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An exploratory study of the implementation of electronic health records: a two country comparison

Helen Cripps

Craig Standing
Edith Cowan University

Vesna Prijatelj

AN EXPLORATORY STUDY OF THE IMPLEMENTATION OF ELECTRONIC HEALTH RECORDS: A TWO COUNTRY COMPARISON

Helen Cripps
Edith Cowan University, Australia

Craig Standing
Edith Cowan University, Australia

Vesna Prijatelj
General Hospital Celje, Slovenia

ABSTRACT

The adoption of electronic health records has been significantly slower in Australia than many European countries. This paper compares the implementation process in Australia with Slovenia, looking at the benefits, drawbacks and success factors of e-health implementation. The authors use case studies collected in each country to discuss issues around e-health implementation. Though Slovenia has progressed much further down the road of e-health the commonality of the experiences between both cases was striking.

INTRODUCTION

The role and use of health information systems to support the health care industry is an important one. There are a wide range of information systems in health that perform different functions but all are involved in the management of data and information. Health care is an information intensive industry in which quality and timely information is a critical resource (Ayres, D and Soar, J and Conrick, M., 2006).

In Australia the use of electronic health (ehealth), which is defined as "the adoption and adaptation of e-commerce technologies throughout the healthcare industry" (Wickramasinghe, Fadlalla, Geisler & Schaffer 2005, p. 318) has been slow in coming compared to European countries such as Slovenia. Ehealth in Slovenia was first introduced in the form of electronic patient records in 1996, as part of the implementation of a national electronic health insurance card (Prijatelj, Rajkovic, 2009). As a relatively small country of 2 million people the implementation of ehealth has been a fairly centralized and incremental process driven by government departments. In comparison, the Australia experience of implementation has been ad hoc with no common platform between the Federal and State governments, the private and public systems and the various levels of health care. The different approaches to implementation of ehealth could be best summarized as centralised for Slovenia and erratic for Australia.

E-HEALTH

Both Australia and Slovenia have implemented ehealth on a regional and institutional basis first and are now seeking to develop a national electronic patient record system, however they have arrived at this point through very divergent processes. In Slovenia there is a high level of adoption of electronic records systems in hospitals, health clinics and pharmacies. Apart from general practitioners, which have an almost 100% adoption rate, the health system in Australia is well behind all other sectors of the economy in its use of computerised systems. Currently, Australia is ranked in the middle among industrialised nations for ehealth, with the low use of electronic technologies for communication and clinical information transfer (Pearce and Haikerwal, 2010).

E-HEALTH IN SLOVENIA

In June 1991, Slovenia obtained its independence as a nation and by 1993 the nation was moving towards an ehealth system. The initial driver of the implementation of ehealth was the National Health Insurance Company, which in 1993, gave computers to all the Government Hospitals initiating the move towards ehealth. The main drivers for the implementation of the patient record system was to meet the needs of the National Insurance Company for the effective reimbursement of health care provided by the Hospital, and secondly reporting to the Government on the services rendered by the hospital. It was an ad hoc implementation process with no Government policy driving it, rather it was the National Insurance Company and the need to improve administrative services.

In June 2010, a number of interviews were undertaken focusing on the implementation of e-health in Slovenia. Interviews ranged from a regional government hospital, academics, software vendors and key government officials. The following discussion of the implementation of ehealth in Slovenia is based on case study interviews within a regional hospital (Hospital). In 1993, the expenditure on information technology (IT) in a medical field compared to that used in an administrative and business context was relatively low. The priority area for spending on IT in the Hospital was in administration, business systems and record keeping. This changed when funding was provided to support the delivery of health care through IT. To begin with it was mainly administrative staff, not medical staff, using the system. Initially problems arose due to lack of expertise in IT of staff working in the health care system (Prijatelj, 2006). The Hospital had its first ehealth system in 1993 in the form of Clipper Data base. The next stage was an Oracle database with a graphical user interface (GUI). When the Hospital changed to a GUI the existing system was rebuilt to make it easier to use. It was difficult to get clinicians and information systems people to work collaboratively. The system in the Hospital uses a single interface, not multiple systems, as the program was developed in collaboration with the Hospital.

