Health Infostructure and the Cultural Imperative

Michael Shortt and Jennifer Thornhill

If building health infostructure were purely a technological issue, then decision-makers would need only purchase the best hardware and software. In reality, the challenge is only minimally technology-based. Experiences in Canada and abroad have found that successful implementation of e-health solutions requires a profound understanding of end user needs and capabilities as well as a cultural shift in how information is collected, managed, shared and used. Which data will contribute to better healthcare for Canadians? How will that information be used? Who will use it? And how can the data be collected?

For the most part, discussions of health infostructure tend to revolve around issues of information architecture – for example, system scalability (or capability) – as well as system security, access and privacy. Without question, these are crucial issues; for example, the privacy of patient information must be appropriately safeguarded. But even the most technologically perfect system could fail to improve the quality of healthcare if the human factor is not taken into account.

The human factor has several aspects. First, the technology must be developed with the end user in mind. If it greatly increases the workload of the user – doctors, nurses and other health professionals – or does not provide clear value or is difficult to use, the rate of adoption will be low. Second, a skilled workforce is needed to build, operate and maintain health infostructure. Despite the widespread use of information technology in Canada, it has proven difficult to find personnel with the right mix of technological and clinical savvy.

What Is Health Infostructure?

Health infostructure is the development and adaptation of modern systems of information and communications technologies in the health sector in order to improve access, efficiency, effectiveness and the quality of clinical or health services processes (Health Canada 2002). The type of information captured can range from purely clinical data, such as patient test results and medical histories, to system-level administrative data on wait times and health human resources. The application of these data can be divided into two categories based on their intended use: *primary use*, which supports the direct provision of healthcare (e.g., generating immunization reminders automatically [Canadian Health Services Research Foundation (CHSRF) 2006]), and *secondary use*, which supports healthcare service delivery (e.g., improved performance reporting [CHSRF 2008a]).

To a certain extent, the distinction depends on one's point of view. Some believe that the secondary use of data will become the primary benefit of health infostructure. However, the division is not an arbitrary one since the cultural shift involved in using secondary data is far greater than that for primary data. The Ottawa Hospital experienced this first-hand when creating its "data warehouse," which integrated the organization's existing infostructure into a common data-sharing and -storage network (CHSRF, 2008b). This common dataset can be used to make comparisons (for example, to standards of practice or between hospital wards) and inform quality improvements. Overall, the accomplishments have proven far more challenging than implementing each of the individual clinical support systems. One of the key success factors for the project has been having a team of highly skilled specialists – from data analysts to programmers – to tease useful information out of the immense amount of raw data hospitals produce daily. Appropriate people are particularly hard to find, because in healthcare, context is tremendously important and information technology skills are simply not enough (CHSRF 2008b).

Where Does Canada Stand?

A 2007 Commonwealth Fund report ranked Canada last among six Western nations for its use of information technology in several aspects of healthcare (Davis et al. 2007). Nonetheless, large investments in health information technology have been made in Canada – to the tune of $1.2 billion for more than 283 projects, according to Canada Health Infoway (2009a). Implementation is well under way, with many examples of best practices. There are wide variations across the provinces in terms of the application of e-health strategies. Progress in almost all jurisdictions is high for public health surveillance, patient registries and the digitization of diagnostic imaging, but often lags in areas such as provider registries, e-prescribing and interoperable electronic health records (Canada Health Infoway 2009b). To close these gaps, Canada Health Infoway estimates that by 2015, Canada will invest $350 per capita on infostructure – a significant increase from the current level of $133 per capita. The 2015 estimate is more in line with 2009 spending levels for the United Kingdom ($280 per capita) and Veterans Affairs in the United States ($350 per capita) but far below the $570 per capita spent by Kaiser Permanente (Canada Health Infoway 2009a).

In their recent book, *High Performing Healthcare Systems: Delivering Quality by Design*, Baker et al. (2009) identified information technology and the "meaningful measurement" it enables among the key attributes of high-performing healthcare systems. Indeed, international evidence suggests that significant benefits will accrue once e-health strategies are fully implemented. Denmark has used e-prescribing to cut medication errors by more than half, and New Zealand anticipates fewer specialist referrals thanks to its electronic health record system. A literature review suggests that electronically generated reminders increase patient adherence by 10 – 15% (Health Council of Canada 2006).

How Health Infostructure Can Make a Difference

Although e-health will not cure all of Canada's healthcare challenges, there are three areas in which sound health infostructure can be particularly effective: safety, efficiency and coordination of care.

