ICT's Role in Healthcare Transformation

Report of the Health ICT Industry Group

November 2009

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Introduction and Acknowledgements

Under the auspices of HISI (Health Informatics Society of Ireland), Prorec Ireland and the Irish Computer Society, an ICT Industry group was established in mid-2009 to report on the role that Healthcare ICT can play in delivering a world class health system to the citizens of Ireland.

The group comprised representatives from 17 companies engaged in the Healthcare ICT sector (see Appendix A) ranging in size from large multinationals to SMEs. The findings and recommendations are based on the national and international expertise and experiences of these companies and supported by the latest research in regard to delivering optimum health and social care in a safe, cost effective and efficient manner. The final report was also reviewed by a further group of Healthcare ICT companies (see Appendix B) who have associated themselves with the report's content.

The essential tenet of the document is that lives can be saved, patient care outcomes improved, and costs reduced through the effective use of ICT in the healthcare transformation process.

The group would like to acknowledge the encouragement, support and advice received from senior officials from the Health Services Executive, the Department of Health and Children, the Department of Finance and the Health Information and Quality Authority during the preparation and review of the report.

We would also like to thank the Health Informatics Society of Ireland, Prorec Ireland and the Irish Computer Society for their role in the initiative, and Enterprise Ireland, BT and Microsoft for the provision of physical and electronic facilities to support the activities of the group.

1. Executive Summary

Continued progress in critical elements of Ireland's healthcare service, including patient safety, quality and financial effectiveness is now crucially dependent on a radical improvement in our use of Healthcare ICT. Despite considerable progress, the quality of Ireland's healthcare service remains below the best in Europe. But, alarmingly, the cost is already amongst the highest - whether measured as a percentage of government spending or of GNP. This level of expenditure is unsustainable, particularly when cognisant of the favourable demographics that the country currently enjoys. Previous underinvestment in ICT and the related process re-engineering are significant factors in this poor financial picture.

Health Service Transformation cannot be achieved without ICT

The HSE Transformation Programme calls out six transformation priorities that refer to easily accessible integrated health services, centred around the patient who moves seamlessly from primary care to acute hospitals and back again. The Programme also calls for standards-based performance management and measurement throughout the health service.

A modern national health ICT infrastructure is the essential first step to achieving this transformation, enabling clinical information to be passed securely and quickly between practitioners, and medical instructions communicated clearly and quickly using electronic means for increased patient safety. It is no longer acceptable for Irish healthcare providers to jeopardise patient safety through poor or non-existent Health ICT systems, a practice which could be deemed to be negligent when compared with current international norms. It is noted that in the Euro Health Consumer Index report issued in September 2009, the area where Ireland performs poorest in is e-health, such as electronic transfer of medical data between professionals, e-prescriptions and lab tests electronically communicated to patients. Indeed, senior clinicians have stated that investing to improve our ICT capability is now more important than additional investment in clinical facilities.

Potential benefits

The next leap in healthcare quality and cost effectiveness will come about as a result of improved ICT. Many European countries have already embarked on this journey, and a recent study sponsored by the Swedish EU presidency[1] indicates the dramatic benefits being achieved.

If the benefits identified in the 6 countries studied could be realised in Ireland on a pro-rata basis, the sheer scale of the opportunity becomes clear. As examples, we could achieve:-

- €195m annual saving by treating chronic illness in the home
- €79m annual saving through the use of electronic patient records to improve hospital processes and thereby reduce unnecessary bed days
- 106,000 fewer prescription errors per annum in the primary care sector
- 292 fewer diabetic deaths per annum

[1] eHealth for a Healthier Europe!, Gartner, July 2009, Swedish Ministry of Health and Social Affairs

These direct cost savings, improved patient safety and improved access to care are made possible through ICT investment in areas which have a well-proven business case, such as Electronic Transfer of Prescriptions, Clinical Decision Support, Electronic Health Records, and Chronic Disease Management Systems, all underpinned by a modern IT infrastructure.

HSE working in partnership with Industry

To begin the realisation of such a vision in Ireland, we need to substantially increase our investment in, and our effective use of ICT. The HSE needs to focus on a structured, prioritised implementation programme, working in partnership with the Irish ICT industry. The HSE will need to leverage heavily the skill and capacity of the industry in multiple areas, including process re-engineering, systems development, system operations and system absorption. Innovative approaches to project financing may also be possible in some areas to reduce the upfront investment cost to the HSE.

Investing for a potential 400% return

As an indication of the scale of the investment, in order to bring Ireland to a median position of healthcare IT capability in the delivery of patient care, a tripling of the HSE's ICT budget is required, increasing it from 0.75% to 2.25% of the total HSE budget. The additional investment will enable the implementation of a wide range of patient care and administrative applications delivered via a robust and secure infrastructure. Industry experience indicates that the breakeven time for the individual investments in such a programme will vary from less than 1 year to 5 years. In the longer term, a European Commission study[2] indicates a typical lifetime Return on Investment of 400% for advanced Healthcare ICT systems.

Leadership critical to success

Above all else, critical to the successful transformation we are calling for, will be leadership - from government, from the HSE and from the ICT Industry. To ensure that we maximise the return from the high levels of investment involved, clear focus will be required on the definition and quantification of objectives, programme management and benefits realisation. Independent monitoring may be required at appropriate junctures. The positive participation of all stakeholders is essential and the introduction of financial incentives may be required to ensure such participation. While early wins demonstrating the delivery of clinical value from Health ICT should be prioritised, expectations should be managed over the long term with political, clinical and executive leadership committed to a 10 to 15 year transformation programme.

[2] eHealth is Worth it, the economic benefits of implemented eHealth solutions at ten European sites, Karl A. Stroetmann, Tom Jones, Alexander Dobrev, Veli N. Stroetmann, Sept 2006, European Commission

Recommendations

In order to prepare for this journey we make the following nine recommendations:

- The commitment to and resourcing of a **modern IT-enabled healthcare system becomes a national priority for government**, with leadership coming from the Minister for Health and Children.

- The **CEO and board of the HSE accepts leadership responsibility for the effective execution of the ICT programme** and the related process re-engineering, as essential elements in building a world-class, affordable health care service.

- The **HSE triples its expenditure on Healthcare IT** over the next 3 years, from 0.75% to 2.25% of total budget, this being the level of expenditure required to bring Ireland into a median position of healthcare IT capability in the delivery of patient care.

- The **HSE's capacity to implement IT systems is enhanced by a long term partnership with the Irish ICT industry** to leverage the expertise, capability and resources available.

