Leadership

IVEY | Centre for Health Innovation and Leadership

Innovation Takes Leadership:

Opportunities & Challenges for Canada's Health Care System

Anne Snowdon, R.N., Ph.D.
Jeremy Shell, B.A., M.B.A.
K. Kellie Leitch, O.Ont, MD, MBA, FRCS(C)

Table of Contents

Introduction

The health of a population is directly related to its productivity and a country's economic, growth and competitiveness. Yet, Canada's health care future is uncertain. Our system faces a rapidly rising demand for quality health care services that are timely and accessible to an aging population experiencing increasing rates of chronic illness[1]. To ensure Canada's future economic competitiveness, we must work to ensure the sustainability of a strong health care system. How? The Ivey Centre for Health Innovation and Leadership believes the answer lies in health system innovation: technological, procedural and cultural.

So, if that's the answer, how are we doing? In short, not so well. A 2008 McKinsey & Company report found that Canada earns a "D" grade in innovation, placing 13 among 17 developed nations in this economic and future prosperity indicator[2]. Further, according to the Conference Board of Canada, "Canada ranks near the bottom of its peer group on innovation, ranking 14th among the 17 peer countries. Canada's low relative ranking means that, as a proportion of its overall economic activity, Canada does not rely on innovation as much as some of its peers. Overall, countries that are more innovative are passing Canada on measures such as income per capita, productivity, and the quality of social programs."

Innovation

Innovation is new or better ways of doing valued things. An "invention" is not an innovation until it has been implemented to a meaningful extent. Innovating is not limited to products, but includes improved processes and new forms of business organization.

From Report: "Innovation and Business Strategy: Why Canada Falls Short", Council of Canadian Academies, April 2009

Yet these rankings don't tell the entire story. Canada ranks reasonably high among developed nations in the creation of new knowledge. Our scientists and academics are among the most prolific in the world in the production of published articles and abstracts that advance science and technology in every field imaginable. The same Conference Board report notes that Canada produced 844 scientific articles per million population in 2007, earning a respectable

"B" ranking. The same report, however, gives Canada a "D" ranking for technology exchange – dead last among our peers – and a "D" in number of patents by population. In other words, we're doing "OK" producing new knowledge (i.e., inventions), but we're doing a horrible job as a nation in translating that knowledge into productivity (i.e., innovation adoption).

In health care, the story is the same, but the consequences are more severe. While an "innovation adoption deficit" in the general economy hurts Canada's economy and our prosperity, that deficit has profound impacts on our health and our health care system. By failing to more quickly adopt new technologies, innovative processes and procedures, Canadian health care is becoming less and less efficient, more and more expensive. It cannot meet the high standards for quality that citizens expect. Ontario is projecting that 70% of provincial tax revenues will be required to meet demands for health care by 2015 if there are no changes in the current health system[3]. The story is the same in every Canadian province.

Further, since the health of a population is directly related to its economic productivity and global competitiveness, then health care delivery must be viewed as an economic engine, and not a cost. The health care system in Canada is the largest "business sector" in the country, yet few think of it in this way. More often, health care is seen as an extension of government or public service, and not as a key component of our economy capable of producing greater wealth and prosperity. Among the Canadian companies that produce innovative health technologies, most tend to ignore the domestic market for their innovative products, often meaning these companies are vulnerable to being absorbed by multinationals who take the benefits offshore.

Furthermore, exacerbating the "innovation adoption deficit" is a shortage of leadership in our health system. Nationwide, we lack highly qualified, skilled managers in the health care industry with knowledge and skills to drive change and push the adoption of new and good ideas[3]. While Canada boasts the second most highly educated population in the world[4] and our institutions produce world-class doctors, nurses and other health care professionals, these professionals need to directly engage in innovation in order for health system innovation adoption to be successful.

Making the problem worse still is that the early research that exists has uncovered virtually no evidence of what "best practice" for innovation looks like in a publicly funded health system, such as Canada's. Without empirical, irrefutable evidence, even those leaders inclined to seek

out innovative solutions to serious problems will have little, if any, research that provides "best practice" approaches for the implementation of innovative solutions in the Canadian health care system.

We make the case in this paper that to ensure Canada's competitive economic future, the country must ensure the sustainability of its health care system by supporting and encouraging innovation adoption.

> *The Canadian health care industry is facing substantial challenges in the not-so-distant future. The solutions to Canada's health care problems require innovation and leadership: technological, procedural and organizational. The trouble is, the culture of Canada's health care system is averse to innovation and lacks the strategic mechanisms to develop and implement innovative techniques, processes, technologies or policy. The Ivey Centre for Health Innovation and Leadership has been established to remedy these problems.*
>
> *Dr. K. Kellie Leitch, April 30, 2010*

The Ivey Centre for Health Innovation and Leadership

To be a catalyst for this discussion on the innovation adoption and leadership deficits in Canadian health care, the Richard Ivey School of Business (Ivey) has created the Ivey Centre for Health Innovation and Leadership (the Centre). The Centre represents Ivey's efforts to bring the skills and experience of management education and scholarship on the subject of leadership to the health sector. This is not a new foray for Ivey. Since 2001, Ivey has been home to the country's only health-centered MBA program, first known as the Bio-Tech MBA and more recently as the Health Sector MBA. This new program builds on prior success, expands our program offering and will develop nation-wide leadership in the creation of "living laboratories" for innovation in health care systems.

It is the Centre's mission to ensure that developmental processes and a system-wide innovation adoption framework (or frameworks) exist to promote new technological innovations and best practices in Canadian health care. The Centre seeks to bridge the efforts of Canadian industry and health care leaders by forming strategic partnerships that empower improvements in health care innovation and economic growth in Canada. The Centre will be a focal point to build leadership capacity and promote a culture of innovation in health care.

Many of the Centre's activities and concepts — such as, partnership development, leadership capacity building, and creating a culture of innovation — are largely foreign to the health care system as we know it today. The Centre will seek to introduce these proven business strategies in ways that are respectful of the culture and unique nature of the Canadian health care system.

A key feature of the Centre's activities is the annual Global Health Innovation Conference that brings together top global health experts and health industry leaders to identify opportunities for innovation and to prioritize health system challenges in need of innovative approaches and solutions. The conference acts as an annual expert review and surveillance system for the Centre's activities to provide focus on those initiatives and trends that offer the best opportunity to have the greatest impact.

At the inaugural Ivey Global Health Innovation Conference in 2009, the health and industry leaders that assembled to discuss, debate, and identify health system priorities, found consensus around the question:

What is the most effective process for innovation adoption, sustainability and productivity enhancement in a universal, publicly funded, health care system?

This question arising from the conference was not a surprise. Angst over the sustainability of Canada's health care system is as universal as the system itself.

> *"Canadians see the inexorable climb of health spending as the number one issue that must be addressed if we are to get our fiscal house in order before the current health accord runs out in 2014."*
>
> *Dr. Anne Doig, President of the Canadian Medical Association*

The conference participants also identified four key priority areas where greater focus was needed and where the greatest impact on health system innovation can be found:

- Financial drivers to innovation & sustainability,
- Health leadership & building a culture of innovation,
- Medical devices innovation, and,
- Health information technology innovation & adoption.

Each of these key areas is now a priority target for the Centre. Two of these priority areas focus on innovative technologies (e.g., health information technology innovation & adoption, and medical devices innovation). The other two priority areas focus on features of the health system (i.e., financial drivers to innovation & sustainability, and health leadership & building a culture of innovation) that play a critical role in innovation adoption. An extensive review of the literature in all four areas generated research questions that have informed the Centre's strategy in its inaugural year (Figure 1) and, it is expected, will continue to be the focus for some time to come.

