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PATIENT MANAGEMENT WITHOUT WALLS

BREAKING DOWN THE WALLS OF HEALTHCARE
Patrick Wong

eHEALTHCARE—CHARTING THE FUTURE HEALTHCARE PROGNOSIS
Paul H Keckley, PhD

HEALTHCARE WITHOUT WALLS—DELIVERING THE FUTURE PARADIGM
Marc Perlman and Brett Davis

BUILDING CONNECTIVITY, INTEROPERABILITY, AND COMMUNICATION IN eHEALTHCARE—THE HEALTHCARE PROVIDER PERSPECTIVE
An interview with Lynn Harold Vogel, PhD, and Rick Skinner

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Breaking Down the Walls of Healthcare

Patrick Wong

The healthcare ecosystem is changing. The confluence of several critical factors is necessitating a comprehensive re-evaluation of healthcare systems and the delivery of care. Established healthcare systems in developed countries will need to adjust to address the predicted chronic disease epidemics and the demands of an aging population. In developing systems, healthcare modernization is a priority as we witness a rising prevalence of 'Western' diseases. The explosion of data and associated implications for data management will also need to be tackled. These exacting challenges will also create exciting opportunities to build healthcare systems of the future that are underpinned by enabling technology. This eHealthcare environment will focus on patient-centric systems that reduce complexity, improve efficiency, and provide better patient outcomes.

The transition towards eHealthcare, a vision of personalized healthcare that encompasses everything from patient empowerment to having a single slice-through view of the patient, will require a move away from an acute delivery platform to one that will focus more on managing the patient for life. This is a move towards healthcare 'without walls', where a connected healthcare delivery platform will be supported by greater use of patient-controlled data, the leveraging of health data through analytics, and empowered patient and physician communities. The adoption of disruptive technologies will also move treatment and patient management beyond the confines of the traditional institution. Increasing use of analytics layered over disparate data sources will help to transform the data mountain into actionable information. These are some of the exciting themes explored in *eHealthcare—Patient Management Without Walls*.

Paul Keckley, Executive Director of Deloitte Center for Health Solutions, provides an insightful perspective on the future prognosis of healthcare delivery. From the concept of the 'medical home' to understanding the realities of healthcare reform and the future landscape of healthcare, he presents his thoughts on the challenges and opportunities facing healthcare providers.

Marc Perlman, Global Vice President for the Healthcare and Life Sciences at Oracle, and Brett Davis, Senior Director of Oracle Health Sciences, discuss how the complexities of healthcare bring about inefficiencies that detract from the core focus: treating patients. From a solutions perspective, Marc Perlman and Brett Davis argue that to make healthcare systems more efficient the infrastructure needs to be able to support continuity of care and collaboration, irrespective of the care setting. Healthcare information technology has the potential to enable connectivity and interoperability that will drive better patient care and, ultimately, improved patient outcomes.

Finally, Rick Skinner, Vice President and CIO for Cancer Care Ontario, and Dr Lynn Vogel, Vice President and CIO of MD Anderson Cancer Center, present their visions for a healthcare environment without walls. They share their expertise and experience of implementing the healthcare information technology roadmap and the strategies used to facilitate connectivity, interoperability, and communication between researchers, physicians, and patients in the rapidly evolving field of cancer care. ■

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eHealthcare—Charting the Future Healthcare Prognosis

Paul H Keckley, PhD

Paul H Keckley, PhD, is Executive Director for the Deloitte Center for Health Solutions (DCHS), the health services research arm of Deloitte. He has had a distinguished 30-year career in health services research in the private sector and academic medicine. He is a health economist and policy expert. DCHS' studies focus on trends in developed and developing systems of care around reform of health systems, disruptive innovations and the role of consumers. The findings are featured regularly in the *Wall Street Journal* and *New York Times*, on Bloomberg, CNN, and Fox News, and trade and professional periodicals. Previously, Dr Keckley served in leadership roles at Vanderbilt Medical Center including international joint ventures, the Vanderbilt Center for Integrative Health, the healthcare MBA program launch and as Executive Director of the Vanderbilt Center for Evidence-based Medicine. He is Visiting Professor at the Vanderbilt University School of Medicine and Adjunct Professor at the Owen Graduate School of Business. He completed his BA at Lipscomb University, his MA and PhD at Ohio State University, and a Fellowship in Economic Policy at Oxford University.

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Healthcare systems are in a period of transition. Buffeted by rising costs and increasing demands for resources, many are flawed systems that need to be fixed. However, the challenges involved in this process have the potential to create many benefits. Transformational solutions will require the adoption of disruptive innovations that leverage technology. Data will be translated into healthcare information that can provide meaningful insight to the provider, engage the consumer, and lead to connected care focused on prevention.

21st Century Healthcare Systems Challenges

Healthcare in the 21st Century must overcome myriad obstacles before it can deliver the clinical benefits of many of the significant advances seen in life sciences and medicine over the past few decades. An increased ability to identify symptoms and risks factors, together with larger data capacity, has given a greater insight into the nature of many diseases. These advances also provide the tools to better predict disease progression, especially in certain populations—a possibility that has many implications for patient management. Here, the focus of care shifts away from facility-based services that react to a patient's condition once identified to a scenario where the condition may be prevented from actually developing or progressing. This is the realm of predictive, personalized medicine. The changing nature of disease detection and treatment will also require a substantial change in the systems of care. The challenge is that many care systems simply do not have the infrastructure to detect and treat diseases efficiently at an early stage.

The economics of modern healthcare present another significant challenge. Healthcare is consuming more resources in both developed and developing systems of the world. In the US, healthcare expenditure is an estimated 16% of the gross domestic product (GDP) and is predicted to continue to rise at 2.5 times the rate of the economy, reaching 20% of GDP by 2016.[1,2] The increase in the number of patients with chronic conditions also has a significant impact on costs, with nearly half of the US population currently afflicted with at least one chronic condition, such as diabetes, obesity, cardiac disease, chronic respiratory conditions, or cancer. Treatment of these conditions accounts for 78% of total health costs.[3] The question then arises as to how do you fund the development of health systems to support the changing demographics of healthcare and the associated economic and resource burden?

In developed systems, health information exchanges (HIEs) have been proposed as one model to assist in forming, maintaining, and strengthening physician/patient relationships for chronic care. The rationale is that HIEs allow physicians to access a complete view of their patients' treatment plans, including factors such as adherence levels. Physicians can then coach patients through the long-term behavioral changes required to maintain their health and keep costs in check.

The way that healthcare information is captured, stored, and accessed also presents a significant challenge. Data allow systems of care to address many of the challenges faced. It is realtime access to data that will provide insight and allow information to be channeled into innovative methods of care. If the mechanisms for capturing data that will inform how healthcare expenditure is distributed are not available and if the data that can identify and connect disease pathways to genetic and environmental factors are absent then the challenges will remain unaddressed. Information tools are being developed online that will help systems to not only retrospectively examine data to develop patterns, but also provide forward-thinking models with predictive value.

Opportunities and Obstacles in the New Healthcare Economy

In the new healthcare economy, the ability to leverage technology to empower individuals to care for themselves will be a significant trend. The connection between electronic healthcare records (EHRs) and personal health records (PHRs) and the ability to tap into clinical data warehouses to analyze and identify the best treatment models is another exciting opportunity.

The development of systems that will harness personalized medicine has the potential to individualize treatment to an extent that no

1. Deloitte Center for Health Solutions, Comparative Effectiveness: Perspectives for Consideration, Deloitte Development LLP, 2009. Available at: www.deloitte.com/us/comparativeeffectiveness
2. The Long-Term Outlook for Health Care Spending, Congressional Budget Office, November 2007. Available at: www.cbo.gov/ftpdocs/87xx/doc8758/11-13-LT-Health.pdf
3. Co-ordinating Chronic Care Management through Health Information Exchanges, Deloitte Center for Health Solutions, 2007. Available at: www.deloitte.com/us/healthsolutions/hie

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generation has experienced before. These opportunities create a need for fundamental system transformations. Systems need to change to facilitate the move towards greater innovation in the design and delivery of healthcare.