The system at the Hospital was developed from the ground up through meetings between the staff and software designers. In Slovenia each hospital wanted an individual system, however there has been some form of standardisation due to the requirement of the National Insurance

Company and reporting purposes. Hospitals were able to electronically interface with the National Insurance Company in 1995. Considering its long history the area of Health Informatics is still developing in Slovenia. Slovenia is currently working on the implementation of a national strategy for eHealth, called "e-Zdravje2010" (ehealth 2010). This will be driven by the Ministry of Health which is the central agency for national health policy in Slovenia. This strategy aims to advance eHealth by merging individual health information systems into an integrated health system. This will be linked to a single health information portal, and will enable all those involved in health care including individuals, to have access and safe and reliable exchange of data (Erzen, 2010). Part of the strategy is the development of a basic patient summary that is applicable for the national electronic health records for storage on the portal. It is also proposed to include a patient summary on an updated version of the Slovene Health Insurance Card (Drnovšek, Giest and Dumortier, 2010).

E-HEATH IN AUSTRALIA
Compared to the centralised public health systems of European countries Australia has a multi-tiered system with state and federal government involvement and a large private health sector (Prijatelj, Rajkovic, 2009). This makes the design and implementation of ehealth systems extremely complex, as the National EHealth Transition Authority (NEHTA) has found. There is widespread uncertainty surrounding the adoption of ehealth in Australia from a political, policy, administrative, clinical and patient perspective. A compounding factor is also the lack of a consistent approach by all levels of government, the public and private health providers, and primary and tertiary health care (Australian Health Ministers' Advisory Council, 2008).

The multiplicity of stakeholders in health care makes adoption very erratic with some areas of the health sector strongly adopting ehealth and others resisting adoption. This is evidenced in Australia with around 90% of General Practitioners (GPs) now using computerised clinical packages. While prescribing is the most commonly used electronic function (98% of those who use a clinical package), medication safety functions, such as checking drug–drug interactions, are also frequently used. GPs reported widespread use of electronic health record functions, including ordering laboratory tests (85%), updating allergy information (84%), and generating health summaries (84%) (McInnes, Saltman & Kidd, 2006). While general practice is advanced in its adoption of ehealth there is as yet no mechanism for securely sharing electronic information between practices and hospitals.

According to Pearce and Haikerwal (2010) the issues around adoption in hospitals are different, due to scale and the level of disconnection between those who use electronic tools for their work (patient care, research, planning, measuring and evaluating), and those who provide funding (local, regional, state and federal managers and legislators). Although there is a lack of uniformity in systems implementation in other countries in Australia "*the uncoordinated implementation of differing, incompatible systems within hospitals, between hospitals in a region and across boundaries compounds a dire lack of national coordination and so loses the*

benefits of drawing on expertise and knowledge across the nation" (Pearce and Haikerwal, p398, 2010).

Though ehealth is mooted to reduce costs associated with health service delivery (Dearne, 2009), there are high costs linked to implementation, including infrastructure, equipment, training programs, and the change management required to introduce the associated new business practices. According to Dixon (2007), adoption of an ehealth system introduces risks as the system may not improve workflow efficiencies or reduce medical error rates and at the same time could open the door to legal action for improper handling of protected information. For Australia, the cost to implement an ehealth system is $1.6 billion Australian Dollars (AUD) over the next four years (Dearne, 2010a). For regional and remote areas of Australia the issues relating to infrastructure and cost are magnified (Rao, 2009). It is suggested that governments may need to provide some financial incentives to facilitate adoption of ehealth (National Health and Hospitals Reform Commission, 2009).