- As part of the move towards a smart economy, **the government directs Enterprise Ireland to establish a healthcare technology cluster**. The government should also ensure that the public procurement process encourages R&D, experience-building and knowledge-sharing within SMEs, for example by supporting "lighthouse" applications in selected areas.

- **A Unique Health Identifier and a national Electronic Health Record system** spanning primary and acute care is implemented **within 3 years**. These systems offer major benefit in terms of patient safety, healthcare quality, chronic disease management and financial effectiveness. They are the essential building blocks for future healthcare ICT systems.

- **Open standards are utilised** to ensure interoperability into the future between different healthcare ICT systems.

- A **major focus is placed on developing IT skills and knowledge within the HSE**. This should include widespread IT familiarisation programmes for management, clinicians and administrators, supported by education and training from the ICT industry.

- The **HSE board establishes a high level advisory group**, comprising internal executives and external experts from the medical, academic and business communities to provide ongoing advice on the exploitation potential of Healthcare IT.

The ICT industry in Ireland is willing to rise to the challenge of supporting the HSE in its goal of transforming healthcare for the benefit of our citizens. As we succeed together in this mission, we will also begin to position Ireland as a world class supplier of healthcare services and healthcare ICT systems for the global market. In this way we will establish valuable assets for the new smart economy.

2. Ireland's Healthcare Challenge

2.1 Where we stand today

Despite much progress over recent decades, healthcare in Ireland faces a time of great challenge. By some measures our health remains good, but there are many challenges in both the medical and financial areas. In regard to our achievements to date, it is evident that the country experiences good and increasing life expectancy. In areas such as perinatal care, Ireland is a recognised leader. In many fields our medical professionals are recognised as world class. Our anti-smoking policies are much lauded in international public health circles.

We are living healthier, longer lives. Our cardiac health is greatly improved and our cancer services are reaching world class standards with increasing survival rates. The substantial progress achieved has recently been indicated in the Euro Health Consumer Index 2009, where Ireland has made a significant improvement to 13th place out of 33 European health services reviewed. However in some fundamental areas we lag behind our European peers. We have high morbidity rates for circulatory and respiratory diseases. Diabetes and obesity are on the increase. Standards and outcomes vary significantly depending on where you live and are receiving treatment, and unfortunately the health service has suffered major scandals due to lack of independent auditing and verification of clinical practice.

Some of the issues we face are not unique to this country. Across the western world, governments struggle in the face of rapidly ageing populations who require increasing healthcare provision in tandem with their increased life expectancy. We note with concern that cancer, diabetes, substance abuse and other 'lifestyle' conditions have grown as our affluence has increased. And all the while, governments, citizens, and private companies struggle with the ever rising trend in healthcare costs. The old reliable models of healthcare provision are in flux. In the UK and Europe, there is considerable effort to manage the growth of private healthcare services. In the U.S. the Obama administration is locked in a bid to expand America's public healthcare.

In Ireland, while we experience the full impact of these global trends, we face our own additional, unique and frustrating challenges. The much anticipated HSE Transformation Programme is behind schedule on a number of fronts. Efficiencies have not materialized as quickly as planned; staff levels remain high; there remains frequent duplication of effort; and opportunities for economies of scale have been missed. The change of focus from Acute to Primary care has been slow, with few Primary Care teams in place and entirely inadequate step-down facilities to relieve beds in our acute hospitals.

As we try to address these medical challenges, we face at the same time a deteriorating financial situation. The economic downturn has exacerbated the existing financial crisis across the HSE. We have evolved as one of the most expensive health service in the OECD, with the cost of the public healthcare system spiralling towards 45% of the

government's income. Using a different measure, it is estimated that the total national spend on healthcare in 2009 will be greater than 10% of GNP, a figure in excess of most of our European peers.

Of deep concern is the fact that this unsatisfactory situation has been arrived at despite Ireland having very favourable demographics. Our average population age is lower than our peer countries, and our dependency ratio (people of working age as a percentage of total population) is also very favourable. If the required transformation is not successfully achieved while these demographic factors are so positive, the long term outlook is indeed bleak.

Looking at some of the problems in more detail, we note that some 60% of the public healthcare budget is spent on salaries and related benefits, which has left little for capital development or innovative programmes. It often seems that financial priorities get confused. Expensive infrastructural resources remain underutilised due to staffing shortages.

Anecdotal and real data demonstrate excessive costs for overtime, medical card payments and drugs compared with European averages. Opportunities for shared services have not been exploited, with excessive levels of staffing across multiple procurement offices, labs and other facilities. Tracking of resource utilisation has been a huge problem in the multifaceted world of the HSE and is currently being addressed by the independent Resource Allocation Group, recently established by the Minister for Health and Children.

Buried among the statistics, and all the reports of problems and inefficiencies is the alarming fact that Ireland spends far less than our peer countries on ICT - approximately 0.75% of total HSE budget, compared to an average figure of 2.5%. As a consequence of this underinvestment Ireland has failed to exploit the potential of tried and trusted technologies to reduce costs, enhance operations, and improve clinical outcomes. For example we have failed to implement systems such as Computerised Practitioner Order Entry (CPOE), also known as Order Communications, and a Unique Health Identifier, systems that have delivered well-documented results in other jurisdictions through eradicating human errors that can lead to dire clinical consequences. The HSE's multiple, separate financial accounting systems render it difficult to monitor day to day expenditure or compare performance between regions and hospitals. The HealthStat reporting system is an important first step and demonstrates what can be achieved by better monitoring and reporting of output and outcomes. This system also illustrates how much more could be achieved at a local and national level if the IT systems better supported that work.

The lack of standardised systems restricts our ability to deliver information where it's needed, and to collect information to support public health initiatives and facilitate research. Consultants and clinicians across the country are frustrated by this lack of technology and its impact on day to day operations, and rightly so. Leading clinicians have stated that from our current position, investment in Healthcare ICT is more important than additional clinical facilities.

2.2 The role of ICT in the HSE Transformation

Clearly the underinvestment in ICT has not caused all the problems in our health service, nor is it a panacea to address all the issues. However, as with complex service enterprises such as airlines, insurance and banking, the transformation needed cannot take place without significant investment in ICT and the co-requisite business process re-engineering. ICT is the key enabler to a successful transformation which will meet the requirements of all the stakeholders - patients, professionals and taxpayers.

