Connected Healthcare

How data, connectivity and devices are improving patient outcomes

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How to address the challenges of connected healthcare

Robin Duke-Woolley, the CEO of Beecham Research and Therese Cory, a senior analyst at the firm, discuss the challenges associated with providing connected healthcare and go inside TELUS' Health and IoT strategy to overcome them

In order to ensure a continuum of connected care throughout the healthcare supply chain over the lifetime of a patient's treatment, several challenges need to be addressed, for example:

1. Datasets from devices must be integrable and interoperable to enable full analytics

Devices that connect healthcare equipment to computer systems for analysis are very specific as to what data they collect. The data sets emanating from separate devices are not necessarily inherently compatible or interoperable. The greatest challenge is to establish consistency of data between multiple data collection systems, to allow the data to be analysed in its entirety.

Healthcare systems are also extremely complex in terms establishing secure communication between various data sources. For example, some solutions use multiple communication protocols. If a patient is being treated in multiplicity of ways, a single unified record should be accessible from anywhere by any person involved in the patient's treatment.

2. Connectivity technology must be consistent and dependable

Hospitals and clinics routinely use Wi-Fi and Bluetooth for communication, technologies which have their advantages and disadvantages. However, many are struggling with Wi-Fi connectivity because it is not very stable when faced with high volumes of connected devices. Many older hospitals require investment to support better connectivity technologies in future.

After collection, data is sent to the cloud and stored in the patient electronic medical record (EMR) where it can be analysed and monitored by medical teams through an IoT provider. Healthcare facilities need flexible, fast and reliable connectivity. In remote areas cellular connectivity has a clear advantage, and centralised cellular provides a wider area of coverage. Cellular technologies, particularly LTE are anticipated to support better and more reliable connectivity. Intensive care units equipped with infusion pumps and vital signs monitoring equipment often utilise a hybrid connectivity solution, such as Wi-Fi and cellular.

3. Data must be securely held and privacy assured

In healthcare, data privacy, data security and data governance need to be established from the start. Notable pain points are around spectrum congestion and preventing cyber-attacks. As the use of wearable monitoring technologies increases, particularly outside the hospital, these devices will be at increased risk from cyberattacks; there have been worrying reports of attacks on hospital websites.

TELUS offers a range of smart healthcare options for clinical, pharmacy and consumer solutions

TELUS Health's strategy

TELUS Health is Canada's largest healthcare IT provider. The company has invested more than C$3.2 billion in healthcare over the last decade. TELUS Health's mission is to transform healthcare through connected health to help improve health experiences for all Canadians. Its social purpose focuses on improving access to quality healthcare and delivering better health outcomes through technology for all, including the most vulnerable citizens.

IoT is a growing business within TELUS. With its own IoT dedicated network to sustain the growth, TELUS is well poised to accelerate 5G adoption. TELUS IoT takes a vertical approach to market to solve customer challenges, so aligning with TELUS Health is a natural fit. The intersection of TELUS Health and TELUS IoT will drive meaningful change and accelerate digital transformation in a fragmented healthcare environment.

TELUS offers a range of smart healthcare options for clinical, pharmacy and consumer solutions. These comprise services to enable IoT to digitise and connect all parts of the ecosystem.

The company envisages three points of entry into the market:

Step 1: Build reach. TELUS has strongly penetrated primary care; 28,000 clinicians now use its EMR platform. 6,500 pharmacies also use its practice management and distribution solution. Electronic prescriptions connect physicians and dispensers.

Step 2: Calibrate patient experience. TELUS is looking to further penetrate the consumer market for virtual care. At present, 1.5 million Canadians use virtual care and the company expects this to accelerate in the future.

Step 3: Utilise data. Data is key to optimising outcomes. This means greater use of AI and business intelligence. At present there is wide disparity across the country regarding healthcare – five million Canadians do not have a doctor.

Figure 1: Connecting equipment with patients in hospitals (Source: TELUS Smart Healthcare)

For hospitals, smart healthcare is using the power of IoT to digitally transform with people-centric healthcare solutions for better treatment outcomes

In parallel with the above, the company is targeting the following user categories:

- Government, primary healthcare providers including physicians, pharmacists and allied healthcare professionals; and hospitals and long term care facilities: Providing support for these stakeholders.
- Employers: Through a global pandemic and an increase in mental health issues, there has never been more demand for employers to provide healthcare services to employees.
- Consumers and patients direct: Empowering Canadians to manage their healthcare, and providing value through innovative apps and connection services.

