

I-INC WHITE PAPER SERIES:

Healthcare Quality Improvement in British Columbia – a Pilot Project

Date: September 1, 2018

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INCUBATE INNOVATE NETWORK OF CANADA

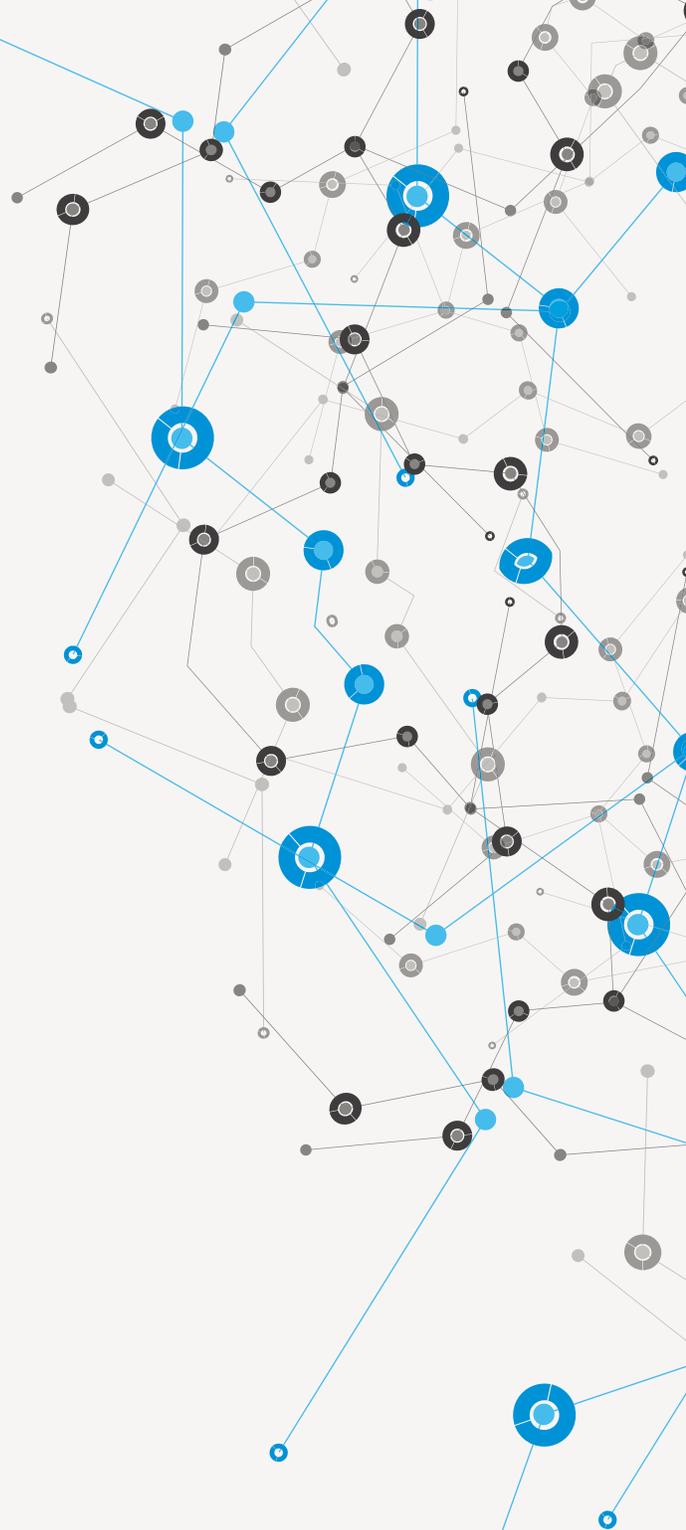


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Foreword

Canada's innovation strategy and competitiveness depend upon the ability of skilled innovators to apply their knowledge and innovations to important problems and challenges of global significance.

Our nation's healthcare system, often a source of national pride, has recently been ranked as one of the least efficient of developed nations by [The Commonwealth Fund](#). Significant opportunities exist to improve the efficiency of healthcare in Canada through initiatives such as Patient-Centered Care, Quality Improvement and Data Science, as well as adoption of new technologies and practices.

Digital health innovators and companies can play a critical role in understanding current challenges and opportunities, as well as designing solutions to deliver quality healthcare efficiently. But in order to innovate, researchers and digital health companies first need access to data, and to a framework and systems that protect the privacy and security of data.

This white paper, authored by Jean Gelinias, MD, FRCPC, Anesthesiologist and Intensivist, and founder and CEO of Xerus Medical Inc., offers a blueprint for a platform and approach to practically enable digital healthcare innovation in Canada. To implement the platform and unlock its potential, collaboration among patients, clinicians, healthcare providers, organizations responsible for

health data, as well as researchers and innovative companies developing solutions, is essential.

In the fast-moving world of technology innovation, collaboration is the best path to successful solution definition and implementation. Canada's healthcare organizations, universities, technology accelerators and innovator companies have essential roles to play, and will need to work closely together to achieve results. We look forward to seeing the benefits that can arise from this initiative and invite you to contact us for more information.

