November 6, 2016

Mr. Ed Clark
Special Advisor to the Premier
Government of Ontario
Legislative Building
Queen's Park
Toronto, ON M7A 1A1

Dear Mr. Clark:

It is an honor to provide commentary to your working group studying the e-health investments in Ontario.

During our recent phone call, you asked me to address two topics

1. What is the clinical value (not economic value) of e-health to a society?

2. Should Canada mandate a single EHR per region?

For the past 20 years, I have served as Chief Information Officer and Chief Medical Information Officer at Beth Israel Deaconess Healthcare System, overseeing the electronic systems supporting 3000 doctors, 14,000 employees and 2 million patients. I am also a practicing emergency physician using the electronic tools I oversee. Finally, I am the International Healthcare Innovation professor at Harvard Medical School, traveling 400,000 miles per year around the world to assist countries with healthcare information technology strategy. From that Harvard work, I can assure you that the e-health challenges in Ontario are the same as those in the rest of the world.

Executive Summary

For question #1, it is important to understand the historical work on this topic done by the Rand Corporation in 2005 (http://content.healthaffairs.org/content/24/5/1103.full), the Congressional Budget Office in 2008 (https://www.cbo.gov/sites/default/files/110th-congress-2007-2008/reports/05-20-healthit.pdf), and the OECD Health ICT Benchmarking Pilot Group in 2016 (http://jamia.oxfordjournals.org/content/early/2016/08/20/jamia.ocw111.abstract).

Those studies as well as my personal experience provide an enumeration of the quality, safety, efficiency, patient empowerment, and population health benefits of e-health. I discuss each area in detail.

For question #2, experiences in England, Australia, Denmark, Canada, and the US suggest that one size does not fit all. However, neither does complete e-health entropy provide maximal benefits. I have concluded that a small number of EHRs, certified to provide functionality and interoperability in support of national policy goals, is the best approach. These small number of core systems can be complemented by an ecosystem of thousands of add-on apps or modules that accelerate innovation, but the number of different EHRs in a region should be closer to 10 than 100.

1. Clinical Benefits of e-health

In the historical studies done over the past decade, the benefits of e-health are divided into quality, safety, efficiency, patient empowerment, and population health. I will discuss each individually.

Quality benefits from e-health

What is quality? Countries across the world have implemented different quality measures to help understand variations in care, identify top performers and compare value (quality/cost) of the healthcare delivered.

Measuring quality is very hard. Consensus groups often take into account every possible outlier/exception resulting in quality computations that require numerous data elements, many of which are not gathered as part of the process of care. "Mrs. Smith, did your husband start showing symptoms of a stroke 1 hour/59 minutes ago or 2 hours/1 minute ago. Our quality measure is the use of thrombolytics for strokes less than 2 hours old."

However, done right, the notion of using data to measure care processes and outcomes improves care. For example, I have glaucoma. The United States has created quality measures for all clinicians such as blood pressure control, cholesterol monitoring/statin prescribing, and smoking cessation counseling. All of these are desirable public health outcomes, but more relevant quality process measures for my ophthalmologist would be intra-ocular eye pressure testing, visual acuity testing, and visual field testing. Appropriate outcome measures might be the subjective quality of my eyesight and its impact on my activities of daily living.

Payment reform in the United States will base reimbursement (starting in 2018) on quality, cost, practice improvement, and adoption of electronic tools in support of these goals. Measuring quality with relevant, specialty specific metrics, then aligning incentives to improve quality creates a patient and population level clinical benefit.

Typically, the economic models developed around e-health enhanced quality are based on the principle of patients receiving the right care at the right time, thus reducing billions in unnecessary, wasteful and redundant care. Keeping patients with chronic disease healthy at home is better than treating them once they are already sick.

Why is e-health necessary for quality measurement?

In the era before electronic health records, quality was measured by abstracting key indicators from paper. This time consuming process was generally done on a yearly basis, so clinicians would learn about opportunities for improvement one year after suboptimal practice.

Today, quality feedback can be real time or near real time. For example, the decision support systems of Beth Israel Deaconess tell each clinician what should be done during each patient visit to optimize their quality of care based on medical history.