TELUS offerings

1. Connecting hospitals and pharmacies

For hospitals, smart healthcare is using the power of IoT to digitally transform with people-centric healthcare solutions for better treatment outcomes. There is a high density of assets within the hospital environment that can usefully be connected – beds, wheelchairs and other assets.

TELUS sees the possibility to start connecting all these assets via application programme interfaces (APIs), introducing connectivity where there was none before. This then enables a richer, fuller set of information to flow to the right people at the right time, providing recommendations for treatments.

For these solutions, the company partners with ThoughtWire for a true IoT healthcare solution. ThoughtWire's technology incorporates a digital twin approach for smart healthcare, through connecting data points, providing situational awareness to physicians and bringing real-time insight to healthcare workers. This approach can also monitor the state of the patient and determine if they are deteriorating before they go into cardiac arrest, or monitor for prescriptions - whether these have been delivered, and whether treatment plans are being adhered to. It puts information directly in the hands of caregivers and management to create better patient outcomes, increase clinical collaboration and optimise workflows throughout the hospital.

Figure 1 shows how previously unconnected systems can improve situational awareness and reduce the cognitive load for clinicians and staff. Real time contextual data about the patient is sent to the IT system, which generates automated alerts if a risk threshold is passed.

According to the company, one third of all prescriptions issued in Canada are not filled, and half of these patients do not adhere to their medication

The information can be used to recommend actions to the right people at the right time for critical path workflows, including patient code blue, transport and drug prescriptions. As a result, clinicians can respond rapidly to patient needs based on all available information, down to the latest patient vital signs.

PharmaConnect is a tool for connecting pharmacies with patients. Automated prescription reminders for refills or renewals help patients remain on their prescribed therapy, view their prescription profiles and order refills online. The tool sends automated messages from a library of templates to patients via email, text messages and other notifications to help them comply with their medications. The software also supports billing and claims reimbursement.

According to the company, one third of all prescriptions issued in Canada are not filled, and half of these patients do not adhere to their medication. Wearable intelligent devices should improve the data flow between patient and clinician and ensure adherence, leading to better patient outcomes.

2. Health for Good Mobile Clinics

TELUS Health sponsors a specially equipped outreach service, Health for Good Mobile Clinics in a number of Canadian cities. The country has different levels of maturity in respect of healthcare. The mobile clinics aim to bring healthcare to marginalised or homeless populations, as well as offer harm reduction services for people experiencing substance abuse.

These compact vehicles are equipped with TELUS Health solutions that enable the creation of an electronic medical record for each patient. The clinics build a comprehensive health history for the future care of the patients, while enabling improved access to shared information between healthcare professionals. As of 2019, there were nine such mobile clinics, and since its launch in 2014, the programme has generated 22,000 patient visits.

3. Healthcare services for consumers and patients at home

TELUS Health provides services for consumers and patients at home through their smartphones.

Babylon is a chat-style symptom checker powered by artificial intelligence, which provides patients with one-on-one virtual consultations with a licensed physician. Launched in 2019, Babylon has become Canada's fastest-growing consumer virtual care service, with tens of thousands of users. This service is complemented by the

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company's acquisition of Akira, a virtual care platform targeting insurers and employers which covers more than 500,000 lives.

TELUS also claims to be the largest Canadian-owned provider of personal emergency response services, supporting independent living for older citizens.

Espri is an app designed to support the mental health of front-line workers, particularly relevant in the pandemic crisis.

Home Health Monitoring enables patients with a variety of chronic diseases or conditions to monitor health factors from their homes through their computers and smartphones, and share this information electronically with health professionals. By tracking the patients' results regularly, the healthcare team can adjust treatments as required.

TELUS' Future vision

TELUS sees a number of improvements that can be made to overcome current challenges to a fully connected healthcare system and is working towards introducing these:

- **System fragmentation**

The Canadian healthcare ecosystem continues to operate in silos. Fully connected smart healthcare needs a fully digitised patient experience; however, in all healthcare, there can be resistance to major and sudden change.

Improvements are taking place across the country to ensure that there is an appropriate flow of information across the care continuum. New exchanges are being established, such as the TELUS Health Exchange, to support the secure exchange of information between healthcare applications. TELUS is working with a number of provinces to connect their systems for greater health system benefit.

