

AGFA *Agfa*
HealthCare

Renfrew reduces compounding errors using IV workflow technology

Renfrew Victoria Hospital – in Renfrew, Ont., about 90 km west of Ottawa – is the first hospital in Canada to install an innovative solution to improve the safety of the medications being manufactured in the pharmacy department.

PharmacyKeeper Verification uses iPads and a cloud-based software suite to ensure every step in the preparation of chemotherapy and sterile products in pharmacy is done correctly and is documented.

"We're excited to be using this software," says Andrew Wagner, Director of Pharmacy at RVH. "While hospital pharmacies have compounded medications and chemotherapy for years, and for the most part safely, when errors happen the consequences for patients can be huge. We wanted to ensure we were at the cutting edge of technology used to improve patient safety."

Selection of the new PhamacyKeeper system was made with input from the entire team at RVH. "Our decision was based on contributions from nursing staff and physicians, along with pharmacy," says Wagner.

Several recent examples of major incidents in the United States and Canada have created a paradigm shift in the oversight of pharmacy compounding, and changed the mandate of the Ontario College of Pharmacists increasing its oversight of hospital pharmacies.

What most of the public and even many within hospitals don't realize is the exacting work that goes on in the pharmacy. Medications received from manufacturers are in sterile vials, but the pharmacy staff must then use these sterile vials to prepare

PharmacyKeeper Verification uses iPads and cloud-based software to ensure high quality standards are met.

patient-specific medications in a fashion that is always accurate and maintains a sterile product.

However, the process to do so hasn't really changed in the past 30 years, and is still mostly paper-based tracking and visual double checks. Much more can be done to ensure the safety of what is mixed in the pharmacy.

One such example is bar coding. "My local Canadian Tire has been scanning bar codes since the early 1980s; the hospital gift shop started doing it in the '90s. But in hospital pharmacies, despite having bar codes available on medications for years, barcode scanning technology has not re-

ally been adopted," says Kevin McDonald, Director of Northwest Telepharmacy Solutions. "This is a high stakes business, mixing chemotherapy and other medications. Mistakes can have serious consequences, and we need to do everything possible as pharmacists to prevent errors."

From a nurse's and patient's perspective, in almost all cases, what comes out of the pharmacy is a clear bag with a clear liquid inside of it. Other than a label with the patient name and what is "supposed" to be in the bag, it is a leap of faith that no errors have occurred in the pharmacy and that every technique used followed a process that ensured the product remained sterile.

Northwest Telepharmacy Solutions is already the leader in providing remote pharmacist solutions and checking for hospitals. "When we saw the opportunity and improved safety that these IV workflow solutions can bring to the pharmacy, we did a search for the best solution the world has to offer," says McDonald.

Of several workflow solutions on the market, PharmacyKeeper is the fastest growing one in the United States and is KLAS rated as the top solution. The fact that it uses simple and available technology (iPads) significantly improves the value and portability of this solution.

As a technician prepares the product, bar codes are scanned to ensure the correct products are being used, and expiry dates with lot numbers allow traceability in the future.

Photographs are taken using an iPad, and these photos can then be used by pharmacists to check that the product was prepared accurately. "What we like about this software is that we can now easily track, review and audit every detail of the compounding process for every patient who has received a compounded product, including the specific lot number of a medication," says Wagner. "Above all, we're doing what we can to minimize the risk of errors made during compounding and ensure the safety of all our patients."

Not only is the remote-checking ability accurate, it is also convenient. When a technician was required to mix an emergency pain medication on Christmas Eve, Wagner appreciated checking the accuracy from home rather than making a special trip into the hospital.

Edmonton home to Canada's first stroke ambulance program

Canada's first mobile stroke unit is in Edmonton, operating as part of a three-year pilot project out of the University of Alberta Hospital and funded by the University Hospital Foundation. The unit can be dispatched within a 250 kilometer radius of Edmonton meeting regular ambulances carrying patients with a suspected stroke en route.

CT scans and potentially other forms of treatment are conducted at the meeting point, with the goal of decreasing the time to treatment from the onset of stroke symptoms.

Around the world, stroke ambulance programs operate or are being evaluated for use in several US cities, as well as the UK, France, Belgium, Switzerland, and Australia, among other countries.

What is it? Essentially a stroke unit on wheels, a mobile stroke unit is a modified ambulance (or custom-built vehicle resembling a large ambulance) that is equipped with a CT scanner to provide immediate imaging of patients with suspected stroke before they get to the hospital.

Aside from the CT scanner, other features can vary, but may include tele-

stroke equipment, point-of-care laboratories, thrombolytic drugs, plus the standard emergency response equipment found in a regular ambulance.

A key feature of the stroke ambulance is the staff on board. In addition to a paramedic or emergency medical technician, the vehicle may also be staffed by those specially trained for the rapid diagnosis and treatment of stroke, including neurologists, nurses, radiology or CT technicians, or other health professionals.

If telestroke equipment is installed, the vehicle allows staff to consult with in-hospital specialists.

Given the potential for this vehicle to impact stroke care, especially in rural and remote parts of Canada, Ottawa-based CADTH examined the available evidence as part of its efforts to scan the horizon for promising new health technologies.

How much is it? A mobile stroke unit represents a significant investment for any health care organization.

The costs include the initial purchase of the vehicle, plus the equipment, as well as ongoing operating, maintenance, and staffing costs. The reported cost of the Edmonton vehicle is more than $1 million.

What does the evidence say? Does the evidence show that faster treatment results in better outcomes for patients? CADTH's limited literature search found two German randomized controlled trials of mobile stroke units, as well as additional observational studies, case studies, and cost studies from Europe and the US.

Much of the research about these vehicles evaluates the time it takes for a patient to receive treatment, but the out-

> **With a CT scanner on board, imaging of suspected stroke patients can take place before they arrive at the hospital.**

come measured varies from study to study. In some cases, a primary end point was the time from when dispatchers activated the stroke alarm to the time a treatment decision was made. In another study, the primary end point was the time from alarm to the time a thrombolytic (or "clot buster") drug was administered.

The evidence suggests that mobile stroke units may reduce the time it takes for patients to receive appropriate treatment, but it's unclear if earlier treatment

in the unit improves long-term functional outcomes.

Researchers in Berlin compared the proportion of patients who had experienced acute ischemic stroke living without disability three months after being treated with pre-hospital intravenous thrombolysis in a mobile stroke unit with patients who received standard hospital care.

No difference was found between the two groups. International research is now underway to determine if stroke ambulances can improve functional outcomes for patients. In terms of cost-effectiveness, a German study found that, despite the initial and ongoing costs, the use of these units may be cost-effective compared with conventional treatment.

Research that will help improve our understanding of how a mobile stroke unit could benefit people with intracranial hemorrhage (hemorrhagic stroke) or triaging people with ischemic stroke who would benefit from mechanical clot retrieval (endovascular therapy) is in early study.

To read the full CADTH article on this device, visit https://cadth.ca/mobile-stroke-units-prehospital-care-is-chemic-stroke

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Use of analytics in community health helps achieve better outcomes
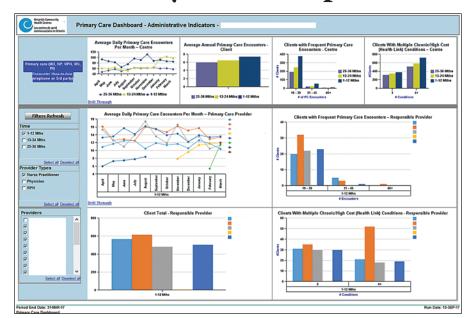
BY RODNEY BURNS

Ontario's Community Health Centres (CHCs) have been using data analysis to inform evidenced-based planning for over 25 years. Today, that experience in simple data analytics is taking us into the sphere of advanced data analytics where we can translate complex, diverse and timely information into better healthcare decisions and healthier outcomes.

CHCs and partner members in the Association of Ontario Health Centres (AOHC) are changing the Primary Care landscape by using advanced analytics. Our cutting-edge computational tools give participating centres a complete view into inter-professional care coordination, health management, and clinical services.

Get electronic: In 2008, 73 CHCs made a collective commitment to begin using their clinical management system as a robust electronic medical record (EMR). Using the lessons learned by early adopters, the AOHC developed an EMR roadmap for CHCs in Ontario.

By 2010 we achieved a significant milestone – almost 90 percent of CHCs were using their clinical management system as a full electronic medical record. A key focus was to capture meaningful socio-demographic data to help determine our strategic priorities, which are identifying and addressing barriers to achieving equitable health outcomes for clients.