The urgent need to address the ICT deficit and the potential benefits of new applications will be outlined in the following chapters. But clearly there will be many challenges in achieving the successful transition to an IT-enabled healthcare system. These challenges include funding the investment, effective process re-engineering, systems implementation, and the HSE's capacity to absorb and adapt to new ways of operating. In these challenges the ICT industry in Ireland stands ready to help. The industry comprises some 70,000 skilled professionals operating in large companies and SMEs, in industry, commerce and academia. It has demonstrated its ability to implement systems as advanced as any worldwide, in recognition of which worldwide centres of excellence have been established here in areas as diverse as e-Government, financial systems, and digital consumer. Similar capabilities exist or can be rapidly developed in healthcare ICT, to help Ireland address its critical healthcare challenge and, subsequently, with the committed support of government, position Ireland as a worldwide leader in the field of Healthcare technology.

3. The Vision for Healthcare and eHealth in Ireland

A modern healthcare system should support the current and future needs of the population it serves. These needs and ambitions are often embodied in a published national vision and strategy for healthcare, including elements such as public health education and improvement, engaging all stakeholders in the planning and delivery of healthcare services, and providing easier, faster and more equitable access to safe medical care. High level targets are usually set, and indicators are put in place to measure progress towards a future of better health outcomes at a sustainable cost.

The HSE Transformation Programme 2007-2010 defined a vision for the Irish healthcare system in 2010: "Everybody will have easy access to high quality care and services that they have confidence in and staff are proud to provide".

The expectation that citizens have of healthcare services continues to rise, and steps need to be taken to understand and respond to these demands. Advances in medical science, especially in the areas of diagnostics, therapeutic medicines and surgical procedures, are suggesting a future where many medical conditions will be predicted, discovered and treated at an early stage and with minimum risk and impact on the patient. A further promise is that many conditions that today are considered life-threatening will in the future be treated as chronic diseases, with patients and their carers managing treatment regimes lasting for decades, often into extreme old age.

Citizens are made aware of these improvements every day through the news media and the internet, and will come to expect effective and safe medical care as a matter of course. Patients will increasingly expect innovative treatments and medicines to be made available to them just as soon as their efficacy and safety is proven. They will expect to be more closely involved in planning their own care (or that of their family or dependants) in partnership with medical staff.

At the same time, the adoption of mobile and digital services in other areas of life will cause many to question why they have to travel to obtain medical care, and they will seek out more convenient sources of information, advice and treatment. People in rural areas, far from specialist clinical skills, will expect the same access to quality treatment as those living in cities, and people living with chronic or terminal conditions will want to live independently in their own homes as long as possible, with local support provided as needed.

At home, in a GP surgery, in an A&E department or hospital ward, patients will demand to be treated with dignity and respect. They will expect everyone involved in their care to have immediate access to their medical record wherever and whenever needed, but they will also assert the right to control what is seen and by whom.

A modern reformed healthcare system should be able to meet and exceed these demands, delivering a better patient experience, fewer unplanned demands on clinical resources, and a more satisfying work environment for the staff. Such a system should

fully exploit the benefits of information and communications technology (ICT for Health or 'eHealth') to help deliver the following results:

3.1 Better patient care (Safe, Effective)[3]

'Safe' means avoiding injuries to patients from the care that is intended to help them (preventable medical errors

In many instances medication errors are due to adverse drug reactions, drug-to-drug interference, wrong dose or wrong patient. However it can also result from incorrect diagnosis (e.g. ischemic or haemorrhagic stroke), falls and injuries whilst in hospital, incorrect surgical procedures, hospital acquired infections (e.g. MRSA) etc. Although eHealth cannot provide all the answers, it can help to reduce medical errors through patient data delivery to the point of care. Collectively, this is often referred to as the 5 Rights of Medication: - Right Patient, Right Medication, Right Dose, Right Route, Right Time

'Effective' is about providing services based on scientific knowledge, also known as evidence-based medicine. The online availability of systematic reviews of medical treatments (e.g. Cochrane) and the possibility of online collaboration between doctors treating individual patients should lead to more effective care pathways and better outcomes. The availability of an electronic health record is necessary to support this way of working, as well as the 'safety' issues above.

3.2 More efficient care processes (Timely, Efficient)

'Timely' means reducing waits and sometimes harmful delays for both those who receive care and those who give care, whereas 'Efficient' is about avoiding waste, including waste of equipment, supplies, ideas, and energy. eHealth can help in many ways to support these aims, by moving patient data instantly to where it is needed, and using electronic systems to order & view lab, radiology and other tests at high speed, cutting delays and speeding diagnosis. Scheduling systems can help to make the most of scarce resources (staff, beds, theatres, equipment), and tracking solutions can ensure that resources can be located when needed. Applying Lean Sigma techniques can also bring dramatic efficiency gains.

3.3 Sustainability (Equitable, Patient-Centred)

'Equitable' means providing care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographic location or socio-economic status. In the case of ethnicity, there are solutions which can assist with language translation or which use graphics to aid communications. Geographical challenges can be overcome by emerging eHealth innovations such as telemedicine for remote consultations, teleradiology for remote expert readings, home patient monitoring of chronic diseases, and sharing the EHR with the patient and carers.

[3] Definitions are taken from the US Institute of Medicine's (IOM) Six Dimensions of Quality Framework from the book 'Crossing the Quality Chasm' (2001) – specifically Safe, Effective, Timely, Efficient, Equitable, Patient-Centred

'Patient-centred' means providing care that is responsive to individual patient preferences, needs and values and assuring that patient values guide all clinical decisions. eHealth can play a significant role, by capturing patient consent to share (or not share) medical data, and also by moving the doctor-patient relationship towards a model of 'shared care' through the use of disease management systems. The ability to educate, inform and collaborate via the internet also promotes patient engagement, independent living and better self-management, and should result in fewer emergency admissions.

4. How ICT can help

A recent publication, eHealth for a Healthier Europe, presented the results of a study conducted by Gartner on behalf of the Ministry of Health and Social Affairs in Sweden under the auspices of the Swedish EU presidency. The study aimed to identify and quantity the potential benefits of a range of eHealth systems, evaluating the potential benefits with reference to a range of metrics, including:

- Availability (access, waiting times and better utilisation of resources).
- Continuity of care (coordination and information sharing among care providers).
- Empowerment (patient involvement in their own care activities).
- Patient safety (reduced risk of patient harm).
- Quality of care (effectiveness and efficiency of care service provision)

A number of key technologies were identified as proven catalysts to significant healthcare improvement, efficiently and effectively meeting the increasing demands of stakeholders in the healthcare environment, patients, professionals and funders. Several of these are outlined in the sections that follow. While this list is not exhaustive, we believe the HSE should strongly consider the benefits to patient care that these and similar technologies can provide.

4.1 Electronic Health Records (EHR)

Electronic Health Records aggregate patient-centric health data from the patient record systems of multiple independent healthcare organisations. An EHR is a long-term record for a patient, detailing his or her involvement with individual healthcare organisations and episodes of care. Many EHRs include detailed clinical data such as individual lab results and prescription refill information.