A review of research concerning electronic health records found one of the major issues was the proliferation of electronic health record formats and systems that have arisen due to the wide ranging needs and requirements of health care professionals and consumers. An additional challenge is to incorporate the international terminologies in order to achieve semantic interoperability across national borders and computer software systems (Hayrinen, Saranto & Nykanen, 2008). In Australia, there seems to be a divide between the government's implementation process and the software vendors who are going to have to make it work. According to the Medical Software Industry Association the vendor community has not been briefed on ehealth despite the expectation that the vendors will be integral to the new system (Dearne, 2010b). Currently the Australian Federal government is seeking a private company to build an analytical and evaluation framework to monitor and measure progress of the personally controlled ehealth record (PCEHR) as it is introduced over the next 18 months. The Federal Government will use a national framework to guide development including uniform standards, a national privacy regime and 'bottom up' testing of the ehealth roll out through lead ehealth implementation sites around the country (Dearne, 2011a).

The Australian Federal government has placed the NEHTA in charge of the implementation of the ehealth record program in Australia with a budget of $467 million.. NEHTA has been set up and funded by The Council of Australian Governments (COAG) to:
- urgently develop the essential foundations required to enable e-health;
- coordinate the progression of the priority e-health solutions and processes;
- accelerate the adoption of e-health, and;
- lead the progression of e-health in Australia.

There is ongoing criticism of the process and the effectiveness of the eventual outcome (Dearne, 2011b). To some extent the horse has already bolted, with the wide spread adoption of systems at all levels of health care system

In Australia there is ongoing debate in the media over privacy and security with the introduction of individual health identifiers. Mahncke and Williams (2006) discussed National Ehealth Transition Authority (NEHTA) secure transmission initiatives and the resultant security issues related to the transfer of shared electronic health records. A review of secure transmission of shared electronic records is expected to promote an environment in which vendors compete for market share and will develop medical applications that are interoperable. These initiatives may indirectly help to reduce the anticipated strain on the health care budget, given the aging population and the baby boomers preparing for retirement. Other benefits include the collection of de-identified information for public health research and the development of health management strategies.

Conversely, according to privacy experts in Australia these healthcare identifiers are seen as de facto national identity numbers, and concerns over patient privacy and the protection of sensitive medical information in electronic systems are yet to be addressed (Dearne, 2009). On the other hand the government believes that electronic health records would enable people to take a more active role in managing their health and making informed decisions (National Health and Hospitals Reform Commission, 2009).

Frydman (2011), states that one of the National Health and Hospital Reform Commission's (NHHRC) recommendations was to promote the use of ehealth. Ehealth is already available but most of these systems do not speak to each other. There are very few standards to support and underline the use of these products. The aim of the NHHRC is to improve health care delivery for all Australians.

An analysis of the successful adoption of national electronic health record programs from England, Germany, Canada, Denmark and Australia highlighted the following critical areas: (a) acceptance and change management, (b) demonstration of benefits and funding, (c) project management, (d) health-policy-related goals and implementation strategy, (e) basic legal requirements, particularly in the field of data protection. It was found that the strategic, organisational and human challenges are usually more difficult to master than technical aspects (Deutscha, Duftschmid, & Dorda, 2010). The more centralised health systems in European countries, such as Denmark and England have a far higher level of adoption than those in Australia and the United States of America.

COMPARISON OF CASE STUDIES
The case study undertaken in Australia focused on the implementation of electronic health records by the Ngaanyatjarra (Ng) Health Service. The Ngaanyatjarra Lands, which are located in the Western Desert region of outback Western Australia, some 1,000 kms from Alice Springs and 1,500 kms from Perth, making it one of the most remote locations in Australia. The Health service is controlled by the Ngaanyatjarra Council which is made up of indigenous elders. The Council receives funding from State and Federal government agencies. The

Council then contracts the provision of health care services out to a private provider who delivers health services to the indigenous people of the Ngaanyatjarra Lands. In May 2004, the Chief Information Officer (CIO) commenced the implementation of a new electronic records system , and existing paper records were copied and placed into the patients' electronic record.

The case study was chosen, as it was an example of the successful use of electronic health records across a health network. It is ironic that ehealth systems are being adopted in the most remote and disadvantaged regions of Australia rather than in the metropolitan areas. The data collection involved interviews of typically 50 minutes to one hour duration with the Chief Executive Officer (CEO), 13 clinicians and 4 IT staff in field trips out to the Ngaanyatjarra Lands, and staff at the Ng Health Service's administrative centre in Alice Springs. The exploratory interviews included questions on the characteristics of the health information system, the barriers that had to be overcome, the benefits of the system and the continuing issues related to the system.