There is widespread recognition that many of the current mechanisms do not work or are inefficient—there is too much trial and error. An overarching obstacle is that many current systems are too complex, too expensive, and too fragmented (see *Figure 1*). This results in major issues in cost, access, and quality. Each year new technologies, medical devices, medications, and procedures are added to the continuum of translating research into clinical practice.

Rearview Vision

There is an obvious linkage between having access to more information through EHRs/PHRs and clinical data warehouses and designing processes that are more efficient. This raises the question of how incentives can be aligned so that they encourage efficient and correct healthcare delivery. Historically, policies and regulations have been built around a 'rearview mirror' perspective of the system. This favors systems that are predisposed to taking care of a problem once it occurs.

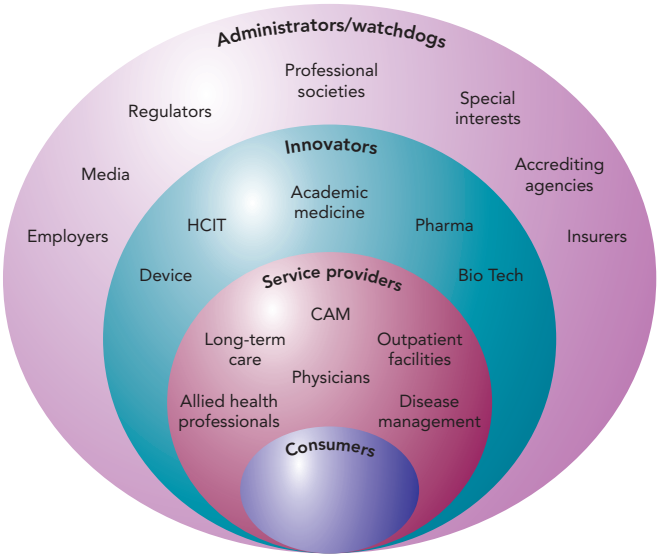
The new trends at the forefront of the healthcare economy are moving towards systems that have a view through the 'front windshield'. This forward perspective allows for the prediction of problems before they occur and facilitates early interventions to mitigate progression of the problem. For example, interventions that have the potential to alleviate the almost pandemic acceleration of obesity or heart disease by mitigating the risk factors. This forward view is information driven. However, while the data are available they are currently not assembled in a way that the end-user can analyze efficiently. A further obstacle has been access to these data. The current paternalistic approach, wherein data access is mainly restricted to physicians as the only group that can apply the data usefully, does not work.

In the world of healthcare policy, there is always the tyranny of the urgent. Policymakers and regulators constantly have to address 'immediate' problems such as lack of facilities, resources, or technology. Tangible results from many of the trends and opportunities that have the potential to transform healthcare will only be seen in 10–15 years' time. Thus, the market compels expenditure in near-term solutions. Therefore, the current view of healthcare is a rearview mirror outlook that treats patients as passive and presumes that doctors and the system paternally guide them through.

The Path Towards Transformed Health—Connected Care

Healthcare is moving away from an acute delivery platform to one that is more focused on managing the patient for life—longitudinal care that incorporates the concepts of wellness and healthy living. Healthcare systems will be challenged to implement meaningful strategies that change consumer behavior by providing levers that effectively and permanently change it. By harnessing technologies and social media, ongoing connectivity between healthcare providers and individuals can be maintained.

Figure 1: The Current Healthcare Landscape



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Shift Left, World Ahead

Intel coined the phrase 'shift left, world ahead'. Assume that the continuum of care is viewed as a horizontal axis, with the patient's home being the leftmost point on the axis and hospital the end-point on the right. Here, 'shift left' signifies a refocusing of efforts away from acute and office-based healthcare services to consumer-focused, personalized technologies accessible to individuals and families at home. The term 'world ahead' represents the ubiquitous potential of digital communication systems and the Internet to facilitate care in the home. This statement differentiates the rearview and forward-looking visions for healthcare. If a system is built from the perspective of the rearview mirror, the shift is not from the acute and office-based healthcare services to the home—it is a shift to the medical office or another facility.

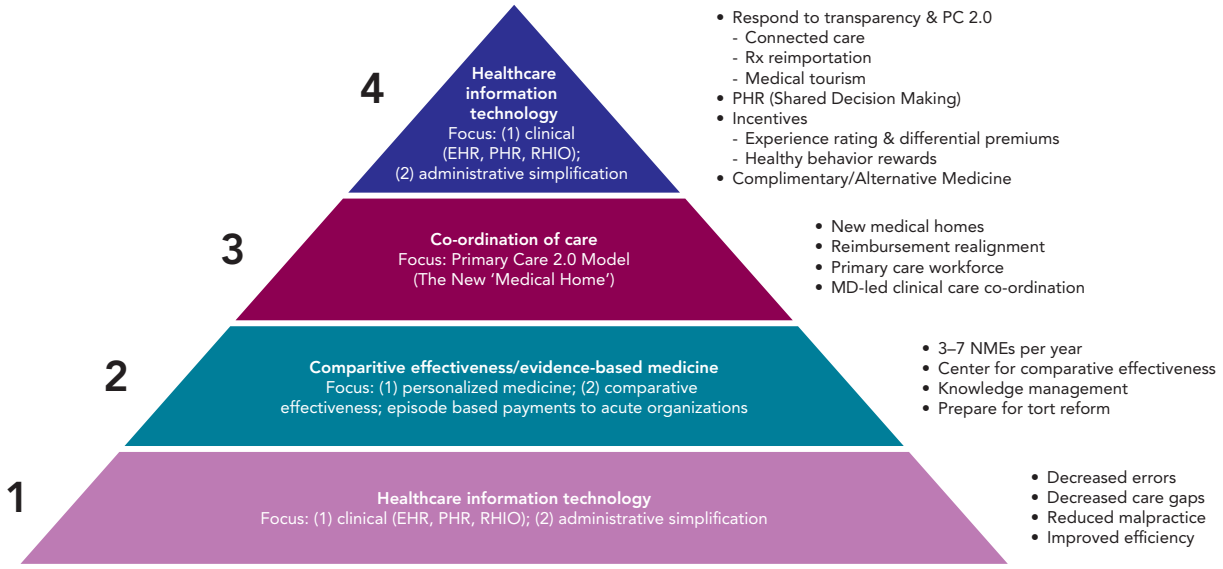
The Medical Home and Connected Care Through Technology

Technology-enabled care at home and the 'medical home' are new models of healthcare delivery that have a common thread. They use 'disruptive innovation' that engages the consumer and aims to reduce costs associated with unmanaged chronic conditions. The term 'disruptive innovation' was coined by Clayton Christensen, Harvard Business Professor and author of *The Innovator's Dilemma* and *The Innovator's Solution*. It describes a technology, process, or business model that brings to a market a much more affordable product or service that is much simpler to use. The change caused by such an innovation is so big that it eventually replaces or disrupts the established approach to providing that product or service.[4]

The current incentives system is based on visits, yet many of the visits to primary care providers do not require a physical examination. Even for an established patient, an intermediate visit could be transacted through an exchange of information. Thus, it could be argued that many of the current incentive systems are misaligned, with a focus on volume rather than outcomes.

4. Christensen CM, Bohmer R, Kenagy J, Will Disruptive Innovations Cure Health Care? Harvard Business Review, 2000. Available at: http://hbr.org/hbr-main/resources/pdfs/comm/philips/disruptive-innovations-cure-health.pdf

Figure 2: The Healthcare Reform Pyramids



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Technology-enabled care at home using in-home monitoring devices in tandem with care management programs to enhance self-care for chronic disease management and post-acute discharge monitoring is one such disruptive innovation that has been proposed as a transformative model.

The technology-enabled connected care model has three features:

- a patient in a residential or home setting;
- a provider relationship augmented by members of the co-ordination team; and
- an EHR linked to a patient's PHR.

This model is a clear representation of the 'shift left, world ahead' idiom. Many of the technologies to support this model are readily available; however, the policies and infrastructure necessary to integrate these technologies and devices appropriately in care management programs are not yet adequately formulated.