In summary, e-health provides the foundation to measure quality, ensure pathways/guidelines/protocols are followed by offering real time decision support, and ultimately improves outcomes. Outcome benefits take longer to realize, but they are starting to show (see King, Patel study and ONC website: https://www.healthit.gov/providers-

professionals/benefits-electronic-health-records-ehrs). Quality improvement without data is nearly impossible.

Safety benefits of e-health

In 1994, Boston Globe reporter Betsy Lehman died after receiving an overdose of chemotherapy at Dana Farber Cancer Institute in Boston caused by a research fellow's misinterpretation of the study protocol. (http://www.nytimes.com/1995/03/24/us/big-doses-of-chemotherapy-drug-killed-patient-hurt-2d.html?pagewanted=all)

My wife was diagnosed with Stage IIIa breast cancer in December of 2011 and was treated with the same drug, Cytoxan, that killed Betsy Lehman. However by the time my wife was treated, all orders were written by computers, not humans, perfectly interpreting protocols and patient specific dose adjustments. She was cured without side effects.

There is a large and growing literature on process improvements that improve safety such as electronic prescribing, provider order entry, and electronic medication administration records.

When I was a resident in Emergency Medicine in 1993, all prescriptions were handwritten. The process was very simple - pick up a pen, write a set of directions that few humans other than pharmacists could read, have no error checks for dose/allergies/interactions, and hand it to the patient in 2 seconds. The paper may or may not be altered or damaged on the way to the pharmacy. What happens today? Clinicians securely access an e-prescribing application that requires a fingerprint for additional verification when prescribing controlled substances. Doses are calculated by computer. All previous history is checked for adverse reactions. The completed electronic prescription is sent to the pharmacy, guaranteeing that the right dose of the right medicine for the right patient is dispensed.

Provider order entry includes order sets that not only stop errors of commission (wrong med, wrong dose) but also errors of omission. When my wife's chemotherapy orders were written by computer, they were complemented by a comprehensive order set of supportive medications that minimized side effects as well as doing lifetime dose checking to ensure that each order was safe over the entire course of treatment.

When patients are given an inpatient medication, electronic pill cabinets dispense the right medication for the right patient. However, there is no guarantee that the nurse carries that medication to the right room. Electronic medication administration records enable the nurse to scan a patient wrist band, scan a unit dose bar coded medicine and scan their badge, providing an error check for the 5 rights (right patient, right medication, right dose, right route, right time) as the tablet inserted into the patient's mouth.

In the examples above, I highlight the safety risks mitigated by e-health. As new technologies are implemented we also need to recognize the new risks created by e-health. Imagine that I want to prescribe Atenolol, a beta blocker used for hypertension control. I use an electronic health record that incorporates advanced lookup features and as soon as I type "AT" it immediately brings up the last medication I wrote for that begins with "AT" - Ativan. Without looking, I approve the medication and the patient receives a sedative/anti-anxiety drug instead of a blood pressure control drug. Such an issue would have never occurred with paper-based systems. This example is fictional, but illustrates how new technologies can have unintended consequences.

After 20 years of implementing automation at Beth Israel Deaconess, I can say that without a doubt, e-health has reduced medical error to the point that in 2016 we have a goal to entirely eliminate preventable harm at the hospital.

Efficiency

E-health was rapidly deployed in the US during the Obama administration to meet aggressive multi-stage policy goals and minimal time was spent focusing on usability. The end result is that 40% of clinicians want to leave the profession because the electronic health record is their enemy. In Robert Wacther's book, The Digital Doctor, he includes a crayon drawing from a 7 year old entitled "a visit to the doctor" in which the clinician and computer are on one side of the room while the patient and family are on the other side of the room. Neither is making eye contact.

There is no reason for pessimism. Electronic health records implemented smartly can improve efficiency and be the clinician's ally.

My mother broke her hip in September 2012. She was asked to bring every plastic pill bottle in the house so that her medications could be reconciled, ensuring a seamless transition from outpatient to an inpatient hospital stay for surgery. Instead of sorting through a paper-bag filled with empty bottles, the clinician used an electronic health record linked to the Surescripts e-prescribing network to automatically (and accurately) create a list of every medicine that had been prescribed or reimbursed for my mother in the recent past.