To provide a comparison to the Australian experience of ehealth implementation, interviews were conducted in Slovenia using the same or similar open ended questions as displayed in Table 1 - *Comparison of Interview Questions* below.

Patients were not interviewed in either case study, because the research focused on administrative issues concerning the implementation of ehealth. There were also practical barriers to interviewing patients, such as language differences and ethical limitations.

Despite the widely varying circumstances by which ehealth has been introduced into Slovenia and Australia, the two case studies showed similar results on the implementation process of ehealth. The main difference in the Slovenian case study was the focus on consultation with government stakeholders, administrative staff and the clinicians prior, during, and after the implementation of the new system.

Table 1 - Comparison of Interview Questions

Australia	Slovenia
System development history?	System development history?

Who are the stakeholders? How were they involved in the project? What impacted did they have on the final system?	What impacted do you think the stakeholders had on the final system?
Requirements of the system?	What are the key features of the System used?
Key features of the western desert health service system?	Type of system used?
What are perceived benefits?	What do you see as the benefits of the system?
How are they measured?	How are they measured?
What barriers have you encountered?	What barriers have you encountered?
How have you overcome them?	Ways that problems were over come?
What problems still exist?	Ongoing issues of the system?
Australia	**Slovenia**
Have you identified any risks with system?	Have you identified any risks with system?
How have you addressed the risks?	How have you addressed the risks?
How do you see the future development of the system?	How do you see the future development of the system?

It is suggested that the benefits identified in both cases could be grouped/aligned? around greater accountability, improved administration, better patient care and more efficient workflows. The benefits focus on the clinicians and administrators, as the patients themselves were not interviewed in the case studies, but they are also considered customers of the ehealth systems. A summary of the benefits identified in the cases studies is presented in Table 2 - *Benefits of Ehealth* below.

Table 2 - Benefits of Ehealth

Category	Benefits	Slovenia	Australia
Accountability	Electronic records are open to increased scrutiny from members of staff and there is less risk of record tampering. If anything is changed you will know who has entered it.	√	√
Accountability	Reduces the possibility of drug fraud, as there is an instant record.	√	√
Accountability	It is safer for the nurses and patients due to the higher quality of information and accountability.	√	*Patients did not show interest in accessing their records
Administration	Reduction in paper based administration.	√	√
Administration	Generation of information and reports for funding bodies.	√	√
Patient Care	Easier and faster access to patient information.	√	√
Patient Care	Ongoing patent management such as recalls.	√	√
Patient Care	The clinician is able to search the electronic record for information.	√	√
Workflow	Better communication among clinicians and staff.	√	√
Workflow	The system can create continuity of care across various clinicians, such as nurses, specialists and pharmacists.	√	√
Workflow	Use of video files to replace film.	√	*Not used in this case due to slow internet speeds
Workflow	An electronic records system can be a means of nurses showing the extent of their work in caring for their patients.	√	*Not a consideration for staff in this case

The drawbacks or difficulties experienced with the implementation can be summarised in Table 3 - *Drawbacks of Ehealth* as issues with the IT systems, the perceived high costs of implementation, the relationships between the players and the government, and the lack of staff expertise in using the ehealth systems.

Table 3: Drawbacks of Ehealth

Category	Drawbacks	Slovenia	Australia
IT Systems	Lack of interoperability between the systems of regional and national organisations.	√	√
IT Systems	Lack of protocols for access to other electronic health records outside of the hospital/health service.	√	√
IT Systems	We still do not have enough medically based applications that help, there are expert systems for administration but not for practicing medicine.	√	√
Perceived Cost	Justifying to funding bodies the high cost of implementing the system properly.	√	√
Perceived Cost	Lack of infrastructure and the high costs of implementation and maintenance, due to the remoteness of the communities.	*No remote issues in this case	√
Politics	The politics of multiple stakeholders is very difficult as everyone has his own needs and priorities.	√	√
Politics	Constant tension between the developers and their customers and the system's users.	√	√
Politics	Increased levels of security due to laws concerning patients' data, security and patients' rights.	√	
Staff Expertise	Attitude towards IT and a lack of previous experience and knowledge among staff.	√	√
Staff Expertise	Lack of uniformity in data entry by staff and between electronic record systems	√	√
Staff Expertise	May not improve the patients' experience as the lack of IT knowledge of the clinicians makes consultation slow.	√	√
Staff Expertise	This system still depends on the patient providing information and the clinician enter the data.	√	√

