E-Health and the Transformation of Healthcare

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Executive summary

Of all the industries whose consumers stand to benefit from the wider application of technology to enable connectivity and knowledge sharing, it is difficult to go past health.

No less than 25% of all Australians suffer from a chronic illness and nearly every one of them would be better off if the medical practitioners who care for, and treat them were more in touch with each other. It is hard to understand how Australians can tolerate the fact that they're not.

This paper sets out the cost – both to the patients and to the nation – of a system in which providers of health care to chronically ill people operate in disconnected silos where one doctor often does not know what another has tested for and prescribed, sometimes even when they are members of the same care team.

The figures for this lack of information-sharing and co-ordination are starkly worrying.

- More than 50% of doctors do not follow best practice guidelines;
- Between 30 and 50% of patients with chronic disease are hospitalised because of inadequate care management
- Fewer than 14% of people with chronic disease are placed on care plans; and
- Less than one per cent of patients are tracked to see if they adhere to care plans. Thus, all but a tiny portion of those plans created are all but useless.

The impact on the individual can be imagined; the cost to the nation is immense. In Australia, it's estimated that improved knowledge sharing and care plan management for patients with chronic disease would generate direct savings to the health care system of more than $1.5 billion per annum. Savings to the community from associated non-health care costs are of the same order. And increased workforce participation and productivity could add a further $4 billion per annum to the economy. .

For the patients, home monitoring could reduce emergency room visits by up to 40%, hospital admissions by 30-60% and length of hospital stays by up to 60%.

The evidence for better outcomes through more proactive patient interaction is persuasive – one study demonstrated that better disease management improved patient satisfaction (71%); patient adherence to care plans (47%); and disease control (45%).

Clearly, the benefits are there to be had. This paper posits that the two key characteristics of health care that should drive the type of Information and Communications Technology (ICT) are:

1. an acknowledgement that the fundamental business of health care is knowledge;
2. the need to be fully cognisant of the inherent complexity of health care composed as it is, of a large variety of highly autonomous, independent practitioners, all with their own systems and practices.

This Paper submits that – given the business environment – three elements have proven to be keys to success: 1) a business model based on the knowledge enterprise; 2) a focus on connectivity; and 3) internet-like ICT solutions.

The **knowledge enterprise** is characterised by networked information, support for autonomy and personalisation and use of systems that are open, adaptive and distributed. This is the business model that has proven to be successful for knowledge-based industries which, after all, health care is. Yet, the business model we use in health is based on an industrial enterprise where the focus is often on the management of physical resources with very little attention to the management of knowledge.

The second key is **connectivity** where competitive advantage accrues to those who invest in connecting power, not raw computing power and large, monolithic applications. The more connections, the better – don't spend time ensuring all the systems conform, get connected. Once connected, individual value propositions will drive stakeholders toward agreements and standards, continually increasing the value of the data in an evolutionary way. This is not what we have in health care where most investment has been directed at the development of large, closed monolithic systems.

The third key to success is the development of **open, internet-like networks of businesses and users**. We must design our systems to accommodate:

- the heterogeneity and incompleteness of information,
- the distributed and diverse nature of the information sources and users; and
- the various forms of autonomous and governed institutions and businesses that are part of the health care system.

What we currently have are attempts to remove the heterogeneity and autonomy from the system so that it can be better run, a bit like a well-organised bank.

The internet is the clearest example of a system which accommodates autonomy and heterogeneity because it 1) connects anything, anybody, anywhere; and 2) divests investment and control of the network (and its services) from a central authority to suppers and users.

Taking these three elements seriously will involve a fundamental change in the way we see both ICT and health care and opens the way to transform chronic disease management in this country.

Moving forward

We should focus on three important areas:

1. get healthcare providers connected to one another
2. track health events across the continuum of care
3. create a broadband network of health services

In business, most high priority and high volume communications are handled electronically. But in health care, high-importance communications – e.g. referrals and hospital discharge summaries – are created using paper and pen and delivered via fax, letter and even by hand.