The pandemic has also highlighted the non-alignment of systems and the disadvantages it brings. Overcoming these will make for better collaboration between stakeholders and a more coordinated response for patient safety. With the pandemic, some issues that have not been addressed for a long time have suddenly been dealt with. For example, fee codes for physicians to bill for telemedicine and virtual consultations were implemented within two weeks. It was in response to this change that TELUS Health quickly developed a virtual care solution that was seamlessly integrated into its electronic medical record solutions to enable 28,000 clinicians to conduct secure video consultations with their own roster of patients. TELUS also helped ease some of the burden on British Columbia hospitals by expanding use of their Home Health Monitoring solution to remotely track and support COVID-19 patients recovering at home.

- **Future wireless networks**

Today TELUS' 4G LTE network covers 99% of Canadians. 4G can support 1,000 times the number of connected devices compared with Wi-Fi. Wi-Fi is a much-used form of connectivity in hospitals worldwide, but TELUS anticipates that it will have its limitations in terms of supporting the large numbers of connected devices in the future. The company sees private cellular networks as a way to address these limitations, particularly for continuous monitoring of patients.

Having started the build out of it 5G network, the company anticipates that there will be many ways that 5G will provide tangible new value in healthcare. 5G is expected to support 10,000 times the coverage afforded by Wi-Fi. It will enable more pervasive and smart data collection, providing massive capacity and speed, with real time access to hospital support systems with many different types of devices connected. It will enable clinical support information being entered into the system in real time, allowing clinicians to suggest appropriate courses of treatment almost immediately. Latency is also much reduced with 5G, with lag time being an important differentiator for collecting data.

TELUS Communications

TELUS is a Canadian telecoms operator. Headquartered in Vancouver, it provides communications and information technology services with C$15 billion in annual revenue and 15.4 million customer connections. It offers wired and wireless communications, data services, Internet, voice, television, video and security services, as well as computing services to businesses. TELUS is Canada's fastest growing telco and also has a global IoT connectivity platform.

The company has several divisions including TELUS Mobility, TELUS Health, and recently it launched its TELUS Agriculture division. TELUS International provides services to global clients; these services support the full lifecycle of the clients' digital transformation journeys and enable them to embrace next-generation digital technologies to deliver better business outcomes. The company offers international roaming to more than 225 destinations.

Over the past decade, TELUS has broadened its reach in IoT-based services and is the only Canadian carrier to offer a purpose-built IoT dedicated network. More recently, it has deployed IoT technology enabling smart city solutions in more than 65 municipalities across the country.

In early 2020, TELUS Ventures announced its investment in Miovision, a Canadian company using computer vision, artificial intelligence and advanced modelling to help cities modernise their approach to traffic management. By investing in smart city technology TELUS will connect and empower municipalities to build stronger, safer communities by easing traffic congestion, reducing carbon emissions and making intersections safer for vehicles, cyclists and pedestrians. The C$120 million investment will help support TELUS' digital transformation strategy, adding key smart city capabilities to its portfolio.

TELUS Communications has a 4G LTE network covering 99 per cent of Canadians. In 2020 the company selected its partners to build out its 5G network and began rolling out the first wave of the network in selected cities in mid-2020.

Connectivity is key for the company's aims: its socially oriented motto is to 'Connect All Canadians for Good'.
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How TELUS connects workers and improves healthcare

When a Canadian healthcare provider needed a reliable communications platform to enable its professionals to serve patients more effectively and securely it turned to TELUS' Aware 360. During the COVID-19 pandemic, the system has truly proved its worth

The organisation's team needed a reliable communications platform through which they felt safe and connected, yet could quickly alert authorities

This comprehensive healthcare provider has been operating in Calgary since 1973. It offers both clinical and social components in almost all of its programmes, which include a large community health centre complete with pharmacy, lab and wellness programming; a youth health centre, seniors health centre, mobile health and dental care buses, a series of housing programmes, and a community food centre. This organisation is staffed by hundreds of personnel, and hundreds more volunteers and donors are dedicated to offering high-quality care to vulnerable Calgarians. Here, whole health is the goal – and you can't be healthy if you are hungry, isolated, or experiencing mental health struggles. This organisation serves a community that often experiences barriers to care. It works with those it supports on their journey from poverty to stability and from crisis to wellness.