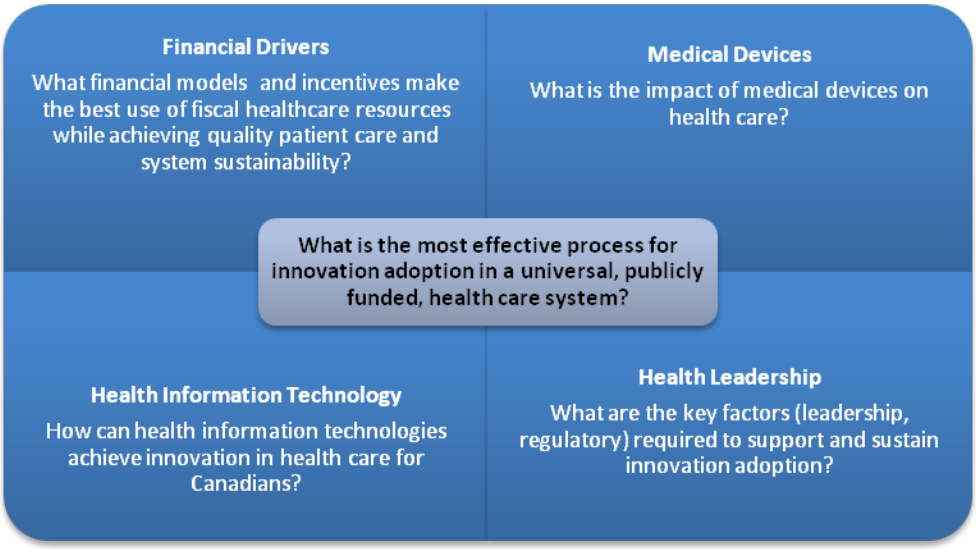

Figure 1: The main research question and four areas of innovation enquiry for the Centre

"I know that for the system to be sustainable, Canadian health care must be leading edge. We must pursue innovation and adopt new technologies, management techniques and processes. While improving the quality of life for Canadians through advancements in health care technologies, we can also generate an economic benefit as a result of our pursuit and commercialization of these innovations and discoveries."

The Honourable Tony Clement, 2009

Financial Drivers to Innovation & Sustainability

Research Focus:

1. **Financial incentives required to stimulate and support adoption of innovative new technologies, processes or systems in health care service delivery.**

2. **Research examining the effectiveness of financial drivers on innovation adoption to improve quality patient care and system sustainability.**

Background:

A very effective strategy that has long been used for achieving specific health service targets in Canada's health care system is to manipulate funding levels. For example, financial rewards are offered to hospitals who achieve their benchmark targets for performance in both quality of patient care and in meeting budget allocations. Financial incentives to reduce wait times for surgeries such as hip or knee replacements have been used in Ontario more recently. However, to date, the majority of strategies that use financial incentives have been focused on achieving budget targets or service delivery targets, rather than achieving innovation in how health service is delivered. Use of financial targets to incentivize innovation in new technologies (such as devices or information technologies) or incentives for leadership in system innovation have not been a common approach in the Canadian system. Our review of the literature focused on finding empirical evidence for how health systems are using financial incentives to stimulate and support innovation adoption to achieve quality of patient care and system sustainability.

Literature Review:

The literature describing financial health models focuses on a variety of model structures, sources of system funding and effective fiscal incentive systems to solicit desired innovative behaviours. Financial models in health systems determine how resources are allocated and send clear messages about organizational priorities. Financial models that demonstrate fiscal commitment to innovation can empower corporate entrepreneurs to generate creative new and innovative ideas[6, 7, 8]. However, most current financial health models are more consistent with out-dated corporate governance models that do not support innovative adoption of new technologies or incentivize management processes that support organizational change[9].

Privatized financial models are driven by revenue generation and expense reduction to maximize profit to shareholders. The primary goal of publicly funded financial models, on the other hand, is the provision of universal access to comprehensive health services for all citizens. In both public and private systems, system efficiency is contingent on having the right funding in the right places at the right time, but the mechanisms and management models required to make these decisions in different systems vary. Price signals and the demand/ supply curve in the private system provide more immediate feedback to system efficiency and efficacy, while these are largely missing, except in artificial ways, in public systems. In the public system, ways must be found to introduce financial incentives that change behaviour.

It is our contention that as Canada redefines and reorganizes its system; government and health industry partners need to work with health system leaders to examine best practices in creating financial drivers to stimulate innovation adoption[10] and ensure systematic uptake by placing resources, direction and incentives where they best serve the goals of the greater health system: enhancing care quality and improving productivity, efficiency and sustainability[11, 12]. For example, new approaches to financing innovation can overcome breakdowns in innovation adoption such as with the failure to see more widespread uptake of electronic health records in Canada's health system to date. Substantial investment has been made in e-health technologies, yet there have been few incentives to support the re-design of health care processes to leverage innovative technologies, or design effective infrastructure to utilize e-health technology[13].

Current Financial Models in Health Systems:

There are a variety of health finance models that are currently in use in health systems around the globe. Each of these financial models was examined for evidence of financial drivers that stimulate or support innovation and innovation adoption. In Canada, the dominant focus of health finance is fiscal restraint and cost containment as demands for health services continue to grow. Health leaders strive to achieve cost savings in order to meet budget targets imposed by their provincial health ministry. There is much less evidence of the use of financial drivers to stimulate innovation. Each of the current models of health finance was examined for their potential to support innovation adoption in Canada's health care system.

Pay-for-Performance Model:

There has been a great deal of attention paid to "pay-for-performance" models that focus on CEO compensation and the performance of health care organizations[14]. Many organizations in a cross-section of industries that pay for performance traditionally outperform those that do not[15]. For any health organization, having a strategic plan and assigning a CEO the responsibility for executing that plan may lead to financial success for an organization[16]. However, when these financial models are implemented in health agencies, outcomes are shown to be less than optimal. Evidence shows, for example, that implementation of a pay-for-performance measure in the U.S. long-term care sector has not been successful and has done little to curb high rates of staff turnover[17].

In 2003, a California-wide, pay-for-performance system was tested covering 25% of California's population, (i.e., 6.5 million people; 7 health plans; 215 physician organizations, government, health plan purchasers and consumer groups). The overall goal was to significantly improve the quality of health care delivered by organizations using financial rewards for performance targets reported publicly. There was substantial evidence that quality of care targets can be effectively supported using financial incentives. However, there is no such evidence in the Canadian health care system.

Recently, the Ontario government announced the implementation of a pay-for-performance financial model that compensates hospital CEO's for performance[18]. The specific details of how this strategy will be implemented remains unclear. In response to Ontario's proposals, Tom Closson, president of the Ontario Hospital Association stated, *"It's appropriate for the government to say, 'Here is where we would like performance improved'"*[19]. Mr. Closson is correct, but before implementing a system that pays for performance, it is also appropriate to ask how pay-for-performance approaches can be used to stimulate and support innovation adoption. Canada needs to resist the temptation to limit the use of financial incentives for supporting only cost containment and meeting service delivery targets. We may achieve much better outcomes by using financial incentives to drive innovation that strengthens health service delivery.

Pay-for-Value and Pay-for-Quality Models:

Like pay-for-performance models, pay-for-value and pay-for-quality financial models are new to Canadian health systems and may reward both strong patient care outcomes and meeting fiscal targets more effectively than the current compensation models[20]. In each of these financial models, standardization and the ability to evaluate performance outcomes remain significant challenges[21]. In order to pay for quality, health systems must define quality in a way that can be easily and effectively measured. How would quality be defined and measured in the long-term sector, versus the community sector or hospital sector? Different sectors within the health system use very different quality indicators. Balanced scorecard approaches may be an effective strategy for achieving a standardized approach to evaluating quality outcomes of a pay-for-quality model, however, there is little current research that fully examines the use of balanced scorecards as evaluation tools in health care. Similarly, how does a pay-for-quality, or pay-for-value system support innovation? Although there is evidence that innovation can lead to increased quality of patient care, there is no identified best-practice of pay-for-quality financial incentives for innovation adoption.

Co-Payment Systems:

Co-payment systems levy taxes on individuals that increase according to the level of risk of a person's health behaviours[22]. Thus, taxes are a dis-incentive to ensure individuals take responsibility for their own health and lifestyle to avoid these taxes. In one study, Aba et al. projected that if a co-payment system had been implemented in the U.S. in the year 2000, a cost savings of $6.3 billion would have been achieved in just one year[23]. Cost savings are the central focus of co-payment systems and there is no evidence that co-payment systems support or drive innovation in health care. These systems simply engage individuals in cost sharing. There are few, if any, financial drivers for innovation in such models. There is no similar cost analysis research on co-payment systems in the Canadian health care system.

Currently, financial models are changing in an effort to drive the health care system to achieve quality patient care while at the same time, meeting cost containment targets imposed on health sector budgets across the country. The use of financial drivers to specifically incentivize innovation in health care is sadly lacking in Canada. Fiscal policy that delivers patient care within prescribed budget envelopes ensures the focus of health leaders will remain narrowly defined in terms of "surviving" health care cuts in funding, while trying their best to maintain

quality of patient care. There may be much greater opportunity for achieving health system sustainability if health financial drivers focus on incentivizing innovation to achieve greater productivity and efficiency in health service delivery.