This is the point where we should begin – simply, aim to get referrals and discharge summaries to be delivered electronically in a convenient and secure form.

Each of these important areas is discussed in some detail in the body of this Paper.

Once health information is flowing electronically and is able to be accessed through open services interfaces, it will then be possible to add incrementally a wide range of value-adding services to this network. The Paper offers some examples in this area.

The Paper raises one final, important point - that of incentives. There is a cost to building this connectivity and information sharing but there is a mis-alignment between those who pay and those who receive the benefit. This barrier needs to be breached by:

- partnerships between government and industry
- governments, private insurers and employers offering incentives for using electronic services, broadband health network and best practice processes

While it is difficult to provide incentives based on health outcomes (given the difficulty of measurement and variability of outcomes) it is relatively easy to measure, and therefore provide incentives for, the use electronic services and best practice processes.

All this will take money, partnerships between government and industry and, of course, goodwill. However, with the right conceptual framework and by taking seriously the knowledge enterprise and the autonomy of care providers and consumers, we can start to transform the way we look after Australia's chronically-ill patients.

The cost of chronic disease

The estimated number of Australians with diagnosed diabetes in April 2006 was 766,437 and growing at 9% per annum.[1] The prevalence of diabetes, including undiagnosed cases, is estimated to be twice that number, and a further 1.5 million persons are pre-diabetic. The direct healthcare costs of diabetes in Australia in 2001 were over $800 million.[2] Other studies estimate that the average direct health care costs for each person with Type 2 diabetes in 2001 was $4,261,[3] equating to more than $3 billion per annum if applied to all diagnosed cases of diabetes in Australia. The addition of non-healthcare costs such as travel, special diets, and carer expenses are estimated to almost double this cost.

Chronic disease significantly impacts labour market participation and productivity. In the US, the participation rate for Type 2 diabetes sufferers aged over 55 years is 70% for males and 48% for females, compared to 84% and 60% respectively for non-sufferers. In addition, working diabetic males [aged over 50 years] earn on average 69% [of that of] non-diabetics.[4]

Poor management of diabetes leads to heart attack, stroke, leg and foot amputations, blindness, and kidney failure. Approximately four million people worldwide die from diabetes every year, and it is predicted that this will increase by up to 80% in the next decade.[5]

The prevalence and cost of other chronic diseases is of comparable magnitude and cost. For example, in 2001 cardiovascular diseases cost the Australian healthcare system $5.5 billion (10.9% of total allocated health expenditure), respiratory diseases $3.7 billion (7.5%) and mental disorders another $3.7 billion.[2]

Conventional approaches do not work

Conventional approaches to health care are not well suited for the prevention and treatment of chronic disease. According to the American College of Physicians, "meeting the complex needs of patients with chronic illness or impairment is the single greatest challenge facing organised medical practice."

Unlike acute care services, which are designed to respond to trauma and acute episodes, chronic illness requires close monitoring and ongoing management across an entire team of care professionals. People with chronic disease need to be provided with a care plan, detailing medications, treatments, tests, and referrals tailored to their specific circumstances. This plan then needs to be tracked continuously, together with prompts and reminders, to help ensure compliance. At the same time, key health parameters, such as blood glucose levels and body weight, need to be continuously monitored and interventions or changes in the care plan effected in a timely way.