EHRs are commonly used to transfer a patient's healthcare information between organisations, allowing stakeholders in the patient's health to access this information remotely. Access to this information allows for continuity of care between different care delivery organisations or other organisations, such as social services, that may come in contact with the patient.

EHRs make information for decision-making available at the point of care and result in less time and effort spent capturing patient data when crossing organisational boundaries. Additionally, ensuring the interoperability of these systems, delivers increased benefit for the patient, clinician and healthcare provider.

4.2 Chronic Disease Management Systems

Chronic Disease Management Systems, CDMS, rely on the use of evidence-based best practices. They allow doctors to organise and use their chronic care patient information efficiently providing fast, easy access to evidence-based clinical guidelines. It includes, for example, what measures should be checked on each patient visit (e.g. blood

pressure, weight, activity level), what medications the patient should be taking, which lab tests should be repeated and when, and what self-care reminders the patient should receive.

Up to 50% of patients with chronic conditions fail to take their medicines properly. In diabetics alone, 20% with type two diabetes forget to take their medicines at least once a week, whilst around 80% are unable to test their glucose even once a day because they have not obtained enough testing strips. CDMS provide tools that any member of a patient's care team can access easily; for example, a nurse, dietician or other care provider may use a patient education report or patient flow sheet from the system to help a patient set and meet self-management goals; similarly, a medical office assistant may use recall reports from the system to proactively schedule follow-up appointments.

CDMS has the potential to reduce costs by improving health outcomes for chronic care patients. Physicians can use CDMS to generate alerts, identify subsets of patients, and track their progress toward goals. By extending this system to the home, patients can also enter their own care management information, and take relevant measurement for their condition, making the registry a complete chronic care record.

4.3 Computerised Practitioner Order Entry (CPOE)

Computerised practitioner/(or physician) order entry (CPOE), also known as Order Communications, is defined as the computer system that allows direct entry of medical orders by the person with the licensure and privileges to do so. Directly entering orders into a computer, at the point of care, has the benefit of reducing errors by minimising the ambiguity of hand-written orders, but a much greater benefit is seen with the combination of CPOE and clinical decision support (CDS) tools. CPOE supports decision making by improving formulary compliance; cost effective medication ordering; appropriateness of medication administration, route, dosage, duration, and interval; decrease in test redundancy and unnecessary duplication. When combined with Electronic Transfer of Prescription, it also improves clinical processes for ordering, saving time and cost while reducing ambiguity due to illegible handwriting and incompleteness of handwritten orders.

4.4 Clinical Decision Support

Clinical Decision Support (CDS) can assist in the avoidance of medical errors. CDS, in conjunction with CPOE, can help clinicians make complex decisions and can trigger appropriate early notification of possible untoward events. The system can immediately raise an alert if a potential adverse drug event or prescription error could be triggered by a prescription. It can also generate dosage adjustments based for example on advancing age or declining renal function. Similarly, decision support tools can alert a physician to reassess the need for medications such as antibiotics that appear to be used for longer than indicated.

4.5 Electronic Transfer of Prescription

Electronic Transfer of Prescription (ETP) makes it easier for GPs to issue prescriptions and more convenient for patients to collect their medication. ETP enables prescription data to be transmitted electronically between the prescribing health professional and the pharmacy, making prescribing and dispensing safer and more convenient for patients.

This improves audit trails for medication and reduces errors that can arise from illegible paper based prescriptions.

4.6 Electronic Appointment Booking

Electronic Appointment Booking Systems allow patients to choose the place, date and time of their first outpatient hospital appointment and automates the process by which a GP refers a patient for specialist care. It allows patients to book appointments on site at the surgery, over the phone or over the internet in the way that is most convenient for them. Electronic appointment booking systems can exist as standalone applications but in highly integrated environment can often be found embedded in systems such as Patient Portals, Self Service Applications and Personal Health Records.

With an Electronic Appointment Booking system, the referral process in which the GP's surgery contacts the specialist's practice who then gets in touch with the patient via post to schedule an appointment is cut down to a single step. Some Electronic Appointment Booking Systems also allow for triage and e-consultations where a clinician in primary care can confirm the need or the specialty to which a patient ought to be referred.

4.7 Personal Health Record

The Personal Health Record (PHR) is an Internet-based patient owned and patient controlled set of tools that allow people to access and coordinate their lifelong health information and make appropriate parts of it available to those who need it. PHR systems can allow patients to manage their own health and the health of others (dependents) through education and monitoring as well as enable the exchange of data with others regarding their health. This technology differs from others in the Healthcare space in that its use and adoption is largely dependent on the patient.

In the case of chronic conditions, for example, a patient could update their PHR with their latest readings and make them available online to a clinician or a nurse. PHRs can enable other transactional self service interactions such as booking appointments or requesting a refill of a prescription. Equally, through a PHR, a patient can communicate with their clinician for advice, guidance or e-consultations.

Finally, a PHR can help a patient access medical information and best practices for the better management of certain conditions.

4.8 Telemedicine

Telemedicine consists of a series of technologies that enable care services to be provided remotely. Telemedicine and other care-at-a-distance technologies can enable the sharing of information in the form or records, images, and audio. Telemedicine can be applied in scenarios where the physical presence of a healthcare professional is restricted, by distance or time. Whether it is for analysis, diagnosis, consultation or treatment, Telemedicine represents a convenient way for patients to gain access to medical skills in a suitable and timely manner. Home health monitoring has contributed to the reduction of unnecessary visits and clinician appointments as well as the identification of potentially serious situations that would require attention of a clinician.

4.9 RFID and Bar-coding

Radio Frequency Identification (RFID) is a technology that allows traceable chips, called RFID tags, carrying a set of predetermined information to be embedded in objects. RFID readers can pick up radio signals which provide particular information related to the carrier such as identification number, name, and medication requirements.

These technologies can be used in a number of ways in a medical setting. For example, Patients can be provided with identification wristbands carrying an RFID tag or a barcode that will be used throughout the patient's stay in hospital. The tag or barcode would allow caregivers to positively identify and match patients to their care – for example to ensure that the right medicines are going to the right patient. This technology also allows patients to be tracked within the hospital, facilitating bed and service management and timely release of outpatients. Bar-coding/RFID can also be used for inventory management and equipment tracking which allows for improved utilisation of expensive diagnostic equipment by providing real-time location information. Some hospitals are already using it to track levels of medications and other supplies.

