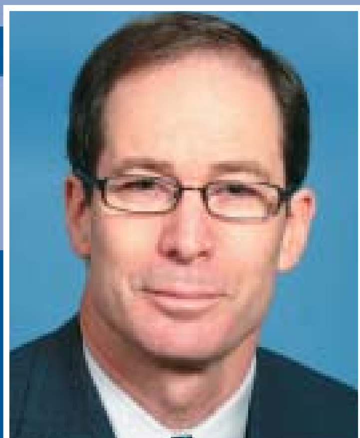

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THE PRESSING CASE FOR AN EHR - THE NEED TO IMPROVE PATIENT SAFETY

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The Problem

Several industries, such as airlines and nuclear power producers, have achieved the status of 'high reliability industries'. They have expended enormous efforts to achieve such reliability in large part because they face very serious consequences, including loss of life, in the event of errors or critical incidents. Such reliability has been achieved through standardization of procedures, design of processes and equipment for reliability, trials for any new equipment or procedures, emphasizing learning from mistakes/near misses, continuous training including simulation of critical situations and training in effective communication for these situations, and staffing for safety with clear designation of back-ups. Surprisingly, health care is still a long way from being able to claim 'high reliability' status. Several recent developments have served to underline the absence of the level of reliability in health care that we have come to take for granted in these other industries, including a realization that our systems for assuring safety are not keeping pace with an increasingly complex health care world and a growing body of research evidence on the extent of medical errors.

Health care has and will continue to become a much more complex endeavour. This complexity is double edged. Medical knowledge itself is growing exponentially and thus becoming more complex. It is, for example, becoming almost impossible for an individual primary care physician to know everything they need to about the drugs they are or should be prescribing, their indications, dosages, side effects and interactions with other drugs. In addition to the increasing complexity of medical knowledge itself, the needs of the people being served by our health system are becoming more complex. An increasing proportion of those served by our health care system have chronic conditions, ones that are not addressed by a simple episode of treatment but rather require ongoing management by a variety of health providers, some based in the community, others in hospitals.

This increasing complexity of care underlines the case for an electronic health record (EHR). An EHR is not an end in itself. Rather, an EHR is key to integrating different service silos and getting health professionals to work together, to achieving a more life-long and less episodic approach to care delivery, to analysis of outcomes and evidence-based practice, to realizing the power of complex genetic and pharmacological knowledge and to connecting front line professionals to best practices and preferred care pathways. EHRs are also key to enhancing accountability and giving patients more meaningful involvement in their care decisions. Perhaps the case for the EHR is most tangible in the context of improving patient safety. There is now broad recognition that the single most important step in minimizing medical errors is an EHR.

A recent Canadian study that examined a broad range of medical and surgical acute care admissions to hospitals suggests that between 9,250 and 23,750 patients die in Canadian hospitals each year as a result of adverse events that are 'highly preventable'. Seven and half percent of admissions are associated with at least one adverse event. Thirty-seven percent of these are considered 'highly preventable'. Five percent of them result in permanent disability, 1.6% in death. Twenty-four percent of the highly preventable events entail serious drug or fluid related events. These results suggest that more people die from preventable adverse events in Canada than breast cancer, motor vehicle accidents and HIV combined. While these results are the most comprehensive to date, they are corroborated by a number of smaller, more limited studies. A study in Ottawa that followed up a sample of internal medicine patients after they left hospital found that 23% experienced at least one adverse event; most of these were drug related. Six percent of the adverse events were associated with

permanent disability or death. The clinical reviewers used in this study judged that half of the adverse events could have been prevented or ameliorated. Another study found that almost half of all serious medication errors result from clinicians not having enough information on either their patient or the drugs that they are prescribing. Further more, research from other jurisdictions indicates that the Canadian experience with patient safety is not unique. Quite comparable findings were obtained from similar research in the U.S., England, France, Denmark, New Zealand and Australia.

A major initiative in the U.S. to identify the most promising strategies for reducing errors found that the single most effective measure to improve safety is to introduce an electronic health record and develop the capacity for computerized ordering of medications and tests. Corroborating this, a survey of senior hospital managers in five countries including Canada found that 80-90% of them said that an EHR was critical to improving patient safety. The Canadian health care system still has much ground to cover in the introduction of an EHR.