But healthcare providers largely operate in disconnected silos, hindering continuity of care. Doctors often do not know what medications and tests have been given to patients by other doctors, even when they are members of the same care team. It is even more difficult to bring relevant medical knowledge to the point of care, to create integrated care plans, to monitor a patient's progress against the care plan, or to alert care providers when a patient's condition requires intervention. The Economist has referred to this as "Health Care's Outrageous IT Gap".[6]

Over 50% of doctors do not follow best practice guidelines[7] and 30-50% of patients with chronic disease are hospitalised because of inadequate care management.[8] In Australia, despite Commonwealth financial incentives, less than 14% of people with chronic disease are placed on care plans. Worse still, less than 1% of patients are tracked for adherence to care plans, rendering all but a tiny portion of those plans all but useless.[9]

People with chronic disease also have difficulty managing their own care. Even without complications, diabetes management requires self-management training, regular and timely laboratory evaluations, clinical nutrition therapy, compliance with medication regimes, regular self-monitoring of blood glucose levels, and regular podiatric and ophthalmic examinations.

New approaches can work

The benefits of a more effective system for managing chronic illness are considerable, particularly for State Governments, which bear the major cost of managing acute episodes and disease complications. Communities would also benefit from increased workforce participation and productivity, as well as reduced indirect healthcare costs.

Evidence indicates that more proactive disease management, better utilization of knowledge, care-coordination, and remote monitoring of a patient's medical condition can make a significant difference to health outcomes and healthcare costs.

Numerous pilot studies show that home monitoring of persons with chronic disease can reduce emergency room visits by up to 40%, hospital admissions by 30-60%, and length of stay for those hospitalised by up to 60%, as well as providing significant improvements in quality of life.[10]

Other studies have suggested that physicians who receive electronic clinical reminders follow medical evidence more frequently than physicians who do not receive these reminders.[11]

In the US, Chronic Disease Management (CDM) programs that focus on proactive patient interaction have also produced significant improvements in healthcare processes and outcomes. A recent study[12] of over 16,000 titles and review of 102 rigorous studies published between 1987 and 2001 concluded that disease management programs were associated with marked improvements in many different processes and outcomes of care. Of the outcomes studied, disease management appeared most commonly to improve patient satisfaction (71%), followed by patient adherence (47%) and disease control (45%).

A number of CDM programs have reported significant cost savings. American Healthways, a company that provides disease management services to consumers and businesses, claims that participants have shown significant health improvements and cost savings of 23% for the entire population and nearly 64% for those patients with chronic heart failure. Ohio State Teachers federation found that implementation of a disease management program for 5,800 enrollees resulted in $8.6m savings in the first year. LifeMasters, another disease management service provider, studied 100 of its patients with advanced congestive heart failure and found that web-enabled disease management improved clinical outcomes and treatment compliance and saved nearly $500,000 in costs.[13]

Other productivity gains and improved health outcomes should be available from the better information sharing and better coordination of care between settings, such as presentation to a new medical practice or referral between care providers; the presentation to a hospital from the community or as referred by a doctor; and discharge from hospital to a GP or aged care facility.

In these situations, better sharing of information should result in a reduction in Adverse Drug Events (ADEs). This in turn should lead to reduced hospital admissions, reduced visits to other healthcare providers, and reductions in medications and pathology costs associated with treatment of the ADEs.

In Australia, it is estimated that improved knowledge sharing and care plan management for patients with chronic disease would produce direct health care savings of over $1.5 billion a year.[14] The savings in non-health care costs (such as travel, special foods, and carer expenses) are estimated to be the same order of magnitude. And increases in workforce participation and productivity could add a further $4 billion per year in benefits to the economy.

Information and Communications Technology (ICT) is essential to achieving these benefits—we simply do not have sufficient medical and healthcare personnel to be able to carry out these tasks and programs without substantial automated support. But so far, with very few exceptions, the impact of ICT in chronic disease management has been minimal. Why is this, and what can be done to change the situation?

Knowledge, connectivity, and autonomy

I will below try to spell out a simple way forward, based on some very simple objectives. But before I do that, I first wish to challenge the conventional framework for thinking about ICT solutions for health care.