Conclusions & Recommendations:

Financial strategies that drive innovation are a key ingredient for creating a culture of innovation within the health care system. Our review of the current state of best practice in health finance reveals a startling lack of financial drivers to support innovation within existing funding models for the Canadian health care system.

Recommendations to drive innovation using financial incentives include the following:

1. **Innovation needs to be valued in Canada's health care system, and one important way to create this value is by implementing financial incentives that "drive" innovation.**

   Health systems need financial incentives to support "grass roots" innovation projects that will build momentum towards system level innovation. Financial drivers are a critical ingredient for health innovation adoption. As small innovation projects develop and are funded, employees get engaged in the process of innovation and momentum builds towards a culture of innovation. This "living laboratory" concept rewards health professionals directly for engaging in the innovation process. As they do so, they learn and experience innovation. If health systems really value innovation, then they need to acknowledge the importance of innovation by creating incentives around it.

2. **In order to understand how financial incentives for innovation work, we need to use "proof of concept" testing in Canada's universal health care system.**

   Financial incentives can be a very powerful tool to motivate particular changes in health care. However, we have little idea of how these financial incentives actually work to stimulate innovation. Before implementing financial incentives, we need to test these models using small scale projects, or "living laboratories", to better understand how, or if, these incentives actually achieve innovation. Too often, decisions about financial incentives are made at the system level, based on predictions of outcomes demonstrated

in other countries. Understanding how financial incentives can be used most effectively to stimulate innovation in *Canada's* health care system is an important first step in designing financial models that support innovation at the system level.

3. **Identify the key indicators that can be used to systematically evaluate the effectiveness of financial drivers that stimulate health innovation.**

   Health care is a complex system that relies heavily on "best evidence" for determining the most effective approaches for health care service delivery. Yet, the "best evidence" for how health financial drivers and incentives can be used to support innovation and system sustainability is less well developed. Business schools and their research teams have substantial expertise in finance and can contribute significantly to identifying the best methods to evaluate the effectiveness of health financial drivers that incentivize innovation in health care. Engaging the expertise of Canada's business schools in this area offers the greatest potential for creating the necessary tools and knowledge that will drive innovation in health systems.

No doubt, new health financial drivers will play an important role in innovation adoption in Canadian health care. Research examining the use of financial incentives as drivers for innovation in the Canadian health sector is, so far, very limited. The Centre will promote and disseminate research that tests new financial models and approaches supporting the adoption of innovative processes, products, and technologies. We are eager to participate in these "living laboratories".

Health Leadership & Building a Culture of Innovation

Research Focus:

1. **Leadership approaches and health systems factors required to support successful innovation adoption.**

Background:

Strategic, innovative leadership and leadership that encourages innovation and risk-taking is crucial for achieving long-term sustainability in health care. However, there is very limited research that describes the leadership competencies necessary to support innovation adoption in the context of Canada's health care system. If innovation is important for achieving a sustainable health system that offers quality patient care, then leadership competencies necessary to support and sustain innovation in the system are foundational for achieving this goal. However, innovation is not a central focus of most education programs in health leadership. Our review of the literature focused on empirical studies of health leadership competencies and leadership approaches that are effective for stimulating and sustaining health system innovation.

Literature Review:

Creating a Culture of Innovation in Health Systems: The literature describing organizational innovation adoption in the broader economy is rich. It focuses on organizational behaviours and structures that promote frequent knowledge-sharing, cross-functional team-building, procedural idea development and idea champions[24]. The literature also discusses effective leadership styles and the need to build capacity in leadership to support innovation. Despite this rich body of knowledge, there is little that has examined these questions in the context of the Canadian health care system.

The little research there demonstrates that the Canadian health system and its stakeholders are resistant to change, and have a limited ability to embrace early adoption of valuable new technologies and procedures. It is clear to us that the system and its stakeholders need to embrace the leadership principles that drive learning organizations to become "innovation factories"[25]. The question becomes, "How?"

In order to build "innovation factories" in health care, organizations need to develop cultures that support and encourage innovation. These "factories" will have well developed processes and support mechanisms for employees to identify and test promising new ideas. They will have established evaluation and testing procedures, measures of recognition and reward, as well as "idea champions" designated within the organization who are responsible for spearheading new initiatives. Research shows that having these measures of responsibility and recognition for innovative ideas in place is exceptionally effective in soliciting buy-in to support innovation efforts[26].

Capturing new ideas or re-generating old ideas is related to the concept of "idea champions". Leaders who promote innovation must logically seek to understand the organizational practices that create idea champions. Idea champions are often "mavericks" who see things in their own way and challenge pre-existing norms and conditions. These individuals will creatively seek improvement even when there is no corporate process or reward for doing so. Idea champions become strong advocates for their ideas and can challenge others to see things in new ways, despite the fact that these visionaries are most often met with opposition. To empower idea champions to develop valuable innovations, wise organizations allocate time, resources and access to cross-functional teams to empower idea champions to progress ideas into testable and measurable projects. The support of executives in promoting idea champions and their work is pivotal in garnering the resources and recognition required of organizations to facilitate cultures that encourage idea champions[27, 28]. This type of openness to testing new ideas may be an important strategy to support innovation adoption by developing "innovation" environments operating within the existing Canadian health system, drawing on cross-functional resources from academia, industry and front-line service providers.

The most innovative organizations act as "knowledge brokers": they pass old information and developments around systems and promote knowledge sharing[29]. In this way, firms engage cross-functional skill sets in making the best use of existing resources and materials. This process is consistent with the actions of "value captors" who seek to prevent repetition in development and any waste of labour or material generation[30]. To create an "innovation factory" in health care that drives an innovative organizational culture, health leaders need to: capture and promote good ideas system-wide, re-generate old ideas periodically to see if they have new potential relevant to modern projects (promote institutional memory usage), and push promising projects into testing[31].

Innovation factories pride themselves on generating large numbers of valid experiments, which are tested and evaluated in small project applications that identify the potential success of a new idea. In this type of environment, failure of a new idea is viewed as an important opportunity for learning and building strengths in the organization. In fact, these organizations believe the *real* failure occurs when new ideas are never acknowledged, considered or tested, resulting in organizations that rely on traditional practices and routines averse to innovation.

Core Leadership Competencies Associated with Innovation: System leadership has been described in terms of a "4+2 Formula". The formula identifies four key management fundamentals of successful organizations: *culture, structure, strategy and execution*. To be successful, an organization must master these four fundamentals as well as at least two of four secondary management practices. Secondary management practices include: *talent management, leadership, innovation and the ability to develop partnerships*. According to the formula and its theory, these competencies can only thrive once health care systems create cultures, structures, strategies and execution capabilities to support innovation adoption[32].

In U.S. health research, the practice of competency modelling to drive leadership training has received attention. Competencies are defined as skill sets that correspond to strong leadership performance. Competency modeling involves evaluating leaders through interviews, psychometric analysis and peer benchmarking[33]. The foundation of any successful competency modelling program is an established sense of organizational goals, and clearly identified competencies and abilities that support the achievement of those goals. Additional research and hypothesis testing are required to further validate the competency model for application in identifying, developing, credentialing and promoting health care leaders[34, 35], particularly in the health system.

Development of core leadership competencies sustains strong organizations in the long term and gives them expertise on which they can build, despite the occurrence of disruptive innovations over time. For example, Sony is famous for its miniaturization competency. Throughout the massive electronic evolution of the past thirty years, Sony has remained competitive by capitalizing on its ability to apply their core competency to a diverse variety of undertakings[36]. Core competency focus helps to arrange organizations efficiently and direct stakeholder improvement toward serving future competitive advantages based on past success. In health care, an organization must understand its past and know its strengths, and

then have the ability to build on those strengths to achieve innovation in patient care quality and efficiency. Little empirical evidence is available that examines how core leadership competencies develop within organizations in the Canadian health care system.

Current State of Leadership in Canada's Health Care System: Anecdotal evidence suggests health care lags behind other industries in leadership development practices and human resource functions[37]. Not nearly enough is known about what type of leadership skills are most effective in supporting innovation in the health sector. In studies involving key informant interviews, researchers discovered six common leadership challenges in the U.S. health system, including:

- industry lag in development,
- adequacy of leadership representation of the populations served,
- professional conflicts and territorial behaviour between system actors,
- time constraints for innovation development,
- technical competency challenges in health organizations, and
- budget constraints on supporting innovative activity.

Leadership challenges in the Canadian health system are not well documented – though this is one area where we feel a look to the U.S. system and studies such as the one noted here can, provide some insight — and there are few, if any, studies that have identified strategies for developing leaders who have the knowledge and skills to stimulate and support innovation in the health sector.