The Canadian health care system comprises many health care providers and service organizations. Patients are able to navigate this network relatively freely, obtaining services from a variety of providers/organizations. Each service organization and independent provider has their own approach to the management of health information and deployment of an electronic health record.

At one end of the spectrum, some service organizations may have mature EHRs (paperless hospitals with robust ADT, clinical and clinical departmental electronic systems), integrated with other service organizations (laboratories, pharmacies), and exchanging data in a timely, proactive manner. Other provider organizations may have the rudiments of an EHR, and foster a spirit of communication and collaboration. At the opposite end of the spectrum some health service providers may have minimal or no EHR, rely on an assortment of media (paper, CD, film etc) and communicate on an episodic, reactive basis. In many settings patient information tends to be maintained on an event basis, rather than longitudinally. Current treatment guidelines, protocols and drug therapy information are not readily available at the point of patient care or contextualized and integrated with patient data.

Physicians and other health service providers may be constrained by the lack of EHRs that span the range of health service organizations being used by a patient. Information on health services, medications, and/or therapy provided to patients from service organizations beyond the physician's own setting is rarely available or provided in a timely, proactive manner. Physicians often have to "seek" out important patient information, which if found, becomes available after the patient consult. Many physicians do not have enough integrated information, *at the point of patient care* from all the providers who have provided services to a patient. This denies them the comprehensive picture they need for their decision-making.

Currently points of of health service delivery are not uniformly well connected such that information flows in both directions between health service providers in a timely, consistent manner. For example, a patient's medications are well monitored while they are in a hospital and this is usually supported by a hospital information system EHR. However upon release, the hand off to community health care providers is often not supported by appropriate information transfers or shared information access. Furthermore, our episodic model of treatment presents difficulties in managing chronic illnesses and recognizing what kinds of drugs and therapies work over time - a key to patient safety.

Opportunities for EHR and Supporting Technology to Improve Patient Safety

The primary uses and functions of an EHR typically include Patient Care Delivery, Management and Support Processes, Financial and Administrative Management and Patient Self Management. Secondary uses and functions include Education, Regulation, Research, Public Health and Policy Development. The EHR should, at minimum, support the delivery of effective and efficient patient care, improve patient safety and facilitate management of chronic conditions.

Patient safety is improved significantly when *multiple service providers* have access to a comprehensive, longitudinal EHR. For example, computer assisted diagnosis and chronic care management programs can improve clinical decision-making and adherence to clinical guidelines, and electronic reminder systems can improve compliance with treatment protocols. Improved and immediate access to diagnostic, laboratory and assessment results can reduce health service redundancy and improve quality. The availability of an EHR at the point of care delivery, coupled with clinical decision making tools, can reduce errors adverse events and eliminate unnecessary tests and procedures, contributing to the reliability of service delivery.

Canada Health Infoway (CHI) and health service providers have developed an EHR framework, reference architecture and and technical and data standards to establish a framework for the EHR. This work is fundamental to progress in this area. Many of the health care technology vendors also recognize the importance of creating solutions that provide components of an EHR to support the continuum of care, within and outside of, the walls of health care facilities. An EHR which includes patient information, clinical information (e.g. medical history, lifestyle information), clinical departmental (diagnostic and laboratory results) and medications is often found within the walls of a hospital. By web enabling applications and increasing security functions, Many of the health care technology vendors recognize the importance of creating solutions which provide components of an EHR to support the continuum of care, within and outside of, the walls of health care facilities. Secure vendors are supporting web access to rich and comprehensive patient data beyond the walls of the hospital, at the point of patient care. This is technically viable, economical, and, scalable approach is and available today.

Family physicians and many community facilities lack the financial and technical resources required to acquire, implement and sustain comprehensive EHR solutions such that the ownership of EHR solutions usually exists at an institutional level. Over the span of several years, many hospitals and health regions have made significant yet incremental investments in the building blocks of an EHR. These building blocks include Admission, Discharge and Transfer (ADT), clinical and clinical departmental applications. In many cases, modules or subsystems were purchased from a variety of vendors, prior to establishing an e-health and EHR strategy and roadmap. The result can be a plethora of applications with very little integration, and distribution of valuable patient data across a number of disconnected information silos. Critical patient data also often exist in electronic form in pharmacy or laboratory networks. In other words, the EHR building blocks often exist, but do not communicate with each other to provide a comprehensive history of diagnostics, services, and therapies.