The potential benefits of implementing technology-enabled care at home include increased medication adherence, reduced avoidable post-acute complications, and improved self-care management of chronic conditions. These efficiencies in care could produce potential annual savings of 20% or more in healthcare expenditure.[5] However, technology alone is not the key. It must be incorporated into a care management program personalized to an individual's needs and under the oversight of a care team.

The availability of more robust information systems able to capture and manipulate complex clinical data from connected devices and an increased focus on integrated population health management creates an opportunity to converge care management with these technologies. This will augment the live patient–physician relationship with more virtual interactions and provide the potential to better co-ordinate care.

Challenges to effectively implement this model include consumer concerns about health information privacy and security, payment and reimbursement issues, resistance from the medical community, fear of technology, and unresolved regulatory and oversight issues.

Another transformative model is the 'medical home'. This is not a home in the traditional sense. It is a primary care-focused model where co-ordination of continuous, integrated care is under the oversight of a primary care physician.[6] The concept was first introduced by the American Academy of Pediatrics (AAP) in 1967 and referred to a central location for archiving a child's medical record, with connections to specialty services and support functions.

The American Academy of Family Physicians (AAFP) and American College of Physicians (ACP) have developed models referred to as 'advanced medical homes' and the 'medical home'. These enhance the AAP model by integrating care co-ordination features with pay for co-ordination and performance—essential components identified by a chronic care model by Edward Wagner.[7] Primary care clinicians serve as advocates for patients and are paid to co-ordinate their care, thus averting unnecessary tests and procedures, hospital admissions, and avoidable complications. The goal is healthier patients and more satisfied providers, yielding cost savings. This concept differs from the technology-enabled connected care platform in one key aspect: while the medical home concept is under the supervision of primary care physicians, the technology-enabled connected care model may be used by specialists overseeing patients recently discharged from a hospital.

Technology-enabled care at home and the 'medical home' are concepts that require a transformational shift from population-based healthcare to personalized medicine; from incentives based on volume to performance-based reimbursement; and from physician opinion-led care to evidence-based care.

5. Connected Care: Technology-enabled Care at Home, Deloitte Center for Health Solutions, 2008. Available at: www.deloitte.com/us/connectedcareathome
6. The Medical Home: Disruptive Innovation for a New Primary Care Model, Deloitte Center for Health Solutions, 2008. Available at: www.deloitte.com/us/medicalhome
7. Wagner EH, Chronic disease management: What will it take to improve care for chronic illness?, *Eff Clin Pract*, 1998;1:2–4.

These trends are one framework for a forward view of the system. Central to this framework is effective knowledge management underpinned by healthcare information technologies (HITs) that connect the infrastructure. The improved clinical and financial outcomes, if implemented appropriately, can yield a more productive and competitive workforce in an increasingly global economy.

Understanding the Realities of Healthcare Reform

Healthcare reform is often hampered by the economics of the *status quo* and inertia from consumers. Accordingly, changes tend to be incremental. Deloitte has proposed four interdependent areas of focus that provide a solid foundation for systemic reform in the US: essentially a healthcare reform pyramid (see *Figure 2*).[8] The pyramid is a framework for considering healthcare reforms that are timely and necessary. It reflects the fundamental relationships between the key focus areas of HIT, comparative effectiveness, co-ordination of care, and consumerism. In the context of healthcare reform, comparative effectiveness is about aligning care with evidence, reducing inappropriate variation, and reducing costs. Comparative effectiveness requires the organization of information in a way that enables more effective decision-making. The presumption is that data collected from disparate sources—for example from individuals, medical records, laboratory results, and diagnostics etc.—can be structured into information that will help determine which diagnostics and/or therapeutics work best for a patient population with specific characteristics. The raw data need to be in searchable integrated repositories.

In many developed systems of the world, comparative effectiveness is used to define 'standards of care'. In the US, the American Recovery and Reinvestment Act of 2009 has placed new emphasis on comparative effectiveness research. The allocation of funding is partly to encourage the development and use of clinical registries, clinical data networks, and other forms of electronic health data that can be used to generate or obtain outcomes data. For healthcare providers, accurate, relevant clinical effectiveness information available at the point of care could improve the quality and efficiency of care, may reduce avoidable errors, and may spur demand for electronic medical records. However, if comparative effectiveness is used as rule rather than a tool it may lead to restrictions and potentially discourage personalized care. Another important issue will be the need for greater transparency and the ability to structure the information so that it provides meaningful insight to consumers. The increasing use of data will also bring the issue of privacy to the fore. About one-third of the US population is concerned about loss of their privacy and security in relation to electronic PHRs.[9] Privacy issues can be partially addressed by a variety of methods, including encryption standards and civil and criminal regulations. The structures surrounding the oversight of electronic health information exchange will also need to be established and questions remain over which model will be the most acceptable: government-led, public sector-led, or private-sector-led.

Future Prognosis for the Healthcare Landscape

The pressure on healthcare is currently cost. Systems of care based on volume and not performance essentially reward duplicative services and inefficiency. Over the next decade this scenario will change as healthcare delivery embraces economic reality; if this occurs, healthcare delivery will be framed against the cost versus the result of care. Engaged consumers will play an increasing role in their own healthcare management. There will also be a shift from the acute view of healthcare delivery, where the hospital is the epicenter of care, to one where connected care focused on prevention is delivered from a variety of sites. These sites range from the conventional (the primary care office and ambulatory facilities) to the non-conventional (the technology-enabled home, retail pharmacies, and medical tourism). Increased transparency of safety and outcomes is also predicted. The increasing deployment of HIT that facilitates these transitions is set to be another significant trend. The impact of comparative effectiveness will depend on the wide adoption of HIT systems and the use of EHR data. Beyond that is the re-engineering of systems of care to incorporate healthcare information that can be translated from data that are being generated and collected now. ■

8. Reducing Costs while Improving the US Healthcare System, The Healthcare Reform Pyramid, Deloitte Center for Health Solutions, 2009. Available at: www.deloitte.com/us/healthreformpyramid
9. 2010 Survey of Health Care Consumers Key Findings, Strategic Implications, Deloitte Center for Health Solutions, 2010. (Available at: www.deloitte.com/us/2010consumerism

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Healthcare Without Walls—Delivering the Future Paradigm

Marc Perlman and Brett Davis

Marc Perlman is Global Vice President for the Healthcare and Life Sciences Industry at Oracle, responsible for driving strategy and industry enablement across the organization. With more than 28 years in the healthcare industry, he brings extensive experience of working with payers, providers, consumers, and the federal government to improve operational performance, clinical quality, patient safety, and revenue-cycle performance.

Mr Perlman joined Oracle from McKesson Corporation, where over his 12-year tenure, he progressed through operational and sales leadership roles in the healthcare information technology and medication safety and automation businesses. Prior to McKesson, he held executive roles with various healthcare organizations focused on analytics, services, and innovative disease-management programs. Mr Perlman holds a degree in business administration from Drake University.

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Rapidly evolving technologies are reshaping medical knowledge and how diseases are detected and managed. This will be both a boon and a burden. Greater knowledge will facilitate improved care for the patient but will also create more complexity. A complex ecosystem creates an environment that may comprise continuity of care. The concept of healthcare 'without walls' that promotes collaboration and innovation will be central to a more efficient system that focuses on preventive care and longitudinal disease management.

The Complexity of Healthcare

The modern healthcare system has an extremely complex structure. With the rapidly evolving technologies that are reshaping medical knowledge and how diseases are detected and managed, healthcare will become even more complicated. Yet, despite its complexity, the intricate ecosystem that supports it—from care providers to payers, and drug and device companies to regulators and policymakers—only really focuses on one person: the patient.

While there are undoubtedly pockets of innovation, many systems suffer from underperformance, large variations in the delivery of care, and inconsistent outcomes due to gaps in available evidence. These inefficiencies have negative implications on the core tenets of healthcare: quality, cost, and access. Most importantly, these inefficiencies impact the safety of the patient—the person at the epicenter of this complex system. The seminal report by the Institute of Medicine (IoM)[1] highlighted the fact that, in the US, a large number of deaths each year (44,000–98,000) are due to preventable medical errors and that these had an associated cost of $17–29 billion.