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Executive Summary

From a macro perspective, new and expensive medical technology, as well as an aging population, put tremendous resource demands on our healthcare system. Without significant increases in productivity, these growing needs will be difficult, if not impossible, to sustain. Jurisdictions capable of applying translational medical innovations to their healthcare systems will reap extraordinary economic, social and political rewards. For the promise of translational medicine to be realized, secure and efficient data sharing must be mastered. Simple obstacles, like stakeholders not being able to efficiently share anonymized data, or even more basic issues like not having access to secure and reliable hospital WiFi, are enough to doom countless good yet basic ‘first step’ projects.

Interestingly, the most basic enablers of healthcare innovation are well understood and surprisingly inexpensive to implement. Some of these ‘1st generation safe and secure data gathering building blocks’, like Vanderbilt University’s REDCap, are already widely used by leading institutions in British Columbia and across the world, but the innovation potential that these tools enable is still largely untapped. Presently, we are in the early innings of the healthcare information technology revolution. Things are starting to move very quickly in many forward thinking jurisdictions, and now is the time to actively engage with the ongoing paradigm shifts in medical data collection and sharing.

If we make it a priority, British Columbia and Canada at-large have the type of healthcare environments that could permit us to ‘out-innovate’ other jurisdictions. For this to happen, we need to be proactive and make decisions at a speed that enables innovation. Our system might not be as nimble as some parts of the American system and we need to acknowledge that efficient and timely decision making is a powerful competitive advantage.

We propose setting up a **quality improvement pilot project** to show what the **perioperative journey of the 21st century** could and should look like. Using well-understood, inexpensive and secure technology, we would demonstrate to clinicians and administrators the potential value of seamlessly and inexpensively obtaining, analyzing and visualizing **patient-centric quality improvement (QI)** data. The primary or first-order aim of the project would be to demonstrate how, once equipped with good data, clinicians and administrators can improve patient care and satisfaction as well as improve productivity. The secondary aim would be to demonstrate how this type of pilot project can become a powerful catalyst for a wide range of initiatives that involve various stakeholders, ranging from local academia and innovative startups to companies like Telus.

Well-implemented, patient-centric QI systems can not only reduce healthcare costs, but can do so while improving the quality of care. **Good care can and should be less expensive.**



Introduction

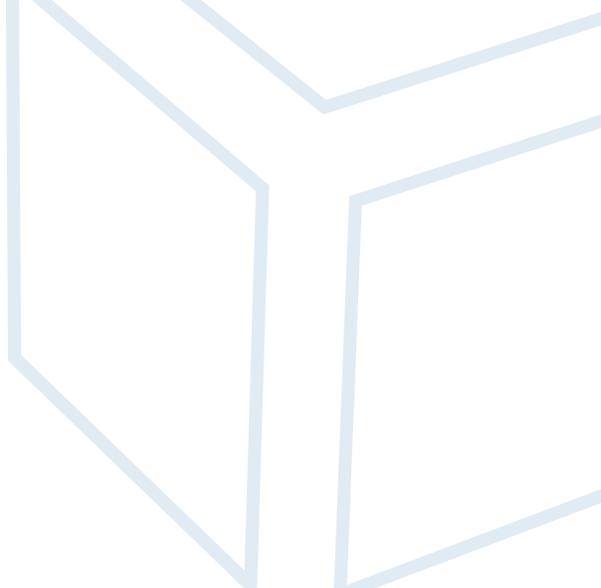
History repeatedly demonstrates that groups who master a technology not only benefit directly, but also end up selling their innovations to those unable to figure it out for themselves. Government and regulatory policy is particularly important for healthcare innovation where efficient data sharing is a fundamental prerequisite to being able to develop many truly cutting edge products. Healthcare data sharing is a complex and highly regulated process where trust and good communication between various stakeholders is essential. Without trust, meaningful innovations are difficult if not impossible. Luckily, well-understood solutions designed to build 'trust foundations' are already widely used. Some of these trust building solutions, like the REDCap data management platform, are inexpensive to set up and maintain, and can provide the necessary common language that will enable us to safely and efficiently create, develop and sell cutting edge healthcare technology.

Healthcare Technology Disruptors

There are currently **two major positive technology disruptors** of medical care:

1. Biotechnology: Innovations such as very precise small molecule medications, 3rd generation antibodies, CRISPR, cellular therapies, molecular diagnostic tools, etc., are sophisticated technologies riding the coattails of the genomic revolution. These technologies are not directly dependent on seamless data sharing, but are usually developed and tested in ecosystems that share healthcare data efficiently. Biotechnology is often thought to be all about ‘test tubes and molecular biology experiments’, but biotechnology is now very much a data science. Access to good clinical phenotypes is quickly becoming a basic necessity for cutting edge biotechnological innovation.