Physician leadership: One area of fairly robust study centres around the question of physician leadership. Most of the literature has identified it as a critical component of health system innovation. As front-line soldiers in the battle to achieve good health, physicians are very attuned to the shifting needs and trends in the health of populations they serve. Physicians are also leaders in determining how patient care services are organized and delivered by virtue of their decision making role in diagnosis and treatment decisions. In McGahan's *How Industries Change*, the author advocates that organizations cannot change intelligently to improve sustainability and competitiveness unless they understand the overarching trends in their industry and society[38]. Physicians are a key stakeholder group in providing this knowledge. McGahan further identifies four states of change: radical (disruptive innovation, paradigm shifting), creative (constant redevelopment of assets), intermediating (fragile, shifting relationships) and progressive (incremental improvements in quality and efficiency)[39].

The health sector is subject to all of these forms of change in a variety of areas and capacities. Yet, too often there is a "disconnect" between changing trends in population health needs, and the structure of how health services are organized and delivered. This disconnect is described in the following statement from K. Scott:

> *We routinely take the latest medical technologies of the 21st century and embed them within a service delivery and patient flow process – with its appointments, waiting rooms, and so on – that has remained fundamentally the same since the 1950's*[41].

In each instance, the ability to process and build on physician and other health professional input empowers good managerial decision making and the marriage of need and progressive change management. The result of this knowledge is better organizational strategic decision-making. Leadership strategies that engage physicians and health professionals to identify and plan for changes in population health trends need further examination.

Physicians as front-line specialists have invaluable knowledge about the health care system and the needs of patients. However, as the health care system becomes increasingly complex, fewer physicians have the skill sets to lead and support innovative change. Many physicians have little experience or training in using and implementing management information systems. Although physicians who are consulted in planning and budgeting of new systems demonstrate greater adoption of new methodologies and processes[40], greater attention to engaging all members of the health care team (professionals and managers/leaders) in a collaborative approach to innovation and change is needed.

Existing literature suggests that screening physician candidates for management positions should be done rigorously. The best doctors are not necessarily the best suited to promote innovative and efficient cultures[41]. Leadership selection at all levels of health system administration is crucial to system success and sustainability[42]. Leadership competency assessments for system leaders and health professionals being groomed for leadership roles can improve career planning, career development and allow health leaders to identify and improve upon weak competency areas in talented personnel[43]. Clinicians and staff promoted because of excellent clinical skills can benefit greatly from management and leadership training that can enable them to match strong technical skills with methodologies for using knowledge to improve system performance and innovation[44].

A good physician leader has high emotional intelligence, knows his/her own strengths and weaknesses, inspires teams to work toward common goals, is empathetic to staff and patients, and encourages developmental thought and open discussion[45]. Physicians with strong leadership qualities generate positive hospital staff relationships and increased collaborations among peers[46].

Physician leadership is a critical component of health system leadership and the adoption of innovation. Yet, physician leadership approaches have not received substantial attention in the empirical literature. Although, it is very clear that physician expertise and experience are critical for quality patient care, physicians are also an essential member of the health care team and have the capacity to allow the health system to achieve innovation adoption. Why? Physicians define how patient care services are organized and delivered. They are also the front-line workers attuned to the shifting health needs and trends in the populations they serve. Health care organizations cannot effectively strategize to improve sustainability and competitiveness unless its leaders understand relevant social and industry trends[47]. However, there is limited opportunity for physicians to share their knowledge and experience in health trends and less opportunity to influence health system leadership that is fundamental for innovation adoption. Physician knowledge sharing is integral in effectively directing competency building[48].

Role of Physicians in Health System Governance: Physicians face the challenges of changing physician-hospital relationships as a result of economic pressures, quality improvement demands, looming physician shortages and new graduate lifestyle choices. To date, physicians have had a unique relationship with leaders in clinical settings, such as hospitals. Specifically, physicians are often not employed directly by a hospital. They are granted privileges to use hospital facilities in return for providing emergency patient care services. Thus, physicians are often not governed by the administrative structure of the health system organization as are other employee groups, such as nurses, allied health professionals and support staff. This unique relationship between a physician's practice and the organization's administrative structure places physicians in a very unique role in the governance of the health care system.

More recently, a variety of new models to align the structural and economic goals of hospitals and physicians have surfaced, including organizational structures, such as physician-advisory councils, joint ventures, and cross-functional "super groups" that may offer new opportunities for physicians to develop greater awareness of leadership trends and practices[49]. At a basic level, new health system administrative policies should be making greater efforts to facilitate

communication between physicians and administrators, physician involvement in decision-making and physician leadership development through formal training[50]. Further, no structural changes to the health system can be effective without physician leaders capable of supporting new initiatives[51].

Leadership Style and Innovation: In a study examining relationships between physicians, health managers and staff, findings indicated that manager empathy was positively related to transformational and inspired behaviour on the part of stakeholders[52]. Democratic leadership styles are preferred by modern health professionals, as are managers with social awareness who practice relationship management. Developing relational skills and improving emotional intelligence can help physicians relate better to other members of the health care team and create cultures of openness, which have been linked to innovation and creativity in health service delivery[53]. Leadership arrogance or hierarchical models of power, and control over members of the health care team, is said to be the enemy of cooperation and innovative collaboration in health systems, and a grave cause of danger for quality of patient care when these behaviours replace competence[54].

Conclusions & Recommendations:

If "innovation" is the silver bullet in the battle to achieve health system sustainability in Canada, then the best hope for creating a "culture of innovation" is having leadership with a capacity to empower individuals to improve their own work environments and the system as a whole[55]. Strategic, innovative leadership is crucial for achieving long-term sustainability in health care[56].

Skilled leaders, who can cope with complex health management issues[18], while building and sustaining organizational cultures of innovation, are more critical than ever.

To date, research on leadership and its role in supporting innovation has focused almost entirely on the role of physicians with no mention of other members of the health care team. It is telling that there is no mention of other professions in this literature. Clearly, there is substantial work to be done to examine how health care teams can work together to achieve innovation in health care and determine what type of leadership is needed to accomplish this important goal.

Leadership that supports and sustains innovation in Canada's health care system needs to consider the following actions:

1. **Create cultures of innovation in health care: turn patient care service delivery into "living laboratories" for innovation.**

   What does a culture of innovation mean? It means that every employee, health care professional and manager is supported and encouraged to look for new ideas and new ways to provide patient care more efficiently and effectively. It means these ideas are then tested using focused pilot studies, so that the potential for innovation can be quickly identified. It means rewarding and recognizing innovation and promoting the emergence of "idea champions" who lead innovation cultures.

2. **Innovation just doesn't happen: we need to educate and socialize health professionals and researchers in innovation and entrepreneurship.**

   Health education curriculums (in medicine, nursing, social work, psychology, EMS, allied health, etc.) need to integrate innovation and entrepreneurship as core competencies for health professionals and leaders. Course work in health innovation, entrepreneurship, and strategy should be required in every health related curriculum. Business schools need to partner with health science faculties to deliver this curriculum to ensure it is most current. Opportunities for students from health disciplines and business schools to socialize, collaborate and learn together about innovation in health care need to be created and encouraged.

3. **Build collaborative networks of multi-sector partners to support innovation in health care.**

   Health care is a complex system that will require the combined expertise of many partners to shift health care towards a culture of innovation. The challenges health care faces are extraordinary, and can only be solved by combining a wealth of expertise from sectors, including health leaders from private industry, business, entrepreneurial organizations, policy instituions and academia.

Medical Devices Innovation

Research Focus:

1. The impact of medical devices on health care service delivery and the processes that facilitate the commercialization of new medical devices.

Background:

Advances in medical devices are thought to embody the greatest potential for breakthrough innovations in health care delivery, leading to quality patient care and financial efficiency outcomes[58]. In addition, the medical device industry holds immense economic potential for the Canadian economy, given Canada's well developed capacity for health research, especially in medical device development. Still, the Canadian health system's limited ability to integrate and adopt device innovations (or any innovations) into health services slows industry momentum[59].