Often, the greatest areas of inefficiencies are in the transition points between different care providers and in the continuity of care for the patient. In the future, these areas—continuity and collaboration—will become as important as the traditional core tenets of quality, cost, and access. The complexity of healthcare creates an environment that may compromise continuity of care. Without an effective platform to drive continuity and collaboration, the transfer of information can become fragmented, leading to vital data falling through the cracks.

As chronic conditions with multiple morbidities, such as diabetes, become ever present, the need to address preventive care and long-term disease management will become central to healthcare. By ensuring that transitions between care settings and through the different phases of disease progression are smooth and effective, the quality of care improves. The concept of a healthcare system 'without walls', essentially a new support network of innovation, will help drive this continuity and cultivate collaboration.

Making Healthcare Work Better—The Learning Healthcare Paradigm

The fierce debates around the astonishing figures from the IoM's *To Err is Human* report[1] led to the convening of a series of IoM workshops that set out "to marshal senior national leadership from key sectors to explore a wholly different approach to the development and application of evidence for healthcare".[2] The first of these workshops laid the foundations of the paradigm of "the learning healthcare system".[2] This paradigm advanced the notion that a major force for driving safety, quality, innovation, and value in healthcare will be the creation of information systems that not only facilitate the transition points in healthcare but also capture data for effective learning.

1. Kohn LT, Corrigan JM, Donaldson MS (eds), *To Err Is Human: Building a Safer Health Care System*, Institute of Medicine, National Academy Press, Washington, DC, 1999.
2. Olsen L, Aisner D, McGinnis MJ (eds), *The Learning Healthcare System: Workshop Summary (IOM Roundtable on Evidence-Based Medicine)*, Institute of Medicine, National Academy Press, Washington, DC, 2007.

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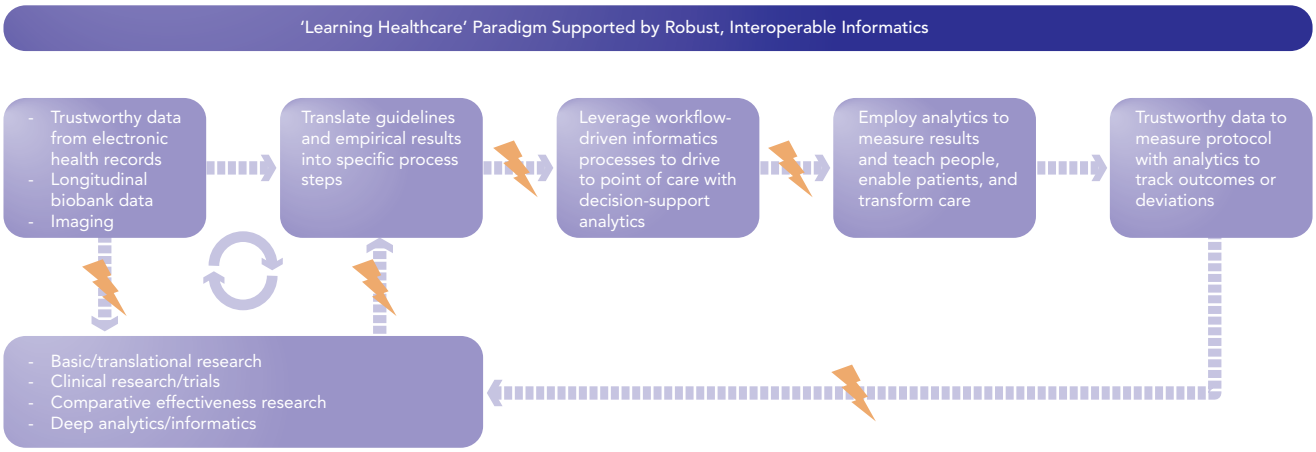
Figure 1: The 'Learning Healthcare' Paradigm Supported by Robust, Interoperable Informatics



… but today's healthcare information technology systems fall short of enabling this vision.

The learning healthcare system would 'generate and apply the best evidence for the collaborative healthcare choices of each patient and provider'.[2] Central to this transformation is health information technology (HIT) as an engine for learning. This is a concept that has also been proposed by other developed nations as a means to drive innovation and improve healthcare delivery.[3]

The overarching concept is that, if data capture is performed in a way allowing effective aggregation and analysis, it will facilitate the understanding of what works and what does not in healthcare (see *Figure 1*). This in turn will help to foster innovation and create new insights that feed back into the system to perpetuate the knowledge cycle. This is learning healthcare as a seamless loop that can learn from every patient/provider encounter to ensure continuity, collaboration, and efficiency. To implement this requires installation of the correct processes and the right information systems to support these processes.

The learning healthcare system also aims to engage and empower patients, align incentives with value and learning, and apply evidence for long-term care—care for life. Despite these aims, many of today's HIT systems fall short of enabling this vision.[4] The learning healthcare paradigm will be information- and knowledge-intensive. This will require data being available at the right time, at the right place, and in a form that is actionable.

Consider the example of current medical literature. A learning environment requires systems that can disseminate information and evidence effectively. Healthcare data and information need to surface at the point of care and encourage collaboration. Yet, the sheer volume of data published can be overwhelming and there is often a very long lag between research and application to clinical care.

This situation has led to physicians turning increasingly to the internet for clinical information. According to two recent surveys 86–89% of US physicians use the Internet to gather health, medical, or prescription drug information.[5,6] The hazard is that physicians may be relying on erroneous information available widely on the Internet. This information is often not connected to the data sets and analytical tools that will augment the clinical decision-making process. In the learning healthcare system, near-realtime evidence-based clinical content delivered by HIT would be the source that physicians gravitate towards to support the practice of medicine.

Personalizing Healthcare

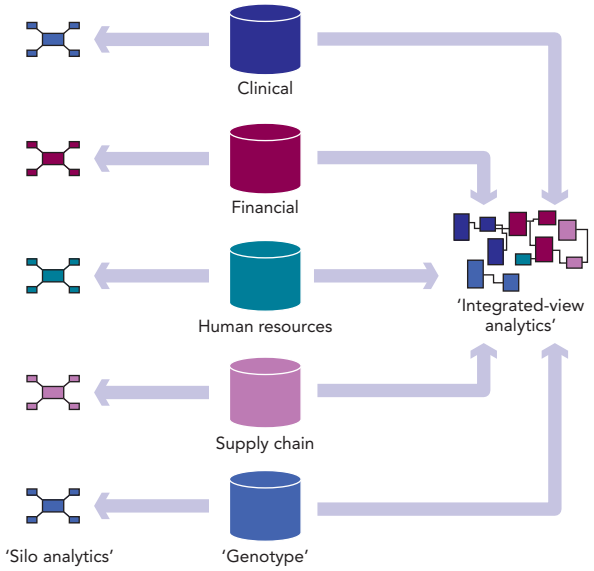
In the complicated network that is modern healthcare, the patient remains at the center. The patient will become a less passive consumer as healthcare is transformed in the information age. As with physicians, patients are increasingly turning to the Internet for healthcare information. A 2008 survey by the Pew Internet & American Life Project found that 61% of US adults looked online for medical information.[7] With the stimulus of electronic health records (EHRs), the potential for patient engagement will continue to increase. The informed and empowered patient will not only help to improve science but will also increase the demand for personalized medicine.

Personalized healthcare is defined by the IoM as "the tailoring of medical treatments to the individual characteristics of each patient"[8] or, put more succinctly, 'the right therapy for the right person'. This is a paradigm that will enable continued innovation in the learning healthcare system while addressing the unsustainable cost/quality challenge.