DISCUSSION OF BENEFITS AND DRAWBACKS

Extending the comparison to other countries where the research also found many benefits, and drawbacks with implementing ehealth practices. For example, the benefits of ehealth adoption included the categories of patient care and workflow; and the drawbacks, included the categories discussed problems with IT systems, politics and staff expertise.

Much of the research indicates that many of the benefits and drawbacks of adopting an ehealth system are interlinked. The majority of health care professionals do perceive benefits to information technology, but also cite major barriers to its implementation in their work setting or environment. Barriers include privacy concerns (particularly an overwhelming demand for patients' medical records to be guaranteed against data theft and prying), lack of access to capital by health care providers, complex systems and lack of data standards that allow exchange of clinical data and legal obstacles (Anderson, 2007).

Pearce (2009) states that the true benefits of having electronic medical records (EMR) will only be realised when the idea that it is more than simply information that was once recorded on paper, and that EMR's can be used to improve patient care. Computers are being used by General Practitioners (GPs) for an increasingly broad range of functions and EMRs allow multiple sources of information to come into play in the GP consultation.

Collaboration between clinicians, researchers and clinical software developers is vital to advance the process of remotely accessing general practice EMRs. A project focusing on the use of remote access of EMRs for the purposes of collecting data during a collaborative research project (involving the staff of three general practices and an external research team), revealed numerous benefits, and difficulties such as increasing the functionality of the software programs used in general practice, along with improvements in the utilisation of the software capabilities. (Young, et. al., 2010).

Black, et al. (2011) found that there was a large gap between the postulated and empirically demonstrated benefits of ehealth technologies. A lack of robust research on the risks of implementing these technologies and their cost-effectiveness has not been demonstrated, despite being frequently promoted by policymakers and ''techno-enthusiasts''. In the light of the paucity of evidence in relation to improvements in patient outcomes, together with the lack of evidence on their cost-effectiveness, it is vital that future ehealth technologies are evaluated against a comprehensive set of measures, ideally throughout all stages of the technology's life cycle. Such evaluation should be characterised by careful attention to socio-technical factors to maximise the likelihood of successful implementation and adoption.

Lê Quynh, (2005) examined the concepts and issues relating to the development of an integrated health record system and identified problems which are faced by many health workers in relation to intercultural communication (in order to achieve semantic interoperability), privacy issues and safe data collection in health care.

As the use of electronic health records becomes more common, health care professionals will adjust, and find that there are many advantages to using EHRs. Nurses will also be instrumental in helping to improve new systems as the primary users of this new technology (Catalano, 2006).

THE IMPLEMENTATION PROCESS COMPARED

Unlike the current ehealth adoption process in Australia which is ad hoc, the Ng Health's implementation was a top down approach driven by the CEO of the contracted health care firm, the CIO and the Chief Health Informatics Officer. The CEO managed the money and the political issues and expectations between the government funding bodies and the Indigenous elders of the Ngaanyatjarra Lands Council. The CIO dealt with the delivery of technical services in the desert environment, while Chief Health Informatics Officer supported the clinical staff. Between the three of them they managed a client base of around 1,500 patients located in the Western Desert region of outback Western Australia, some 1,000 kilometres (kms) from Alice Springs and 1,500 kms from Perth which relies on satellite technology in some locations. The move to an electronic patient health record was seen by the CEO of the contracted health care firm as the only way to effectively manage the health records of his very mobile client group. The Ngaanyatjarra people move from community to community and even across state borders to access services in other health systems.