Literature Review:

The literature describing innovation adoption of medical devices and technologies focuses on four key issues:

- practitioner adoption and uptake,
- policy structures necessary to support adoption,
- funding models for innovation adoption, and,
- facilitators for uptake and adoption,

Physicians are key facilitators in the successful adoption of medical device innovations[60]. They are directly involved in the use of medical devices to deliver patient care, and are often the best knowledge resource in generating valuable device innovation opportunities[61]. Physician-generated devices, on average, receive two and a half times the research citations of non-physician medical device inventions[62]. In addition, physicians are most trusted by patients, and are important solicitors of the consumer acceptance of new devices that may decide the outcome of device adoption[63]. All health care professionals (e.g., nurses, allied health, pharmacists, etc.) who take ownership of new technologies can become powerful champions for adoption of new devices.

System level and government regulation have a profound effect on device innovation. This effect is compounded by the role regulation plays in determining the financing available to device innovators through venture capitalists and angel investors[64]. Governmental regulation, approval procedures and fees have been identified as significant barriers to innovation adoption[65]. However, there is little research that identifies a strategic approach or international best practices to streamlining these processes to support faster adoption of new medical device technologies.

Medical devices that offer improved quality of life for patients are developing rapidly in response to the growing prevalence of chronic illness in countries around the world[66]. For example, ConforMis Inc. engineers knee resurfacing implants for osteoarthritis patients that preserve more bone tissue than traditional knee replacement surgeries[67]. Medical devices (e.g., joint implants) can be constructed using computer assisted modeling to identically match and fit a device to a patient's unique physical features[68]. Medical devices have resulted in the availability of exact replicas of hip and knee joints for patients who require joint replacement surgery[69]. These kinds of innovative medical devices can improve care quality while saving costs on repeat procedures more common with current products and procedures[70]. These technologies, and many other like them, hold tremendous promise both for patients and for the health system, but our system needs to significantly evolve and change in order to properly embrace their potential. For example, new incentive and compensation models are needed that reward the personalization of devices that will inevitably be more expensive on a per-unit-basis.

Devices that achieve implementation in Canadian health systems do so in spite of significant disadvantage. Adoption of innovative new devices is not supported at the health system level, evidenced by limited resources, such as staff training and consultation[71]. Despite Canada's leadership in the development of new medical devices, the slow and tedious process of adopting these devices into health institutions has severely limited the impressive potential these technologies offer the Canadian economy. Strategies that support rapid prototyping and beta site testing of new medical devices in the health system are needed in order to change the slow pace of innovation adoption in Canada's health care sector. Process re-design and strategic approaches to engaging health professionals (particularly physicians) are important parts of the strategy. If these can be put into place, Canada has the potential to become a world leader in medical device innovation in a very short time — particularly in the emerging area of medical device development[72].

Conclusions & Recommendations:

At the moment, there is little research that identifies a strategic approach to streamlining processes that support faster adoption of new medical device technologies. Yet, significant barriers to innovation adoption in this area have been identified in the literature.

Engaging health professionals early in the development process, and determining the impact on work flow productivity and patient outcomes increases the likelihood of adoption of a new product process or system. We make three important general recommendations that are important in encouraging innovation of medical devices in the Canadian health care system.

1. **Encourage the medical device industry to engage health professionals early in the development process.**

   Health professionals are the single most important stakeholder when it comes to supporting adoption of new medical devices. Researchers in the medical device industry need to build collaborative partnerships with health professionals in practice settings, and do so earlier in their research and development cycle. When health professionals are involved in the early development of new devices, they become the product champions, which leads to the much greater likelihood of integrating these new technologies into practice routines.

2. **Undertake an international best practice review of regulatory regimes to identify practices most conducive to adoption of innovative medical devices in the health system.**

   In order to quickly and efficiently develop a strategy to stimulate adoption of medical devices, a systematic review of policy and regulatory structures that support innovation of medical devices in other countries is an important first step. Canada needs to take advantage of the lessons learned by other countries with successful track records in innovation. These opportunities for learning offer a distinct advantage to critically examine what policy and regulatory structures work to support innovation of medical devices vs. which are barriers that slow the innovation process. Rather than re-invent the wheel, Canada has much to learn about how these countries promote and implement innovation in the medical devices sector.

3. **Undertake early "proof-of-concept" testing to examine the impact of devices on the quality of care, and health system efficiency.**

   In order for the medical devices industry to grow and thrive in Canada, there needs to be a well developed system for early proof-of-concept testing. This testing is needed to quickly and efficiently identify the viability of medical device innovations before having to go through extensive regulatory processes. This strategy is one of "fail early, and fail cheap" whereby new prototype devices have the benefit of being examined for clinical outcomes on quality of care and health system efficiency early in the device development process. It is believed that this proof-of-concept approach to medical device development will offer substantial momentum for successful new medical device adoption in Canada.

Health Information Technology Innovation & Adoption

Research Focus:

1. **Evidence for how information technologies have, or might offer, opportunities for health system reform and sustainability. Research will include an examination of future trends particularly around consumer-driven models and the expected impacts of these trends on the health system.**

2. **The strategies that best incentivize adoption of health information technologies (HIT).**

Background:

Every conceivable industry has been transformed by information technology. Information technologies have revolutionized banking, the travel industry and entertainment. Manufacturers are connected with their suppliers and customers in a supply chain of incredible complexity, and even more amazing speed. The financial services industry moves trillions of dollars in nano-seconds and the variety of services offered to clients is only bounded by imagination. These services can be delivered from anywhere in the world, at any time of day or night. Yet, when we look at health care, we see a system still struggling with some of the basics of the information age. Health care is arguably the most information-intensive of industry sectors – perhaps rivaled only by financial services. About 2,000 health care transactions happen every minute of every day in Canada, according to Canada Health Infoway. The information recorded or transmitted contains everything from the mundane to the life-critical, and until just a few years ago, the vast majority of these hundreds of millions of health-related transactions involved handwritten records. Critical information was filed in hospitals, doctors' offices and clinics with limited ability to retrieve the information when and where needed. This is starting to change, but change is happening too slowly.

Health information has the potential to create seamless delivery of health care services by digitizing basic health records, using electronic tracking of patient information through the health system, and improving digital communication among health professionals, patients and their family members. In other words, health IT (HIT) could completely transform the system and contribute greatly to its long-term effectiveness and sustainability.

Curiously, and despite all the evidence, the health care system in Canada seems either unable or unwilling to learn the lessons of other industries and embrace information technology to the full extent possible. Despite evidence that improvements in productivity can be linked to investments in information technology[73], the amount spent by Canadian hospitals on information and communications technology in 2005 constituted only 1.5 per cent of their operating budgets; this percentage hasn't improved much since then. This percentage stands in contrast to countries including Italy, Sweden, and the United Kingdom who allocate in excess of five per cent of hospital budgets to information and communications technologies.[74]

Literature Review:

The digital era is one of the most significant global trends in history, having already revolutionized access to information and the development of new social networks worldwide. The Information Age has been defined by widespread use of the World Wide Web, often accessed using small, personal devices that are a part of the daily routines of individuals around the world. Individuals use the Internet to source health related information with greater ease than ever before[75, 76]. In addition, social networks provide an impressive array of health information to individuals with the click of a button on a personal device.

Personalized health technologies and products have the potential to leverage innovation in health systems to achieve greater quality of care and enhanced efficiency in health service delivery[77]. Practitioner performance improves when practitioners use computer assisted diagnosis, computerized reminders for preventive care, disease management systems, and computerized drug dosing and prescribing systems. HIT allows for the analysis of clinical data for many patients, leading to systemic reductions in adverse drug events, and reduced time to identify and report public health threats and hospital acquired infections. Rapid improvements in the efficiencies and effectiveness of access to information have enabled many businesses in other sectors to customize services and products (before and after market) to greater degrees than previously thought possible[78]. Yet, in the health sector, these technologies face slow system integration, despite substantial investment in planning and resources.

There has been relatively little empirical research focused on the key components of successful innovation adoption of health information systems. The costs and benefits associated with adoption of these innovative technologies have not been well defined[79]; though it can be extrapolated from other industries that the potential value is substantial. Health information

technology holds the promise of achieving greater efficiency and productivity in health care service delivery, however, the approach to re-designing service delivery processes that creates the opportunity for enhanced efficiency and productivity is not well understood. In the United States, health information technology has demonstrated better coordination of care across health systems, reducing the number of "dropped balls" and patient safety challenges[80,81,82]. In Canada, there is evidence emerging that HIT offers similar outcomes.

HIT adoption is mired by significant barriers in Canadian health care, and implementation costs are very high[83, 84]. A further challenge for innovation adoption of health information systems is the serious risk of a skilled labour shortage constraining the implementation of HIT across Canada[85]. A strong and very knowledgeable workforce that is equipped to manage and sustain a robust health information system will be needed to achieve innovation adoption of health information systems nationally. According to some estimates, Canada will need to fill 112,000 IT-related health care jobs in the next five years[86].