There are two key characteristics of health care that should drive the type of ICT solution we consider. First, we need to take seriously that the fundamental business of health care is knowledge: knowledge of the patient, knowledge of medical treatments and practice, knowledge of the healthcare system, and knowledge of the prevailing environment. This knowledge is extensive and complex, is continuously changing, must be shared among many providers and consumers, and must be brought to bear at the right time, in the right context, at the point of care. Second, we need to be fully cognizant of the inherent complexity of health care: it is composed of a large variety of participants, highly heterogeneous systems and practices, highly autonomous and independent agents, and highly distributed information sources and health services.

In such a business environment, there are three elements that have proven to be key to success: (1) The knowledge enterprise, (2) Connectivity, and (3) Open Internet-based networks of businesses and users.

The knowledge enterprise

The business model that has proven to be successful for knowledge-based industries is the knowledge enterprise. Yet the business model we use in most healthcare systems is based on an industrial enterprise. This is characterized by a focus on physical components, big players to get economies of scale, detailed planning, standardization, stability, and locked-down, tightly integrated computer systems. The aim has largely

been to move from what is seen by many from an inefficient “cottage industry” to a more efficient industrial enterprise.

This approach may be suitable for running hospitals but it will not work for managing and preventing chronic illness across the continuum of care. Here, the organisations and people involved use different systems, different practices, different data and different processes. The type of care is also different: it requires continuous care surveillance, with reminders and alerts sent to the right people and followed up with the right intervention at the right time.

The model of information systems has to adapt to match this model of care. Instead of the industrial model, which may work within a hospital setting, we need a knowledge enterprise model – the kind that is typical of Google, Amazon and eBay.

The knowledge enterprise is characterized by networked information, support for autonomy and personalisation, and the use of systems that are open, adaptive and distributed.

Not many are thinking this way in health care. We are still planning, standardizing, and buying the big systems. These kinds of electronic healthcare systems, currently being rolled out in the UK, require massive investments – between 5-10% of annual health care expenditure.

Some jurisdictions are also moving to mandate a limited number of “authorised” applications rather than setting up the infrastructure that would allow for a multitude of interoperable systems. It is difficult to think of anything more likely to kill innovation or more antagonistic to the Internet revolution than the restriction of an entire industry to a limited number of “standard” software applications.

Connectivity

The second key is connectivity.

In the period of the Information Economy (1970 to 1995), competitive advantage lay with investing in **crunching power**: large applications that could process more information more quickly than others. Technology adoption was driven by Moore's Law: the performance to price ratio of computing doubles every eighteen months.

But for the Knowledge Economy (from 1995 forwards), raw computing power and large monolithic applications are not the key to success. Here competitive advantage accrues to those who invest in **connecting power**: connecting to more people and more systems to share knowledge faster and farther. The prevailing law is Metcalf's Law: the value of a computer is proportional to the square of the number of connections it makes.

The more connections the better: think of LimeWire (sharing music files), YouTube (sharing video clips), and Skype (Voice over IP). The key message: don’t spend time getting agreement on the data, don’t spend time ensuring all the systems conform – *get connected.*

Once connected, individual value propositions will drive stakeholders towards agreements and standards, continuously increasing the value of the data in an evolutionary way. The need to understand the flow of information will drive faster

adoption of standards, in a virtuous cycle of increased information flow, improving standards, and increasing value.

However, this is not what we have focused on in health care. Instead, most investment has been directed at the development of large, closed, monolithic systems. The Electronic Health Record (EHR) is almost universally seen as the key to better knowledge sharing in health care, but rather it is the connectivity of the players that is the key. It is the information flow that is important, because from that everything else derives. Without it—without the connectivity to populate and to access health data—health care will remain a world of disconnected silos of information.

Open networks

Thirdly, we need to design our systems to accommodate the heterogeneity and incompleteness of information, the distributed and diverse nature of the information sources and users, and the various forms of autonomous and governed institutions and businesses that are part of health care. Instead, the conventional approach in health care can largely be characterized as an attempt to remove the heterogeneity and autonomy from the system, so that is can better run like a well organized bank.