Personalized healthcare has several potential benefits that will reshape healthcare delivery (see *Box 1*). Moreover, it is increasingly likely that personalized healthcare will be less theory and more reality

3. Ham C, *Learning from the Best: What the NHS Needs to do to Implement High Quality Care for All*, NHS Institute for Innovation and Improvement, 2010. Available at: www.hsmc.bham.ac.uk/news/pdfs/Learning_from_the_Best_Final_PDF.pdf (accessed August 24, 2010).
4. Stead WW, Lin HS (eds), *Computational Technology for Effective Health Care: Immediate Steps and Strategic Directions*, National Research Council, 2009. Available at: www.nlm.nih.gov/pubs/reports/comptech_prepub.pdf (accessed August 24, 2010).
5. Hall & Partners and Google, Custom HCP Study, August 2009. Available at: www.fdasm.com/docs/Connecting%20with%20Physicians%20Online%20Webinar%20Deck--%20final.pdf
6. *Physicians in 2012: The Outlook on Health Information Technology*, Manhattan Research, LLC, 2009.
7. Fox S, Jones S, *The Social Life of Health Information*, Pew Internet & American Life Project, 2009. Available at: www.pewinternet.org/Reports/2009/8-The-Social-Life-of-Health-Information.aspx (accessed August 24, 2010).
8. President's Council of Advisors on Science and Technology, *Priorities for Personalized Medicine*, Office of the President of the US, September 2008. Available at: www.whitehouse.gov/files/documents/ostp/PCAST/pcast_report_v2.pdf (accessed August 24, 2010).

Figure 2: From Siloed Systems to an Integrated Single View



Box 1: The Potential Benefits of Personalized Healthcare

- Shift the emphasis in medicine from reaction to prevention
- Select optimal therapies and interventions
- Increase safety and reduce adverse drug reactions
- Increase patient compliance to care plans through proactive monitoring in the home setting
- Reduce the time, cost, and failure rate of clinical trials
- Reduce the overall cost of healthcare while preserving quality and innovation

in the coming years as healthcare policymakers give the concept greater support.[9]

HIT will play a critical role in enabling personalized healthcare. The excitement generated by molecular technologies is compelling, with tremendous advances in sequencing and the $1,000 genome moving towards reality. If personalized healthcare is to make an impact, however, there is still a vital need to reduce the lag from discovery to validation. To enable the personalized healthcare paradigm systematically, there needs to be greater understanding of the link between biology, health, disease, and the environment.

The hurdles in the way of this reality are simply that many current clinical systems are not sufficient for the information challenge. At the heart of personalized healthcare are data/information, which reside in silos across the healthcare ecosystem. The explosion of data; quantum leaps forward in the understanding of human biology; and the move back from a reductionist view to systems biology have created an increasingly information-rich environment. Despite this, it could be argued that healthcare is still relatively knowledge-poor.

Putting in place the right HIT infrastructure to capture outcomes data that create a better understanding of health and disease and then applying such knowledge in a systematic way to care in a framework that rewards value will be critical for the advancement of personalized healthcare. Importantly, many of the operational reasons for why it is essential to have interoperable HIT systems will also support HIT for personalized healthcare.

Health Information Technology—Healthcare Intelligence

As with the learning healthcare paradigm, personalized healthcare will require deep predictive and prescriptive analytics to provide an integrated view of all the data captured. Insights from combining clinical, biomedical, operational, and financial data will transform the current paradigm into a highly networked medical care system based on proactive treatment and longer-term outcomes. The seamless feedback loop of the learning healthcare paradigm also needs to be supported by robust, interoperable informatics. This framework approach will reduce costs due to inconsistent use of effective interventions and alleviate the risk of errors.

Many of the challenges faced by the life sciences/biopharmaceutical industry are also barriers in the healthcare industry. These industries are constrained by IT legacy factors, such as data silos, which impede the flow of information and prevent a single view of the disparate data (see *Figure 2*). Legacy systems were not built to communicate efficiently with each other. Many were designed to automate very specific workflows within healthcare settings. The interoperability challenges lead to information gaps. Add to this the predicted data proliferation as new EHR systems are integrated and the challenges increase.

Data need to be transformed into actionable healthcare intelligence that drives more-informed decisions and effective and efficient care. The primarily descriptive business intelligence and analytics that are currently deployed—such as dashboards, scorecards, budget, and planning tools—will not be sufficient. Neither will many of the existing clinical decision support tools be adequate to enable health intelligence.

Decision support and business intelligence systems that enable analysis across the disparate data sets, from health, demographic, and financial data, will enable this transformation. The existing core transactional systems can be leveraged or built on not only to improve operational efficiency but also to improve patient care. To protect future IT investments and support a learning system, healthcare organizations will need to plan for the inclusion of metadata on financial transactions, provider and payer details, and demographic information in EHRs. As the core transactional systems become embedded and mature, data aggregation, integration tools, and analytics need to be layered around data silos to create the absolute transformational change in healthcare that is needed.

With the growing realization of the value of leveraging transactional data to drive operational efficiency and enable better patient care, healthcare organizations are increasingly looking to enterprise resource planning tools, customer relationship management, and human capital management solutions. Moreover, healthcare organizations are looking to drive operational efficiency through a shared services environment.

9. H.R. 6498: Genomics and Personalized Medicine Act of 2008. Available from www.govtrack.us/congress/bill.xpd?bill=h110-6498 (accessed August 24, 2010).

Shared operations can help to push efficiency gains in areas such as payroll, supply chain, and procurement.

Delivering the Future Paradigm

The delivery of healthcare is changing. Worldwide, policymakers, healthcare providers, supporting industries, and payers will all play a significant role in the transformation of healthcare from the current reactive model to one that is personalized, predictive, preventive, and participatory.[10] The convergence of systems' approaches to disease, new metrics, imaging technologies, and HIT tools will create a learning healthcare system that uses robust, evidence-based medicine to manage empowered patients.

To deliver this vision there needs to be a technology-driven approach that creates the framework for 21st-century healthcare. Connectivity and collaboration across the main healthcare data foundations will support rapid learning and high-quality care (see *Figure 3*).

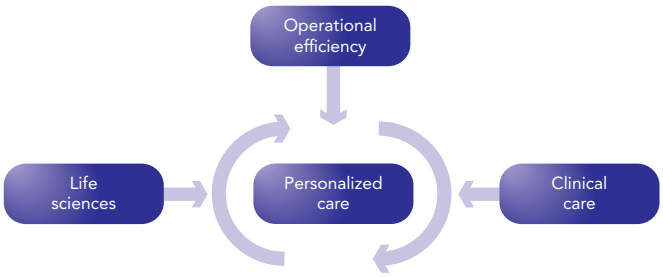
The resources required for secure storage and management of the vast volume of data are an essential consideration. The quantity of data generated each year—including laboratory tests, diagnostic images, prescriptions filled, patient visit logs, and financial transactions—is in the petabyte ranges. These multimodal data sets will require open systems, open standards, or the ability to normalize datasets and bring them together into a common view and workflow.

In the US, the Office of the National Coordinator of Health Information Technology and Clinical Data Systems Interoperability is striving to make open standards available. Personnel are building standards-based reference architectures and reference implementations. Standards, such as Health Level Seven (HL7) for medical information in message packet format, have been established.[11] So have schemes for the transformation of legacy records from a vast array of systems and formats into a common XML-based schema and record. Solutions that overlay existing legacy systems and provide integration engines with out-of-the-box semantic mapping for health-information-exchange support will protect investments associated with legacy systems.

The US Nationwide Health Information Network (NHIN) is a set of standards, services, and policies that are designed to support secure exchange of interoperable health information over the Internet. The NHIN consortium—a group of federal agencies, local, regional, and state-level health information exchange organizations—and integrated delivery networks have been helping to develop the NHIN standards, services, and policies. The initiative requires a comprehensive gateway to be built to connect the 26 NHIN-member agencies to the NHIN infrastructure. This is the CONNECT gateway. Sun Microsystems has been actively engaged in this initiative and its open source technology has been selected as the backbone of the CONNECT gateway software.

Demands for the meaningful use of EHRs and the increasing recognition of the value of leveraging secondary data will create challenges in terms of privacy and security. The largest obstacle is the matter of data ownership and the confidentiality of medical information. How does one ensure that only the right people get access to the data and that systems are compliant with regulations,

Figure 3: Connectivity and Collaboration—An Integrated Approach to Change



such as the Health Insurance Portability and Accountability Act? Identity and access-management solutions will play a crucial role in securing access to information, as well as protecting against fraudulent use. Using a single, standards-based framework for security will help to manage the risk associated with access and compliance management.