The challenge

With thousands of people throughout Calgary relying on their services, the organisation uses a robust electronic medical record (EMR) system with more than three hundred medical staff actively using the system. From case files to the medical history of patients, the system is integral in connecting staff to the community they serve, and any delay or system downtime could be disastrous. In addition, many members of the team work in an outreach capacity in the community. They require stable technology solutions that keep them connected on the go.

Community work and home visits require additional safety and security needs and protocols for the staff, particularly in instances when they are responding to situations that involve distress or behaviour escalation. The organisation's team needed a reliable communications platform through which they felt safe and connected, yet could quickly alert authorities, if needed. During the early phase of the coronavirus pandemic, there was also a heightened level of anxiety in the community, and with many businesses closed, people were more isolated. Now more than ever, the organisation had to have a network partner that was reliable and had experience dealing with rapid technology and service offering changes while its team worked quickly to reach members of the community.

Why TELUS?

TELUS is experienced in providing mobile resource management solutions for a variety of industries, so when this Calgarian organisation began searching for a reliable network partner about five years ago, it quickly realised that, in addition to the strength of the network, the suite of mobile safety solutions TELUS offered, called Aware 360, was exactly what it was looking for. Aware 360 includes four modules – SafetyAware for lone and at-risk workers, a cognitive screening app called Aware4Duty, iDriveAware for driver behaviour monitoring, and GoBand addressing the new COVID-19 contact tracing requirements.

The organisation was looking to integrate a tool to connect those working alone, and for teams deployed to potentially higher-risk situations that could require emergency response support. It also needed a way to log where workers had

travelled to and to be able to pull up medical or historical files as well as check in with the office in order to follow safety and administrative protocols. The Aware 360 system provided all of this, and more. This healthcare organisation and TELUS have had a long-standing business relationship for many years, and share many of the same values, particularly regarding care and safety. It was natural that they would explore work solutions available for their mobile staff. After a series of meetings, TELUS was able to prescribe a solution that not only was a technical fit, but also fitted into their budget as a not-for-profit.

The TELUS experience

Today, this not-for-profit's EMR system operates on the TELUS network, with hundreds of staff members using Aware 360 by TELUS, from doctors to outreach workers, to psychiatrists, pharmacists, and others. Outreach teams can check in and out easily, schedule and log all on-site visits down to the second using GPS technology, and access medical files securely on their mobile app.

In addition to the app, Aware 360 is a cloud-based system with additional technology that makes the staff feel safe and efficient, such as panic wristbands for outreach workers. It is able to monitor all the data in the system across each of its centres, and across all employees and citizens. Over the past two years, employee turnover and retention rate has consistently improved. Technology solutions that streamline and enhance the work experience have played a role in this success. During COVID-19, this organisation worked around the clock to completely change the way it served its community. Tapping into the resources at TELUS, the two organisations quickly strategised to develop ways to keep their community connected during the pandemic. They quickly adapted to new methods of providing the critical support the Calgary community needed during this unprecedented time.

"We were really demanding of all of our vendors during the days and months following the COVID-19 outbreak, as we had people still depending on us to not miss a beat. The entire TELUS team really stepped up to the plate, working with us to find solutions to deliver service while ensuring the safety and security of our employees and volunteers. We could not have changed our entire business process without the help of vendors like TELUS," commented the healthcare provider's IS/IT manager.

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Benefits to healthcare provider:

- Keep social and health teams safe while out alone in the field
- Emergency alerts to back office and first responders
- Reduce social and COVID-19 risk interacting with the public
- Improve employee efficiency via the automated scheduler tool
- Quick access to medical and historical data of citizens

TELUS

Better connections for a smart, healthier future

The pandemic has placed healthcare at the forefront of everyone's agenda but providers had already been improving their connectivity and digitalisation to support patients' access to healthcare and position themselves for the future. This includes 5G connectivity and artificial intelligence-enabled robots that will underpin greater automation and truly smart healthcare. Luc Vilandre, the president of TELUS Health and Michael Cihra, the vice president of IoT at TELUS, tell Robin Duke-Woolley, the CEO of Beecham Research, how TELUS has been serving its healthcare customers and what the smart future looks like in healthcare

RD-W: TELUS is heavily involved in the healthcare sector with TELUS Health. Can you tell us more about what TELUS Health offers?