The paradigm example of a system built to accommodate heterogeneity and autonomy is the Internet, and there are two keys to its success: (1) connecting anything, anybody, anywhere, and (2) divesting investment and control of the network (and its services) from a central authority to suppliers and users.

When the Internet was conceived in the early 1990s, it was radically different from the prevailing ICT model at that time. As Tim Berners Lee, the founding father of the World Wide Web, said in 1991: “The dream behind the Web is of a common information space in which we communicate by sharing information. Its universality is essential: the fact that a hypertext link *can point to anything, be it personal, local or global, be it draft or highly polished*” [my italics]. This was highly radical at the time, where uniformity, accuracy, and completeness of information was considered an essential part of computing methodology.

The Internet was also designed from the beginning to have no central authority and to operate “while in tatters”. While initial government investment was essential to provide the core infrastructure, the Internet’s huge growth has cost the taxpayer little or nothing, as each node is independent and has to manage its own financing and its own technical requirements. This allowed a mix of government and private investment, new applications and services to “plug in” and add value, and new and innovative technologies and business models to rapidly evolve.

These three key factors—the knowledge enterprise, connectivity, and open networks of users and suppliers—have already transformed the retail, finance and music industries, and are beginning to transform film and television.

However, by and large, health care is not thinking along these lines. There is a strong move towards centralized systems and control. There is a strong focus on standards and agreed terminologies. All of which can be positive, but not when used to constrain the development of open networks of innovative healthcare services and businesses.

Moving forward

Taking seriously the above three elements involves a fundamental change in our way of seeing ICT and health care and opens the way for transforming chronic disease management.

But what next steps can we take to move forward? There are, in my view, three important areas to focus on: (1) Getting healthcare providers connected to one another, (2) Tracking health events across the continuum of care, and (3) Creating a broadband network of health services, such as services for supporting chronic disease management.

Electronic messaging among providers

In businesses today, most high priority and high volume communications are handled electronically. Yet in health care, these high importance communications – such as referrals and hospital discharge summaries – are largely transmitted using paper and pen, fax, letter, and hand delivery. This state of affairs would be inconceivable in almost any other industry, let alone one that rests so fundamentally on knowledge and its sharing across the supply network.

This is where we should begin. We should simply aim to get referrals and discharge summaries to be delivered electronically in a convenient and secure form, even if much of the message content is in blobs of text or scanned documents. And we should simply use whatever standards or conventions are currently in practice.

To do so is not particularly expensive nor does it require any substantial change in business processes or care practice. In most cases, referrals, orders and results are already generated electronically – it is just that somehow they wind their way into paper documents, fax machines and letters rather than being transmitted electronically. The technology to do this is also simple and well known – encrypted email and secure web portals are all we need (though more on this below).

In some places, we are already on the way. A number of hospitals provide electronic discharge summaries and most pathology results are now delivered electronically. But this should be universal, and should be extended to include referrals, orders, hospital admissions, results and follow-up actions across the entire spectrum of care.

If this were to be done, it would help ensure that GPs, care teams, hospitals and community centres knew what each other was doing. The timely and accurate communication of health information would also reduce the large number of avoidable adverse events and other miscommunications that commonly occur between care providers.

But most important, as in any knowledge enterprise, connectivity is key to driving further value from the enterprise. Once information is flowing electronically, other applications and services can build on this information at relatively low incremental cost; without it, the cost becomes prohibitive, blocking any movement forward.

An example of this approach is The Tasmanian eHealth Collaborative Project, being supported by major private insurers, private hospitals, the Department of Veterans Affairs and the Australian Centre for Health Research in collaboration with the Tasmanian Department of Health and Human Services. This project aims to provide an ICT infrastructure for distributing electronic discharge summaries from private hospitals to the primary GP and other authorised care providers. It involves the

collaborative development and adoption of an electronic discharge summary and a secure messaging system that can be shared across both the public and private sector. The information will be transmitted in a secure environment via a broadband network, allowing the sharing of information with GP, other authorised and consented healthcare providers, and the consumer.