Delivering technology that connects patients, providers, and other members of a patient's support network will improve care. US Oncology's EHR system, iKnowMed, provides a network of over 800 oncologists with centralized access to comprehensive patient information. The migration from a paper-based environment to the iKnowMed system has enabled increased insight into treatment progress that facilitates intelligent and compassionate decision-making for providers. In addition, the system can identify viable patient candidates for clinical trials to support research initiatives for physicians participating in the US Oncology Research network. The Oracle Beehive suite allows providers to connect with peers or global experts on rare conditions. It also allows patients to interact with specialists without requiring an in-person consultation. This allows care-givers to improve access and the quality of care delivered to their patients, especially those with chronic diseases.

Conclusions

Healthcare and the life sciences are converging, because many of the established business models are challenged by an innovation gap and external pressures. Providing long-term care to improve outcomes requires the healthcare system to capture and have access to the right data to ensure that the care delivered is optimal for individual patients.

The challenges of creating a healthcare system using a 21st-century information ecosystem are many, but not insurmountable. The right HIT infrastructure is imperative to support a personalized, value-based, affordable, 'rapid-learning' healthcare system. The tools required to capture data and crystallize decisions in support of evidence-based initiatives, to improve healthcare outcomes and efficiency, are available.

Enterprise health analytics will help address the core challenge of aggregating data from all the multiple domains—clinical, financial, operational, and research—to provide an integrated comprehensive view of those data. The walls will need to be taken down; data will need to flow freely but securely, all the way from life sciences organizations through the providers to the patient. ■

10. Weston AD, Hood L, Systems biology, proteomics, and the future of health care: toward predictive, preventative, and personalized medicine, *J Proteome Res*, 2004;3(2):179–96.
11. http://www.hl7.org/ (accessed September 14, 2010).

Building Connectivity, Interoperability, and Communication in eHealthcare—The Healthcare Provider Perspective

An interview with Lynn Harold Vogel, PhD, Vice President and Chief Information Officer, University of Texas MD Anderson Cancer Center, and Rick Skinner, Vice President and Chief Information Officer, Cancer Care Ontario

Lynn Harold Vogel, PhD, is Vice President and Chief Information Officer (CIO) at The University of Texas MD Anderson Cancer Center (UT-MDACC) in Houston, Texas. The Center is the world's largest and is consistently one of the highest-rated facilities devoted to the prevention of cancer, research into cancer, and the care and cure of cancer patients. MD Anderson has been named in the CIO100 list of the most innovative IT organizations. Dr Vogel is also an Associate Professor of Bioinformatics and Computational Biology at UT-MDACC, and an Adjunct Professor of Management at The University of Texas School of Public Health. At UT-MDACC, he serves as the Senior IT Executive. He also serves as a faculty member for the College of Healthcare Information Management Executives (CHIME) CIO Boot Camp experience. Dr Vogel was awarded one of ten 'Best in Class' designations for his work in bridging clinical care and research through IT. His education at the bachelors, masters and doctoral level was completed at the University of Chicago. He is a Fellow, Charter Member, and a Trustee at CHIME, a member and Fellow of the Healthcare Information Management Systems Society (HIMSS), and a member of the American Medical Informatics Association (AMIA).

Richard I Skinner is Vice President and Chief Information Officer (CIO) of Cancer Care Ontario. He is a healthcare IT executive with over 25 years' experience in healthcare information systems, including positions such as CIO for health systems and a medical research laboratory, independent consulting, and as project manager for the development and implementation of the US Department of Defense's global medical information system. He is currently Vice President and CIO of Cancer Care Ontario, responsible for providing IT and information management for the province's cancer, chronic kidney disease, and access to care programs and services. He was formerly a director at Navigant Consulting, a global professional services firm specializing in healthcare and litigation support, and was responsible for the healthcare IT practice. He was also Vice President of First Consulting Group (FCG), a healthcare-IT-focused firm active in helping its clients in provider, health plan, government, and life sciences organizations achieve their goals through the use of IT. He led the outsourcing business unit for FCG. Mr Skinner was previously Vice President of Information Services, and CIO for the Providence Health System, a $4 billion dollar organization which operates hospitals, a health plan, and various physician practices and manages numerous home health and long-term care businesses across the four western states in the US. Mr Skinner was also a US Army officer, retiring as a Lieutenant Colonel after leading the army's healthcare IT initiatives as a program manager as well as performing in army command and leadership roles. Rick is an author and frequent speaker on healthcare IT as well as a leader in US national organizations such as the College for Healthcare Information Management Executives and the Certification Commission for Healthcare IT. In 1994 he received the Healthcare Information Executives Forum Crystal Award for Excellence. Most recently, he received the John Gall Award for Healthcare CIO of the Year at the 2002 Healthcare Information Management Systems Society (HIMSS) Conference.

In the eHealthcare environment data-rich networks supported by predictive analytics and realtime computing capabilities will not only enable connectivity and collaboration within the walls of a healthcare system, but also between the converging disciplines of health and life sciences. Transformative technology solutions, coupled with technology-centric legislation, will create tremendous opportunities. The resulting improvements in the flow of information from data capture to analysis and actionable information can accelerate the transformation of innovative research into clinical reality as well as encourage communication between healthcare providers, carers, and patients.

Addressing the Challenges of Modern Healthcare

The modern healthcare organization is faced with unique challenges, from realigning incentives to transforming quality of care with an engaged consumer. Moreover, many organizations are not only focused on care delivery but are also specialized research institutions. In the field of cancer care, this is particularly prevalent, with the concept of translational medicine—or 'bench-to-bedside research'—very much a core focus. Add to this the prevailing move towards more personalized and evidence-based medicine, which cancer care is very much at the forefront of, and the picture is one of very specific challenges that require very specific capabilities.

'Making Cancer History' is the central tenet of the University of Texas MD Anderson Cancer Center. The world-renowned cancer center endeavors to meet this goal with integrated programs in patient care, research, prevention, and education. The demands of such a large, complex organization are supported by a health IT (HIT) infrastructure that aims to facilitate connectivity and interoperability across disparate transactional and clinical systems and enable a collaborative environment between all of the major stakeholders, from researchers, oncology specialists, and referring physicians to administrators, business managers, and patients.

For Lynn Harold Vogel, MD Anderson's vice president (VP) and chief information officer (CIO), ensuring that this complex organization runs efficiently presents both interesting and unusual challenges: "The IT organization needs to support a fully integrated, academically-oriented cancer centre. This means providing IT support across the spectrum from research to education to prevention to clinical care, as well as supporting the financial and administrative back-office. This is a fairly broad portfolio compared with other IT organizations in healthcare, which either focus on the clinical care aspect or the research aspect." MD Anderson's IT group currently comprises approximately 700 people across about a dozen different departments. The multifunctional personnel that make up the IT group are all focused on supporting their customers, from direct support of applications to supporting activities such as project management and security.

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At Cancer Care Ontario (CCO), the challenge is to ensure that its HIT strategy can support cancer care across the region. Cancer Care Ontario's mandate is to facilitate quality, accountability, and innovation in the province's cancer care system with the implementation of HIT and eHealth systems. CCO's 2008–2011 Ontario Cancer Plan has six main goals, which are to:

- reduce the incidence of cancer;
- reduce the impact of cancer through effective screening and early detection;
- ensure timely access to effective diagnosis and high-quality cancer care;
- improve the patient experience across continuum;
- improve the performance of cancer systems; and
- strengthen translation of research into improvements in cancer control.

More recently the CCO's mandate has been expanded to include managing the provision of care for chronic kidney disease. What this means is that CCO oversees the operation of a significant part of the overall health system within the province of Ontario. To achieve this, CCO has to allocate funding for various procedures, diagnoses, and treatments and so on, as well as setting the quality standards and metrics for those procedures and processes. Within the approximately 700 personnel at CCO, about 500 are employed within an IT capacity. According to Rick Skinner, VP and CIO for CCO, "In order to be able to set all these standards and measure performance against them, eHealth or digital information about the performance of the health system in those areas will be critical. It is about providing actionable information on the health system to decision-makers."