In contrast, the implementation of ehealth systems in Slovenia on a local level has often been a more bottom up approach with the use of stakeholder groups, representative committees of clinicians and administrative staff. The use of champions to encourage adoption at a clinical level was also successful. Despite the long history of health informatics in Slovenia it was considered by some interviewees an under resourced field of information systems expertise. In the case of Slovenia, the main institutional driver for ehealth adoption has been the National Health Insurance Company rather than the government itself, although the Health Minister at the time of the data collection was a very strong advocate for ehealth (Prijatelj, Rajkovic, 2009).

CRITICAL SUCCESS FACTORS

Compared with urban counterparts, the Ngaanyatjarra lands provided a very challenging environment in which to implement a digital health records system. In what should have been an impossible situation, the case study demonstrated that in an environment with few options and little choice, a workable and successful system can still be delivered. In one sense a 'needs must' ethos (the overwhelming drive to make the project a success) drove the acceptance and overcame the drawbacks. There was also a sense that once the process was started the difficulties had to be overcome, as there was no going back to the old system with so much at stake. It could be expected that greater choice and the proliferation of options should lead to a better end result, however a multitude of options and stakeholders can lead to paralysis in

decision making. The reasons why it was successful can be abstracted to general principles that can be applied to other challenging contexts.

1. Devolve decision making to the regional level as those involved are best placed to make decisions that will lead to practical and useful outcomes.
2. Streamline the decision making (the fewer levels the better).
3. Develop simple systems that can be used by people with limited IT skills. Make hardware systems modular so that hardware modules can be replaced rather than repaired.
4. Try to have those making decisions as close to the patients as possible so that they are patient driven.
5. Make benefits transparent to the patients since they are more likely to make compromises on privacy issues.

In the case of e-health implementation in Slovenia the devil has been in the detail in gathering support at all levels, developing expertise and changing workflow practices in public based health systems. The Australian case was of a private organisation which received government funding but had far greater ability to pick and choose their staff, this meant little resistance during the implementation process. In contrast in the Slovenian case study there was far greater consultation with the staff and stakeholders. In the Ng case study the physical environment was a challenge, whereas in Slovenia it was the organisational and bureaucratic environment that was more challenging. From the Slovenian case study a number of principles that aided adoption have been identified.

1. The early establishment of consultative committees for the development, testing and refinement of the e-health system.
2. The identification and promotion of champions for the adoption process at the clinical and administrative levels to communicate with the rest of the staff.
3. The negotiation of agreed positive expectations and outcomes of the system, prior to implementation, so there are no surprises and the likelihood of sabotage by disgruntled staff is reduced.
4. Find and train people who can understand and communicate with systems vendors, clinicians and hospital administrators.

CONCLUSION AND FURTHER RESEARCH

Although the case studies varied greatly, the basis of any health system are its people. Technology is only a tool to help solve problems and in both case studies it was the role of individuals and their commitment to ehealth that overcame the issues such a funding, staff resistance and meddling of multiple stakeholders.

Slovenia has been developing ehealth for over 20 years and are still struggling with issues around the implementation of a unified system because the electronic health records are based around regions and specific IT vendors. This has prompted the move to a portal and summary health record.

In comparison, Australia is a long way behind other developed nations in its implementation of ehealth. The insights gained from these case studies may be of assistance to the government and health administrators in the effective implementation process. A centralised store for electronic health records is also part of the Australian Federal Government's E-Health Strategy. The size and complexity of Australia's health system, in comparison to the centralised European systems, makes the task of successfully creating an e-health system seem insurmountable. If the current news media in Australia is any measure, the implementation of ehealth throughout all levels of health care will be a long, costly and painful process, littered with mistakes and waste.

As case studies are a limited form of data collection, and in this instance the settings for each case varied greatly, further data collection is required. Further case studies are being collected by the researchers in the hope of refining the success factor for the adoption of ehealth in public, private and remote health services. The authors are currently developing theory around the implementation of ehealth which it is hoped with be tested in a quantitative data collection and opportunities will be sought to communicate the findings of this research to the health practitioners and administrators which are on the front-line of implementation.

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