Another emerging trend in HIT is the move to Personal Health Records (PHRs). These PHR technologies — being delivered by companies as large as Microsoft and Google, and by start-up innovators such as Indivo — have made few inroads in the formalized Canadian health care system, but it is clear they hold great potential and are trends worth watching. These technologies allow consumers to import, store and share standardized health records[87, 88, 89] and offer patients the opportunity to achieve autonomy in managing their own health information[90].

The emergence of PHRs in the health sector presents both challenges and opportunities for the management of health information. In the current health care system, health information records are managed and controlled by the health care system (e.g., hospital based medical records, primary care physician patient records). In the future, PHR hosts and the social networks they spawn, may assume greater responsibility for "housing" and managing health information[91, 92], whereby health consumers become responsible for managing and communicating their personal health information to various health system stakeholders. So far, there are few, if any, studies examining the implications of PHR technologies on health information systems and processes. Integration of PHR technologies into the health care system to achieve productivity and efficiency in health care delivery has not been described in the literature. The challenges associated with personal health records, such as privacy protection, are a significant concern in this arena. These challenges have not been examined empirically[93, 94, 95, 96].

Social networking is another area that has the potential to influence patient perspectives and decision making, while also creating collective wisdom among patients who are experts at "experiencing" a disease and who are highly motivated to control or manage exacerbations[97]. For example, the web site "PatientsLikeMe" claims it is the largest database of ALS (Amyotrophic Lateral Sclerosis or Lou Gehrig's Disease) patients in the world totalling 5% of all ALS patients[98]. Such a large group in a self-managed community has huge potential to assist health professionals in uncovering trends in patient symptoms and treatment responses[99]. Still, these web sites have gone largely unnoticed in a Canadian health sector that is unable to embrace and leverage these technologies.

Emerging health information technologies are positioned to have a substantial impact on Canada's health care system. These technologies can enable patients to communicate directly to their physicians or other health care providers, supported by detailed, accurate records of their personal health experiences and trends over time[100]. However, empirical testing related to re-designing health care services to take advantage of these technologies has not been conducted. Nor is there much in evidence that examines how PHRs can improve the delivery of health services (e.g., reduce wait times), while at the same time enhance quality of patient care and patient satisfaction at the system level. There is much promise in PHRs, and there is little doubt that system-wide benefits will be found. However, quantifying the benefits and identifying the best strategies to widely implement the technologies is important work yet to be done. There is much the Centre can do to engage health industry stakeholders to develop implementation strategies that re-design health services to leverage these technologies and advance quality patient care and cost savings.

Conclusions & Recommendations:

Health information technology has much to offer in the area of health care system innovation (e.g., streamlined communication, seamless flow of patient information, improved clinical practice environments). In fact, as some have rightly noted, health care "Chief Information Officers" (CIOs) should change the "I" to become "Chief Innovation Officers" to more accurately reflect the role they have to play in the transformation of health care. Yet, a strategy for how to systematically and cost-effectively integrate HIT within the Canadian system remains a challenge to all managers of the system.

The following recommendations are three important actions we believe Canadian health system leaders and HIT managers can take:

1. **Systematically engage key health system stakeholders (e.g., clinicians, patients, management, health statisticians and IT developers) in early stages of information technology development, and all stages through to implementation.**

   Involvement by health professionals in the design and development of HIT can create win-win scenarios where HIT can benefit patients, organizations and clinicians without imposing additional work or loss of flexibility. Health professionals need to be involved early in planning, testing and execution of HIT. Similar as in the use of medical devices, noted above, physicians are critical members of the health team who can focus HIT projects and solutions quickly and effectively with other members of the health care team. It should be also understood by everyone involved that implementation of new systems will take time and will need to be performed in sequence to create success, so any benefits and issues can be fully understood and stakeholder buy-in generated. Further, it needs to be understood by all stakeholders that implementation of a new information technology must also examine and re-engineer all of the business and clinical processes the technology supports. This step-by-step approach corrects mistakes early and helps to avoid the catastrophic failure of "big bang" implementations.

2. **Examine health systems globally to determine the critical factors necessary for successful design, implementation and adoption of information technologies in Canada's health system.**

   Health systems in many other countries have already achieved an extensive record of successes in the use of health information technology with respect to health system efficiency and productivity. Canada needs to learn from these other countries in order to more quickly identify "tried and true" strategies for successful HIT innovation.

3. **Incentivize health teams and health leaders to engage and develop health information technology.**

Appropriately integrating health information technology within Canada's health system will require substantial investments in time, energy and commitment from health teams. Health system leaders will need to create financial incentives for health teams by appropriately rewarding and recognizing employees when they do engage in the development and integration of HIT systems, since they are critical to the success of HIT innovation.

Conclusion

There is a clear link between innovation and productivity. Productivity, in turn, generates higher standards of living and greater wealth, and there is no reason why we can't turn the innovations we generate in health care into higher productivity and a competitive advantage for Canada. Indeed, we must.

We must:

1. **Grow leadership capacity for innovation in Canada through education, skills development, and team-building across all of the health system. For example, every health institution in Canada should make someone responsible for innovation. Doing so will develop a culture that can identify, understand, embrace and enable innovation.**

2. **Build momentum for innovation within the system starting with small projects first. The health system is complex and needs to "learn early and fail cheap", instead of doing the opposite, which is more typical.**

3. **Create a culture across the health system that puts focus on adoption and commercialization of ideas and innovations, not just the creation of new knowledge.**

Most importantly, our research and experience shows that "Innovation Takes Leadership" and building these leadership competencies is an investment our system must make in order to be sustainable.

References

[1] Conference Board of Canada. (2008). How Canada Performs: A Report Card on Canada.

[2] McKinsey and Company. (2008). Breaking Away From the Pack: Enhancing Canada's Global Competitiveness, pp. 1-3.

[3] Strategic Plan: The Ivey Centre for Health Innovation and Leadership, pp. 3-4.

[4] McKinsey and Company. (2008). Breaking Away From the Pack: Enhancing Canada's Global Competitiveness.

[5] O'Reilly, C., & Tushman, M. (2005). The Ambidextrous Organization. Harvard Business Review. Harvard Business School Publishing, May 2005.

[6] O'Reilly, C. & Tushman, M. (2005). The Ambidextrous Organization. Harvard Business Review. Harvard Business School Publishing, May 2005.

[7] Young, G. J., Burgess, J. F., & White, B. (2007). Pioneering pay-for-quality: Lessons from the rewarding results demonstrations. Health Care Financing Review, 29(1), 59-70. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=27763771&site=bsi-live

[8] Hanse, F. (2006). Pay for performance expands in health care industry. Compensation & Benefits Review, 38(5), 6-6. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=22521744&site=bsi-live

[9] Deber, R. B. (2003). Health care reform: Lessons from Canada. American Journal of Public Health, 93(1), 20. Retrieved from http://ezproxy.uwindsor.ca/login?url=http://proquest.umi.com/pqdweb?did=277186061&Fmt=7&clientId=2241&RQT=309&VName=PQD

[10] Sigler, K. J. (2003). CEO compensation and healthcare organisation performance. Management Research News, 26(6), 31-38. Retrieved from E-Journals @ Scholars Portal database.

[11] O'Reilly, C. & Tushman, M. (2005). The Ambidextrous Organization. Harvard Business Review. Harvard Business School Publishing, May 2005.

[12] Briesacher, B. A., Field, T. S., Baril, J., & Gurwitz, J. H. (2009). Pay-for-performance in nursing homes. Health Care Financing Review, 30(3), 1-13. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=41529844&site=bsi-live

[13] Shick, S. (2009). Canada faces widespread e-health skills shortage. CIO Canada: Dec. 3, 2009.

[14] Sigler, K. J. (2003). CEO compensation and healthcare organisation performance. Management Research News, 26(6), 31-38. Retrieved from E-Journals @ Scholars Portal database.

[15] Zingheim, P. K., Schuster, J. R., & Thomsen, D. A. (2005). The executive compensation crisis in nonprofit hospitals and medical groups. Journal of Health Care Finance, 32(1), 28-36. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=20302466&site=bsi-live

[16] Kaissi, A. A., Begun, J. W., & Nelson, T. W. (2008). Strategic planning processes and hospital financial Performance/PRACTITIONER APPLICATION. Journal of Healthcare Management, 53(3), 197-209. Retrieved from ABI/INFORM Global @ Scholars Portal database.