Share your data: But we did not stop there. All our member centres were collecting key client data using a common en-

counter classification system – the Electronic Nomenclature of Disorders and Encounters for Family Medicine (ENCODE-FM). It is a systematic and hierarchical clinical terminology for family medicine.

ENCODE-FM simplifies comparability because it is mapped to all terms in the two widely used classification systems, the International Statistical Classification of Diseases and Related Health Problems (ICD-10 and ICD9-CM) and the International Classification of Primary Care (ICPC) code system. Working with our Aboriginal Health Access Centre members, we were able to get key Indigenous identifiers and Traditional Healing Activities added to

ENCODE-FM, making it the only healthcare classification system that we are aware of, with such identifiers.

Next, we focused on procuring a robust provincially certified clinical management system. This meant that we could align with, and integrate into, existing province-wide eHealth systems and datasets like the Ontario Laboratories Information System (OLIS) and the Health Report Manager (HRM).

Promote collaboration: To bring all of this together in a systematic and cohesive way, we developed the Business Intelligence Reporting Tool (BIRT). It helps us to standardize data and reporting amongst all participating member centres. It also gives

our members the power to share queries and reports efficiently.

We consult members at every phase of BIRT's multi-year development to ensure that the technology meets their evolving needs. BIRT consolidates and presents key data from multiple EMRs, elegantly and simply, with bilingualism, privacy and security baked in by design.

Strategic planning decisions and quality improvement got a lot simpler. Today, BIRT is helping our member centres collaborate – developing best practices, gaining efficiencies, and working together to provide their clients timely access to the programs and services that best meet their needs with the evidence to confirm that this is being achieved.

Improve health & well-being: Built on an Oracle platform and using IBM Cognos, BIRT gives our member centres the power to view their operations across multiple programs and services using near-real time dashboards. We develop dashboards on the principles that visualized data should be Strategic, Timely, Accessible, Relevant and Targeted (START).

Using the BIRT Multi Sectoral Accountability Agreement (MSAA) dashboard, a member centre was able take significant strides towards improvement of their screening rates. Being able to identify the challenges, make improvements and see the results in near-real time, the centre increased its screening rates to above the average values for Community Health Centres provincially.

Rodney Burns is CIO of the AOHC.

Financing technology has clinical, business, and legal implications

BY DENIS CHAMBERLAND

Just as managing healthcare technology has become significantly more complex, identifying the right funding model for the task at hand has also become more complicated. I briefly examine below four funding models, not to compare them to each other but to highlight select strengths and weaknesses.

The Traditional Capital-Funded Model: The traditional approach worldwide is the capital-funding acquisition and revenue-funded support model where the hospital directly procures the healthcare technology. In Canada the healthcare technology is generally acquired through a competitive process – typically through an RFP process – where bidders compete against each other for the business, encouraging each one to reduce costs and offer more benefits.

Here, the healthcare technology is usually purchased on a one-off basis, allowing for flexibility in the management of the technology and facilitating annual reviews and changes to be made if necessary.

For example, if the in-house or the external technology support fails or is inadequate, there is an opportunity to quickly adjust the mix and find the arrangement

that will best support patient care.

Despite its widespread use, some important concerns attach to this model:
• There is a dependence on a guaranteed funding stream, which may become unavailable during periods of financial stress.
• Because the capacity to stretch the technology's use during funding shortages is limited, the quality of clinical care can be compromised where unreliable healthcare technology remains in use.

The Rental Model: Renting healthcare technology may make sense where it's not sensible for the hospital to own the technology, which might otherwise remain unused for extended periods of time. For example, renting can make sense when managing fleets of devices where the number needed varies over time. It can also make sense during replacements. For example, renting a mobile CT for several weeks during replacement of the hospital's own CT scanner.

The Leasing Model: In a leasing model, the ownership of the healthcare technology remains with the leasing company and maintenance is often rolled into the deal and provided as part of the lease terms. Here the hospital needs to negotiate with both the leasing company for the funding stream, as well as with the leasing company within the

context of a procurement competition. A positive aspect of leasing is that any technology deficiency is the responsibility of the leasing company. The risk stays with the leasing company.

A key concern with leasing are the many loose ends which can easily be overlooked. First, many leases include provisions obligating the hospital to

Denis Chamberland

keep the technology 'in good condition' and to repair it if necessary, which means the hospital assumes an uncertain financial risk. Second, there is the question of which party assumes responsibility for software updates/upgrades and other technology upgrades during the term of the lease.

The Managed Equipment Services Model: The managed equipment services (MES) model is a life cycle management approach that converts the acquisition of the technology into a services transaction. This is therefore not a capital acquisition.

In this model, the hospital holds a procurement competition (again, usually

through an RFP process) to find a service provider that will take responsibility to procure, install and maintain the technology to a standard of performance that is usually much higher than any other model of technology acquisition or rental. In this model the hospital specifies the service standard rather than focusing on the equipment alone and pays an annualized fixed fee for the services. The competition also tends to drive the costs down when compared to the traditional acquisition model.

The MES contract typically extends to two cycles of the life expectancy of the specific technology, putting the service provider in the position of absorbing and managing the periodic technology reinvestment required to meet the performance requirements stipulated in the MES contract. As such, the service provider assumes the risk of providing future technology, including financing the risk, and the model also helps the hospital's financial planning with a predictable cost profile.

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

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AI algorithms need access to imaging data and human experts for training

Widespread use in clinical practice is still several years in the future.

BY LORELLE LAPSTRA

Artificial intelligence (AI) in the field of radiology is expected to bring a myriad of benefits, including improved diagnosis, faster more efficient patient care and improved workflow. While the potential impact of AI on the practice of radiology has generated millions in investment, there are only pockets of implementation in clinical practices. Widespread use in clinical practice is still several years in the future, in large part because the algorithms at the core of any AI-based radiology application need to be trained and perfected through access to large image data sets and validated and enhanced by human professionals.

"We are still quite far away in most applications because we don't have access to the data we need to train algorithms properly," comments Nils Forkert, PhD, the Canada Research Chair in Medical Image Analysis and member of the faculty of medicine at the University of Calgary.

Forkhert and his fellow researchers often work with small databases with only 20 to 100 data sets, which he notes is not enough to capture all the variants of any disease or syndrome. Algorithms trained and perfected through small data sets are actually too precise because they only reflect one slice of the total patient population.

"Right now we are in the early steps, despite the huge hype around AI. Google's tools are so successful at recognizing cats and dogs because they have access to huge databases of images. This is the struggle that we have in healthcare. We just don't have access to the images we need," continues Forkert.

A recent study by a Mayo Clinic and Arizona State University research team highlights the role that image data plays in developing AI-based, or machine learning (ML) imaging applications.

As explained by techtarget.com, "The basic premise of machine learning is to build algorithms that can receive input data and use statistical analysis to predict an output value within an acceptable range." The team's research explored using ML to assess ultrasound images of thyroid nodules and determine the need for a fine-needle aspiration (FNA) biopsy.

The ultimate goal of this work was to reduce the number of FNA biopsies and their costs; only 10 percent of patients selected to have a biopsy actually have cancer.

"[T]here is a clinical need for a dramatic reduction of these fine-needle aspiration biopsies," said Zeynettin Akkus, PhD, who is with the Mayo Clinic.

Ultrasound thyroid images include features that can differentiate benign from malignant nodules and identifying those features can reduce the number of FNA biopsies. Creating a ML algorithm to identify benign nodules could eliminate the need for nearly half of FNA biopsies, while still providing high-quality care. The team had access to 100 benign cases and 50 malignant cases to develop their algorithm. This limited training dataset required artificial augmentation to train the algorithm, which is not ideal.

Ultimately, the performance of the algorithm needs improvement with more training data. "Hopefully we can increase the [size of the] dataset to thousands of images, and … we are going to have better prediction power," explained Akkus.

To put AI to use in radiology there is an "urgent need to find better ways to collect, annotate, and reuse medical imaging data," reports a paper published in the May 2017 issue of the Journal of Digital Imaging.

Healthcare generates 800 billion images annually, which means the data needed to train algorithms exists. Gaining access to these images is technically challenging because they exist in silos throughout hospitals and health systems.

To find and view images stored on PACS, VNA or XDS repositories requires a high level of interoperability. To meet personal health information privacy requirements and other ethical issues regarding the use of patient data, the data must also be anonymized.

In addition, image data must be properly labeled and annotated to maximize an algorithm's development. Metadata required for medical imaging algorithm development includes imaging modality, exam codes and annotations on an image's content.

Lorelle Lapstra

While DICOM offers a standard file format for image metadata, optional fields are often left blank or filled with proprietary data from an individual imaging system.

High-quality image recognition and analysis not only requires solid standards, but also annotated datasets and labeling that must be input by humans, which is both costly and time-consuming.