The complexity of integrating the mosaic of relevant applications and data to provide a "seamless longitudinal EHR at the point of patient care" requires significant resource investment and can present significant challenges. Conflicting priorities and financial constraints within hospitals have limited broader integration

initiatives. Replacing older technology with seamless EHR technology is often not financially feasible, or it can be a practical or technical challenge. Even if a well integrated EHR exists inside the 'walls of the hospital', it is not always accessible to other service providers in the community, diminishing the opportunities for collaboration.

Many hospitals are moving towards paperless processes and EHRs with web access available which would be available at the point of patient care in their community. This will help address patient safety. However, it is more powerful if a composite EHR exists that is accessible to all service providers, reflective of health services provided within and outside of the hospital community. Many patients receive an array of health service that transcends community and regional boundaries. Providing secure and affordable access to community physicians, and service providers across delivery sites is key. Secure networks, web access, search and reporting tools, and infrastructure that we now find routinely in financial organizations and high reliability industries could be put in place for healthcare service providers.

A cross jurisdiction electronic master patient index (EMPI) would provide consistent and thorough patient identification processes across all service sites. An EHR supported by an integrated EMPI to perform record linkage can provide enormous benefits by uniquely identifying patients and ensuring that their EHR information is as complete as possible.

Other technologies, which compliment or support a robust EHR include pharmacy networks, provider and location registries, computerized physician order entry systems (CPOE), collaboration tools, decision support and knowledge management solutions. Applications such as CPOE, when coupled with EHRs, can also play an important role in providing physicians with secure and rapid access to electronic order entry tools which include patient based decision trees, treatment guidelines, alerts, and knowledge management tools. These application can help reduce errors in prescribing, ordering tests, and treatments. For example, patients often need to be monitored closely after discharge from hospital, with particular attention to drug therapy. With CPOE, physicians have access to an automated order entry system that flags potential drug interactions.

Given the distributed nature and plethora of systems, methods and media used to recordof patient information across service sites, and financial constraints to integrate applications, and the plethora of media used, it is unlikely that a comprehensive longitudinal EHRelectronic health record, supported by an EMPI, which is accessible at each point of patient care, will be introduced available in the near future. However, inexpensive and secure access methods can be implemented and priorities for patient information can be established such that the institution based EHRs which currently exist can provide physicians with a set of triggers to ensure pertinent questions are asked during patient evaluation. This would be a significant step in increasing the reliability of health services.

Other technologies which compliment or support a robust EHR include pharmacy networks, electronic master patient indexes, computerized physician order entry systems, collaboration tools, and knowledge management solutions.

If a longitudinal EHR does not exist, a partial EHR, which triggers healthcare providers to ask the patient appropriate questions regarding their history, is the next best thing. Additional functionality that seamlessly provides current and relevant information on treatment protocols, drug therapies, guidelines, and alerts can significantly enhance patient safety. Ideally, the EHR should be supported by sub-sets of critical patient data, particularly those captured in pharmacy networks. Complete patient-based medication profiles can catch potential level 1 interactions (those that normally lead to acute care hospitalization) to avoid hospitalization and possible death. Pharmacy information networks can prevent drug treatment issues upon discharge.

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Solutions which promote real time collaboration at the point of patient care and allow the best qualified and experienced healthcare professionals to consult on patient diagnosis and care regardless of location are very helpful in reducing error and providing timely access to specialist and expert services. Real time collaboration tools are particularly useful in settings characterized by shortages of professional resources, non-standard hours, heavy workloads and high demand or remote locations.

Knowledge management solutions which automate the collection, compilation, organization and dissemination of current and context sensitive information can provide significant benefits for patient safety. Knowledge management solutions are designed to promote learning from mistakes, communities of action, best practice sharing, decision analysis, apprenticeship, mentoring and network events, all-important aspects of activities for advancing patient safety. Patient safety is greatly enhanced by providing information which helps physicians better understand safe practices, the application of new therapies, or trends in clinical results to look for possible problems before they occur.