2. Medical Information Technology: Medical Information Technology (IT) should theoretically be able to leverage the impressive technological advances that have greatly transformed the way consumers interact with data. Unfortunately, legacy IT systems, the fear of data leaks and simple ‘fear of the unknown’ are all barriers to medical IT innovation. Globally, a relatively small number of forward thinking stakeholders are building the medical IT tools of tomorrow. Some American groups, and countries like the U.K., have resolved permission and privacy issues so as to enable academic and commercial innovation. Efficiently streamlining the permissions process to share anonymized medical data will become an increasingly bigger structural advantage to the lucky few who do it well. Jurisdictions that can’t set up mechanisms to safely, efficiently and seamlessly share medical data will be unable to participate in the lucrative development of new medical data management tools (and biotechnology innovations) and will also see the quality of training for their healthcare professionals impacted. In any trade or profession, having early access to the best tools matter.



As things now stand, Canada mostly buys American-built medical IT technology, which is often **designed primarily to track the provision of services for the purpose of direct patient cost recovery** and with the ultimate goal of making a profit. Many of these American 'billing-centric' medical data management systems (i.e., electronic medical records) ignore or pay lip service to 'patient-centric' quality improvement. An influential article by Ethan Basch, MD, "Patient-Reported Outcomes – Harnessing Patients' Voices to Improve Clinical Care" (*New England Journal of Medicine*, 2017),¹ concisely explains the pitfalls of relying on traditional (i.e., incumbent) medical data management systems if patient-centric quality of care is ever to be meaningfully implemented.¹ (A copy of the article is attached.)

In contrast to the American healthcare system, Canadian provincial healthcare systems are not based on direct patient cost recovery. This could potentially be a large structural advantage if we want to build a patient-centric medical IT system around quality rather than billing. This project would generate meaningful direct and indirect commercial, academic and social benefits. Again, the alternative is to buy non-Canadian products that often do not work well for our health system, and that are expensive to acquire and maintain.

Various initiatives that promote healthcare innovation have been set up all over North America² – including Canadian cities.³⁻⁵ Interestingly, a recently announced American collaboration between Amazon, JP Morgan and Berkshire Hathaway has set out as its mission the creation of a healthcare plan 'free from profit-making' and focused on quality and efficiency.⁶ While little is known about how these American corporate giants want to rebuild the American system, it does seem that the data management tools they want to build are based on some of the fundamental principles of Canadian healthcare. Canada does not have the same legacy profit barriers, nor does it have the U.S.'s extremely complex corporate interdependencies; it will be difficult for much of the American system to overcome these as it tries to focus more on quality and efficiency rather than profit maximization. The Canadian healthcare system has historically considered quality of care as being a key metric to focus on, but has only recently started to leverage technology to help us define, understand and improve patient-centric quality of care.

This could potentially be a large structural advantage if we want to build a patient-centric medical IT system around quality rather than billing.

REDCap

As mentioned previously, trust amongst various stakeholders is the basic first step to making data sharing possible. One notable and very popular example of a 'data sharing building block' is [REDCap](#) (Research Electronic Data Capture). It is a web application for building and managing online research and quality improvement surveys. These surveys enable stakeholders to gain insights about Patient Reported Outcome Measures (PROMs) and Patient Reported Experience Measures (PREMs). Obtaining PROMs and PREMs, although not systematically or even routinely gathered by the vast majority of healthcare providers, are essential to enabling patient-centric QI.

REDCap was created by Vanderbilt University to enable various non-commercial stakeholders to safely and seamlessly get user feedback. REDCap has powerful user access controls and audit trail functionality, and is able to automatically strip out personally identifying information.

Through a partnership between the BC Academic Health Science Network (BC AHSN), the BC SUPPORT Unit, BC Children's Hospital, the Centre for Clinical Epidemiology and Evaluation (C2E2), Island Health, and Population Data BC, [REDCap is offered, for free, to BC academics who want to use it for patient-oriented research](#). Data custodians, clinicians and academics who use REDCap can interact with local commercial innovators, confident that they, and not the commercial partners, control who has access to patient data.



HL7 FHIR Open Health Data Interchange Protocols

Earlier this year, Apple committed to using an open application programming interface (API) for healthcare records — specifically, Apple is using Health Level Seven International (HL7) Fast Healthcare Interoperability Resources (FHIR) open standards to access, aggregate and store healthcare records that Apple will in turn make accessible to consumers. This strategic decision by a big player like Apple could have significant, positive implications for healthcare data exchange and standards, **as it allow users to control their own data and share it with whomever they choose**. This will encourage or force other large technology companies to give consumers of healthcare their own data. In Canada, [Canada Health Infoway](#) is driving the adoption of healthcare data interchange.

Patients are increasingly being considered as the ultimate owner of their own healthcare data; and in many jurisdictions, patients are finally being given access to their healthcare data. The trend of patients becoming the ultimate owner of their own medical data, and the development of American-mandated compatible data exchange standards, will eventually change how healthcare is provided to Canadians.

