

Key Trends in eHealth to Propel Health Transformation and Education

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INTRODUCTION

Access, quality, and affordability of health care for citizens—not only for patients living in urban, but particularly for those living in rural and remote areas—have been increasingly brought into focus over the last decade by governments, health organizations, health professionals, and health consumers themselves in all countries. Canada is no exception, as reflected by major health reports by leading Canadian figures such as the Romanow Report¹ that speaks to the need for eHealth, and the tracking of progress in telehealth and electronic records by the Health Council of Canada.²

With the rapid evolution of information and communication technologies (ICT), such as mobile smart phones, tablets and mobile computers, and the reach of the mobile network and the Internet globally and in Canada, technology-enabled health applications, or eHealth, are rapidly gaining ground in providing improved or unprecedented healthcare solutions. For example, electronic health records (EHR) not only improve documentation of patients' health history to help health professionals and individuals to longitudinally track their illnesses and medication usage, but also facilitate population health analyses for trends and costs for health organizations and governments. Using electronic technologies to connect patients and health professionals at a distance—or telehealth—significantly increases the reach of the health system to provide services to patients in rural and remote communities or those with difficulties leaving their homes due to health challenges. This article explores three rapidly evolving and highly important trends in eHealth that are quintessential for health professionals to watch and consider for incorporate into their health practices to improve health outcomes of their patients and the health system—technology-enabled knowledge translation.^{3,4}

Trend #1: From Electronic Health Records to Translational Informatics

With the rapid explosion of biomedical research and knowledge generated, health professionals are finding it increasingly difficult to keep up with the latest evidence-based medical management of

their patients. Computers, mobile phones, and tablets can serve as decision support aids for clinicians to exercise their best judgment in the management of patients. Medical websites such as Up-to-Date (www.uptodate.com) and essential evidence plus (www.essentialevidenceplus.com), and stand-alone mobile phone-based guidelines (www.bcguidelines.ca) developed over the past decade can help physicians to rapidly search for answers to their clinical questions while interacting with patients.

Health systems are increasingly using EHR to support health system-based decision support, linking literature-based evidence with real-life practice experiences. For example, having computerized physician order entry (CPOE) as part of a hospital-based EHR helps prescribers to harmonize their

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medication selections in clinical disease entities based on literature evidence, patient needs, and medication availability in the hospital pharmacies. Tracking health and disease trends, such as the evolving types of skin infections in hospitals or communities due to methicillin-resistant *Staphylococcus aureus* (MRSA), can help health clinics and hospitals to choose the right antibiotic coverage for their patients. The Province of British Columbia has a provincial Pharmanet system (<http://www.health.gov.bc.ca/pharmacare/pharmanet/netindex.html>) to monitor medication usage of B.C. citizens over the last two decades, helping to make decisions as to which medications are to be supported or purchased in British Columbia.

In addition to EHR, genomic data will increasingly be used

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as part of healthcare decision-making processes. Currently, even though certain genes are well known to be associated with medication sensitivities—carbamazepine with Stevens-Johnson Disease⁵ or warfarin hypersensitivity⁶—rarely do patients currently have their genomic data checked prior to prescription of these medications. However, with the decreasing costs of decoding human genomes and the increasing understanding of genomics, proteomics, epigenetics, and the rapid pace of research in these domains, it is clear that in

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the near future, genomic data will become a key part of clinical practice. Already, 23andMe (www.23andme.com) is a web-based service that has been active in offering genomic decoding for the general population at an affordable price to find out about maternal and paternal lineage, ancestry composition and DNA relatives. The service was previously offering health-related genetic reports to inform the person of the types of known inheritable diseases and medication reactions to which one was vulnerable. However, this health-related service was suspended upon the urging of the United States Food and Drugs Administration, as 23andme needed to prove the accuracy of prediction of these diseases to FDA for approval.⁷ There is a call for integrating genomic data into EHR to longitudinally track disease manifestations and correlate them with the person's own genomic data to uncover new associations. For example, the PREDICT project at the Vanderbilt hospital⁸ is a pharmacogenomics project that tailors medication prescribing to individual patients' genetic information as a demonstration of the power of personalized medicine⁹, the customization of healthcare to the individual patient.