The system is expected to enhance the quality and safety of care and improve care coordination and continuity of care for patients by providing fast, reliable and legible information exchange between private hospitals and GPs. It will help support the sustainability of the health sector by providing a business and technology solution that can be easily extended to support a range of healthcare providers, including Specialists, Community Services and Allied Health. Most important, the solution will be designed so that it can easily be extended to facilitate and support the development of other broadband-based health services—such as chronic disease management services—across the wider healthcare community.

This then leads us to the next area of focus.

Tracking health events

The tracking of referrals, discharge summaries, orders and reports among care providers covers a large number of health events and provides a wealth of important information about patients and their care. However, the inclusion of other health events would greatly multiply the benefits.

Many health events are already electronically generated and stored; the problem is, they are not communicated among the care team or to the patient. For example, prescriptions for medications and many health assessments are already generated electronically either using clinical desktops (e.g., prescriptions) or secure web portals (e.g., medical examinations for private pilot licences).

To electronically track and share knowledge of these events should not be difficult – for a start, this information could simply be sent electronically to a secure server on the Internet that allowed other authorised and consented users to access it. And it requires minimal change to existing practice: the only process change required is to hit a "send" button rather than the print button.

Similarly, we could easily track most patient encounters with the health system by getting electronic access to MBS and PBS data. This information is already available to requesting consumers via letter – why not make it available to consumers electronically, within an appropriate authentication regime such as provided by digital certificates? The tax office already provides businesses with access to their tax records and other sensitive business information using digital certificates. Exactly the same mechanism and exactly the same technology could be provided to consumers to let them access their MBS and PBS records. Making it legal (and borrowing the technology from the tax office) is the only barrier preventing this from happening.

Other health events provide direct information on a patient's health status. For example, many patients with chronic disease use home monitors to track important pathophysiological information, such as blood glucose levels. Usually, the only person who sees this information is the patient. But many of these devices allow the data collected to be uploaded into a home computer or transmitted via phone to a remote

server. Once on the computer or uploaded to a server, it is relatively simple to take the next step and share this information with others on the care team.

Well almost. There is an important technological issue involved here. Unless all these communications (including e-referrals and discharge summaries) are able to be shared with the consumer and authorised and consented healthcare providers, it will be very difficult for anyone to get a patient-centred view of the information. This means, in particular, that the communications should not be purely point-to-point between care providers, as is the case for email messages. Such point-to-point communications are hidden to other parties, so that the knowledge of the related health event is not easily shared with the rest of the care team or the consumer. Moreover, it would not be possible to "plug in" software applications and services that were dependent on such information, as the information would also be hidden from these applications. In addition, point-to-point solutions cannot handle situations where the recipient is unknown (as, for example, when the patient chooses to go to different pharmacies to collect prescription medicines), and they need complex mechanisms for ensuring that the email was actually received **and noticed** by the recipient ("non-repudiation").

These considerations are particularly relevant in Australia, as some of the most popular e-referral systems being adopted by GPs and others are email-based, point-to-point solutions. But by not getting the conceptual framework right—by developing point solutions without a view to how these solutions could be used in an entire system of care—we are driving down a dead end.

Of course, not all the information collected from these various sources may be understandable to the patient or the care team. But it is a good start. And in the same way that applications such as MYOB and Microsoft Money assemble and analyse electronic transaction records from a multitude of banks and other institutions, it is not hard to imagine that software suppliers could develop local applications to assist users with the management of health records, including the financial side, once the data is available to them.

None of this is difficult, either technically or from a change management perspective. The information may be non standard, incomplete, and may, in some cases, be difficult to interpret. But this will drive users to adopt standards and, as they do so, more and more of the information will become understandable and more and more will become machine interpretable. Incrementally, a full EHR will emerge.