Traditional electronic medical data gathering platforms and Electronic Medical Records (EMR) are widely understood to not be user friendly for healthcare workers and even less so for patients. Healthcare workers have even been known to [leave the profession early](#) due to difficulty using these burdensome EMR systems. A [2013 RAND report](#) commissioned by the American Medical Association found that poorly designed data management systems like EMR were a major contributor to healthcare professionals' poor morale as well as their growing lack of engagement to the care model evolving around these newer data management systems. Unfortunately, the few commercial providers of EMR have historically provided very limited choice to purchasers of medical data management systems. A recent [Wired article](#) elegantly explains how the data sharing standards will enable various stakeholders to build the innovative and disruptive products that will drag healthcare into the 21st century. This could be an extraordinary, once-in-a-generation opportunity for those who can leverage the ongoing paradigm shifts.

A Brief Overview of Healthcare Quality Improvement

Systematic Quality Improvement (QI) is a fundamental principle of modern manufacturing. Japanese manufacturers, using American management processes, started demonstrating the value of [Kaizen techniques](#) 50 years ago.⁷ The necessity of routinely using medical QI to ensure that Evidence-Based Medicine (EBM) is actually effective has been understood for a long time,⁸⁻¹⁰ and the pathways to implementation and potential IT infrastructure to create valuable and reproducible quality improvement has been well described.¹¹ Unfortunately, wide-scale medical QI has proven difficult to meaningfully implement.¹²

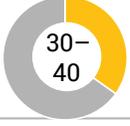
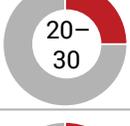
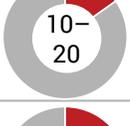
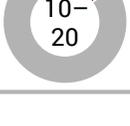
Uncertainty as to whether new evidence-based findings apply to 'my patients and practice' is compounded by clinicians and administrators lacking the basic tools to determine if new interventions actually make outcomes better or worse. What cannot be quantified or measured cannot be reliably and consistently improved. Open loop systems are inherently difficult to improve. As an analogy, a manufacturing company building a product today without having robust and timely feedback data for quality control and improvement would be at a serious competitive disadvantage, and would most likely be out of business quickly.¹³

Without the 'closed loop' patient-centric feedback mechanism that only the medical QI process can deliver, the constant flow of new clinical trials and guidelines becomes extremely hard to integrate into medical practice, and can in turn inhibit clinical and administrative excellence.¹⁴ A recent report by the McKinsey Global Institute highlights the **low productivity growth** and limited data and analytics 'value captured' by the US healthcare system.¹⁵

The McKinsey report lists some of the barriers that decrease the uptake of better data gathering and management: **lack of incentives**, the **difficulty of process and organizational changes**, a **shortage of technical talent**, **data sharing challenges**, and **regulations**.¹⁵ None of these issues are insurmountable if motivated stakeholders collectively decide they want to make it work. Again, trust is the starting point.

What cannot be quantified or measured cannot be reliably and consistently improved.

There has been uneven progress in capturing value from data and analytics

	Potential impact: 2011 research	Value captured %	Major barriers
Location -based data	<ul style="list-style-type: none"> ▪ \$100 billion+ revenues for service providers ▪ Up to \$700 billion value to end users 		<ul style="list-style-type: none"> ▪ Penetration of GPS-enabled smartphones globally
US retail ¹	<ul style="list-style-type: none"> ▪ 60%+ increase in net margin ▪ 0.5–1.0% annual productivity growth 		<ul style="list-style-type: none"> ▪ Lack of analytical talent ▪ Siloed data within companies
Manufacturing ²	<ul style="list-style-type: none"> ▪ Up to 50% lower product development cost ▪ Up to 25% lower operating cost ▪ Up to 30% gross margin increase 		<ul style="list-style-type: none"> ▪ Siloed data in legacy IT systems ▪ Leadership skeptical of impact
EU public sector ³	<ul style="list-style-type: none"> ▪ ~€250 billion value per year ▪ ~0.5% annual productivity growth 		<ul style="list-style-type: none"> ▪ Lack of analytical talent ▪ Siloed data within different agencies
US health care	<ul style="list-style-type: none"> ▪ \$300 billion value per year ▪ ~0.7% annual productivity growth 		<ul style="list-style-type: none"> ▪ Need to demonstrate clinical utility to gain acceptance ▪ Interoperability and data sharing

1 Similar observations hold true for the EU retail sector.
 2 Manufacturing levers divided by functional application.
 3 Similar observations hold true for other high-income country governments.

SOURCE: Expert interviews; McKinsey Global Institute analysis

Figure 1. Capturing value from data and analytics.