Medical imaging domain experts, medical image informaticists, researchers and others, are working to standardize, and potentially automate, the image labeling process to ensure that image data sets have the attributes that AI systems require.

Like any medical resident, algorithms need continuous training to deliver high-quality and accurate diagnosis and decisions support. Access to data, such as edge cases, is critical to creating AI systems that can deliver on their promised benefits.

To create the large data sets that AI needs, in addition to developing and adhering to metadata standards, healthcare systems must address technical, legal and ethical issues. On the technical end, imaging studies can differ significantly depending on the parameters of individual imaging systems.

And to create algorithms that truly capture the deep knowledge of radiologists, AI systems need to support integrated access. The right solution would put AI outputs, such as diagnoses, in front of radiologists in an unobtrusive manner. The radiologist could accept, decline or correct an algorithm's findings and then send their validations back to AI system for further refining the algorithm.

This collaborative loop offers clinicians the ability to interact with AI development before they put it to use, relieving the perceived "threat" that AI presents to radiologists and their profession. A collaborative process between machines and humans will also help to eliminate the cultural resistance to the idea machines will replace humans. While there is much debate among radiologists about this issue, AI in radiology is predicted to augment radiologists' clinical practice and not replace it.

Lorelle Lapstra is the VP of Healthcare Products with Calgary Scientific and is responsible for the healthcare product portfolio.

Visual analytics enabling hospitals to achieve quick insights

BY DIANNE CRAIG

LAS VEGAS – Many hospitals are using business intelligence (BI) software to drill down through and gain valuable, quality metrics from the vast amounts of patient data, operations data, and other information they collect. While traditional BI platforms were made for data specialists, the visual analytics platform from Tableau software is designed to be more of a self-service approach for achieving quick insights and measurable results, and equally important, for getting the right information to the right people.

"It's a data myth that a BI platform takes away power and flexibility from the people," said chief product officer Francois Ajenstat, during the conference keynote at Tableau Software's fall TC17 conference in Las Vegas. "We want Tableau to be a creative canvas for creative thinking and decision-making."

At TC17, where more than 14,000 attendees met, Tableau announced the beta release of Tableau 10.5 – the latest version of its analytics platform, as well as several new innovations. One key innovation was Hyper, a new in-memory data engine that will replace the current one for faster extracts, with the ability to 'slice and dice half a billion rows of

> **Tableau announced the beta release of its analytics platform, as well as the Hyper data engine.**

data in sub-seconds', as was demonstrated during the keynote. Another new introduction was the release of a data prep product code-named

Project Maestro, which instantly edits and updates data rows.

At the TC17 sessions, clients from a wide range of industries talked about their experiences with Tableau. Here is a look at some of the unique applications hospitals have found for Tableau – including developing visual dashboards to improve everything from operational efficiencies to patient care.

Alberta Health Services: Alberta Health Services, which has 9,700 physicians and 650 facilities serving the province, has developed a

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Mackenzie Health improves hand hygiene with ultraviolet technology

BY STEFANIE KREIBE

'With the dramatic increase of mobile devices such as phones and tablets used by patients, families and healthcare providers, hospitals are increasingly challenged to keep germs out of care environments," says Heather Candon, Manager of Infection Prevention and Control (IPAC) at Mackenzie Health in York Region, Ontario. "Recent research has shown these devices, can carry all sorts of germs. At Mackenzie Health we are always looking for ways to stop infectious viruses from entering the hospital and avoiding transmission between patients."

In the spring of 2017, Mackenzie Health identified the need to find a way to sanitize a number of mobile devices, not only for healthcare team members, but also for patients, visitors and the general public.

With the organization's recent implementation of a new electronic medical record, enabled by more mobile devices than ever, the need to find a safe and proven way to effectively and quickly clean devices became urgent.

Enter Mackenzie Health's partnership, with CleanSlateUV, a company that specializes in Ultraviolet (UV) technology to sanitize a wide range of small, non-critical mobile devices such as cell phones, tablets, ID badges, stethoscopes, watches and other hard, non-porous items. Following a surface-clean to remove any visible dirt, the technology can sanitize these common devices in 30 seconds. UV technology is not used to sanitize equipment that breaks the skin of a patient.

"We're encouraged by the results and are pleased that many people now clean their cell phone regularly, such as when they enter the lobby or while they are waiting in the coffee line," adds Candon. "This is a good thing all year-round, but even more so during flu season."

Following a successful pilot of the technology at Mackenzie Richmond Hill Hospital by the Mackenzie Innovation Institute (Mi2), the equipment is now available in the main lobbies of the hospital for use by the care team and visitors.

Mi2 is a separate entity that acts on Mackenzie Health's applied innovation vision and helps build the infrastructure needed to create and propagate sustainable change. By developing partnerships with industry and academia, Mi2 has established an evaluative focus on implementation, usability, adoption and scalability of disruptive innovations, predominately in healthcare technology, but also in evidence-based practice changes and alternative service delivery and procurement models.

Partnerships are built on a common vision of healthcare innovation and remain critical to the success of early innovation initiatives.

"Innovation is a key enabler in achieving our vision to create a world-class health experience," says Richard Tam, Executive Vice President and Chief Administrative Officer for Mackenzie Health.

"We believe that, through pioneering projects such as the partnership with CleanSlate, we can help demonstrate the value of mobile, 'smart', and secure communications in a healthcare environment and are looking forward to the opportunity to expand our findings for the benefit of the general public."

The Mi2 team in collaboration with Mackenzie Health staff worked closely with CleanSlate to optimize their technology and improve their design for use within a hospital. The feedback shared helped CleanSlate refine their equipment and the hospital benefited from a solution that is fast, user-friendly and effective.

"Our collaboration with Mackenzie Health's staff and the Mi2 team has been fantastic," says Manjunath Anand, Chief Technology Officer at CleanSlate UV. "Their feedback led to meaningful product design and user interface improvements, and they helped prove how valuable the technology can be to patients and visitors, not just to clinicians. This has created value for users and for hospitals seeking a one-stop solution for the problem of mobile device sanitization and personal hygiene."

CleanSlate's technology was initially intended to be tested in a clinical setting. After a deeper review, the Mi2 team in consultation with Mackenzie Health staff, identified that the system would potentially receive more foot traffic in a public setting and be of value to a broader audience.

Stefanie Kreibe is Senior Communications Consultant with Mackenzie Health.

In future, more radiologists will be in therapeutic side of medicine

CHICAGO – With AI and machine learning now appearing that can spot lesions and other problems, where does this leave the radiologist – especially five to 10 years from now, when these solutions will have matured? Will radiologists play second fiddle to machines?

This issue was on the minds of many at the RSNA 2017 conference last November. The president of the RSNA, Saskatchewan-born Dr. Richard Ehman, urged his colleagues to "Embrace disruption. If we don't, we will become victims."

Dr. Ehman, a professor of radiology at the Mayo Clinic, in Rochester, Minn., asserted that radiology must evolve through a process of continuous innovation. "If we continue to re-invent ourselves, we will continue to serve our patients."

His colleagues on the podium gave vivid examples of how radiology is already changing. Dr. Roderick Pettigrew, former head of the National Institute of Biomedical Imaging and Bioengineering, stressed that the radiologist must evolve into a data scientist.

To do this, radiologists will need to work more closely with other experts in computer science, along with other medical disciplines.

He used a video to demonstrate how a GI expert in London, UK, could deploy telehealth to work with a radiologist in Mumbai and a computer scientist in Atlanta to diagnose a cancerous lesion in a patient undergoing a colonoscopy.

All three experts conducted their work on a single computer screen, where they were represented as cartoon-like, animated avatars. Meanwhile, 3D reconstructions of the patients' bowel and other parts of the anatomy floated on-screen, where they could be turned, pulled apart and examined by the radiologist.

As this occurred, the radiologist gave his report and suggestions for therapies.

"It's mixed reality," said Dr. Pettigrew. "You can bring your favorite expert into the team."
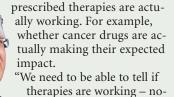
He said in the future, the radiologist workstation will appear more like that of a pilot's cockpit in a jetliner, but with 3D images appearing on screens around him or her, along with dashboards of physiologic data.

Dr. Elias Zerhouni, also a keynote speaker, agreed that data will play a bigger part in radiology – namely in the form of big data science and genomics.

Dr. Zerhouni, VP of research and development with Sanofi, and a former leader of the NIH in the United States, said radiologists will shift from interpreting spatial and temporal information in images to connecting this data with genomic and even environmental information.

He claimed that a big gap in radiology exists in the ability to tell whether prescribed therapies are actually working. For example, whether cancer drugs are actually making their expected impact.