In reality, more complexity is required behind the scenes. Authentication and control of access rights require some sophisticated software, as well as agreed processes and authorities for controlling digital certificates and providing unique identifiers for consumers and providers. Privacy and consent must be carefully handled, allowing consumers and care providers to determine what is and what is not shared. There must be facilities for audit and non-repudiation must be guaranteed. But none of this is a barrier—the solutions already exist.

Chronic disease management services

Once health information is flowing electronically and able to be accessed through open services interfaces, it is then possible to incrementally add a wide range of value-adding services to this network. These services could be local applications, residing at a

hospital, on the GPs desktop, or with the consumer. Alternatively, they could be provided as hosted services by a variety of Application Service Providers (ASPs).

For example, ASPs could begin to develop a range of services for assisting with chronic disease management. These services could include intelligent monitoring and decision support software to assist in key care management tasks, such as continuous patient monitoring, creating and tracking personalized care plans, and the issuing of reminders and alerts to both care providers and consumers. They would provide a scalable, cost effective way of assisting providers and consumers comply with evidence-based care management practice. Consumers and their carers could be reminded of appointments, medication renewals, and tests, followed up to ensure compliance, and provided with continuous feedback on key health parameters.

As these services are developed, further disease management capability – such as referrals management, self education, population-based audit, provider feedback, and automated billing – could be "plugged in" to the network quickly and at minimal cost.

Such an open, Internet-based approach is key to the development and operation of a fully electronically-enabled healthcare system. It will provide far more direct and far faster access to market for small and innovative enterprises than possible under conventional distribution models; it enables businesses to link to and utilise technologies provided by other businesses; and it is most cost-effective for government, as many of the costs and risks of development are borne by the private sector.

For example, with the assistance of funding from the Department of Health and Ageing, Precedence Health is currently working with the Department of Health in Western Australia and a range of other partners—Diabetes Australia (WA and Victoria), Working Systems Solutions, IBM, Intel, Cisco, the WA Centre of Excellence in e-Medicine, the Lions Eye Institute and the Eastern Goldfields Medical Division of General Practice—to develop a broadband health network of chronic disease management services in the Eastern Goldfields Region of WA. The system, called *IDMS* (Intelligent Disease Management Service) will provide a full service facility for disease management, care surveillance, and wellness monitoring for people with chronic disease and complex needs. It uses a broadband network of web-based and call-centre services to assist healthcare providers and consumers to continuously monitor and manage chronic disease.

In particular, *IDMS* services are aimed at increasing the use by chronically ill people of care management plans, providing continuous support for adhering to those plans, and better coordinating the delivery of care across the care team. These care management services are provided by an Operations Centre, which is manned by nurse educators and other healthcare professionals. The Operations Centre uses a range of decision support and monitoring software connected to a broadband network and to collect health information and monitor health events across the continuum of care, including GPs, Specialists, hospitals, pharmacies, community centres, and pathology labs. The communication between care providers, consumers and *IDMS* can take place via any communication channel, including phone, SMS, email and web-based portals and services.

Using *IDMS*, healthcare providers will find it easier to manage and track their patients, as well as being immediately alerted to conflicts in medications across care providers or

serious changes in patient condition. Consumers and their carers will be reminded of appointments, medication renewals, and tests, followed up to ensure compliance, and provided with continuous feedback on key health parameters.

By the end of the project, *IDMS* is expected to substantially increase the uptake of best-practice and evidence-based care plans, improve compliance with these plans, improve management of key pathophysiological parameters, and increase the efficacy and efficiency of care coordination. This in turn will lead to reduced hospital admissions for consumers with chronic disease, greater quality and safety of care, increased equity of access, and reduced adverse events, length of stay, waiting lists, morbidity and mortality. The project should also help increase workforce productivity and participation rates. It will be of significant value in informing industry and government on how to tackle chronic disease and provide evidence of the efficacy of broadband-based models of care delivery. The system will be extensible across the state and nationally by connecting to healthcare provider services in other regions.