National Surgical Quality Improvement Program (NSQIP)

Because there is such widespread consensus that medical QI is very important, expensive and labour intensive, relatively basic initiatives like the [National Surgical Quality Improvement Program \(NSQIP\)](#)¹⁶ by the American College of Surgeons (ACS) is gaining significant traction in the US and in Canada. As the ACS states: “You can’t improve a hospital’s surgical quality if you can’t measure it; and for that you need robust, valid data”.^{17,18} The pilot we describe below aims to demonstrate that we can gather data that in the short term is synergistic to the data gathered by initiatives like NSQIP, and that in the medium term, could lead to gathering significantly more and better data for a fraction of the cost of NSQIP.

You can’t improve a hospital’s surgical quality if you can’t measure it; and for that you need robust, valid data.

Regulatory Environment for Quality Improvement

In the US, the [Medicare Access and CHIP Reauthorization Act \(MACRA\)](#) of 2015 is one of the driving forces leading to the adoption of quality improvement. The new model will now require certain care providers to submit information on the quality of service being given and how valuable it is to the patient, thus increasing clinician accountability.

To the best of our knowledge, no Canadian province has any legislation similar to MACRA, but various Canadian organizations are putting more and more emphasis on patient-centric quality improvement. For many years, organizations like the Canadian Medical Protection Association have been encouraging their members to become [leaders in quality improvement](#) and to see quality improvement as an important tool to help reduce malpractice claims and payments. [The Royal College of Physicians and Surgeons of Canada promotes physician-led quality improvement](#)

initiatives by granting them a specific type of credit that is relatively difficult to obtain. Doctors of British Columbia, like other provincial physician associations, has a [provincial program](#) that enables quality improvement through [medical staff partnerships](#) with local health authorities. [Health Quality Ontario](#) has been very proactive in its promotion of quality improvement initiatives.

[Canada Health Infoway](#) is a Canadian health initiative which promotes digital health solutions. Their most recent strategic plan focuses on giving patients and their care providers access to the data needed to [improve the patient experience and improve care](#). Advocating health data transparency and centering healthcare interactions around the patient tend to directly and indirectly foster quality improvement.



Why Focus on Patient-Centric Quality Improvement?

Although data-driven, patient-oriented medical quality improvement is still a relatively young field, it is one that patients, administrators, physicians, academics, politicians and the medical business community can all readily endorse as a significant healthcare need.¹⁹⁻²¹ This precious consensus should be judiciously leveraged so as to enable interested stakeholders to set up a **test ecosystem that develops the quality improvement tools** we need to deliver excellent and efficient care.



The Big Picture Opportunity Medical Quality Improvement Offers

Beyond the obvious 'first order benefits' that patient-centric quality improvement offers, there are many less obvious but pertinent reasons why focusing on quality improvement makes sense.

Healthcare quality improvement is complex and has a lot of moving parts. This complexity has historically been seen as being more of a problem than as an opportunity. Obtaining, processing, analyzing and visualizing healthcare data is a huge industry that currently is in the very early stages of catching up to the quality levels that retail consumers and healthcare workers have come to routinely expect when using and visualizing non-medical data. The innovation opportunities for BC, or for any jurisdiction that gets this right, are staggering. Our pilot project will demonstrate that we could turn complexity into many different opportunities.

Once a basic 'digitally based' quality improvement infrastructure is running and obtaining good patient-centric data, stakeholders with a wide array of synergistic interests and expertise could be 'looped in'. Efficiently gathering data requires expertise ranging from an understanding of **non-invasive 'patient-centric sensors', natural language processing, big data storage, management, analysis and visualization**. Each one of these categories could be broken down into multiple subparts and niche areas of expertise. Each one could eventually spawn thriving local expertise and businesses.

Healthcare authorities, non-profit, and governmental organizations that promote *patient-centric care*,²² *elder care*,²³ or those that advocate for specific medical problems²⁴⁻²⁶ could all be potential partners. Academic institutions like Simon Fraser University, Emily Carr University and the University of British Columbia could each provide numerous potential academic partnerships with specific expertise to inform and improve subsequent iterations of our pilot project.

BC has a deep pool of local companies developing the tools and expertise to gather and process data. **Numerous BC healthcare-focused companies we regularly talk to say they would very much like to participate in local projects, but find it hard to find local partners and have to do most of their development in the US, in other provinces, or even overseas.** Many have told us that this puts them at a disadvantage against their American and Canadian competitors. We have identified BC clinicians, academics and companies that have valuable expertise and technology for the first part of our pilot project.

Once set up, our pilot project would facilitate direct and indirect 'matchmaking' between various healthcare stakeholders.

A Potential Local Pilot Project

Our ultimate aim is to develop scalable and networkable medical products and solutions that primarily focus on improving medical therapeutic efficiencies. We describe below a modular pilot project that starts modestly but could quickly and meaningfully scale up. The first step of our project requires us to continue our development of a user friendly and efficient digital patient-centric quality improvement data gathering platform using agile methodologies. Applying this methodology to

healthcare innovation fosters highly efficient and truly outside the box solutions that would not likely be found by simply 'throwing money at the problem'.

For the sake of simplicity, we separate the project into two phases, but there would be considerable overlap between different parts of the project as it moves forward.