"We need to be able to tell if therapies are working – nobody can do this today."

He said that new technologies like PET/CT and PET/MR have the greatest potential in this area. Of course, the machines will also need the right "software". "We need to de-

velop biomarkers to do this," he added.

Dr. Zerhouni didn't disparage the use of AI in radiology; instead, he insisted it would be very useful. He commented that there can be a huge variation in the quality of readings from one radiology centre to another, and that AI could be used as a decision support tool to achieve greater consistency and higher quality outcomes. "It can improve our performance as a community, and reduce error rates."

With whole sets of studies in the cloud, and processing in the cloud, radiologists could compare their readings against these models. Using these high-quality benchmarks, radiologists will be able to produce more accurate diagnoses.

He pointed out that in some areas, machines can do a better job of identifying and classifying diseases. For instance, in the area of textural analysis, computers can be trained to be more accurate than humans.

The challenge, he said, will be to produce high-quality repositories of studies in the cloud. Without top-notch data, you cannot produce good models.

The issue will become, he said, "who has the best reference patients, and who has the cleanest data."

Dr. Richard Ehman

Read all about it.

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Healthcare Technology

Blockchain solutions are starting to appear in the healthcare sector

Blockchain is already a powerful tool in the financial sector; healthcare may be next.

BY DR. SUNNY MALHOTRA

Blockchain technology – cryptographically secured, distributed ledgers – has existed for almost 10 years and is beginning to emerge as a viable solution in healthcare. Startups are addressing pain points such as medical record interoperability, data security, reimbursement, and pharmaceutical supply chain management. Blockchain is already a powerful tool in the financial sector because the ledger cannot be altered or accessed without permission.

These principles make blockchain uniquely suited to host healthcare transactions and patient information.

Blockchain is a public ledger of cryptocurrency transactions which can disrupt data management, including data access for clinicians and family members or researchers, and healthcare supply chain management and financial transactions.

Here are some major use-case scenarios of blockchain technology in the ecosystem:

Electronic medical record interoperability: Pokit-Dok is an API developer for healthcare sectors such as claims, pharmacy, and identity management. PokitDok has a blockchain solution called DokChain which is a network of financial and clinical data transaction processors in the healthcare industry.

This provides a secure network for patient data from EMRs, medical devices and pharmacies through a distributed blockchain network.

Identity protection: There have been attempts to create an identity prototype based on blockchain technology that could provide a digital identity to those without a formal ID including refugees who would benefit from education and healthcare services.

Blockchain Health is a software company that provides healthcare organizations with HIPAA-compliant digital identity for people and allows them to

> The rise of cybersecurity concerns has made this technology an important issue for healthcare providers, pharma, insurance and biotech stakeholders.

share health data with researchers using the integrated platform.

Pharmaceutical and biotech solutions: Blockpharma focuses on tracing drug sales online by developing an application programming interface that can plug into pharmaceutical companies' information systems. This can also be helpful for the illegal counterfeit drug market.

Clinical solutions: Doc.AI's Robo-Genomics platform is a deep conversational

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

agent designed to provide decision-support based on genetic data comprehension. The decision support can be provided for disease, pharmacogenomics and family planning.

Risk management: HealthCombix is a company which provides a token-based healthcare payment and risk management network enabling payments, data asset monetization and risk adjustment. The platform preserves digital privacy and interoperable data brokering. This empowers patients and providers with control over the data. Consumers can control data exchange for research, precision health and disease intervention.

Reimbursement: Gem Healthcare Network develops blockchain applications on the Ethereum blockchain. It enhances security via permissioned blockchains in which patients control access and a shared ledger system in which every new change is recorded. They are pursuing health claims management by allowing patients, providers, and insurers to securely view a patient's health timeline in real-time.

The implementation of blockchain technology and penetration into the healthcare market has provided solutions to multiple barriers the sector is currently facing. The rise of cybersecurity concerns has made this technology an important issue for pharma, insurance, and biotech stakeholders. Many have started to embrace these solutions, but they need to be integrated into large-scale applications to become practical solutions.

How to improve procurement in Canada's healthcare sector

BY LYDIA LEE

What should a great healthcare Request For Proposal (RFP) look like?

In its simplest form, the purpose of an RFP is to connect a specific problem to the best and most innovative solution. The RFP should articulate an organization's challenge and outline a creative, effective and efficient way in which the third party firm would provide assistance to address that challenge.

All too often, however, ill-prepared RFPs can attract the wrong vendors, exclude new innovators and increase the cost of sales, ultimately diminishing the value that can be attained by both parties.

While RFP preparation is a bit of an art, I do believe that most RFP shortcomings can be remedied at no cost for considerable benefit.

Why is this issue important? Over the course of my career, I've been on both sides of the RFP process in healthcare, first, as a former hospital CIO and now as a digital healthcare consultant.

Based on the diverse perspectives that I have experienced over my career, I want to share what I have learned about the process and how to improve RFPs overall, so that issuing organizations can receive the quality of help they need.

I see three standout challenges with public sector healthcare RFPs that diminish value creation. Below are some observations as well as easy fixes that every organization can implement to make the RFP process simpler and more effective:

Unclear scope and conflicting requirements: RFPs issued by hospitals are often unclear in scope because they fail to articulate the problem the organization is experiencing.

The RFP may have too many requirements, which aren't essential to solving the problem. These "kitchen sink" RFPs reflect to the marketplace that there wasn't enough attention

Lydia Lee

paid to the most important engagement elements.

Responders then risk focusing on the wrong priorities, diluting the ultimate benefit for the client. Or, RFPs have internal contradictions, such as desiring innovative, flexible approaches, while the evaluation criteria focus on detailed minutiae that ties the vendor's hands, limiting the ability of the vendor to actually create an effective solution.

"Kitchen sink" RFPs or contradictory requirements, typically leave vendors cold because we can't be sure that we can actually interpret and meet an organization's true needs.

Instead, RFPs should include clear problem statements that articulate

the challenge being addressed and why. Organizations should have a clear image of what success looks like and should seek qualified individuals who are not part of the RFP committee to review the RFP for clarity before posting.

By checking that your evaluation criteria reflects the experience and attributes needed to solve the problem at hand, it will increase your chance of a successful outcome. Be sure to edit the requirements to eliminate non-essential ones. The more freedom you can give to the responders about how to approach your request, the more likely you will get better proposals.

Rigid submission templates: Having sat on many proposal evaluation panels when I was on the buying side, I understand that templated responses are faster to review because they restrict proposal content. However, a template that's too rigid impairs responders' ability to give a

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Population health management: Will you rise to the challenges?

BY MICHAEL BILLANTI

While the term 'population health' is becoming commonplace, it lacks an accepted, industry-wide definition. As such, its potential to impact change can be misunderstood or misrepresented. Population health is more than simple information queries and analytics – to make a real difference, it must provide actionable outputs and clinical recommendations for proactive healthcare.

Population health is taking responsibility for managing the overall health and wellbeing of a defined population and being accountable for its health outcomes. It encompasses the proactive application of strategies and interventions to defined groups of individuals (e.g., people with diabetes, cancer patients, those with mental health issues, or the elderly with multiple comorbidities) with the goal of improving the quality of care and outcomes in an integrated, caring and efficient way for citizens.

Michael Billanti

A Canadian advantage? If we take the view that population health is part of a wider health and well-being strategy that includes wider determinants of health, such as housing, the environment and employment, Canadians are at a clear advantage over other's globally.

We are data rich, and live in a relatively integrated society where health, education, social services, labour and finance ministries are all run by each of the provincial or territorial governments. We should be able to better leverage these, although siloed, very mature sources of information.

The UK and other European countries also have an advantageous opportunity. Our socialized medicine systems are provincially based, with integrated social care systems, and as such we can bring together a full battery of healthcare, social care, community assets and the citizens themselves in a truly integrated and holistic system of care.

For example, in England, there is a 12-year discrepancy in life expectancy across the Wirral peninsula, a small area about 24 km long and 11 km wide, with key opportunities to improve outcomes for chronic diseases such as diabetes, COPD, asthma, and depression.

The region has areas of both high and low income, high rates of smoking and alcoholism, poor housing and low employment rates. The health system realized that the population health opportunity is to establish new care models that holistically address health, care and social determinants of wellbeing.