4.10 Business Intelligence (BI) for Real Time Detection of Hospital Infection Patterns

Through the collection, storage, analysis and interpretation of data, business Intelligence systems can generate valuable actionable knowledge for tactical and strategic decision support, trend recognition, forecast, predictive modelling and strategic analysis. Additional capabilities include the ability to distinguish previously unrecognised disease patterns, identify at-risk patients, and review the performance of individual physicians.

Business Intelligence and in particular Data Mining are useful tools in the detection of outbreaks when used for the real time detection of infection trends within hospitals. Trend recognition in wards and hospitals can lead to the reduction of outbreaks such as Hospital Acquired Infections (HAIs) if detected at an early stage. These tools are being used to analyse vast amount of data in real time and to help distinguish patterns that could indicate abnormal situations that would require further attention or action from healthcare professionals.

5. Examples of Best Practice

Moving on from a list of specific applications, there are many examples from across the globe, and indeed in Ireland, where individual hospitals, hospital groups, and health authorities have achieved large benefits from the investment and utilisation of ICT. They have driven improvement in patient care and satisfaction; simplified operational processes; reduced clinical replications and errors; improved utilisation of resources (staff and equipment) and leveraged additional benefit from existing ICT investments. A small number of these are now described:

5.1 Trinity Health

Organisation: Trinity health is the 4th largest Catholic Health System in the United States

Solution Deployed: Electronic Health Record (EHR)

Overview:

Trinity Health has become one of the top 10 hospitals for clinical performance, as recognized by the Thomson Reuters' 100 Top Hospitals: Health Systems Quality/Efficiency Study. Through the implementation and utilization of Health Informatics technologies which have an EHR at their core, the Trinity Health Group have been able automate and simplify processes which has driven improved care quality and patient safety in the following ways:

Decreased severity adjusted mortality by approximately 26 percent since 2005.

Decreased instances of hospital-acquired pressure ulcers by approximately 36 percent since 2006.

Surpassed Joint Commission clinical performance standards for acute myocardial infarction, heart failure and community-acquired pneumonia.

Allowed critical care nurses to spend more time at the patient bedside by decreasing time spent on documentation.

Decreased the amount of time it takes to deliver medication to patients by approximately 40 percent.

By integrating electronic health records and other decision support tools within the clinical care environment, the hospital's clinicians are making more informed decisions about patient care, creating better, safer outcomes for our patients while streamlining crucial processes within the hospital including electronic management of medication administration, provision of access to evidence-based clinical data for clinicians and identification of opportunities for clinical, operational, financial and regulatory improvement.

5.2 York Hospitals

Organisation: NHS Foundation Trust

Solution Deployed: Wireless Network and IP Telephony in Emergency Care Setting

Overview:

York Hospitals NHS Foundation Trust have a converged voice and data network with almost 4000 phones and over 2000 PCs. A system has been developed to make use of the wireless network, using wireless phones which integrate with the hospital's patient record.

There are two main routes for emergency admissions into the Hospital. A GP may phone the hospital to arrange an emergency admission, at which point the Bed Manager records the details directly into the electronic patient record. Alternatively a patient may have arrived in the Emergency Department, and a decision to admit is recorded on the system from there. Either of these events will create a "pending admission" on the system, and send a message to the wireless phone on the on-call doctor(s) while the ward will also be notified of the pending admission, through it appearing on their own "wardlist" and electronic whiteboard. From either a wireless phone or a computer screen on the ward, the medical staff will be able to see some basic details of the patient including the reason for admission, and any other information passed by the GP, along with alerts such as MRSA status.

When the patient arrives on the ward, they are "accepted" by the ward staff, and a further message is sent to the wireless phone, informing the doctor that the patient is present. The doctor, using the phone, can acknowledge and accept the admission, which lets others know they have accepted the responsibility of attending the patient. A list of "my patients" is always accessible on the wireless phone. The staff on the ward can see that the patient has been accepted using the electronic whiteboard which is automatically updated. The benefits achieved by this solution are:

Dramatically improved admission process, with duplication of effort eliminated.

Fewer unnecessary interruptions for medical staff to take phone calls.

Improved patient safety, as the system tracks the patient from first call to the first attendance by a doctor.

Transition from a reactive to a pro-active system better communications.

Sharing of bed management information for all locations, reducing the need for "walk-abouts".

5.3 Sundhed.dk

Organisation: Sundhed.dk is Denmark's public national health portal. It is a collaborative project between the Danish Ministry of the Interior and Health, and a number of local authorities.

Solution Deployed: Public Health Portal

Overview:

Denmark wanted to increase communication between its various public and private healthcare providers, including GPs, pharmacies, hospitals and clinics. Previously, there was no way for a patient or a healthcare provider to view a patient's consolidated healthcare records, so providers wasted valuable time tracking down medical histories. Nor was there are national solution that allowed Danish citizens to search for information on general health concerns, medicines and diseases.

The public health portal, Sundhed.dk now integrates health-related data from disparate healthcare systems throughout Denmark. Through the portal, doctors can access patient health records, view data from the National Patient Register and communicate with other healthcare providers. For patients, the portal offers access to health-related data, e-consultations and the ability to communicate with healthcare providers.

As of 2006, more than 170,000 users were accessing the portal every month. More than 86,000 citizens and 4,000 healthcare professionals are able to access the portal with their digital signature.

Denmark now has a flexible, scalable portal solution that integrates disparate healthcare systems nationwide. Today, Sundhed.dk connects all of the Danish National Health Service facilities, including 10,000 private health staff, 220 pharmacies, 80 hospitals, 5 government administration regions, all public health ministries' resort areas and 150,000 health service personnel. The portal has the potential to reach 5.4 million Danish citizens.

Patients can schedule a medical appointment using the portal's scheduling module. Patients simply make an electronic request for an appointment and receive a confirmation via e-mail. This feature has slashed administrative tasks, as personnel can schedule appointments throughout the day when time is available instead of being tied to the phone.

Patients can renew their prescriptions online, view test results and receive electronic consultations. E-mail consultations have reduced the number of phone calls that patients make to a doctor's office and cut the cost of consultations by some 50%.

5.4 St. James Hospital, Dublin

Solution Deployed: Automated electronic debt collection solution

Overview:

St. James Hospital had almost 400,000 patient episodes, made up of emergency, outpatients, inpatients, daycare and electives in 2008. The hospital faced substantial challenges with outstanding revenue from the various private health insurers in the market, as a result of the historical paper based health insurance claims process. In

addition, the claims process was not seen as a priority within the complexity associated of a large multi-specialty public hospital.

The Director of Finance of the Hospital set up a programme improvement and revenue-cycle redesign that identified the key problem issues in the revenue cycle; identified the systemic causes of the problems; and outlined best practices that could eliminate the problems.