Sharing Expertise and Experience

MD Anderson's primary goal is making cancer history, and CCO's primary mandate is to meet the goals of the province's cancer plan. The need to share knowledge efficiently within the organizations and beyond is paramount to achieving these critical mission goals. Customer-focused systems that support the often rapidly-changing needs of the organization are also essential.

"MD Anderson made a decision some years ago to develop the electronic medical records (EMR) system in-house, which is very unusual," notes Dr Vogel. "There are probably less than a half a dozen healthcare organizations in the US that are actively conducting software development. We are making excellent progress in that area. The development teams are focused on supporting and innovating clinical care as well as cancer research through its own application development."

The custom-built EMR system at MD Anderson combines patient data from both the treatment and research sides of the organization. On the clinical side is the EMR application called ClinicStation, which has evolved over the last decade to become a flexible workflow system that can collate data from 40 back-end systems. This ensures that patient records are accurate and up-to-date and provides physicians with a complete view of a patient's history. On the research side, MD Anderson has developed ResearchStation. A third product called TissueStation has also been developed, and will assist in the management of biospecimens, an area that now plays an integral part in cancer diagnosis and treatment (see Architectural Foundations for Translational Healthcare). The primary goal of these applications is to assist the dissemination of important data within the organization. The implementation of an enterprise resource planning (ERP) system will support both clinical and business processes.

At CCO, challenges arise from the fact that data come from a variety of different sources across the province and not from a single institution—the epitome of 'healthcare without walls'. These data then need to be aggregated and rationalized before the appropriate questions can be asked and the right decisions made. This raises the question of jurisdiction, in terms of IT strategy and implementation. "You are faced with two answers to that problem," says Rick Skinner. "Answer number one is, typically, to implement the same set of systems for everyone. Answer number two is to let each stakeholder choose the system they want and then address the challenge of infrastructure support, interface development, and integration. In Ontario, like most jurisdictions, we are stuck somewhere in the middle."

While it would certainly be more efficient to have everyone using the same laboratory systems or computerized physician order entry (CPOE) system, the reality of historical legacy systems, timing, and other factors, precludes this. The issue then, at the very least, is to look towards standardizing data elements to ensure that data can be used efficiently by multiple stakeholders. The challenge continues to be how to seamlessly let data and care information flow throughout the healthcare continuum of care.

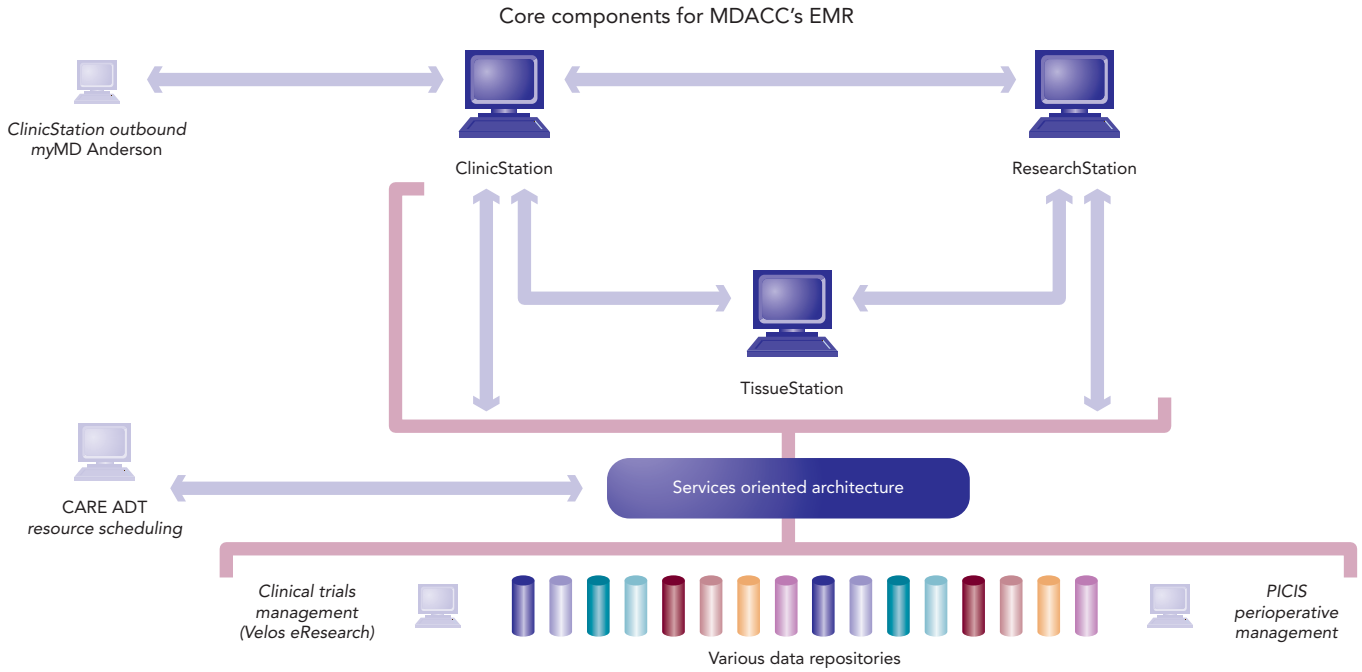
"CCO has had, over the past five or six years, a consistent strategy toward improving the performance of the cancer care system. That strategy includes a combination of incentivizing change through paying physicians incrementally for improvements, increased accountability through measurement and public reporting of performance, and an extensive and well co-ordinated clinical network," says Rick Skinner. The IT strategy to support these targets has evolved into a concept called 'instrumenting the health system'. This concept is based on identifying the information required to manage performance, developing or acquiring the systems necessary to collect that data, and finally using informatics to analyze and report on the data sets. Essentially, this is about developing systems that foster interoperability and communication among the cancer care community and patients in Ontario.

Architectural Foundations for Translational Healthcare

The vision of translational medicine and, by association, personalized medicine, is reliant on very different data sets to the historically discrete data that healthcare is accustomed to.

At MD Anderson, mainframe systems housed many different types of data—both relational and non-relational, including proprietary database systems. The aging architectural model presented several challenges in terms of integrating patient-centered information. For example, the complexities involved in extracting proprietary data meant that the organization only extracted and loaded data for analysis. As a result there were very limited data transformation processes. The characteristics of biospecimens and genomic data are less about discrete items, such as a particular image, and are more focused on pattern-matching and the interpretation of

Figure 1: Facilitating Connectivity Through a Service-oriented Architecture Framework



patterns of data. This can create problems in terms of integrating these new data types via traditional HL7 interfaces. Furthermore, the vast volume of genomic data being collected can become unmanageable within a single data model and repository structure. Any barriers to incorporating new data models into clinical systems environments will be a large constraint on improving healthcare. For MD Anderson, a move to service-oriented architecture (SOA) was the framework around which the vision of translational medicine is being built.

"The services architecture enables us to have a virtual data repository, which means that new forms and structures of data can be introduced into the matrix without having to change the underlying data model every time you have to add a new source of data," says Lynn Harold Vogel. "The historical models of interoperability were about moving discrete data from one point or database to another. These database models relied on single, physical data repositories, with HL7 interfaces. Interoperability challenges within MD Anderson have been solved with SOA. An SOA platform provides the organization with an enormous amount of flexibility in terms of how we build processes and capabilities to support the business (see *Figure 1*)."

The SOA architecture also facilitates the custom-built EMR system at MD Anderson. Many existing clinical systems do not have fully integrated image capabilities. Images typically have to be stored in a separate picture archiving and communication system (PACS), which presents problems of access and interoperability. At MD Anderson, the clinical component of the EMR, ClinicStation, provides immediate access to images because the SOA framework enables the PACS to be 'exposed' as a service to ClinicStation product and 'consumed' by the physician. The ResearchStation environment, which is built in open source Java, is intended to enable integration of research data (e.g. biomarker data) with data from clinical practice. TissueStation has been developed to manage biospecimens. These components are all brought together under what is probably one of the most fully implemented SOAs in healthcare and provides a focus on clinical transactions.