They have created a population health model to solve these problems at their source to improve the wellbeing of these citizens and reduce the stress on the healthcare system. As I discuss population health with organizations across Canada, the stories that Health Canada, CIHI and local public health publications tell are strikingly similar and provide the very same opportunities.
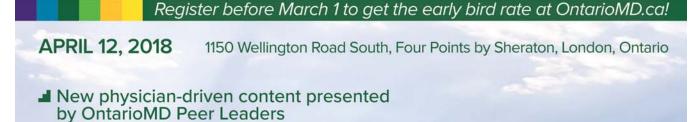
Informatics is the enabler: Population health management informatics are rapidly evolving to step up to these opportunities, but it is by no means clear what a full set of informatics capabilities will be.
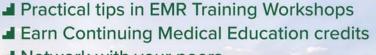
At the root of it we adopt concepts like Big Data, which is great for enabling the investigation and discovery of issues. Most of the Canadian healthcare organizations we speak with already know the issues they have, so the thought of another analytics solution or different way of aggregating and organizing data seems off-putting.

But this is where we need a new way of looking at the problem. It is key to how

SMArTVIEW tests early warning system for post-op patients

Ground-breaking system aims to reduce complications and mortality after cardiac or vascular surgery.

BY DIANNE DANIEL

The sooner you learn of a potential risk, the more likely you are to mitigate it. That's the premise behind recent strides to bring early warning systems to hospital surgical wards, where the goal is to reduce complications, emergency room visits, hospital readmissions and mortality rates after surgery by more closely monitoring patients – even after discharge.

In January, Ontario's Hamilton Health Sciences (HHS) started to enrol patients in its SMArTVIEW trial, a ground-breaking project that aims to reduce complications and improve outcomes in patients aged 65 and older who undergo cardiac or vascular surgery.

While in hospital recovering from surgery, patients are outfitted with wireless respiratory pods, blood pressure cuffs and oxygen saturation monitors, all of which are continuously monitored by the Philips Guardian system. Radio frequency hot spot transmitters placed throughout the surgical ward allow them to roam freely without losing connection.

If there is a change in their vital signs that reaches a predefined threshold score, nurses are notified via a verbal message on their smartphones to "check vitals" and are given two minutes to respond. If they don't answer, they get a second verbal reminder with an additional 30 seconds, and if they fail to respond to that, an alert is sent to the charge nurse.

This paging interface was built by ThoughtWire, and was conceived by the team to recognize that busy nurses need a timeframe to respond, and contingency built in place, in case they can't respond right away.

"Research from leaders in our group has shown that hypoxia, where your oxygen saturation is less than 90, can be related to complications, such as having a heart attack post-op," said Dr. Michael McGillion, a scientist at HHS's Population Health Research Institute and Principal investigator for SMArTVIEW, along with HHS cardiologist and co-lead Dr. PJ Devereaux.

"The idea is to call early attention back to bedside," he added.

In order to reduce alert fatigue, there is a delay built into the system so that it doesn't send notifications with every little change in patient status, explained Dr. McGillion, noting that some patients will normalize on their own. When responding to SMArTVIEW notifications, nurses check patient vitals and input additional information required by the system, such as temperature. The Guardian system provides an early warning score, and if warranted, clinicians intervene, engaging the rapid response team when necessary.

SMArTVIEW is considered a pioneering study because close patient monitoring continues for 30 days after discharge – the period which is known to be the likeliest for an adverse event to occur. Each patient enrolled in the program goes home with a tablet, plus Bluetooth-enabled vital signs equipment, such as a blood pressure monitor and weigh scale, oxygen saturation probe.

The SMArTVIEW trial provides a cellular data bundle, so there's no cost to patients. At the end of 30 days, they simply box everything up and return the equipment via pre-paid courier.

Once at home, patients are asked to measure their vital signs three times daily – morning, afternoon and evening – and results are automatically sent to the tablet. The only measurement entered manually is temperature.

They then use their tablets to hold daily video visits with their SMArTVIEW nurse, a newly created role for the hospital. Appointments are scheduled, but nurses adapt to the patients' schedules as required.

Because the management and collection of patient data – including vital scores – is handled remotely by the Philips eTrAC ambulatory telehealth program, SMArTVIEW nurses are able to monitor their at-home patients using the Philips eCareCoordinator dashboard. Patients also use their tablets to photograph their surgical wounds, which are either sternal or leg incisions, enabling SMArTVIEW nurses to perform visual assessments and watch for signs of infection.

"We've had a tremendous response from patients

who are saying, 'This is wonderful. Now I get to take the hospital home with me'," said registered nurse Filomena Toito, one of four initial SMArTVIEW nurses. "Patients have expressed that sense of relief that they are still connected to the hospital team and that their care continues even beyond the hospital walls."

SMArTVIEW nurses are a new addition to the hospital workflow, serving as a bridge between the new monitoring technology, the patients, and the nursing staff to help resolve issues and coach people on how to use the devices. In addition to monitoring the early warning scores, the SMArTVIEW nurses gauge their patients' overall wellbeing, asking how they're eating and sleeping, for example.

"Patients feel so empowered that they're using this new technology," Toito said, "Having that connection is so reassuring and it's helping with best possible care as an outcome."

Karen Barrett, Natalia Worek, and Carley Ouellette are also key members of the SMArTVIEW nursing team.

"A key concept of the study is that when there's a transition from hospital to home, there are gaps," added Dr. McGillion. "The argument we are making

is that the SMArTVIEW nurse gets to know the patient on the ward, know their story, know their issues, and then follows them for the first 30 days at home."

Patients are also empowered to take part in their own healing process. Researchers involved in the project have developed SMArTVIEW Restore and Recover, a five-week education program developed in collaboration with QoC Health that includes interactive videos and podcasts. Patients learn how to communicate pain, what foods to eat to promote recovery and how to transition back to physical activity over time, for example. They also stay in contact with a recovery coach stationed at the hospital.

SMArTVIEW is funded in part by Ontario's Health Technologies Fund, a fund administered by Ontario Centres of Excellence on behalf of the Office of the Chief Health Innovation Strategist. In addition to Philips Healthcare and ThoughtWire Corp., partners include QoC Health Inc., CloudDX, XAHIVE Inc., Argyle Public Relations and the Ontario Telemedicine Network. McMaster University and HHS are also collaborating with Coventry University and Liverpool Heart and Chest Hospital in the U.K., where trials are under way this year.

"They've kicked it up a notch, where they have international team members, trans-disciplinary teams, patient advocates, sector experts and top clinicians. It's a pretty exciting team," said OCE Director, Innovation Procurement, Tania Massa.

Massa said SMArTVIEW is addressing a significant hospital symptom by taking an active approach, as opposed to reactive, and by empowering patients to prevent adverse effects following surgery. At the end of the demonstration project, which involves 600 patients who will be monitored for a period of six months, she expects to see a strong business case put forth for wider adoption of the program

"We're hoping to see reduced readmissions and improved patient satisfaction," she said.

Rob MacLellan, Project Manager, ICT Initiatives at HHS, called early warning systems an emerging field in healthcare. His team devoted 900 hours towards integrating the system, working with the different vendors to connect the various pieces. "We crunched our brains as best we could to think of what could go wrong, and now we're just waiting for the 'Aha! Moment', as in, 'Aha! we didn't think of that one'," he said.

He, McGillion, and Devereaux credit the hospital's clinical informatics, IT and biomedical technology team for working with Philips and ThoughtWire to bring the trial live. Because ThoughtWire was already in place at HHS to support a separate early warning initiative, the alerts generated by the Philips smart monitoring technology are integrated with the existing ThoughtWire notification process.

"Patient information goes up into the Philips cloud. We don't store anything on the hospital side," explained MacLellan.

At Kaiser Permanente Northern California, an early warning system called Advance Alert Monitor (AAM) has undergone testing since 2013. By the end

of this year, 21 sites will be using AAM to observe all medical-surgical patients in order to predict and prevent crashes.

The idea for an early warning system sprouted as early as the 1980s, when a number of studies pointed out that outcomes for patients who suffered cardiac arrest on the hospital ward and were subsequently transferred to the intensive care unit were extremely poor.

"When I quantified the outcome of unplanned transfers to the ICU at our Kaiser Permanente facilities in northern California, it became clear to me that these patients were really sick; they were 3 percent of hospitalized patients, but one of five of the deaths," said Dr. Gabriel Escobar, Regional Director for Hospital Operations Research for The Permanente Medical Group (TPMG) at Kaiser Permanente Northern California.

He is also a Research Scientist at the Kaiser Permanente Northern California Division of Research.

Dr. Escobar's team realized early on that vital sign data would be key to predicting which patients were at risk. Using data from more than 650,000 patients, they worked to develop a predictive model that forms the basis for AAM. The system started out as a web service, grabbing real-time data from a hospital's Epic electronic medical record (EMR), applying advanced algorithms to arrive at an early warning score, and sending an alert for those patients at greatest risk.