LV and MC: Our journey in healthcare began more than a decade ago. Our mission is to transform healthcare through connected health solutions – helping improve health experiences for all Canadians through a three step strategy:

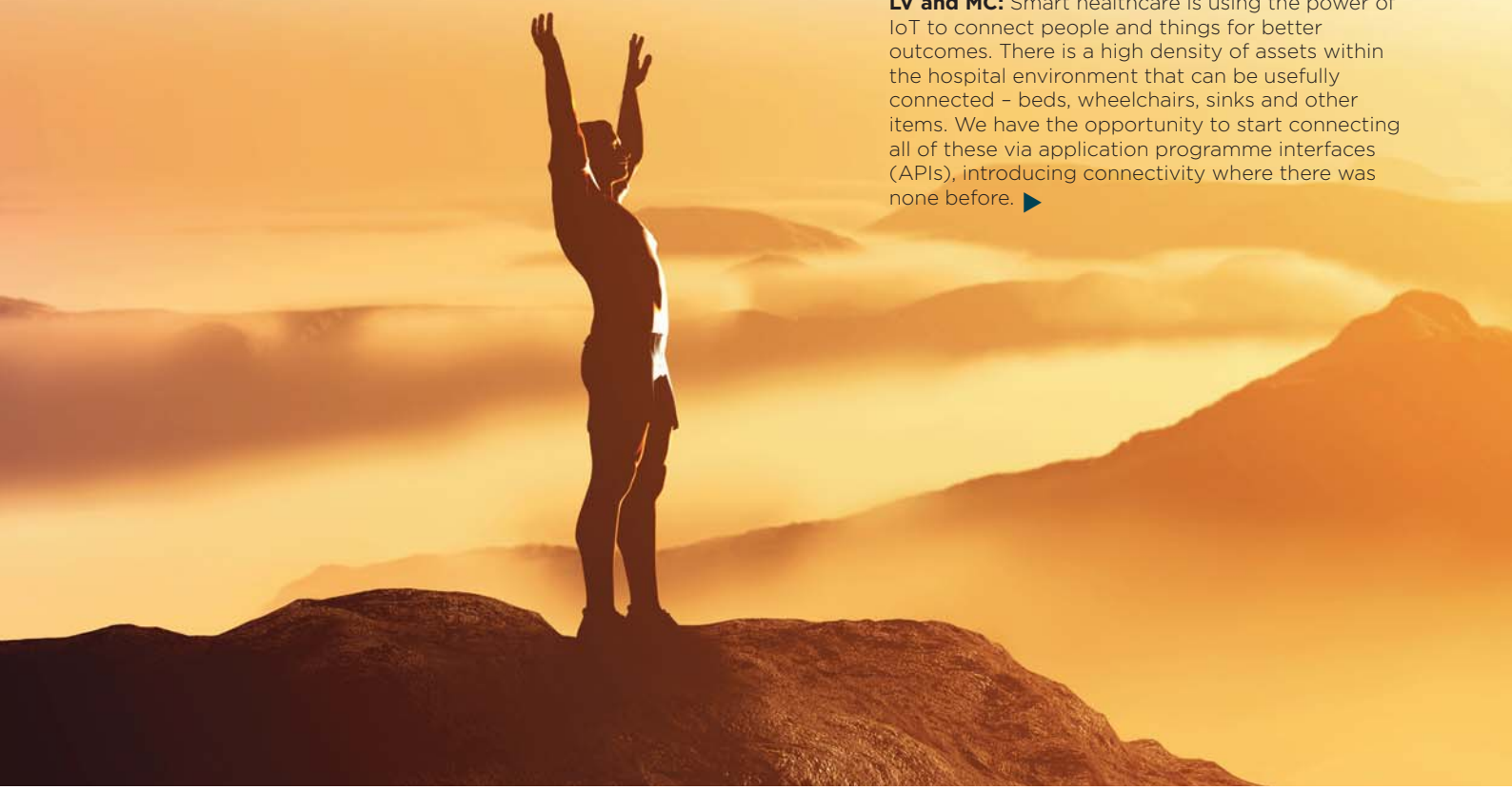
- **Step 1:** Build reach. We have strongly penetrated primary care. For example, 28,000 clinicians now use our electronic medical record (EMR) platform. 6,500 pharmacies also use our pharmacy management and distribution solution. More than 1.5 million Canadians are using our virtual care platforms, helping to fill the gap for the five million Canadians without a family doctor. The combination of our world-class network infrastructure and digital health solutions enables people and things from all parts of the healthcare ecosystem, including hospitals, business locations and homes, to access the smart healthcare system.