I was recently diagnosed with hypertension and my clinician wanted to understand the relationship of my elevated blood pressure to activities of daily living (driving in traffic, drinking tea, stressful business meetings). I used a bluetooth-enabled blood pressure cuff to send telemetry to my phone and then I used the BIDMC@Home app to send it to my clinician's electronic health record. He was able to diagnose and treat my high blood pressure based on data submitted by me. He determined that I had primary hypertension inherited from my parents because there was no acute medical cause and no relationship of activities/diet/stress to my blood pressure measurements.

We've learned that using the electronic health record for data input alone does not improve efficiency (http://annals.org/aim/article/1692572/meeting-meaningful-use-criteria-managing-patient-populations-national-survey-practicing). However, interoperability for sharing data among providers and patients does spread the burden of data collection sufficiently such that clinician efficiency improves. The key to success is including efficiency improvements as one of the goals of any e-health program and not just asking clinicians to capture more data.

Patient Empowerment benefits of e-health

In 1999, Beth Israel Deaconess began sharing medical records with patients. (http://jamia.oxfordjournals.org/content/13/1/91). Today over 120,000 patients per month view their clinician notes, send secure communications to their providers, and refill medications. At the beginning, many were concerned that patients would find mistakes in the medical record and would sue. Over the past 17 years we've learned that engaged patients and families do find errors and correct them before harm occurs. They are less likely to assert malpractice than a patient who is uninvolved in their care.

Here's an example of how my wife used these tools to achieve a good outcome at low cost with high quality.

She experienced a few weeks of elevated heart rate, unintended weight loss, and brittle hair - all symptoms of thyroid disease. She used the Beth Israel Deaconess secure texting application to develop a care plan with her primary care giver. The first step was a set of thyroid function tests at a local lab 5 minutes from our home. Those results were sent by the lab to an app on her phone and within hours we confirmed she was hyperthyroid. She used the patient portal application to set up an appointment with a specialist the next day at a location a few minutes from our home. At that appointment she was diagnosed with Grave's disease and the clinician electronically prescribed Methimazole to a pharmacy 50 feet from our home. My wife walked to the pharmacy and now a few weeks later, she's symptom free.

Many studies have been done about patient empowerment with e-health (http://www.partners.org/cird/pdfs/CITL_PHR_Report.pdf) and we know that the right tools reduce costs, improve the care experience, and enhance respect for patient preferences.

Population Health benefits of e-health

The terms population health, public health, a learning healthcare system, precision medicine and big data all mean different things to different people.

I describe this entire field of inquiry as "gathering data from patients in the past to care for patients in the future".

Ultimately, all clinical benefits are at the individual patient level, but this is accomplished by improving health care delivery systems and individual provider performance.

E-health has been particularly effective in the United States in gathering data from electronic health records and sending it to aggregate databases for syndromic surveillance, immunization reporting, and reportable lab followup, such as sexually transmitted disease (https://www.ncbi.nlm.nih.gov/pubmed/25581157)

E-health has enabled community wide registries that can be used for identifying gaps in care across populations. Care managers can close those gaps, reducing illness and enhancing wellness.

The Obama administration's Precision Medicine initiative is based on the idea that phenotype and genotype data from the population along with appropriate decision support can be used to discover novel treatments for diseases and to support custom care plans based on the experience of similar patients.

The RAND study (http://content.healthaffairs.org/content/24/5/1103.full) concluded that HIT-enabled prevention and management of chronic disease could eventually double forecasted e-health savings while increasing health and other social benefits. It also concluded that e-health benefits were unlikely to be realized without related changes to the health care system.

Thus to summarize question #1, e-health has demonstrated clinical benefit in quality, safety, efficiency, patient empowerment and population health. Policy goals, redesigned workflow and technology must be implemented in parallel to align incentives and maximize the benefits of

using e-health tools. Simply creating new technologies and forcing clinicians to use them is unlikely to result in much benefit.

2. How many EHRs should co-exist in a region?

In every country I've visited (there are 195 in the world right now and I've been to about half), I've never found a healthcare IT program that succeeds by disenfranchising stakeholders and imposing a single EHR solution from above. Asking users what the want/need, then working collaboratively to deliver a workflow solution that enables them to practice at the top of their license tends to overcome resistance to change and minimize provider dissatisfaction.