The score is based on more than 62 separate factors, including multiple lab values; nursing assessment data such as vital signs, neurological status and pulse oximetry; and, patient demographics. It identifies those patients who are at risk for deterioration within 12 hours. The first sites to pilot the system were Kaiser Permanente's South San Francisco and Sacramento medical centres where AAM ran every six hours and displayed results directly in the EMR.

As Dr. Escobar described, alert fatigue was a very real issue. "There's a trade-off. If you make the alert too sensitive, you'll be generating a lot of work for physicians and nurses for no yield," he said. "If you make it too specific, you'll miss too many patients."

Based on that early experience, Kaiser Permanente decided to move ahead with a different implementation plan, incorporating an existing off-site command center called eHospital Safety Net to serve as an AAM hub.

The centre is staffed by eHospital nurses who now receive the AAM alert notifications, interpret them, and collaborate with the larger clinical team to review and plan next steps, making changes where necessary to address early changes in a patient's conditions.

The hub model means the scores can be run more frequently, increasing the likelihood of successfully intervening to prevent a patient from crashing. It also gives frontline clinicians an opportunity to understand how the scores are derived and how to apply them appropriately, noted Dr. Vivian Reyes, a Kaiser Permanente emergency physician and TPMG Regional Director of Hospital Operations,

"I'm hoping over time this will become 'Oh, of course, the predictive model' so when we roll out subsequent scores, people already know how to use them and there won't be room for misinterpretation," she

said. This spring, Kaiser Permanente Northern California will conduct an in-depth evaluation of the AAM system, looking at 1.2 million hospitalizations from before the system went live, up to February 2018. Preliminary data shows mortality rates have dropped, said Dr. Reyes. "We've also seen a decrease in the ICU length of stay, which is huge," she added. "It's hard to pull patients back once

they've crashed and coded, but if you can prevent that from happening, they get back to their normal physiological state faster and they don't need the ICU."

Moving forward, the Kaiser Permanente implementation team is planning to apply AAM to patients who are admitted to the hospital after a visit to Emergency but are awaiting a bed, referred to as ED boarders – a high-risk group.

They are also working closely with Epic to integrate the AAM workflow directly into their electronic medical record, removing the need for using web services.

"The real challenge is not in developing these predictive models," noted Dr. Escobar. "The real challenge is in making sure you integrate them seamlessly into the workflow so that they really help clinicians, not add to their burden."

Physicians partner with game developers to create VR for healthcare

BY DAVE WEBB

David Wyand's introduction to bringing lifelike, immersive reality to the medical field came through a chance meeting.

In the fall of 2016, at a virtual reality meetup, the lead-developer with Toronto-based Quantum Capture encountered Dr. Clyde Matava and Dr. Fahad Alam, two Toronto-based anesthesiologists. The two had co-founded the Collaborative Human Immersive Interaction Laboratory (CHISIL), a community of medical professionals from across Canada devising VR systems to simulate patient experiences and training scenarios.

The veteran of game engine design with now-defunct Garage Games became one of the first developers to work on a CHISIL project. It was new territory for Wyand, and for Quantum.

Quantum is known as the virtual people people, providing hyper-realistic, 3D, full-body scans for VR and augmented reality content developers, largely gaming companies. "None of us had ever done a medical simulation before," Wyand says. "It ended up being more complicated than some."

Quantum worked with CHISIL to develop an immersive simulation of a fibre-optic bronchoscopy procedure. The trainee selects appropriate monitors and equipment while operating the bronchoscope handle, scoping the throat of an imaginary patient with tracheal damage.

Meanwhile, there's a virtual collar to be removed, chatter and instructions from other doctors to be processed, and, at the end of the day, a score reflecting performance.

Dr. Matava, an assistant professor of anesthesiology at the University of Toronto and staff member at Sick Kids Hospital, and Dr. Alam, a staff anesthesiologist at Sunnybrook Health Sciences Centre in Toronto and director of research at the Sunnybrook Simulation Centre, founded CHISIL in 2014.

CHISIL has been lauded for its ChildLife Virtual Reality application, a 3D headset that simulates the preoperative experience in a 360-degree interactive environment. More than 200 patients—mostly children at Sick Kids and adults with anxiety issues—have used the headset, finding it prepares them better and calms their nerves more than a PowerPoint presentation or drawings.

Anxiety can affect all stages of surgery, requiring more anesthetic and extending hospital stays. (The application is available for download by Apple users on iTunes.)

"We're at the forefront of bringing virtual reality to healthcare," says Dr. Alam. The mission of CHISIL is to develop VR for patient and medical education, as well as clinical applications: assessing, diagnosing and treating patients. It's a community of "the right people in the right places," with common interests for common outcomes, that can move the technology from conception through validation, Dr. Matava says.
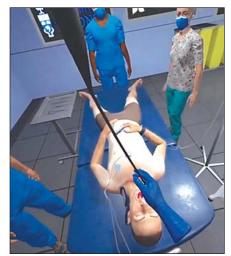
There is some resistance in the field. Clinicians are very wary of consumer technology, according to Matava. "Virtual reality is something that stays at home," he says. CHISIL is trying to move VR from a gaming experience to something of clinical value.

There's a learning curve attached. They've had to learn about the technologies and the many skill sets involved in creating an immersive experience: not just graphic design, game design and coding, but directing, set design, acting and scripting.

"It really does take a village to build virtual reality," says Dr. Matava.

Quantum photographed Sunnybrook's trauma bay, modeled a patient's mouth and trachea, and replicated every device—what it looked like, what it sounded like. The game development process calls for a game document, which details player options and consequences; the team worked with Dr. Alam and Dr. Matava on a flow chart for the procedure.

It wasn't easy creating all of this, as the doctors were conducting their day-to-day clinical duties and were pressed for time. The need for close collaboration, combined with the doctors' busy schedules, demanded

CHISIL has developed a VR broncoscopy simulation.

Dr. Fahad Alam   Dr. Clyde Matava

flexibility from the Quantum team.

"We had to make sure when they were available, we were available," Wyand says. That meant lots of nights and weekends.

And it was necessary to add different levels of sophistication and difficulty. For example, Drs. Alam and Matava breezed through the simulation in early iterations, so it was necessary to toughen it up for more experienced users.

In the end, the project was a success – it resulted in a useful immersive reality training tool for clinicians.

Meanwhile, another member of CHISIL is working on how to use virtual reality to explore the connections between anesthetic use and cognitive deficits.

Dr. Sinziana Avramescu is the senior investigator for virtual reality and cognition with CHISIL. She is working on how immersive reality can help predict, diagnose, and eventually treat post-operative delirium (POD).

POD is often associated with general anesthetic use, and is a persistent threat. Its incidence varies from nine to 87 percent depending on the age of the patient and the severity of the surgery, according to a 2011 paper from the Washington University School of Medicine in St. Louis. POD is associated with increased length of hospital stay and a cost of $164 billion a year to the healthcare system in the U.S. alone. More frightening is the 10-20 percent increase in mortality for every 48 hours of delirium, and a 10-fold increase in the risk of dementia.

"That's quite scary," says Dr. Avramescu. "Having surgery, most of the time, isn't optional." Dr. Avramescu, a clinician investigator and assistant professor at the University of Toronto, says rapid diagnosis is key to ameliorating the negative outcomes of POD.

Identifying patients likely to experience POD could help. While much is unknown about the risk factors, a previous history of cognitive problems appears to predispose patients, according to a New England Journal of Medicine article by Dr. Sharon Inouye. Patients with mild cognitive impairment can often disguise symptoms in order to function in the community, Dr. Avramescu says; they can't hide spatial impairment from a 3D simulation.

By engaging the patient in a fully immersive experience to test spatial cognition—a maze, in this case—early signs of dementia can be detected without the need for an expert interviewer and patients screened for more in-depth investigation.

Dr. Avramescu's mission is ongoing. The team is at the storyboarding stage of the spatial awareness project. After initial development comes a screening test on healthy volunteers. Further down the road, she hopes the technology can be used for treating POD, not just diagnosing it. "That's a huge thing to do, to help them get better, not just telling them they have a problem," she says.

Demand for medical robots growing quickly, especially in Asia

The medical robots market is projected to reach US $12.8 billion by 2021, up dramatically from $4.9 billion in 2016, and growing at a rate of 21.1 percent annually during the forecast period. The estimate was made by tech research company Markets and Markets, which authored the report, Medical Robots Market, Global Forecast to 2021.

According to the company, the highest growth rate will occur in the Asia-Pacific region. The fast expansion in the region can be attributed to the growth in the number of approvals of robots for medical use in Japan, rising prevalence of cancers in China, growing robotic procedures backed by rising number of hospital beds in India, rising adoption of medical robots in Asia, funding collabo-

rations across the Asian region, and training programs in Australia.