Phase 1: Providing QI Services to Hospitalized Surgical Patients

We will provide quality improvement services to well-defined surgical patient groups and progressively engage other patient groups as we automate and increase our process efficiencies. For various reasons described below, we focus on patients undergoing **elective major surgical interventions** (hip, knee, intra-abdominal or thoracic surgeries) **who require postoperative hospitalization**.

Our **first objective** would be the development of the **quality improvement tools** that are needed to perform the comprehensive, scalable, cost-effective, and patient-centric quality improvement that many centres of excellence now routinely

perform. (See attached *New England Journal of Medicine* article for a description of this medical QI trend amongst American centres of excellence.)

As mentioned previously, we have designed, and are continuing to design, these tools to be compatible with widely used systems like REDCap and **electronic health data standards proposed by Health Level Seven International**. This enables a wide range of stakeholder participants to more easily and seamlessly add their specific expertise to the medical quality improvement process (see **Phase 2**).

Rationale of starting with the elective surgical patient population

Providing quality improvement feedback to hospitalized patients undergoing major surgery has numerous advantages that include:

- a. The relative **homogeneity of the patient population and of the surgical procedures** makes it easier to gather meaningful and actionable feedback. This in turn makes it easier to improve the quality of clinical care. This homogeneity also helps us quickly build better tools (i.e., **continuous quality improvement of the process and tools**).
- b. The large number of patients needing major surgeries means we will be able to develop robust QI products for a very 'resource-intensive' group of hospitalized patients. Small, clinically meaningful improvements of metrics, like discharge readiness, can have very positive personal and systemic effects.
- c. Studying elective surgical patients enables us to obtain a **physiological 'presurgical event' baseline**. Being able to measure a 'presurgical trauma' baseline is **scientifically valuable and unique** and could be extremely useful in helping clinicians and academics understand multiple disease processes for which obtaining a physiological baseline is very difficult, if not impossible.

Put another way, the elective surgical QI process would not only permit us to learn from the postoperative complications and to improve prevention strategies, but would also help us gain a better understanding of a defined segment of the medical patient population. An example of disease process parallels would be the association of **postoperative delirium and neurodegenerative pathologies**. This 'baseline characteristic' would be an interesting catalyst to various collaboration opportunities involving patient advocacy organizations, academics, clinicians, health authorities and business stakeholders. The data generated would be fertile grounds for artificial intelligence and big data experts. These types of data initiatives can meaningfully help develop the 'biotechnology ecosystem' that will in turn enable the type of innovation that can truly improve medical care (see **Phase 2**).
- d. As discussed in more detail below, the **opioid epidemic** was in part started by the liberal and unquestioned use of postoperative narcotics. **Surgery is still a very active 'trigger event' to long-term opioid addiction**. There is now a widespread consensus that developing strategies to decrease postoperative narcotic use are urgently needed. Without robust and reliable quality improvement data, it is very difficult to track and reliably decrease perioperative narcotic use. British Columbia has the necessary clinical, academic and corporate expertise to become leaders in this field. What is missing is a way to bring all these experts together. We believe what we are proposing would significantly increase the speed at which we could develop and test narcotic sparing strategies and develop leading narcotic stewardship policies and tools.
- e. Xerus Medical is already participating in a QI pilot project sponsored by Alberta Health Services whereby a group of University of Alberta anesthesiologists and orthopedic surgeons are evaluating patient satisfaction (PROMs and PREMs) and mobility throughout the knee replacement perioperative period. The aim of the study is to get a better understanding of concerns that make a patient's postoperative journey difficult. Using REDCap, the clinician researchers ask patients about their pain levels, nausea, sleep difficulties, mobility difficulties, general satisfaction, etc. This information is cross correlated with various anesthetic postoperative pain relief strategies, with the ultimate aim of developing better therapeutic protocols. Xerus Medical contributes the expertise that makes the data gathering and analysis seamless and cost effective.

Phase 2: Looping in Partners

Improving healthcare outcomes necessitate various types of collaborations. As mentioned above, we are designing our quality improvement tools in a way that enables collaboration and integration of various expertise and technology. Also previously noted, complexity has historically been seen as being more of a problem than as an opportunity. Obtaining, processing, analyzing and visualizing healthcare data from our pilot project will demonstrate the many innovation

opportunities in fields ranging from the development of valid **patient-guided PROMs and PREMs, noninvasive 'patient-centric sensors', natural language processing, big data storage, management, analysis and visualization.**

Below, we briefly present: a) a few examples of potential quality improvement collaborations that could emerge from our pilot project; and b) a non-exhaustive list of stakeholders who would be interested in our pilot project.

a) A few examples of potential collaborations our Phase 1 could generate

Narcotics sparing strategies

The ongoing, devastating **narcotics epidemic** is a small and important example of why we need better QI. This epidemic has refocused attention on the fact that perioperative narcotics use is a significant initiator of long-term narcotics dependence, and that current systems are not designed to minimize narcotics use while also optimizing postoperative patient satisfaction and pain relief.²⁷⁻³¹ Developing regional expertise and an understanding of the relationships between postoperative pain, hospital and home narcotic use, patient analgesic needs, and eventually figuring out how to systematically and optimally minimize postoperative narcotics use, all require the efficient sharing of anonymized QI data. Some would say 'the horse has already left the barn' and that focusing on hospital narcotics use is too little too late, but we strongly disagree.