Safe Care

Hospital admissions alone have been estimated to generate 44,000 adverse drug events in Canada every year (Baker et al. 2004). Electronic prescribing or e-prescribing – which is capable of flagging allergies, drug interactions and substitutions – has long been regarded as offering the potential to improve patient safety. Canadian studies have found that e-health can improve appropriate prescribing by up to 18% in primary care settings (Tamblyn et al. 2003). Additionally, in systematic reviews (Garg et al. 2005; Hunt et al. 1998), electronic decision aids have also been shown to increase adherence to clinical guidelines and consequently, the quality of care.

Efficient Care

Several national-level studies have pointed toward potential cost savings from fully functional infostructure. A report by Booz Allen Hamilton (2005), for example, estimated that Canada could save $6 billion annually from an infostructure that costs $1 billion a year over 10 years to implement. A more concrete example is Ontario's Telehealth Network, which saved $5.2 million in travel grants by avoiding 20 million kilometres of travel (Health Council of Canada 2006). Another opportunity is the digitization of diagnostic imaging and laboratory tests, which will virtually eliminate the estimated 15% of unnecessary medical tests ordered due to lost or unavailable test results (Canada Health Infoway 2009a).

Coordinated Care

Health infostructure holds great promise as an enabler of interdisciplinary co-operative care. Team-based delivery of healthcare has been a priority of primary care reform and is especially important for managing complex chronic diseases (Weicha and Pollard 2004). A fully interoperable electronic health record would allow healthcare workers to coordinate care across multiple sites, and avoid the duplication of or conflicting treatments.

Diagnosing the Underlying Problems and Helping Providers become Part of the Solution

Long before improvements in quality of care can be realized, a crucial first step is to identify and assess the underlying problems in healthcare with a view to comparing these to the functional capabilities of health infostructure. For example, some medication errors are dose errors, caused by incorrect directives (e.g., a patient who should take only one pill a day is incorrectly advised to take four pills a day). E-prescribing systems could help resolve these errors (thereby improving patient safety) only if they include integrated standardized directives. Other medication errors are caused by drug interactions, so an e-prescribing system needs to have the capacity to automatically flag drug interaction effects. Both examples illustrate why e-health capabilities must be designed to address the root problems.

"If clinicians do not use information technology to deliver care, there will be zero return on investment too," says Dr. Robyn Tamblyn, a professor in medicine and epidemiology, biostatistics and occupational health at McGill University. The promise health infostructure holds for improving quality can only be met by understanding the environment in which physicians, nurses and other health professionals work, and then equipping, training and inspiring them to apply e-health strategies in their daily tasks. If users see no immediate value, or if the systems are perceived to create undue additional workload, uptake will be hampered. In many European countries, considerable planning has gone into engaging the users of e-health systems, says Dr. Tamblyn. However, Canada has yet to address this issue as part of its national interoperable electronic health record plan.

Conclusion

Although technical and security challenges to e-health persist, the greater challenge is a cultural one. Designing an infostructure that aids healthcare delivery is merely the beginning; to fully harness the power of e-health, organizations must shift their culture to also recognize the value of secondary data in improving safety, efficiency and coordination. Even in a digital age, the human factor is always the decisive one. HQ

Acknowledgement

We thank Dr. Robyn Tamblyn for contributing her time and expertise.

References

Baker, G.R., P.G. Norton, V. Flintoft, R. Blais, A. Brown, J. Cox, E. Etchells, W.A. Ghali, P. Hébert, S.R. Majumdar, M. O'Beirne, L. Palacios-Derflingher, R.J. Reid, S. Sheps and R. Tamblyn. 2004. "The Canadian Adverse Events Study: The Incidence of Adverse Events among Hospital Patients in Canada." *Canadian Medical Association Journal* 170(11): 1678–86.

Baker, G.R., A. MacIntosh-Murray, C. Porcellato, L. Dionne, K. Stelmacovich and K. Born. 2009. *High Performing Healthcare Systems: Delivering Quality by Design.* Toronto, ON: Longwoods Publishing Corporation. Retrieved July 23, 2009. <http://www.longwoods.com/home.php?cat=571>.

Booz Allen Hamilton. 2005. *Canada Health Infoway's 10-Year Investment Strategy: Pan-Canadian Electronic Health Record.* Toronto, ON: Canada Health Infoway.