On the basis of product, the market is segmented into instruments and accessories and medical robot systems. The medical robot systems segment is further fragmented into surgical robots, rehabilitation robots, non-invasive radiosurgery robotic systems, hospital and pharmacy robots, and other medical robotic systems (capsule robots and robots for emergency medicine).

In 2016, the surgical robots segment commanded the largest share of medical robot systems. However, the rehabilitation robot systems are likely to grow at the highest rate during the forecast period.

On the basis of application, the medical robots market is segmented into la-

paroscopy, orthopedics, neurology, special education, and other applications (gynecology, urology, cardiology, and nanomedicine). Of these applications, the neurology segment is expected to grow at the highest rate during the fore-

> **Rehabilitation robot systems are expected to develop and grow quickly during the forecasted period.**

cast period. However, the laparoscopy segment is estimated to command the largest share of the market, by application, in 2016.

In 2016, North America accounted for the largest share of the global med-

ical robotics market. North America's leadership in the market can be attributed to favorable reimbursement scenario in the U.S., funding by the U.S. Department of Defense, grants from NSF for research activities in the U.S, rising venture capital investments in the U.S., government support in Canada, and increasing medical robot purchases backed by rising preference for minimally invasive surgeries.

Key players in the global medical robots market include Intuitive Surgical, Inc. (U.S.), Stryker Corporation (U.S.), Mazor Robotics Ltd. (Israel), Hocoma AG (Switzerland), Hansen Medical Inc. (U.S.), Accuray Incorporated (U.S.), Omnicell, Inc. (U.S.), Ekso Bionics Holdings, Inc. (U.S.), ARxIUM (U.S.), and Kirby Lester LLC (U.S.).

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BC surgeon first to study the carbon footprint of operating rooms

VANCOUVER – In the first study of its kind, Vancouver General Hospital Surgeon Dr. Andrea MacNeill analyzed the carbon footprint of surgical suites at three hospitals in Canada (VGH), the United States (University of Minnesota Medical Centre), and the United Kingdom (John Radcliffe Hospital, Oxford).

Dr. MacNeill found the choice of anaesthetic gases used in surgery can be a major contributor to greenhouse gas emissions from operating rooms.

The study, published in The Lancet Planetary Health journal, found that it's possible to reduce emissions in healthcare settings and reduce costs. Researchers measured the direct emissions (gases), indirect emissions (electricity), and other emissions (surgical waste) according to the Greenhouse Gas Protocol. The data was collected and evaluated in 2011.

According to the study:

• Operating theatres are a resource-intensive subsector of healthcare, with high energy demands, consumable throughput, and waste volumes. The environmental impacts of these activities are generally accepted as necessary for the provision of quality care, but have not been examined in detail. In this study, we estimate the carbon footprint of operat-

Dr. Andrea MacNeill studied the carbon footprint in operating rooms in Canada, the U.S. and the U.K.

ing theatres in hospitals in three health systems.

• The annual carbon footprint of the studied surgical suites ranged from approximately 3218 tonnes of CO2 equivalents to 5187 tonnes of CO2e. While there were differences in the size and case load among all three surgical suites, there were also variations in the major contributors to greenhouse emissions. For instance, at Vancouver and Minnesota, anaesthetic

gases were responsible for 63 percent and 51 percent of the total surgical emissions, compared to only 4 percent at Oxford.

• Operating Theatres were found to be three to six times more energy-intense than the hospital as a whole, primarily due to heating, ventilation, and air conditioning requirements. Overall, the carbon footprint of surgery in the three countries studied is estimated to be 9·7 million tonnes of CO2e per year.

• According to Dr. MacNeill, it means that surgeries are approximately equal to 2 million cars on the road every year.

• The Lancet Commission on Climate and Health has called for the healthcare community to take a leadership role in advocating for emissions reductions, and to critically examine its own activities with respect to their effects on human and environmental health. This study is the first to estimate the considerable climate impacts of surgical services.

How VGH is reducing its carbon footprint: VGH is already making changes based on the findings. When the study was done in 2011, the default was desflurane, one of the primary contributors to global anaesthetic gas emissions and one of the most expensive anaesthetic gases. Desflurane is still used, but it's no-longer the "go to" gas at VGH.

"It wasn't difficult to switch," said anaesthesiologist Dr. Mitch Giffin. "There wasn't a significant difference from a patient perspective." Additionally, an anaesthetic gas capture system will be built into the new operating room project at VGH.

"The 16 new operating rooms afford us an opportunity to do what's right for the environment and our patients," said Shelly Fleck, OR Operations Director, VCH.

Innovative procurement simplifies access to surgical pathway solutions

When Sinai Health System in Toronto wanted to see what benefits patient monitoring technology could offer elderly patients at their Mount Sinai Hospital and Bridgepoint Active Healthcare campuses, they issued an RFP to find vendors who could provide solutions.

The exercise followed the traditional approach to procuring a product, according to Lily Yang, Senior Director of Quality and Patient Experience, Sinai Health System: identifying a solution to a problem, scouring the marketplace and vetting the vendors.

A different take that's caught Yang's attention, however, is innovative procurement, an approach used by the Ontario Telemedicine Network (OTN) to qualify vendors to provincial Vendor of Record (VOR) arrangements.

The first VOR OTN has recently made available – via its Innovation Centre at https://otn.ca/innovationcentre/ – features three surgical vendors: InTouch Health, SeamlessMD, and Vivify Health. Each offers mature and market-tested patient engagement technologies that standardize surgical pathways and improve health outcomes.

"This open innovative thinking will accelerate the process for sure," says Yang. "Vendors are knocking on doors, hoping for data sets and proofs of concept. It's nice to have OTN cut through it. Many hospitals would be challenged by the expertise and resources needed to

evaluate the many existing technology vendors emerging. This approach is more about the future."

OTN's competitive process focused on qualifying solutions that improve the patient experience, decrease length of stay, reduce readmissions, and decrease surgical cancellations. The VOR, https://otn.ca/innovationcentre/surgical, is supported by all 14 of Ontario's Local Health Integration Networks (LHINs), that can be readily utilized by Broader Public Sector organizations.

"By leveraging this VOR, Ontario healthcare organizations will be able to more quickly gain access to qualified solutions," says Dr. Ed Brown, CEO, OTN.

The solutions on the VOR support pre-operative optimization, enhanced recovery after surgery protocols, remote monitoring, patient education, patient-reported outcome (PRO) collection, secure messaging, and analytics, according to Matthew Nelson, Director, Solutions and Venture Development, OTN.

"The VOR can be a useful resource for hospitals seeking solutions to help standardize protocols for before, during and after surgical care, in order to get patients back on their feet more quickly while maintaining quality of care delivery," says Nelson.

InTouch Surgical is a patient-centric healthcare app that allows doctors and surgery patients to stay connected throughout the care journey. Among other things it provides the patient with procedure-specific content to prepare for before and after surgery; verifies con-

sents and confirms identity, procedure, and surgical site; identifies factors that may delay or even cancel surgery; and provides alerts when symptoms require intervention.

Studies of the solution have shown improved outcomes through patient involvement and by incorporating safety protocols and remote monitoring. These include, specifically:

• Decreased readmission rates by 60.8%
• Decreased deep vein thrombosis by 56%
• Decreased surgical site infections by 75%

> **Using the Vendor of Record arrangements, Ontario hospitals can quickly obtain and implement solutions.**

• High patient satisfaction with a Net Promoter Score of 77

SeamlessMD enables health systems to elevate the patient experience, improve health outcomes and lower costs through innovative patient technology. Accessible via smartphone, tablet or computer, the SeamlessMD platform keeps patients on track from preparation through recovery with reminders, video-based education, progress tracking and PRO data collection. Providers monitor patients remotely and can access real-time dashboards to measure compliance and outcomes, intervene sooner for patients at-risk and drive up quality.

SeamlessMD's patient engagement and quality improvement platform is frequently used by health systems to deliver value-based models of care, including Enhanced Recovery After Surgery, Perioperative Surgical Home, prehabilitation, readmissions prevention, bundled payments and PRO data collection.

Research completed by academic medical centres has shown SeamlessMD to reduce readmissions (67% 30-day readmission reduction with Sinai Health System), hospital length of stay (1.5-day reduction with Saint Peter's Healthcare System) and phone calls (80% of Sunnybrook-Holland Centre patients reported avoiding at least one phone call).

Vivify Go enables physicians to use mobile devices to improve patient management, engagement, and education, as well as adherence outside of the clinical environment. For patients preparing for or recovering from surgery, it maintains a better connection with the care team to improve outcomes and support self-management.