Trend #2: Telehealth and Telemonitoring

Traditionally, telehealth refers to the use of ICT to facilitate consultations between clinicians—such as primary care doctors with medical specialists—or between clinicians and patients directly. This approach is most aptly applied for the diagnosis and management of patients in rural and remote communities, or other locations where patients are routinely underserved. The book *Telehealth in the Developing World*¹⁰ and a recent World Health Organization report “Telemedicine: Opportunities and Developments in Member States – Report on the Second Global Survey on eHealth”¹¹ chronicle many exemplars of telehealth in action.

In the last decade, tremendous progress has also been made in telemonitoring, using technologies to monitor patients' conditions and health statuses in real time, whether the patients are in a clinic, hospital, or home environment. These monitoring technologies extend the clinicians' ability to understand the patients' health

conditions in addition to being able to view and communicate with them virtually. For example, weight, blood pressure, oxygen saturation, simple lung functions, heart rhythms and electrocardiograms can now all be easily monitored, continuously if necessary, on patients from the comfort of their own homes, with the results transmitted electronically to monitoring centers of clinicians' offices. These telemonitoring approaches, together with virtual telehealth interviews, greatly extend the access and quality of care beyond the acute care hospitals into community settings.

Trend #3: Mobile Health and Social Media

Mobile and smart phones are rapidly opening up unprecedented opportunities for use in health, also known as mobile health or mHealth. Strategies of use include virtual and continuous monitoring of patients as mentioned in the previous section, and provide connectivity for the individuals to communicate with others in multimedia fashion through social media, videos, and voice. For example, cell phones have been successfully used as heart rate and oxygen saturation monitors, pedometers, diabetes monitors, and pregnancy and post-partum care guides. Mobile EHR can facilitate patients' entering of their own data to track health progress in real time.

Four categories of mHealth applications are increasingly deployed, including:

1. Biometrics monitoring: the aforementioned real-time monitoring strategies through development of peripherals that can be attached to commercially available mobile phones are rapidly expanding. Close-to-commercial release of ultrasound probes or eye screening tools and clinical-grade microscopes are already of large-scale implementation.
2. SMS: text messaging functionality, which is highly popular amongst mobile phone users, is actively being leveraged to assist patients in their knowledge acquisition and behavioural change. Strong evidence is currently accumulating in using text-messaging functions to promote smoking cessation¹² or regular medication usage.¹³ For example Text4baby (<http://www.text4baby.org>) is a highly successful service offered in the United States to promote healthy pregnancy and post-partum well baby care through the sending of a series of timely messages to help mothers with their own health and the wellness of their newborns.
3. Health Apps: educational materials, such as clinical guidelines for patients to follow or information about medications, calculators for health-related numbers such as body-mass index, can be put into downloadable reading materials or even interactive Apps.
4. Mobile social media: many social media sites, such as Facebook, Twitter, Tumblr, and microblogs, can now be accessed through mobile phones. Patients can connect themselves to related communities of shared health interests for knowledge exchange. In addition, clinicians can also communicate with patients to support them in their optimal self care. In British Columbia, the interCultural Online health Network (iCON, www.iconproject.org) endeavours to carry out this support through Web 2.0 to the province's Chinese citizens in addition to other cultural groups, including South

Asian and Aboriginal populations.

Clinicians' roles in eHealth Uptake

Clinicians such as physicians and nurses play pivotal roles in the delivery of health services to patients in all communities. With the emerging importance of entrenching eHealth into our healthcare delivery system, it behooves health professionals collectively to familiarize themselves with the use of ICT for health services delivery and peer communications and consultations. They need to understand the advantages and limitations of ICT and blend this understanding with their health expertise and perspectives to maximize the efficacy of eHealth services in order to match the expectations of their patients and the governments that represent them. In the meantime, health system leaders and health policy-makers also need to steer health reform to incorporate exemplars of eHealth as part of the fabric of improving health access, quality, and cost-effectiveness so as to maximize the leverage of modern technologies into supporting patient wellness, whenever and wherever patients live and work. Serious consideration of how to integrate these eHealth trends into our health care service delivery will help bring success in the future. Calls for integration of eHealth into the core part of training of the next generation of health professionals surface in major reports such as the Global Independent Commission's "Health Professionals for a New Century" report¹⁴ and the Association of Faculties of Medicine of Canada's (AFMC) "The Future of Medical Education in Canada" (FMEC) report.¹⁵