Clinicians who prescribe narcotics, hospitals and health authorities are all interested in promoting narcotic sparing strategies, but often lack the necessary data to make informed decisions and

to evaluate complex outcomes. Stakeholders developing the tools to gather the necessary data could greatly facilitate the development of narcotic sparing strategies. Companies who have the technology to quantify home medication use would be looped in to help us determine patterns of postoperative narcotics and narcotic sparing medication usage. Patients who have had issues with postoperative narcotic use and an interest in helping us understand the problem and find solutions could be valuable resources. Looping in academics and companies with expertise in the field of remote postoperative patient feedback would eventually be necessary to help determine cost effective ways to integrate various strategies and techniques in remote patient monitoring and communication. A more detailed discussion of this topic is well beyond the scope of this paper, but we believe British Columbia could, under the right conditions, become a leader in this field of perioperative narcotic stewardship.

Biotechnology innovators need better clinical phenotypes

This topic would require an in-depth discussion, but as briefly mentioned above, biotechnology innovation is now heavily dependent on the ability to access good patient phenotypes (i.e., good patient-centric data). A well designed and active phenotype databank could be a powerful 'innovation magnet' for numerous academic and commercial partnerships.

A well designed and active phenotype databank could be a powerful 'innovation magnet' for numerous academic and commercial partnerships.

Managing the back and forth between care homes and the hospital

Aging patients transitioning from living autonomously at home to home support, or to various types of long-term care homes, are requiring more monitoring and tracking technology. The vast majority of healthcare systems separate the care (and data) of patients in artificial administrative silos (hospital, home care, nursing home, etc.). This is historically understandable, but doesn't make much clinical sense, nor is it in any obvious way (possibly **including privacy issues**) beneficial to older patients who can have difficulty advocating for their needs. Numerous companies and

stakeholders are developing technology to help patients remain autonomous or to assist them in dealing with their loss of autonomy, but few are building technology that also helps connect various care silos. Recent standardization efforts like HL7 FHIR could dramatically change the data sharing landscape. There could be meaningful interest by various local technology stakeholders in working with us to build 'patient-centric digital bridges' between the acute care hospital and various long-term care environments.

Patient-Focused Electronic Medical Records

As mentioned above and in the attached *New England Journal of Medicine* publication, Electronic Medical Records (EMR) are notoriously focused on the patient's wallet and not focused on the patient's quality of care. New data sharing standards like HL7 FHIR now make it possible to develop clinically useful quality of care focused EMR that the powerful providers of legacy EMR will not be able to stop clinicians from using by making access to their data difficult or impossible. An open

standard provides the opportunity to develop quality focused EMR which, in the opinion of the author, is one of the most underappreciated opportunities in healthcare, and for many reasons the quality improvement process is the ideal framework to build better EMR.

Stakeholders from industry and academia with an expertise in data visualization, data storage, communication, security, big data, artificial intelligence and machine learning could all be potentially interested collaborators.

b) Potential participants

The following organizations have been identified as potential participants, aligned with the objectives of this initiative:

- [Canada Health Infoway](#)
- The [BC SUPPORT Unit](#) (Support for People and Patient-Oriented Research and Trials)
- Vancouver General Department of Anesthesiology and Perioperative Medicine
- Surrey Memorial Department of Anesthesiology and Perioperative Medicine
- [Innovation Boulevard](#)
- [Simon Fraser University Faculty of Health Science](#)
- [Telus Health](#)
- [The Digital Supercluster](#)

Conclusion

Obtaining, processing, analyzing and visualizing healthcare data are huge innovation opportunities. For the sake of our patients, citizens and innovators, we as a society want to be in the group that is figuring out how to enable and leverage healthcare innovation. Jurisdictions that don't figure it out will buy the technology from those that do.

We propose setting up a quality improvement pilot project that will generate the type of patient-centric data that will help clinicians and administrators deliver better care. The valuable anonymized data we gather will in turn attract various stakeholders who will build the tools that will help BC become a medical information technology and biotechnology leader.

If you are interested in learning more about this project, please contact us at jean.gelinas@xerusmedical.com.





About Xerus Medical

Xerus Medical is a Vancouver, BC-based company that is helping to solve one of the big deficiencies of the perioperative patient journey: the paucity of good patient feedback on which to base quality improvement interventions. Xerus Medical was founded on the premise that implementation of the latest state-of-the-art research findings must be done in conjunction with robust patient-focused quality improvement feedback. We strive to give patients, clinicians and administrators the scientifically valid means to consistently improve care. For more information please visit <https://www.xerusmedical.com/>.