The VA, Kaiser, and Department of Defense are completely vertically integrated which means that payers and providers in all sites of care (inpatient, outpatient, emergency, urgent care, long term care) are part of the same organization and management structure. A single EHR platform works in those circumstances. However, when a country has private payers, private providers, or a mixture of a public payer with private providers, there is not a single command and control structure. There will be heterogeneity in requirements and care processes. A single EHR vendor cannot support all use cases. Similarly having 100 different EHRs is unlikely to provide the data integration and care coordination needed by a regional group of healthcare organizations. The right answer is a parsimonious approach - the fewest number of EHRs and technology tools to meet the needs of the region - not 1 and not 100. In Eastern Massachusetts we use about 6. I recently asked a number of experts to quantify their experience with multiple EHRs in a region. The consensus was that the sweet spot for being able to achieve a balance between clinician choice and standardizing work across multiple EHRs is 3 different vendors per region.

What about interoperability among different EHRs?

First, what is interoperability? I believe it is having access to the data you need to coordinate care when you need it without a lot of effort or cost. If clinicians are paid more for repeating tests, they will repeat tests. If sharing records requires a convoluted workflow using some application outside of the EHR, clinicians will rarely take the time to exchange data. If privacy policies do not clearly define consent and allowable uses of data, clinicians will be too intimidated by compliance issues to embrace healthcare information exchange. Make data sharing part of the job/pay program, make it integrated into the EHR, and standardize the process for making data available to all stakeholders who need it, then data will flow.

Having a small number of interoperable EHRs in region will enable the standardization of care in specific ways known to improve clinical outcomes, the ability to operate more as a unified system by having effective information exchange among providers involved a patient's care, and the ability to measure progress toward goals.

None of the benefits of e-health can be accomplished without some degree of commonality in function across the EHR systems. Hence the reason that some kind of certification program is needed to validate an EHR has the minimal functions needed to support regional policy goals.

Although in theory, a single EHR system for region, sounds appealing, in practice it is not practical. Particularly in a setting like Canada which is diverse, many providers are private and independently owned, and where many providers already have EHR systems (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4284187/)

An ideal approach would be to balance the need for consistency with the need for variety to meet different needs by choosing 3-5 designated EHR systems. Given that Canada already has a large installed base, however, this will be a considerable challenge

The biggest issue is getting provider engagement. Since Canada is essentially a single payer system, it could take a carrot and stick approach – make EHR use a requirement, provide transition assistance to get the provider base to EHRs meeting certain criteria, and provide differential compensation down the road for those who adequately use such systems and those who don't. A program that provides requirements and transition incentives for providers to choose systems that meet minimal requirements, with a transition period, is probably the only practical approach

There is evidence from the US that transition assistance needs to include both funds and some organized resources (http://bmchealthservres.biomedcentral.com/articles/10.1186/1472-6963-14-370)

While Canada may not be able to get everyone onto one of the chosen systems, however, moving the majority of the market there and making it increasingly painful for those who want to keep their own distinct systems could be very effective

Limiting the ability of Provinces to set their own requirements is a critical component of success in areas such as privacy related to data exchange, public health reporting, and interoperability.

Defining a nationwide approach for interoperability and requiring that the designated EHR vendors have built-in capability out of the box would be ideal. Ideally, a centralized authority such as Infoway will provide critical shared services to support exchange, like a nationwide provider directory and record locator service. On the policy side, Infoway could also create a lightweight governance framework for exchange that defines basic rules of the road.

What about innovation? The small number of EHR vendors specified for a region will enhance work standardization and data exchange, but it is unlikely the core EHRs will evolve rapidly. Increasingly there is a movement to open EHRs to third party developers so that an ecosystem of add on apps/modules can thrive and accommodate new requirements in parallel (see the Argonaut Project at http://www.argonautproject.org)

In summary, a limited number of EHRs for a region, complemented by add on apps, along with policy and technology enablers for collaborative work, is foundational to achieving the benefits of e-health.

I hope this is helpful to you and I look forward to our meeting tomorrow evening.

Sincerely,

John D. Halamka MD
CIO, BIDMC
Professor, Harvard Medical School