Strategies for EHR deployment to address patient safety

Patient safety can be summarized as the avoidance, prevention, and amelioration of adverse outcomes, events (errors, deviations, accidents) or injuries stemming from health care processes. Although hospitals and health regions are committed to patient safety, a systemic approach to the problem is required. Knowledge sharing, lessons learned, programs, focus on prevention, investments in information management and technology, policy and organizational responses from governments and health regions, are all required to address patient safety. There is no doubt that an electronic health record accessible at the point of patient care can significantly improve patient safety and earn the health sector status as a 'high reliability industry'..

The vision the authors offer for the future is a truly integrated EHR patient management record which is very descriptive, has a high level of completeness and accuracy, and contains built in alerts (go, caution, stop) and triggers, to facilitate informed decision making. Strategies to realize the vision include:

- Federal, provincial and regional health initiatives to develop a data set comprising information elements that are 'pivotal indicators' for patient safety. Improving the quality and completeness of patient information and incenting service providers to collect pivotal indicators such that alerts, triggers and flags can be applied
- Encouraging and funding hospitals and regional health authorities to embark on EHR strategies and deployments. Involving providers to develop strategies for EHR processes and workflows as their support is critical for a successful transition. Service organizations should develop a multi-year (3 to 5 year) 'tactical road map' (plan) with practical deliverables to outline how they will achieve the EHR vision. The plan should identify opportunities and barriers to achieve the EHR vision, set out strategies to address opportunities and meet challenges. Current services, solutions systems and capabilities should be assessed to determine how they can support the vision.
- Designing and implementing best practices and processes which promote patient safety. Configuring applications, particularly with workflow capabilities, to support these processes.
- Building on the work of Canada Health Infoway and best practice guidelines, establish electronic master patient indexes at provincial levels with cross-jurisdictional capabilities. Providing each service setting with the capability to connect.
- Providing physicians with access to comprehensive and integrated EHRs at the point of patient care through improved networks, web and collaboration tools.
- Support the health system with virtual teaming capabilities and equipping physicians with real time e-collaboration tools in the context of EHRs. Connecting service sites and sharing information on a proactive rather than reactive basis
- Defining the change management strategies required to successfully implement patient safety processes, and tools. Shifting the focus and culture from episode management to patient management. Using technology to support patient management and an accessible EHR.
- Empowering patients by providing them with reliable self-monitoring tools, including interactive secure websites to conduct progress analysis and self-assessments.
- Encouraging vendors to develop middleware and interfaces that facilitate manageable and economical integrations of building blocks and applications.
- Promoting sharing of technology investments and skilled technical resources across health regions to reduce costs and risks and fully leverage e-capabilities.
- Focusing on patient safety in the health care system, rather than the needs of individual health care providers.
- Investing in knowledge management solutions to share knowledge and best practices on patient safety practices and models. Shifting cultures to be better aligned with patient safety (cultures which don't share learnings from adverse events or which emphasize punitive dynamics will not advance patient safety).

Despite dramatic advances in patient care, the health system is increasingly complex making the minimization of adverse events an even greater challenge. Many errors related to patient safety can be addressed by focusing on systems and processes. Well designed, secure, and accessible EHRs , coupled with patient safety best practices and optimal processes offer the most important opportunities for improving patient safety.

The health sector faces a paradox. On the one hand, it is offering patients increasingly effective diagnostics and hugely more potent treatments. On the other, its organization and management of service delivery is raising more and more alarm over its capacity to provide these services safely. Given the risks of permanent harm and even death, it is surprising that the health sector has not, to this point, joined the ranks of other 'high reliability industries' and developed the culture, tools and processes to assure a very high level of safety. Perhaps the explanation for this lies in the diffuse, and often unpublicized nature of the harm that is occurring. The demise of patients who are often already sick, suffering harm from care one at a time, here and there lacks the public impact, and subsequent independent inquiry, that usually comes with a major plane crash or nuclear disaster.

This article has pointed to the potential improvements in patient safety that would result from a broadly shared EHR and related tools. The challenge now is to make meaningful progress to realizing this potential. It falls to leaders in the health sector to articulate a compelling vision and case for proceeding down this road and making the necessary investment of resources. A significant part of this case has to centre on the level of harm being done by our health system in the absence of an effective, widely applied EHR.