Their findings from this programme were that each claim paid submission was taking on average more than 100 days to receive payment, and the hospital faced significant risk with written off debt. The claims office were constantly fielding calls from consultants seeking updates on claims relevant to their patients. Furthermore the reporting on status of revenue-cycle was extremely difficult due to paper based process.

The solution to these issues lay in the electronic gathering and collating of information, and the utilisation of this real-time electronic data to reduce claims unpaid. A solution was developed which addressed all of the issues detailed above which also seamlessly integrated with the hospital patient administration system to create a seamless link between patient registration and claim generation. The benefits realized by the hospital through the utilisation of this solution have been:

Cash collection has increased by 100%.

Staff resources to manage hospital claims processing reduced by 50%.

Debtor days have dropped by 50%

Hospital can easily revert to an individual claim to handle queries

Greater visibility for the claims team on the status of cash collection.

5.5 Secretaria Municipal de Saude de Belo Horizonte

Organisation: A multiunit health agency in Brazil

Solution Deployed: Enterprise-wide collaboration software.

Overview:

The Secretaria Municipal de Saúde de Belo Horizonte (SMSA-BH), reorganised its citywide health services and defined nine health districts that each serve a certain geographic, population and administrative space. In total, SMSA-BH operates 137 healthcare centres, six emergency centres and more than 40 associated hospitals.

Trying to coordinate operations among more than 140 properties, SMSA-BH struggled with providing its geographically dispersed medical staff with ways to collaborate, share ideas and quickly call upon the advice of experts in different fields. Consequently, SMSA-BH patients who needed to seek consultation with specialists had to wait as long as ten days just for an appointment and an average of 15 more days for a diagnosis. SMSA-BH wanted to develop a solution that would enable its personnel to share knowledge and quickly and collectively diagnose patients across the fragmented organization. The agency hoped that by doing so, it would improve the quality and diversity of its health specialists.

In 2004, SMSA-BH implemented a program called BHTelesaúde (BHTelehealth) to promote staff education and support the agency's health professionals. The BHTelesaúde program leverages collaborative software as the framework for two major projects. Doctors use the software's instant messaging capability to consult with each other for quick questions or opinions in a secure real-time environment. For more-

complex cases, healthcare professional can schedule a Web conference, which enables multiple doctors to collaborate in real time and to share documents and files, including X-rays, dermatological images, electrocardiograms, voice recordings and other electronic information.

By implementing a secure and reliable solution, healthcare professionals could easily offer information and ask questions of their peers in real time via instant messaging. SMSA-BH healthcare professionals can work together, at anytime and from anywhere, to improve the accuracy of their diagnoses and reduce diagnosis time from 15 days to just 3 days. Because the solution enables doctors to diagnose patients more quickly, it helps decrease the amount of time a patient has to wait and encourages more people to visit the clinics for regular checkups as well as medical attention.

6. Benefits Realisation

The DoHC and the HSE transformation strategy can only be delivered effectively through the better use of technology and interoperable systems. The adoption of ICT can accelerate the integration, standardisation, and knowledge transfer of administrative and clinical information. Most healthcare information is currently siloed in paper records, bespoke hospital information systems and clinical research databases. "Paper kills" is how Newt Gingrich (Former US House Speaker) described the problem of paper health records, which lead to problems that directly affect the patient in terms of morbidity and mortality.

This section does not confine itself to just the acute hospital model and specifically the adoption of the hospital electronic record but instead extends vision of ICT to cover all aspects of healthcare delivery. This includes how ICT can assist in targeting the individual (prior to becoming patient) in the context of wellness and disease prevention, a key goal of the Irish healthcare strategy.

The benefits realised by ICT can be divided into two distinct components. The first are the direct benefits to patients in the context of their healthcare outcomes and the second are the indirect benefits to the Irish economy through the positioning of healthcare ICT as key component of the development of the 'smart' economy.

6.1 Direct Benefits – 'The Patient and the Individual'

The purpose of this section is to position Information Technology in the context of the benefits across the entire continuum of individual and patient care. This continuum extends from the healthy individual with unrecognized predisposition to certain chronic diseases that could be mitigated through behavioural changes early in primary/community care to the acutely ill inpatient requiring quaternary care for the treatment and management of complex disease.

Table 1 overleaf outlines all components of the entire healthcare system and gives examples of the benefits that are already being realised through the strategic implementation of information technology. Specific examples of benefits realised are listed under the following headings and colour coded to position their benefit in healthcare:

Adverse Drug Events

Hospital Acquired Infection

Care Pathways / Process Improvement

Ambulatory Care/ Home Health Monitoring

Primary / Secondary Care Integration

Healthcare Operational Efficiencies

Diagnostics

The Individual

	Preventative Care Health promotion/screening etc.	**Pre-Hospital/Primary Care** GP/PCT/PHECC	**Sec/Tert/Quat Care** Acute Hospitals/ Specialist Hospitals
Population Level	Targeted health prevention campaigns towards specific patient cohorts Ability to link the patients current illness/disease to national outcomes and prevention programmes	Integrated electronic health record - seamless continuum of patient care between Primary and Secondary Care Development of Primary Care and PreHospital care protocols for patient management in the community, i.e. extending care pathways outside the hospital to ensure effective management and follow-up of the patient	Improved planning and design of healthcare delivery: - standardised processes and care pathways, e.g. Surgical Pathway National healthcare analytics framework with agreed KPIs that correlate with outcome improvements enabling the cost effective delivery of patient care nationally Reduction in serious adverse incidents nationally (ADRs, HAIs etc.)
Inpatient Level	Patient access to Health record and investigations (with appropriate interpretations - Health Literacy issues) to ensure better compliance and involvement in disease management and prevention	GP access to full patient record and investigations. GP/Primary care record integration with acute hospitals	Care pathways and patient protocols for all specialisations to ensure optimal ALOS Implementation of CPOE to reduce serious incidents (ADRs) in hospitals
Ambulatory Care Level	Enable the delivery of healthcare services in the patient's home through home health monitoring	Availability of entire healthcare record at any ambulatory care facility the patient attends, i.e. the information follows the patient	Assurance that all hospital treatments, procedures, medication, management plans, investigations are fully available and communicated to primary care provider
Individual Level (No previous clinical event)	Involve patient proactively in the prevention of chronic disease through an online personalised health record e.g. Mayo Clinic	GP/PCT/PHECC Performance KPIs to assist the patient in making decisions as to where to attend for treatments/procedures Public transparency in relation to Primary Care/PHECC performance	Hospital performance indicators and tables to assist the patient in making choices in relation to their treatment (HAIs/Hygiene) Public transparency in relation to hospital performance

Table 1: Direct benefits realised through strategic implementation of ICT

Specific examples of benefits realised through information technology, as outlined in the Gartner study of 6 EU member states on behalf of the Swedish Ministry of Health and Social Affairs, are provided below;

6.1.1 Adverse Drug Reactions/Interactions/Events

Reducing the Number of Outpatient Prescription Errors through Electronic Transfer of Prescription

5 million yearly outpatient prescription errors could be avoided collectively in the six studied member states through the use of Electronic Transfer of Prescriptions (ETP). The same technology in France and in the Czech Republic could contribute to yearly reductions in the number of prescription errors by over 1 million and 300,000 respectively.