Canada Health Infoway. 2009a. *eHealth Progress Map.* Toronto, ON: Author. Retrieved July 21, 2009. <http://www.infoway-inforoute.ca/lang-en/about-ehr/ehr-progress-map>.

Canada Health Infoway. 2009b. *Vision 2015: Advancing Canada's Next Generation of Healthcare.* Toronto, ON: Author. Retrieved July 19, 2009. <www2.infoway-inforoute.ca/Documents/Vision_Summary_EN.pdf>.

Canadian Health Services Research Foundation. 2005. *Electronic Decision Support Tools Bring Better Care to the Bedside.* Ottawa, ON: Author. Retrieved July 23, 2009. <http://www.chsrf.ca/mythbusters/html/boost4_e.php>.

Canadian Health Services Research Foundation. 2006. *Improve Immunization Rates with Patient Reminder and Recall Systems.* Ottawa, ON: Author. Retrieved July 23, 2009. <http://www.chsrf.ca/mythbusters/html/boost8_e.php>.

Canadian Health Services Research Foundation. 2008a. *Performance Reporting to Help Organizations Promote Quality Improvement.* Ottawa, ON: Author. Retrieved July 23, 2009. <http://www.chsrf.ca/mythbusters/html/boost14_e.php>.

Canadian Health Services Research Foundation. 2008b. *The Digital Warehouse.* Ottawa, ON: Author. Retrieved July 23, 2009. <www.chsrf.ca/knowledge_transfer/pdf/THE_DIGITAL_WAREHOUSE_ENG.pdf>.

Davis, K., C. Schoen, S.C. Schoenbaum, M.M. Doty, A.L. Holmgren, J.L. Kriss and K.K. Shea. 2007. "Mirror, Mirror on the Wall: An International Update on the Comparative Performance of American Health Care." New York, NY: The Commonwealth Fund.

Garg, A.X., N.K. Adhikari, H. McDonald, M.P. Rosas-Arellano, P.J. Devereaux, J. Beyene, J. Sam and R.B. Haynes. 2005. "Effects of Computerized Clinical Decision Support Systems on Practitioner Performance and Patient Outcomes: A Systematic Review." *Journal of the American Medical Association* 293(10): 1223–38.

Health Canada. 2002. *How Canadian e-health Initiatives Are Changing the Face of Healthcare: Success Stories.* Ottawa, ON: Author. Retrieved July 21, 2009. <http://www.hc-sc.gc.ca/hcs-sss/pubs/e-health-esante/2002-succes/index-eng.php>.

Health Council of Canada. 2006. *Beyond Good Intentions: Accelerating the Electronic Health Record in Canada.* Conference proceedings, Montebello, CQ. Ottawa, ON: Author. Retrieved July 21, 2009. <www.healthcouncilcanada.ca/docs/papers/2006/infoway.pdf>.

Hunt, D.L., R.B. Haynes, S.E. Hanna and K. Smith. 1998. "Effects of Computerized Clinical Decision Support Systems on Physician Performance and Patient Outcomes: A Systematic Review." *Journal of the American Medical Association* 280(15): 1339–46.

Tamblyn, R., A. Huang, R. Perreault, A. Jacques, D. Roy, J. Hanley, P. McLeod and R. Laprise. 2003. "The Medical Office of the 21st Century (MOXXI): Effectiveness of Computerized Decision-Making Support in Reducing Inappropriate Prescribing of Care." *Canadian Medical Association Journal* 169(6): 549–56.

Weicha, J. and T. Pollard. 2004. "The Interdisciplinary E-health Team: Chronic Care for the Future." *Journal of Medical Internet Research* 6: e22.

About the Authors

Michael Shortt, BA (Hons), MA (candidate), LLB (candidate), is an intern with the Canadian Health Services Research Foundation in Ottawa, Ontario.

Jennifer Thornhill, BJH, MSc, is the senior policy advisor with the Canadian Health Services Research Foundation in Ottawa, Ontario.

IT services that improve patient outcomes

We understand the increasing demand for accessible, efficient and quality patient-centered care. For more than 30 years and for clients including provincial governments, hospitals and healthcare regions, our dedicated people from coast-to-coast deliver IT services and solutions that never lose sight of the shared goal to improve patient outcomes.

Contact a CGI healthcare professional to help you:

_ Accelerate transformation to EHR
_ Support chronic disease management
_ Facilitate secure health information exchange
_ Automate hospital administration functions
_ Align IT environments with business requirements
_ Manage applications and IT environments

www.cgi.com

CGI
_experience the commitment™