"With customizable engagement intervals and levels, clinicians can monitor biometrics and survey responses, provide educational content and reminders, and conduct live video virtual visits using the patient's smartphone, tablet, or laptop," says Bill Paschall, VP, Business Development, Vivify Health.

"All of the data is transmitted securely to Vivify's cloud-based platform. There are also opportunities to integrate with electronic medical records for better patient record workflows."

Visual analytics

sustainable in-house surveillance dashboard infrastructure using Tableau. Some 100,000 employees have access to Tableau Server, where over 300 publishers have produced over 1,400 clinical dashboards.

AHS executive director, public health and surveillance structure, Dr. Hussein Ushman, says there are two ways AHS uses Tableau: for patient experience and outcomes, and for public health surveillance. Public health surveillance involves an ongoing, systematic collection, analysis and interpretation of data.

AHS consultant, analytics, Kyle Kemp, says traditional surveillance had cost and time issues, and there was the issue that people from the business side didn't speak the same language, as well as other limitations.

"With so much manual work, and simply reporting and creating information was not sufficient…the ability to find information when you need it is equally important. For effective utilization the information needs to be a click away, up-to-date, and interactive," says Kemp. When they decided to build an intelligent, in-house, analytical

> **Analytics enabled the Mayo Clinic to see that vendors were still using mailed invoices, along with EDI.**

infrastructure using Tableau, "the game changed for us," he adds. "It has simplified things for us and the user."

Every dashboard produced has a landing page so people can access them easily with one link. Some of the public health surveillance dashboards they use are Alberta Opioid Surveillance; Know Your Community; Risk Factors at the Provincial Level; and Cancer-Related Risk Factors.

The one for Cancer-Related Risk factors shows cancer risk factors at a glance, as well as risk factors by community ranking, which showed rural communities had lower risks.

Through charts on the dashboard they can compare communities in five zones by one indicator at a time.

Cleveland Clinic: In a presentation titled Powering clinical and operational excellence with EPIC and Tableau, speaker and Cleveland Clinic lead systems analyst, enterprise intelligence, Joan Thompson, described the hospital's challenge of getting the right analytics to the right person.

The Cleveland Clinic has over 3,000 physicians, and 7.1 million patient visits annually to its 150+ locations. Thompson said the overarching goal of the organization's various Care Paths, such as Spine Care, is to make it easier to treat patients, but they were having problems having the right report reach the right person.

When they switched to visual analytics they realized a measurable improvement. "As users needed more information, we would use the power of Tableau to dig into the reports at different levels. They could choose institutions, physicians, care trends, etc.," says Thompson.

They created a Summary Dashboard to try to decrease 'no shows' for appointments by 1 percent. Considering they have 7.1 million patient visits per year, and about 10 percent typically are recorded as 'no shows', even a 1 percent reduction would be very significant.

After creating a summary dashboard with trend graphs around factors like age, ethnicity, time of the week, etc., by zip code for different hospital locations, they found transportation issues were responsible for 38 percent of 'no shows' and that most 'no shows' lived within just 10 miles of each hospital location. This discovery led the Cleveland Clinic to partner with a ride share company.

Mayo Clinic: When the Mayo Clinic was challenged to enable its supply chain analysts with relevant, right-time insights to be able to assess vendor (supplier) performance, they developed a vendor scorecard. TC17 speaker Brian Pringle, a systems analyst in supply chain management at the Mayo Clinic, indicated the scorecards were intended to help them find ways to improve their vendor relationships and to save time and costs involved in managing those relationships.

At first, these scorecards were produced as an Excel spreadsheet. Seven different people that had access to different databases were responsible for making the scorecard, and Pringle had to compile the information.

For the next version of the Vendor Scorecards, he took the compiled information and put it into Tableau visual analytics. It enabled them to look at total purchase orders, purchase order (P.O.) lines, and invoices.

One thing they found was that only 30 percent of invoices came in through EDI while the rest came in through snail mail – even when the vendor was set up for EDI. It was causing them more work, said Pringle, because the vendors using EDI often still also mailed invoices, so they had to check for duplicates.

They were dealing with 1.9 million P.O lines and 6,000 active vendors. One of their primary goals was to reduce effort involved with invoices as well as costs.

How to improve procurement in Canada's healthcare sector

nuanced explanation of why their approach is worthy. This can make it harder for evaluators because they don't have enough information.

A suggestion here is to look at the template from the responder's perspective. Excel is great for formulas, however can make writing difficult. If you decide to set a page limit, be reasonable.

The evaluators' job will be easier if they can ascertain the uniqueness, creativity and fit with their organization from each vendor's submission. This heralds higher quality engagements that drive more successful outcomes for the client.

In the spirit of value for money, I have one more piece of advice: some RFPs still require hard copies and USB keys to be couriered, even though all of the procurement websites provide for electronic submission.

Given that I work in the area of digital

> **Some RFPs require hard copies and USB keys to be couriered, even when their websites allow digital submissions.**

healthcare, I find this requirement somewhat ironic. As healthcare organizations are transferring all of their records to digital form, isn't it time for us to make the transition in procurement, too? It is time to let responders submit their applications electronically and save on the printing and courier costs. In doing so, this process will be a simpler, more efficient and eco-friendly.

Standardized terms and conditions: Public sector RFPs include legal terms and conditions (T&Cs) that the responder must review as part of the submission. For hospitals in a group purchasing organization (GPO), these T&Cs are supposed to be consistent for hospitals in the same GPO.

However, many hospitals use outdated T&Cs with substantive legal differences between them. This forces extra legal review and potentially more risk for the GPO given that its members are using different T&Cs for contracts. GPOs should ensure that their boilerplate RFP form includes current T&Cs and that their members' procurement departments use the correct version.

Win-win for all: Each of these suggestions is aimed at improving RFPs to get the best responses from the marketplace to address clients' needs. In the spirit of continuous improvement for all, I hope these ideas and recommendations can lead to more efficient procurement processes, better engagements and more successful project outcomes.

Lydia Lee is a Partner and the National Digital Health Leader for KPMG Canada.

Population health management: Rise to the challenges?

they will deal with and scale to meet the health and care needs of their populations. It is critical to how they will integrate with other social systems, and to how they will make the data actionable at those intersections where citizens interact with anything that may impact their health.

We have the opportunity to provide near real-time operational approaches that are both predictive and proactive. This is the transformative opportunity that modern informatics offers.

It will only work with whole system change: Although informatics is an important enabler, and it is necessary and urgently needed, it is certainly not sufficient in isolation.

Informatics has complexity and difficulties, no doubt, but sophisticated solutions now exist. I believe the harder challenges lie in maturing the other key capabilities required.

To name a few: leadership with a clear vision and set of agreed priorities; partnership, legal forms and governance, new care models and system redesign, organizational redesign with new and evolving staff roles, payment reform and incentives, citizen engagement strategies, information governance, and above all else, cultural change.

Canada is rapidly falling behind its international peers, and the test for our healthcare system will be to advance these capabilities in parallel with world leaders, else risk getting stuck with the status quo. Consider this a call to action. We should challenge each of the 13 Canadian health

ministries to establish a population health maturity strategy and model. Population health requires a whole-system change, so let's rise to it!

Michael Billanti is Director and General Manager, Population Health, Cerner Canada.

Reduce SSIs

blood glucose and to use insulin therapy to combat high levels. "If we have a blood sugar level of 140 in any patient in our operating room, they get started on an insulin infusion program," said Dr. Dellinger. While the best levels of glucose control are not universally agreed upon, "there are excellent algorithms available," he said.

• Also of great importance is teamwork and the use of checklists. "How well the team communicates and interacts in the OR really influences the rate of complications," he said. "It's not like the old days, when there was one boss in the OR and everyone else shut the hell up." In today's more democratized environment, all clinicians should have the opportunity to be heard and contribute to the work being done. If not, problems can occur.

Checklists are way to ensure that team members get to voice their concerns, as well as monitoring whether all of the right steps have been taken. Dr. Dellinger said he was involved in the World Health Organization's creation of OR checklists, and his hospital was one of eight around the world to first use them. Overall, the eight hospitals had a "50 percent reduction in SSIs, and improvements in reoperation and mortality rates."

He cited several other studies of hospitals using surgical checklists with great success. He also talked about a Texas hospital group that used OR checklists, claimed 100 percent compliance, but experienced no gains. Skeptics in management sent a "quiet observer" into the ORs. When it came to team introductions, concerns expressed, potential for blood loss, and other checklist categories, "it was discovered they were doing a terrible job." So, while the teams were checking all the boxes, they weren't actually carrying out the steps.