- **Step 2:** Develop and enhance collaboration between stakeholders within the health ecosystem. An example of that would be our electronic prescription platforms that connect physicians and pharmacists for a seamless patient experience.

- **Step 3:** Utilise the data. Data is key to optimising outcomes; this means greater use of artificial intelligence (AI) and business intelligence and better clinical outcomes for the patient.

RD-W: How do you define smart healthcare and do you see this replacing clinicians?

LV and MC: Smart healthcare is using the power of IoT to connect people and things for better outcomes. There is a high density of assets within the hospital environment that can be usefully connected – beds, wheelchairs, sinks and other items. We have the opportunity to start connecting all of these via application programme interfaces (APIs), introducing connectivity where there was none before. ▶



This then enables the right information to flow to the right people at the right time, providing recommendations for treatments in real-time. We recently launched our first true IoT Smart Healthcare solution in partnership with ThoughtWire – another Canadian company. The ThoughtWire platform uses digital twin technology to provide situational awareness to physicians and connect previously unconnected systems including IT, building, clinical and patient systems.

Our solution can also monitor the state of the patient and determine if they are deteriorating before they go into cardiac arrest, or monitor for prescriptions — whether these have been delivered, and whether treatment plans are being adhered to. It puts information directly in the hands of caregivers and management to create better patient outcomes, increase clinical collaboration and optimise workflows throughout the hospital.

All of this is designed to aid clinicians in their work, empowering them with information that traditionally has not been available. It will not replace clinicians.

RD-W: Can you outline how TELUS Health offerings are being introduced into the healthcare system? Where do you see the particular pain points that need addressing?

LV and MC: There are three points of entry to the healthcare market that we are working on:

1. Providing support for healthcare professionals. This includes government, primary healthcare providers like physicians, pharmacists and allied healthcare professionals; and hospitals and long term care facilities.

2. Supporting employers. Through a global pandemic and an increase in mental health issues, there has never been more demand for employers to provide healthcare services to employees.

3. Consumers and patients direct. Empowering Canadians to manage their healthcare, and providing value through innovative apps and connection services. Smart healthcare needs a fully digitised patient experience. Highly fragmented silos – each with its own information – are a particular pain point. To use the data for decision support, there is a need to share data across departments.

RD-W: 5G will be increasingly important over the next few years. Can you say more about where you see TELUS utilising this technology in healthcare?

LV and MC: There are many ways that 5G will provide tangible new value. It enables more pervasive and smart data collection, providing massive capacity and speed, with real-time access to hospital support systems with a vast array of devices connected. It can also enhance telemedicine, virtual care and virtual conferencing, and MRI scanners with higher quality picture resolution. Further, it presents the opportunity for real-time clinical support information to be entered into the system allowing clinicians to suggest better courses of treatment in real-time.

Data[1] shows that one out of three prescriptions is not fulfilled. For half of those it is because patients do not follow the treatment instructions for a variety of reasons. Wearable intelligent devices will improve the data flow between patient and clinician and help to ensure adherence, leading to better patient outcomes.

Smart respirators can help enable clinicians to get data more quickly and conveniently for monitoring patient status; most hospitals currently do this manually. Further, augmented reality training for remote surgery is another area of impact - 5G and AI with precision robotics are now leading edge but will become mainstream in the future as technology quickly evolves.

RD-W: The COVID pandemic has highlighted fragilities in healthcare processes. To what extent has TELUS been involved with this recently and how do you anticipate the pandemic having a lasting effect on the healthcare system?

LV and MC: There is always inertia in healthcare, mainly because of fragmented systems. Staff want to do good but are unsure about changing the way things get done.

With the pandemic, issues that have not been addressed for a long time suddenly came to the forefront. For example, fee codes for physicians to bill for telemedicine and virtual consultations were implemented within two weeks. It was in response to this change that we quickly developed a virtual care solution that was seamlessly integrated into our electronic medical record solution to enable 28,000 clinicians to conduct secure video consultations with their own roster of patients. We also helped ease some of the burden on British Columbia hospitals by expanding use of our Home Health Monitoring solution to remotely track and support COVID-19 patients recovering at home.

The pandemic has also highlighted non-alignment of systems and the disadvantages of that. Overcoming these challenges with the help of digital health technologies will make for better collaboration between stakeholders and a more coordinated response for improved patient outcomes. ■

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1 Study published in Annals of Internal Medicine, funded by Canadian Institutes of Health Research (CIHR) March 2014

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