References

1. Basch E. Patient-Reported Outcomes – Harnessing Patients’ Voices to Improve Clinical Care. *N Engl J Med* 2017;376(2):105–8.
2. J Labs. Available from: <https://tech.co/20-accelerators-incubators-healthcare-2017-09>
3. Innovation Boulevard. Available from: <http://www.innovationboulevard.ca>
4. Ward of the 21st Century. Available from: <http://www.w21c.org>
5. Health Innovation Hub – University of Toronto. Available from: <http://h2i.utoronto.ca>
6. Amazon, JP Morgan and Berkshire Hathaway team up on health-care plan ‘free from profit-making’. Available from: <http://www.cbc.ca/news/business/amazon-berkshire-jp-morgan-1.4510071>
7. Kaizen [Internet]. [cited 2018 Jan 17]. Available from: <https://en.wikipedia.org/wiki/Kaizen>
8. The ideal of continuous improvement. *N Engl J Med* 1989;320(21):1424–5.
9. Smith R. Medicine’s need for kaizen. *BMJ* 1990;301(6754):679–80.
10. Glasziou P, Ogrinc G, Goodman S. Can evidence-based medicine and clinical quality improvement learn from each other? *BMJ Qual Saf* 2011;20 Suppl 1(Suppl 1):i13–7.
11. Curcin V, Woodcock T, Poots AJ, Majeed A, Bell D. Model-driven approach to data collection and reporting for quality improvement. *J Biomed Inform* 2014;52:151–62.
12. Dixon-Woods M, McNicol S, Martin G. Ten challenges in improving quality in healthcare: lessons from the Health Foundation’s programme evaluations and relevant literature. *BMJ Qual Saf* 2012;21(10):876–84.
13. Imai M. Kaizen (Ky’zen). 1991. Available from: https://books.google.ca/books/about/Kaizen_Ky_zen_the_key_to_Japan_s_competi.html?id=tCu1AAAAIAAJ&redir_esc=y
14. Timmermans S, Mauck A. The promises and pitfalls of evidence-based medicine. *Health Aff (Millwood)* 2005;24(1):18–28.
15. Henke N, Bughin J, Chui M, Manyika J, Saleh T, Wiseman B, Sethupathy G. The age of analytics: Competing in a data-driven world. Available from: <https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/the-age-of-analytics-competing-in-a-data-driven-world>
16. NSQIP. Available from: <https://www.facs.org/quality-programs/acs-nsqip>

17. Dimick JB, Weeks WB, Karia RJ, Das S, Campbell DA. Who pays for poor surgical quality? Building a business case for quality improvement. *J Am Coll Surg* 2006;202(6):933–7.
18. Bilimoria KY, Liu Y, Paruch JL, et al. Development and Evaluation of the Universal ACS NSQIP Surgical Risk Calculator: A Decision Aid and Informed Consent Tool for Patients and Surgeons. *J Am Coll Surg* 2013;217(5):833–3.
19. British Columbia Patient Safety & Quality Council. Available from: <https://bcpsqc.ca>
20. Improving BC's Health System Performance. Available from: https://www.doctorsofbc.ca/sites/default/files/docsbc_health_system_performance_paper_v8b-web.pdf
21. Canadian Patient Safety Institute (CPSI). Available from: <http://www.patientsafetyinstitute.ca/en/Pages/default.aspx>
22. Canada's Strategy for Patient-Oriented Research. Available from: <http://www.cihr-irsc.gc.ca/e/41204.html>
23. Age Well. Available from: <http://agewell-nce.ca>
24. Alberta Bone and Joint. Available from: <https://albertaboneandjoint.com>
25. Canadian Anesthesiology Society. Available from: <https://www.cas.ca/English/Home.aspx>
26. Cancer Society of Canada. Available from: <http://www.cancer.ca/en/research/policies-and-administration/administration/eligibility-and-requirements/>
27. Medically prescribed narcotics lead to dependence. Available at: <https://www.drugabuse.gov/publications/research-reports/relationship-between-prescription-drug-heroin-abuse/prescription-opioid-use-risk-factor-heroin-use>
28. Alam A, Juurlink DN. The prescription opioid epidemic: an overview for anesthesiologists. *Can J Anaesth* 2016;63(1):61–8.
29. Mudumbai SC, Oliva EM, Lewis ET, et al. Time-to-Cessation of Postoperative Opioids: A Population-Level Analysis of the Veterans Affairs Health Care System. *Pain Med* 2016;17(9):1732–43.
30. Lindstrand AG, Christiansen MLS, Jantzen C, van der Mark S, Andersen SE. Opioids in hip fracture patients: an analysis of mortality and post hospital opioid use. *Injury* 2015;46(7):1341–5.
31. Sun EC, Darnall BD, Baker LC, Mackey S. Incidence of and Risk Factors for Chronic Opioid Use Among Opioid-Naive Patients in the Postoperative Period. *JAMA Intern Med* 2016;176(9):1286–93.