[17] Briesacher, B. A., Field, T. S., Baril, J., & Gurwitz, J. H. (2009). Pay-for-performance in nursing homes. Health Care Financing Review, 30(3), 1-13. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=41529844&site=bsi-live

[18] Howlett, K. (2010). CEO's at Ontario hospitals to face pay-for-performance rules. The Globe and Mail: Tuesday, April 6, 2010.

[19] Howlett, K. (2010). CEO's at Ontario hospitals to face pay-for-performance rules. The Globe and Mail: Tuesday, April 6, 2010.

[20] Young, G. J., Burgess, J. F., & White, B. (2007). Pioneering pay-for-quality: Lessons from the rewarding results demonstrations. Health Care Financing Review, 29(1), 59-70. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=27763771&site=bsi-live

[21] Fallat, A. (2007). Practitioner Application. Journal of Healthcare Management, 52(1), 18-19. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=23778277&site=ehost-live

[22] Aba, S., Goodman, W. D., & Mintz, J. M. (2002). The Health Papers: Funding Public Provision of Private Health - The Case for a Copayment Contribution through the Tax System. C. D. Howe Institute Commentary, COV(22)-22. Retrieved from CPI.Q @ Scholars Portal database.

[23] Aba, S., Goodman, W. D., & Mintz, J. M. (2002). The Health Papers: Funding Public Provision of Private Health - The Case for a Copayment Contribution through the Tax System. C. D. Howe Institute Commentary, COV(22)-22. Retrieved from CPI.Q @ Scholars Portal database.

[24] Hargadon, A. & Sutton, R. (2000). Building an Innovation Factory. Harvard Business Review, May-June 2000. pp. 162, 165-166

[25] O'Reilly, C. & Tushman, M. (2005). The Ambidextrous Organization. Harvard Business Review. Harvard Business School Publishing, May 2005.

[26] Hargadon, A. & Sutton, R. (2000). Building an Innovation Factory. Harvard Business Review, Harvard Business School Publishing, May-June 2000.

[27] Garvin, D. A. & Levesque, L. C. (2006). Meeting the Challenge of Corporate Entrepreneurship. Harvard Business Review, Harvard Business School Press (Boulder, CO), Oct. 2006, pp. 102-112. Retrieved from Harvard Business School Press Reprint # RO610G.

[28] Wolcott, R. & Lippitz, M. (2007). The Four Models of Corporate Entrepreneurship. MIT Sloan Management Review, 49(1), pp. 75-82. MIT Sloan School of Management (Cambridge, MA), Fall 2007. Retrieved from Harvard Business School Reprint #SMR 266.

[29] Hargadon, A. & Sutton, R. (2000). Building an Innovation Factory. Harvard Business Review, May-June 2000.

[30] McGrath, R. G. & Keil, T. (2007). The Value Captor's Process. Harvard Business Review, May 2007, pp. 129-136. Harvard Business School Press. Retrieved from Harvard Business School Press Reprint # RO705J.

[31] Hargadon, A. & Sutton, R. (2000). Building an Innovation Factory. Harvard Business Review, May-June 2000.

[32] Tarantino, D.P. (2007). Organizational Success = "4+2". Physician Executive, 33(3), pp. 80-82.

[33] Garman, A. N., & M. P. Johnson. (2006). "Leadership Competencies: An Introduction." Journal of Health Care Management 51(1): 13-17.

[34] Calhoun, J. G., Dollett, L., Sinioris, M. E., Wainio, J. A., Butler, P. W., Griffith, J. R., et al. (2008). Development of an interprofessional competency model for health care leadership. Journal of Health care Management, 53(6), pp. 375-390.

[35] Garman, A. N. & Johnson, M. P. (2006). Leadership competencies: An introduction. Journal of Health care Management, 51(1), pp. 13-17.

[36] Prahalad, C.K. & Hamel, G. (1990). "The Core Competence of the Corporation," Harvard Business Review, Harvard Business School Press, May-June 1990, pp. 79-91.

[37] McAlearney, A.S. (2008). Using Leadership Development Programs to Improve Quality and Efficiency in Health Care. Journal of Health care Management, 53(5), p. 319-331.

[38] McGahan, A. (2004). How Industries Change. Harvard Business Review. Harvard Business School Press, October 2004.

[39] McGahan, A. (2004). How Industries Change. Harvard Business Review. Harvard Business School Press, October 2004.

[40] Scott, K. (2009). The Search for Effective Physician Leaders: New Strategies for New Challenges. *Physician Executive*, 35(2), p. 44-48.

[41] Scott, K. (2009). The Search for Effective Physician Leaders: New Strategies for New Challenges. *Physician Executive*, 35(2), p. 44-48.

[42] Priselac, T. M. (2007). Remarks to *The National Centre for Health Care Leadership.*

[43] Robbins, C. J., Bradley, E. H., & Spicer, M. (2001). Developing Leadership in Health Care Administration: A Competency Assessment Tool. *Journal of Health care Management*, 46(3), p. 188.

[44] Justice, W. (2005). Searching for Managerial, Leadership Skills along the Yellow Brick Road. *Health Care Purchasing News*, 29(8), pp. 60.

[45] Serio, Catherine D. (2006). Physician Leadership: A New Model for a New Generation. *Medscape Today*. Retrieved from http://www.medscape.com/viewarticle/524045

[46] Tarantino, D.P. (2007). Organizational Success = "4+2". *Physician Executive*, 33(3), p. 80-82.

[47] McGahan, A. (2004). How Industries Change. *Harvard Business Review.* Harvard Business School Press, October 2004.

[48] Tarantino, D.P. (2007). *Organizational Success = "4+2". Physician Executive*, 33(3), p. 80-82

[49] Tarantino, D.P. (2007). Organizational Success = "4+2". *Physician Executive*, 33(3), p. 80-82

[50] Tarantino, D.P. (2007). Organizational Success = "4+2". *Physician Executive*, 33(3), p. 80-82

[51] MacNulty, A. & Kennedy, D. (2008). Beyond the Models: Investing in Physician-Hospital Relationships. *Health Care Financial Management*, 62(12), p. 72-77.

[52] Skinner, C. & Spurgeon, P. (2005). Valuing Empathy and Emotional Intelligence in Health Leadership: A study of empathy, leadership behaviour and outcome effectiveness. *Health Services Management Research*, 18(1), p. 1-12.

[53] Serio, Catherine D. (2006). Physician Leadership: A New Model for a New Generation. Medscape Today. Retrieved from http://www.medscape.com/viewarticle/524045

[54] Serio, Catherine D. (2006). Physician Leadership: A New Model for a New Generation. Medscape Today. Retrieved from http://www.medscape.com/viewarticle/524045

[55] Tarantino, D.P. (2007). *Organizational Success = "4+2". Physician Executive*, 33(3), p. 80-82.

[56] MacNulty, A. & Kennedy, D. (2008). Beyond the Models: Investing in Physician-Hospital Relationships. *Healthcare Financial Management*, 62(12), p. 72-77.

[57] Robbins, C. J., Bradley, E. H., & Spicer, M. (2001). Developing Leadership in Healthcare Administration: A Competency Assessment Tool. *Journal of Healthcare Management, 46*(3), p. 188.