Preventing Adverse Drug Events (ADEs) using Computerized Physician/Provider Order Entry and Clinical Decision Support

Over 100,000 inpatient ADEs could be avoided collectively every year in all studied member states through the use of CPOE and CDS. This equates to the avoidance of over 700,000 extra bed-days, resulting in potential opportunity savings of almost €300 million. In the Czech Republic alone there are over 2.1 million acute admissions every year, 38,000 of which result in a preventable ADE. Of these over 6,200 could be avoided, potentially saving over €6.4 million every year in extra bed-days.

Reducing Medication Errors through Computerised Physician/Provider Order Entry and Clinical Decision Support

Over 26,000 medication errors could be avoided In the Netherlands through the use of CPOE and CDS. This could avoid over 1,300 moderate to severe harm incidents, and result in potential savings of up to €118 million.

6.1.2 Hospital Acquired Infection (HAI)

Reducing Hospital Acquired Infections (HAI) through Business Intelligence and Data-Mining for Real Time Detection of Infections

49,000 cases of inpatient HAIs could be avoided every year collectively in all six studied member states through the use of Business Intelligence and Data Mining for real time detection of in-hospital infections. This could increase availability by over 270,000 bed-days, resulting in opportunity savings of over €131 million.

6.1.3 Care Pathway / Patient Flow

Reducing Diabetic Deaths through Electronic Medical Record and Chronic Disease Management Systems

11,000 deaths caused by complications related to diabetes could collectively be reduced in all six studied member states through Electronic Medical Records with Chronic Disease Management capabilities. The reduction in diabetic death in Spain alone, where the yearly number of diabetic death reaches nearly 10,000, could be as high as 3,000 through the use of the same technology.

Reducing inpatient Mistaken Identity Medication Errors through RFID and Barcoding for Medication Administration

Over 200 inpatient mistaken identity errors could be avoided in the UK and another 200 in the Netherlands every year through the use of RFID and Barcoding for medication administration in hospitals. Further assumed benefits of the technology could also impact patient Safety when used to match the right patient with the right procedure in operating rooms.

6.1.4 Ambulatory Care / Home Health Monitoring

Reducing Hospital Admissions through Telemedicine and Home Health Monitoring

5.6 million admissions to hospitals for chronically ill patients could be avoided collectively in the six member states through the use of Telemedicine and Home Health Monitoring.

Increase in Availability through Home Health Monitoring (HHM) Systems

The Czech Republic could reduce the number of bed-days used to treat chronically ill patients by almost 2.8 million every year, resulting in opportunity savings of over €460 million.

6.1.5 Primary / Secondary Care Integration

Increase in Number of General Practitioner (GP) Appointments through Electronic Medical Record

Almost 65 million GP appointments could collectively be made available in all six member states through outpatient EMR and CPOE. An average of 384 extra appointments per GP per year could be made available in the six member states through the same technology. In Sweden alone, over 370,000 GP appointments could be made available. This is equivalent to 73 appointments per GP per year in Sweden.

6.1.6 Healthcare Operational Efficiencies

Improved healthcare operational efficiencies: ICT implementation will of necessity require the review of existing manual processes in order to streamline them for ICT adoption potentially leading to common patient journeys (surgical, oncology).

Increasing availability by Reducing Hospitalisation Bed-days through Computer-based Patient Record with Computerised Physician/Provider Order Entry

Over 9 million unnecessary bed-days could collectively be avoided in all six member states by reducing the average length of hospital stay through a CPR system with CPOE capabilities. This in turn could result in potential opportunity savings equivalent to nearly €3.7 billion. In the Netherlands alone, 560,000 bed-days could be made available through the same technology, equalling potential opportunity savings of up to €600 million.

Increasing Availability of Secondary Care Appointments through Electronic Appointment Booking

The number of wasted appointments or Did Not Attends (DNA) in secondary care in England could be reduced through the use of Electronic Appointment Booking systems by 600,000, implying a potential opportunity saving over €130 million.

Reduction in Waiting Times through Electronic Appointment Booking

Patients in France could see a doctor 5.3 days sooner through the use of Electronic Appointment Booking.

Reducing the 90 Day Readmission Rate for Congestive Heart failure using Electronic Medical Record and Chronic Disease Management Systems

Patients in France could see a reduction in readmission to hospital for CHF of over 39,000 reaching opportunity savings of over €110 million through EMR with CDMS.

6.1.7 Diagnostics

Reducing Duplicate Surplus Laboratory and Chemistry Tests through Electronic Medical Record/Computer-based Patient Record

Over 800,000 unnecessary laboratory tests on patients could be avoided in England through the use of an EMR/CPR, achieving potential savings of approximately €3.6 million.

6.1.8 The Individual

Increasing Patient Involvement in Managing Chronic Conditions

Patients can become more involved and accountable for the management of their chronic conditions through access to knowledge based best practices via an EMR with Chronic Disease Management capabilities and communication with their physicians through a Patient Portal.

6.2 Indirect Benefits

6.2.1 Additional Benefits to the Health Service

As, with government encouragement, the HSE increases its investment in Healthcare ICT, and systems progressively go into operation, Ireland will begin to experience the tangible benefits from the range of applications described above. Clinicians, administrators and patients will have access to greatly enhanced healthcare information, delivered over a robust digital hyper-connected network. We will realise growing direct benefits in terms of patient safety, quality of care and cost effectiveness. As well as those direct benefits we can expect to harvest indirect benefits in many areas, for example:

Transformed healthcare processes: Co-requisite with the investment in new ICT systems will be the task of process transformation within the HSE. This will require the development of visionary, strong and dedicated leadership both at administrative and clinical levels, and will create an environment where willingness to adapt will bring demonstrable benefit to those involved.

Build a strong healthcare analytics capability: Through the creation of a national healthcare data warehouse, both government and the HSE will be better positioned to measure, monitor and forecast future healthcare demand.