To address the need to integrate eHealth into medical education, the University of British Columbia Faculty of Medicine is introducing eHealth into its new medical school curriculum. Synthesis of the literature on eHealth training identifies the following six core curricular domains to be essential competencies:

1. Knowledge acquisition and management: to pose appropriate clinical questions and be able to access and search electronic resources to locate and compile the relevant evidence to guide current practice; and to document these issues for knowledge dissemination and exchange
2. Critical analysis, clinical reasoning and decision support: to carry out critical appraisal of electronic knowledge acquired, and to interpret through clinical reasoning to apply knowledge to guide patient treatment or health resource allocation; to document actions in electronic health records or surveillance databases and track progress over time; and to identify current evidence gaps that require future research
3. Using technologies for health service delivery: to use electronic technologies such as videoconferencing (VC), desktop VC, mobile devices or tablets, mobile sensors, social media, or other communication strategies to deliver health services or monitor patients remotely; and to understand the limitations of these strategies and what improvements are necessary for continuous quality improvement
4. Intra- and interprofessional communication and collaboration for patient-centred care: to improve communication between doctors, nurses, and other health professionals in order to better coordinate patient care through seamless knowledge exchange, therapeutic decision making, and safe monitoring of patients' progress


5. Communication with patients, the public, and the community: to understand and use electronic approaches such as social media, text messaging, emails and other means to communicate with patients and the general public to improve health services and support them in healthy living
6. Fundamental principles in eHealth: the above five eHealth competencies are underpinned by important core principles that need to be understood including: Privacy and confidentiality of databases, such as electronic health record or health surveillance systems; data quality, documentation, and analysis that determine the usefulness of electronic databases; basics in components of information systems and approaches for selection and usage; and types of electronic tools available to support eHealth, the principles behind their use and their limitations, and how they can be improved in clinical settings

National efforts in eHealth education are also taking place, such as the eHealth education committee of the AFMC¹⁶, and the eHealth expert working group of the CanMEDS 2015.¹⁷

CONCLUSION

This is an exciting time in eHealth to accelerate health system reform, improve health service delivery, and build capacity with eHealth training. These trends also increase expectations for physicians to determine how they will incorporate technologies into their practices. It would be ideal for health professionals and trainees to not only be aware of these eHealth trends, but also actively participate in shaping these trends into routine health practices over time that benefit our communities.

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Extending the Reach of Medical Care for Remote First Nations Communities: Beyond Technology

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As British Columbia's life expectancy (81.1 years) continues to increase for the majority of the population, historically, it has been significantly lower (74.7 years) for First Nations, Metis and Inuit populations.¹ Suicide, traumatic injuries, infectious diseases such as tuberculosis, complications of diabetes, and heart disease are general culprits.² Despite obvious needs in terms of primary and specialty care, recruitment and retention of physicians in remote communities remain a systemic challenge. While the life expectancy differential cannot be accounted for solely by the difference in healthcare providers' distribution, the physician-to-patient ratio is an internationally recognized index of general health. Moreover, the literature

recognizing the effect of the ratio of primary care providers to population as a main contributor to general population health is abundant.^{3,4}

The Aboriginal population has been one of the fastest growing in BC, increasing by 15.3% between the 2001 and 2006 censuses, while the non-Aboriginal population increased by 4.9%. The total Aboriginal population in BC was 196,075 as of 2006.⁵

However, individual communities are small (50-600 people) and widely spread throughout a vast territory. Getting to the local clinic, laboratory or X-ray facility often means travelling by road, air, or water for many hours. Issues such as social isolation, substance abuse, violence, poor compliance with medications, and medical investigations are further significant barriers to the implementation of a reliable, consistent primary

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