[58] Silva, C. (2007). New medical technologies favor consumers, personalized care. *Employee Benefit News, 21*(1), 16-18. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=23843993&site=bsi-live

[59] Robinson, J. C. (2008). Value-based Purchasing for Medical Devices. *Health Affairs, 27*(6), 1523-1531. doi:10.1377/hlthaff.27.6.1523

[60] Robinson, J. C. (2008). Value-based Purchasing for Medical Devices. *Health Affairs, 27*(6), 1523-1531. doi:10.1377/hlthaff.27.6.1523

[61] Robinson, J. C. (2008). Value-based Purchasing for Medical Devices. *Health Affairs, 27*(6), 1523-1531. doi:10.1377/hlthaff.27.6.1523

[62] Pauly, M. V. & Burns, L. R. (2008). Price Transparency for Medical Devices. *Health Affairs, 27*(6), 1544-1553. doi:10.1377/hlthaff.27.6.1544

[63] Schur, C. L. & Berk, M. L. (2008). Views on Health Care Technology: Americans Consider the Risks and Sources of Information. *Health Affairs, 27*(6), 1654-1664. doi:10.1377/hlthaff.27.6.1654

[64] Belkin, N. (2007). In-house Reprocessing -- Why Not? *Healthcare Purchasing News*, 31(10), 68-69. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=26998267&site=bsi-live

[65] Svistounov, A., Kestell, C., Adams, K., & Munday, K. (2007). Effects of Medical Device Legislation on Innovation within Australian Manufacturing Companies. *Innovation: Management, Policy & Practice, 9*(3-4), 343-350. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=28118658&site=bsi-live

[66] ConforMIS, Inc., (2009). ConforMIS receives CE mark for the first and only personalized Bicompartmental Knee Resurfacing System. *Hospital Business Week*. Retrieved from http://ezproxy.uwindsor.ca/login?url=http://proquest.umi.com/pqdweb?did=1773891081&Fmt=7&clientId=2241&RQT=309&VName=PQD

[67] ConforMIS, Inc., (2009). ConforMIS receives CE mark for the first and only personalized Bicompartmental Knee Resurfacing System. *Hospital Business Week*. Retrieved from http://ezproxy.uwindsor.ca/login?url=http://proquest.umi.com/pqdweb?did=1773891081&Fmt=7&clientId=2241&RQT=309&VName=PQD

[68] ConforMIS, Inc., (2009). ConforMIS receives CE mark for the first and only personalized Bicompartmental Knee Resurfacing System. *Hospital Business Week*. Retrieved from http://ezproxy.uwindsor.ca/login?url=http://proquest.umi.com/pqdweb?did=1773891081&Fmt=7&clientId=2241&RQT=309&VName=PQD

[69] ConforMIS, Inc., (2009). ConforMIS receives CE mark for the first and only personalized Bicompartmental Knee Resurfacing System. *Hospital Business Week*. Retrieved from http://ezproxy.uwindsor.ca/login?url=http://proquest.umi.com/pqdweb?did=1773891081&Fmt=7&clientId=2241&RQT=309&VName=PQD

[70] ConforMIS, Inc., (2009). ConforMIS receives CE mark for the first and only personalized Bicompartmental Knee Resurfacing System. Hospital Business Week. Retrieved from http://ezproxy.uwindsor.ca/login?url=http://proquest.umi.com/pqdweb?did=1773891081&Fmt=7&clientId=2241&RQT=309&VName=PQD

[71] Osmani, V., Balasubramaniam, S., & Botvich, D. (2008). Human activity recognition in pervasive health-care: Supporting efficient remote collaboration. *Journal of Network & Computer Applications, 31*(4), 628-655. doi:10.1016/j.jnca.2007.11.002

[72] Cohen-Kohler, J. C., Esmail, L. C. & Cosio, A. P. (2007). Canada's implementation of the Paragraph 6 Decision: Is It Sustainable Public Policy? *Globalization and Health,* 3(12). doi:10.1186/1744-8603-3-12

[73] Arsenault, J. F. & Sharpe, A. (2006). An Analysis of the Causes of Weak Labour Productivity Growth in Canada since 2000, Calculations based on the Canadian Productivity Accounts from Statistics Canada, Cansim Table 383-0021. *International Productivity Monitor*, 16.

[74] See Prada and Santaguida. *Conference Board*. (2007). pp. 30, Chart 16.

[75] Weitzman, E. R., Kaci, L. & Mandl, K. D. (2009). Acceptability of a Personally Controlled Health Record in a Community-Based Setting: Implications for Policy and Design. *Journal of Medical Internet Research*, 11:e14.

[76] Kummervold, P.E., Chronaki., C. E., Lausen, B., Prokosch, H., Rasmussen, J., Santana, S., et al. (2008). *eHealth Trends in Europe 2005-2007: A Population-Based Survey. Journal of Medical Internet Research*; 10:e42.

[77] Hillestad R, Bigelow J, Bower A, Girosi F, Meili R, Scoville R, et al. (2005). Can electronic medical record systems transform health care? Potential health benefits, savings, and costs. *Health Affairs*, 24:1103-1117.

[78] McGahan, A. M. (2004). *How Industries Change*. Harvard Business Review: Oct. 2004, p. 87-94

[79] Ash, J. S., Berg, M. & Coiera, E. (2004). Some unintended consequences of information technology in health care: The nature of patient care information system-related errors. *Journal of the American Medical Informatics Association,* 11:104-112.

[80] Miller, R.H. & Sim, I. (2004). Physicians' use of electronic medical records: Barriers and solutions. *Health Affairs*, 23:116-126

[81] El-Kareh R, Gandhi TK, Poon EG, Newmark LP, Ungar J, Lipsitz S, et al. (2009). Trends in Primary Care Clinician Perceptions of a New Electronic Health Record. *Journal of General Internal Medicine*, 24:464-468.

[82] Menachemi, N., Matthews, M. C., Ford, E. W., Brooks, R. G. (2007). The Influence of Payer Mix on Electronic Health Record Adoption by Physicians. *Health Care Management Review*, 32:111-118.

[83] Miller, R.H. & Sim, I. (2004). Physicians' use of electronic medical records: Barriers and solutions. *Health Affairs*, 23:116-126.

[84] Blumenthal, D. & Glaser, J. P. (2007). Information Technology Comes to Medicine. *New England Journal of Medicine*, 356:2527-2534.

[85] J. Health Informatics and Health Information Management: *Human Resources Report*. (2009).

[86] Information Communications Technology Council (ICTC). (2009). *Canada faces widespread e-health skills shortage*. CIO Canada.

[87] Donner M. Testimony of Marc Donner, Director of Engineering, Google Health: National Committee on Vital and Health Statistics Executive Subcommittee on Privacy, Confidentiality & Security. *Hearing on Personal Health Records*. Retrieved from http://www Ncvhs Hhs gov/090520p07.Pdf

[88] Grossman, J. M., Zayas-Caban, T. & Kemper, N. (2009). *Information Gap: Can Health Insurer Personal Health Records Meet Patients' And Physicians' Needs?* Health Affairs, 28:377-389.

[89] Kaelber, D. C., Jha, A.K., Johnston, D., Middleton, B., Bates, D.W. (2008). A Research Agenda for Personal Health Records (PHRs). *Journal of the American Medical Informatics Association,* 15:729-736.

[90] Kummervold, P. E., Chronaki, C. E., Lausen, B., Prokosch, H., Rasmussen, J., Santana, S., et al. (2008). E-Health Trends in Europe 2005-2007: A Population-Based Survey. *Journal of Medical Internet Research*; 10:e42.

[91] Stewart, D. (2009). Socialized Medicine: How Personal Health Records and Social Networks Are Changing Healthcare. *Econtent*, 32:30-34.

[92] Mandl, K. D. & Kohane, I. S. (2008).Tectonic Shifts in the Health Information Economy. *New England Journal of Medicine*, 358:1732-1737.

[93] Grossman, J. M., Zayas-Caban, T. & Kemper, N. (2009). Information Gap: Can Health Insurer Personal Health Records Meet Patients' And Physicians' Needs? *Health Affairs,* 28:377-389.

[94] Kaelber, D. C., Jha, A. K., Johnston, D., Middleton, B., Bates, D.W. (2008). A Research Agenda for Personal Health Records (PHRs). *Journal of the American Medical Informatics Association*, 15:729-736.

[95] Weitzman, E. R., Kaci, L., Mandl, K. D. (2009). *Acceptability of a Personally Controlled Health Record in a Community-Based Setting: Implications for Policy and Design*. *Journal of Medical Internet Research*, 11:e14.

[96] Nijland, N., van Gemert-Pijnen, J., Boer, H., Steehouder, M. F. & Seydel, E. R. (2008). Evaluation of Internet-Based Technology for Supporting Self-Care: Problems Encountered by Patients and Caregivers When Using Self-Care Applications. *Journal of Medical Internet Research,* 10:e13.

[97] Eysenbach, G. (2008). Medicine 2.0: Social Networking, Collaboration, Participation, Apomediation, and Openness. *Journal of Medical Internet Research*, 10:e22.

[98] Frost, J. H. & Massagli, M. P. (2008). Social Uses of Personal Health Information Within PatientsLikeMe, an Online Patient Community: What Can Happen When Patients Have Access to One Another's Data. *Journal of Medical Internet Research*, 10:e15.

[99] Miller, R. H. & Sim, I. (2004). Physicians' use of electronic medical records: Barriers and solutions. *Health Affairs*, 23:116-126.

[100] Tufano, J. T., Ralston, J. D. & Martin, D. P. (2008). *Providers' Experience with an Organizational Redesign Initiative to Promote Patient-Centered Access: A Qualitative Study.* Journal of General Internal Medicine, 23:1778-1783.