Increased perception of value delivered from the healthcare service: By driving the more effective delivery of high calibre services from the overall investment in our health service, the ICT-enabled improvements will enhance the reputation of the service in the eyes of both staff and the public. This improved perception should improve morale within the health service, and may also provide a better environment to help tackle community programmes relating to lifestyle and behavioural illness.

6.2.2 Indirect Benefit to the Economy

In addition to the benefits which will accrue to the indigenous health service, indirect benefits can be generated for the economy as a whole. Healthcare is increasingly becoming an internationally traded service, where countries may be either net providers or consumers of medical services, depending on their capabilities and capacities. Clearly one of the factors that will influence Ireland's reputation in those markets is our competitive position in all aspects of modern medicine, including eHealth.

Building on our well-recognised advantages of language, and business-friendly environment, Ireland has a tremendous opportunity to exploit multiple opportunities in these international markets. Our enhanced reputation will:

Improve Ireland's competitiveness in the healthcare delivery market: Position Ireland as a leader in the healthcare sector, helping us become a world-class supplier of healthcare services to the rapidly growing international market.

Stimulate direct job creation and business opportunities: Provide a stimulus to the 70,000 person, €20bn ICT industry by protecting and increasing high-value jobs in the growing Healthcare ICT sector.

Attract large Healthcare ICT investments to Ireland: Position Ireland with clear demonstrable capability in a strong and vibrant healthcare ICT cluster, helping attract further inward investment and support the development of the smart economy.

Achieve a leadership position in Healthcare ICT: Through having a demonstrable home base of successful systems, Irish companies will be able to export products and talents to compete and win in the global Healthcare ICT market, valued at €40bn per annum.

7. Recommendations

In conclusion, we restate the recommendations set out in the Executive Summary. These recommendations were developed by the industry group drawing on their experience of large systems implementations in the Healthcare ICT area in different countries. They also aim at addressing specific issues currently being experienced in the HSE transformation programme, as identified to us by various parties involved in that process. We believe that these recommendations will lead to the successful realisation of the potential benefits identified in this report, and at the same time encourage the development in Ireland of a resilient Healthcare ICT sector, capable of supporting the requirements of Ireland's health service into the future and also laying the foundations for a new growth engine within the smart economy.

In order to prepare for this journey we make the following nine recommendations:

- The commitment to and resourcing of a modern IT-enabled healthcare system becomes a national priority for government, with leadership coming from the Minister for Health and Children.
- The CEO and board of the HSE accepts leadership responsibility for the effective execution of the ICT programme and the related process re-engineering, as essential elements in building a world-class, affordable health care service.
- The HSE triples its expenditure on Healthcare IT over the next 3 years, from 0.75% to 2.25% of total budget, this being the level of expenditure required to bring Ireland into a median position of healthcare IT capability in the delivery of patient care.
- The HSE's capacity to implement IT systems is enhanced by a long term partnership with the Irish ICT industry to leverage the expertise, capability and resources available.
- As part of the move towards a smart economy, the government directs Enterprise Ireland to establish a healthcare technology cluster. The government should also ensure that the public procurement process encourages R&D, experience-building and knowledge-sharing within SMEs, for example by supporting "lighthouse" applications in selected areas.
- A Unique Health Identifier and a national Electronic Health Record system spanning primary and acute care is implemented within 3 years. These systems offer major benefit in terms of patient safety, healthcare quality, chronic disease management and financial effectiveness. They are the essential building blocks for future healthcare ICT systems.
- Open standards are utilised to ensure interoperability into the future between different healthcare ICT systems.

- A major focus is placed on developing IT skills and knowledge within the HSE. This should include widespread IT familiarisation programmes for management, clinicians and administrators, supported by education and training from the ICT industry.

- The HSE board establishes a high level advisory group, comprising internal executives and external experts from the medical, academic and business communities to provide ongoing advice on the exploitation potential of Healthcare IT.

The ICT industry in Ireland is willing to rise to the challenge of supporting the HSE in its goal of transforming healthcare for the benefit of our citizens. As we succeed together in this mission, we will also begin to position Ireland as a world class supplier of healthcare services and healthcare ICT systems for the global market. In this way we will establish valuable assets for the new smart economy.

Bibliography

eHealth for a Healthier Europe!, Gartner, July 2009, Swedish Ministry of Health and Social Affairs

eHealth is Worth it, the economic benefits of implemented eHealth solutions at ten European sites, Karl A. Stroetmann, Tom Jones, Alexander Dobrev, Veli N. Stroetmann, Sept 2006, European Commission

Health IT, Explaining International IT Application Leadership, Daniel Castro, Sept 2009, The Information Technology & Innovation Foundation (ITIF)

eHealth Strategy 2008 to 2011, The Scottish Government/NHS Scotland

eHealth, Priorities and Strategies in European Countries, March 2007, European Commission

Denmark's Achievements With Healthcare Information Exchange, Jonathan Edwards, May 2006, Gartner

Enabling Healthcare Reform Using Information Technology, Recommendations for the Obama Administration and 111th Congress, Dec 2008, Healthcare Information and Management Systems Society (HIMMS)

Financing eHealth, Sources of financing and policy recommendations to Member States and the European Commission on boosting eHealth investment, Alexander Dobrev, empirica, Germany, Tom Jones, TanJent, UK, Veli N. Stroetmann, Karl A. Stroetmann, Jörg Artmann, Anne Kersting, Narges Kasiri, Dainis Zegners, Stefan Lilischkis, empirica, Germany, Dec 2008, European Commission

Evidence on the Costs and Benefits of Health Information Technology, May 2008, Congress of The United States Congressional Budget Office

IT for Healthcare, Market Trends, Nov 2008, Enterprise Ireland

Euro Health Consumer Index 2009 Report, Arne Björnberg, Ph.D., Beatriz Cebolla Garrofé, Ph.D., Sonja Lindblad, Sept 2009, Health Consumer Powerhouse AB

Healthcare ICT Strategy, Overview Presentation, Jun 2009, G. Hurl, Health Service Executive

The Economics of IT and Hospital Performance, 2007, PricewaterhouseCoopers

Appendix A:

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GE Healthcare
IBM
IMS MAXIMS
Intel
Microsoft
Oracle
PA Consulting
PricewaterhouseCoopers
Total Training
Xyea

Appendix B:

Companies who have reviewed the report and wish to be associated with the content:-

BearingPoint
eircom
Helix Health
Hewlett Packard Financial Services
IBEC
IMEC Technologies
Irish Software Assocation
iSOFT
Lincor Solutions
MANITeX
Silicon & Software Systems (S3)
Sláinte Technologies
System Dynamics