The challenge of realizing the vision of translational medicine is approached from a different perspective at CCO. "We have a strategic initiative around personalized medicine to try to gauge how quickly we should adopt genomics and other similar technology into the operation. The real challenge is to determine appropriateness. In theory, we could attempt to collect the genome for every citizen in Ontario, store the data in a depository and use the data to assist improvements in cancer diagnosis and treatment. However, such a strategy will not only be hugely expensive but also will have enormous privacy issues," says Rick Skinner. One area that CCO is currently engaged in is assessing the testing of certain genotypes in breast cancer patients that may preclude the use of a particular systemic therapy.

Decision Support Systems for Better Care

The continuum of care as defined by CCO starts with prevention and continues through to palliative care or recovery (see *Figure 2*). CCO's initiatives for 'instrumenting' this continuum include decision support systems that are designed to help the physicians using the available information—from data to information to action.

At the screening stage, CCO has established the InScreen CRM system for increasing screening rates for colorectal cancer. A combination of systems have been implemented at the diagnostic and treatment phases. This includes the Diagnostic Assessment Pathway system, which is in essence a map of the diagnostic journey for specific cancers. At the treatment phase for systemic chemotherapy, CCO has established a cancer-specific CPOE system that provides decision support to physicians. To optimize outcomes, it is essential to reduce medical error. As healthcare delivery moves away from the traditional physical confines of treatment within the walls of a single institution, the risk of errors may increase along the transitions points between different care providers. Collaboration and continuity of care will need to transform to address the changes

Figure 2: The Continuum of Care for Cancer at Cancer Care Ontario

in healthcare delivery in the future. The CCO CPOE system has been used by more than 1,000 physicians, 750 nurses, and 250 pharmacists, serving 50,000 Ontario patients; and 250,000 orders are placed through the system annually. Data from CCO indicates that the CPOE system has helped prevent approximately 8,500 drug errors, 750 hospitalizations, and 500 physician office visits annually.

ClinicStation is the scalable foundation of a custom-built EMR system at MD Anderson. It is an application that can present data from legacy systems and has also been designed to be flexible, allowing for continual upgrades to handle increases in patients, data, and functions. The accuracy of data served by ClinicStation assists decision-making for both physicians and nurses and has helped to increase the productivity of medical staff and enabled better patient care.

Breaking Down the Walls and Engaging the Informed Consumer

Healthcare is moving beyond the traditional four walls of an institution and into a wider domain that incorporates primary care professionals, increasingly informed consumers and communities, and even technology-enabled care at home (the 'medical home' concept).

For many cancer patients and care providers it can be a challenge to communicate the physical and emotional pain caused by cancer symptoms. Many symptom assessment tools are paper-based, which means that they may not always be accessible and easily shared across care settings. "As part of CCO's eHealth initiative, the Interactive Symptom Assessment and Collection (ISAAC) tool has been developed to allow patients to complete an interactive version a standard cancer symptom assessment tool" says Rick Skinner. ISAAC, a standardized, secure, system accessed through touch-screen computer kiosks is in operation in cancer centers across Ontario and puts patients in control of their own symptom assessment and engages them directly in the symptom management process. Patients can also access ISAAC from their home computer via the Internet.

Clinicians have access to the patient's symptom information and this information can be tracked over time and across health care settings. Preliminary evaluation of ISAAC has been positive from both patients and physicians. Other CCO initiatives to engage the patient include access to information on wait times for various procedures via a public website and the publication of monthly and annual scorecards that provides a comprehensive set of cancer indicators from across the province. With patients having access to more information, they can make more informed choices about their healthcare.

"Healthcare organizations have traditionally built their architectures around systems that exist within the four walls of an institution," says Lynn Harold Vogel, "the expectation now is that you need to share that data outside the institution and SOA can enable this connectivity. The question about interoperability is not about applications, it's about architecture."

The SOA environment at MD Anderson helps to break down the traditional walls of healthcare by servicing the myMDAnderson web portals. Patients can access their electronic health records (EHR) via the web portal and see certain information, such as schedules and reports. The portal also allows patients to communicate electronically and securely with their physician team.

The myMDAnderson site also includes a physician portal, which allows referring physicians access to data on their patients who are being cared for at MD Anderson. This data can be incorporated into local treatment plans for their patients. The portals are an essential component of MD Anderson's eHealthcare strategy to engage patients and care providers outside of the hospital setting. While the common approach for healthcare organizations has been to use the marketing potential of the web, MD Anderson has focused on developing its internet presence as a fundamental part of its business processes and workflow.

"The number of communities on the internet is growing at a very quick rate. I think we are starting to see the impact of social networking on healthcare, which adds a whole new dimension to communication and support," notes Lynn Harold Vogel, "We are seeing much more collaboration among our clinicians and our researchers. The recognition is that one person solving one problem is probably not very effective and that many people working on a set of problems and identifying options and solutions will see most of the value."

Enhancing Communication by a Common Language

The vast volumes of data generated by healthcare organizations only has value if it can be managed efficiently and turned into actionable information. However, as in any large organization the data can come from several disparate sources. To further complicate matters, data from the same source may be separated by different definitions and the terms. "In the provision of healthcare and in particular cancer care, the interpretation or the reading of pathology specimens has always been a challenge because you have an individual who is bringing his or her experience/expertise to bear in interpreting what that particular specimen means and then providing an interpretative report that goes out to a physician, who then makes a decision based on this report," says Rick Skinner.

In Ontario, a large-scale effort is in fact under way to replace narrative reporting, with all its potential for misinterpretation, with synoptic reporting or discrete data reporting that uses standardized checklists for the recording of observations for cancer specimens. This system currently covers five different forms of cancer

and it is hoped that over the next few years the coverage will grow to cover virtually all cancer pathologies. Synoptic reporting will improve the information for cancer staging and ensure that decision-making about a patient's treatment is more precise.

"Part of the problem is of standardization and of reaching common understanding about terminology, of being able to use common terminology across different applications," notes Lynn Harold Vogel, "in this area, there is enormous promise in how we think about semantic technologies within the context of healthcare, but we are still in the very early stages and semantic technologies are very much in the realm of research at this point."

The Future for Healthcare IT

eHealthcare and healthcare without walls, driven by transformative technology, is currently in the phase of implementation, according to Rick Skinner, so the emphasis in HIT is about upgrading or putting systems in place, making them operate, and trying to derive short-term benefits from them while managing data flow to provide information that can transform future healthcare. The emphasis will change from systems and infrastructure to actionable information. Predictive analytics, simulations, and other modeling tools have the potential to use data to add rigor to the decision-making processes on resource allocation and transformative healthcare systems.

The question about interoperability is not about applications, according to Lynn Harold Vogel, but about architecture. The challenge is to transform legacy architecture that was focused on a system residing within one physical location to systems that are flexible, scalable, and accessible, irrespective of the care setting.

Like any other healthcare organization, CCO and MD Anderson have exponentially growing data storage needs; however, a more challenging issue is how to facilitate appropriate access to certain parts of the stored data. Privacy is an ongoing concern and healthcare organizations are obligated to safeguard patient information and the privacy of patients. Indeed, there is increasing legislation to maintain records on data access. This in turn will add to the data storage burden. Lynn Harold Vogel estimates that it is possible to generate 10 gigabytes of data everyday just in audit trails of people accessing data. While the need to protect privacy is paramount, it is also necessary to balance that with the need to use data to foster a collaborative environment and for improvement of the health system. Checks and balances are being put in place to deal with privacy issues.

Without doubt, the digitization of healthcare will have a transformative effect. Building connectivity, interoperability, and communication will be essential in the eHealthcare environment. Examining the processes and strategies of MD Anderson and CCO, it is apparent that these two organizations have looked to the future and implemented HIT and data management policies that have positioned them further along the roadmap to healthcare without walls than many of their contemporaries. ■

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