Drivers and incentives

Unfortunately, despite the relative ease of getting everyone connected and the value to the healthcare system, it is often difficult to establish a sustainable business model for investing in the infrastructure and systems necessary to realise the vision. One of the primary causes of this is a misalignment of beneficiaries and payers in health care, combined with the goal of providing universal access to care.

For example, thee cost of building and operating the systems to distribute discharge summaries electronically to GPs and others lies with the hospital. However, the beneficiaries are primarily the GPs (although the hospital may benefit in part from reduced readmissions). With referrals into the hospital, the cost is with the GP but the beneficiary is the hospital. In addition, neither party gets any direct financial incentive from electronic referrals – their task is made somewhat easier, with some administrative cost savings, but the real beneficiary is the consumer (who avoids an adverse event) and the system (which avoids paying for the response to the adverse event).

Expanding connectivity to allow tracking of health events across the continuum of care and the building of an EHR equally struggle for a strong business driver among stakeholders. There could be enough in administrative savings, simplified business processes, and reduced hospital admissions to drive these along, but it is likely to be slow.

At the same time, most of the healthcare solutions developed by researchers and Small and Medium Enterprises (SMEs) struggle to reach market because there is no information technology infrastructure that allows them to connect to the full range of healthcare providers and consumers. Such infrastructure, according to McKinsey, will not be possible without significant support from the government and private sector alike.[15]

The big question is how to break through this barrier. One component is through direct government funding and government industry partnerships, such as initiatives to help fund the development of broadband connectivity and managed health networks and services. This type of government support is critical for developing the open network infrastructure that is essential to sharing information and health services.

Another important component is for the major beneficiaries of more efficient and effective health care (that is, governments, private insurers, and employers) to provide incentives for the use of electronic services, broadband health networks, and best practice processes. This approach has already been successful in driving the uptake of clinical desktops among GPs, and is used (through special Medicare Extended Primary Care Items) to encourage the creation and tracking of care plans for those with chronic disease. In short, while it is difficult to provide incentives based on health outcomes (given the difficulty of measurement and variability of outcome), it is relatively easy to measure and therefore provide incentives for the use of electronic services and best practice processes.

In the end, consumers and the profession will also help drive adoption, as GPs that don't provide the full range of electronically enabled health services will simply not be meeting minimal clinical standards.

By creating an open infrastructure that allows multiple businesses to connect to health information and to the healthcare market, and by using financial incentives to drive users to adopt best practice care and wellness management processes, we will be able to drive private business, investment, and innovation into health care. And in the same way that the Internet has transformed the retail, music and other industries, so will such an electronically connected healthcare system transform the health industry.

Summary

With chronic care, we know we can save billions of dollars each year and greatly improve the quality of life for people with chronic illness. We can prevent progression of these debilitating diseases – it is too late by the time we are hooking someone up to a dialysis machine. Information technology, through sharing knowledge among the care team, through care surveillance and wellness monitoring, can make a dramatic difference.

These outcomes are not difficult to achieve.

We can begin by connecting providers and consumers across the continuum of care and making existing systems interoperable using Internet technologies. We can begin by sharing what we have. We can begin by living with existing business processes, without impinging on the time or practices of healthcare practitioners. We can start in one region – not as yet another pilot project – but as a growing, evolving, operational system.

Once connected, and with the right financial incentives in the right places, individual value propositions will then drive greater electronic data entry, agreed data models, and an increasing diversity of care management and decision support services. Consumers, together with professional healthcare organisations, will drive evidence-based care and practice change. And this in turn will create new business models and opportunities for hospitals, insurers, employers, healthcare providers, and businesses.

It will take money and partnerships between government and industry to get started. It will take different ways of collaborating with and building on the conventional operational systems of the state health departments. But with the right conceptual framework – by taking seriously the knowledge enterprise and the autonomy and heterogeneity of care providers and consumers – we can start to transform the way we look after our chronically ill.

End Notes

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