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## Smart Health Care Cards: Are they applicable in the Australian context?

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### **Abstract**

*One of the applications used in the management of electronic health records are smart health care cards (smart cards). This paper seeks to identify if smart cards would be applicable as part of the implementation of ehealth in Australia. The paper reviews the research around the use of smart cards and a case study on the implementation in Slovenia. Based on an extensive literature review and a case study from Slovenia it would seem the implementation of smart cards has met with varied success. While the benefits cited include; management of patient data, insurance refunds, patient data security and tracking of prescriptions. The drawbacks include cost, poor data quality, lack of interoperability, a lack of scalability and patient data security concerns that have seen the suspension of the use of smart health cards in some countries. In Australia's multi layered health system the drawbacks cited raises questions as to the suitability of smart cards in Australia.*

**Keywords:** ehealth, smart cards, evaluation, Australia

## 1 Introduction

Australia has lagged behind much of Europe in regards to the implementation of national ehealth initiatives. This is partly due to the multi-layered and decentralised health system in Australia. There are multiple funding streams and jurisdictions that have led to confusion regarding responsibilities and missed deadlines for national implementation (Pearce and Haikerwal, 2010). Currently, the ad hoc implementation of electronic health systems in Australia has created a disconnected system and processes which according to Smith, *et al*, (2011, p. 131) do not “effectively support activities such as health surveillance, guidance for policy, service planning, innovation and clinical and operational decision-making”.

The use of smart cards is currently being considered as part of the implementation of ehealth within Australia. If the Australian Government is going to pursue the use of smart health care cards (smart cards) then an evaluation of their effectiveness in context of the experience of other countries may be warranted. To this end an extensive literature review on the use of smart cards has been undertaken and the findings from the case study conducted in Slovenia are also discussed. There has been very little in the way of academic research on the effectiveness of smart cards in the health system. The findings from the current literature available are discussed below.

## 2 The Early Expectations of Smart Cards

Smart cards with embedded microprocessors were developed in the early 1970s and have been used for mass rapid transportation (MRT), secure access to buildings and offices, and for electronic payments. One of the features of smart cards is the integrated encryption keys that help prevent fraud. The smart cards are equipped with memory that can be both read and reprogrammed. However, the capacity is usually limited to between 30 and 100 kilobytes.

A review of the literature concerning the use of smart cards in the health sector over the past 20 years has shown an interesting trend. The earlier articles were filled with expectations that these cards would prove to be a vital part of the ehealth revolution. More recent publications, online sources and the authors' own work indicate the promise had yet to be realised. Early advocates of the implementation of smart cards in a health setting believed that smart cards would provide a means of authenticating an individual's identity, so as to enable secure individualised access to data, and provided definitive audit trails for data access (Neame, 1997). It was proposed that these patient cards would also carry personal details, data on current health problems and medications, emergency care data, and pointers to where medical records for the patients can be found (Neame, 1997).

An early review of the potential of smart cards in the Israeli health system suggested that with their storage capacity smart cards could provide a comprehensive and portable

patient record. The range of formats of cards includes: paper or plastic cards, microfilm cards, bar-code cards, magnetic-strip cards and integrated circuit smart cards (Harefuah, 1995). Even at this early stage concerns were raised over data security, storage capacity, data consistency, access authorisation, data ownership, compatibility of the systems and privacy (Morris, et al., 1995; Harefuah, 1995).

There was even discussion around the use of smart cards in Australia as early 1995, when they were seen as a way to secure patient data and would transform the way medical histories were recorded (Morris et al., 1995). Yet in Australia the electronic cards used in both the public and private health insurance systems only have a magnetic strip and are solely used as a key to access insurance data to claim rebates on service received.

### **3 Implementation of Smart Cards**

The implementation of smart cards in other countries has often been linked to the requirements of a national insurance system, such as in Taiwan where the Bureau of National Health Insurance issued health smart cards in 2004. Similarly in Slovenia the smart card was introduced on the back of the national health insurer's need to more effectively track patient billing data (Cripps, Standing and Prijatelj, 2011). In a number of European countries the introduction of smart cards has been stimulated by strategies for a telematic infrastructure (Haas & Sembritzki, 2006). In addition to tracking medical reimbursements, these smart cards stored healthcare information, including electronic

prescriptions, medical procedure and vaccination records, drug allergy histories, and information about a patient's willingness to be an organ donor.

As part of the introduction of smart cards, the European Commission funded several pilot projects to gather experience in the implementation of the cards. The best known of these pilots are DIABCARD, CARDLINK and NETLINK. These smart cards were deployed either as part of a local or national health information system. There are card systems or pilots implemented in 10 European countries, namely in Austria, Belgium, Czech Republic, France, Germany, Ireland, Italy, Netherlands, Norway and Slovenia (Bartlett & Boehncke, 2008).

Within the United States of America (USA) there has also been the introduction of smart cards on a regional basis, this is due to the expensive health care system that is highly privatised with many different stakeholders and intense economic pressures. This has led to "pockets of innovation" in different geographic regions and different types of health vendors driving their implementation (Bartlett, & Boehncke, 2008).

A summary of the different smart card systems is presented in Table 1 below.

Table 1: Comparison of International Approaches to Identification

Country	Highlights	Identification	Sample Offline Functionality	Sample Online Functionality
<b>Significant Medical Functionality enabled via Token (current or planned)</b>				
<b>Italy</b>				
(Carta di Servizi Lombardy)	9 million citizen cards, 160k providers since 2005.	Token without photo (smartcard)	Emergency Data	Insurance Check, e-Prescribing, e-Referral, Electronic Health Records (EHR)
<b>Taiwan</b>				
(Healthcard)	24 million citizen cards, health professional cards since approximately 2004.	Token with optional photo (smartcard)	Emergency data, vaccinations, allergies, chronic diseases, maternity information, Insurance check.	Periodic verification of card after longer time period of offline use.
<b>Germany</b>				
(Gesundheitskarte)	80 million citizen cards, 2 million providers <i>early applications in test phase.</i>	Token with photo (smartcard)	Emergency Data, possibly other data	Insurance check, e-Prescribing, Medication Log, e-Referral, EHR.
<b>Slovenia</b>				
	2 million citizens	Token without photo (smartcard)	Personal physicians, organ donation, emergency data (planned)	Insurance Check, e-Prescribing (planned)
<b>Token used mainly as a Secure Insurance identifier</b>				
<b>France</b>				
(Sesame Vitale 2)	53 million citizen cards 600k providers	Token with photo (smartcard)	Family doctor, organ donation	Insurance check, EHR planned
<b>Austria</b>				
(eCard)	11 million citizen Cards 30k providers	Token without photo (smartcard)		Insurance check Medical functions planned (e.g. e-Prescribing)

Country	Highlights	Identification	Sample Offline Functionality	Sample Online Functionality
<b>Identifier Card for Citizen ID only – functionality online</b>				
<b>United Kingdom (UK)</b>				
	61 million citizens	Paper card or ID process at provider (verifying forename, surname, date of birth, postcode, sex and address).	Informational – name, address and NHS number	All National Health Service (NHS) Connecting for Health Applications in place or to be rolled out incl. EHR and others.
<b>United States of America (USA)</b>				
	No national approach to identification 300 million citizens.	Plastic card with or without magnetic strip in some instances, occasionally ask for POI including drivers licence	Depending on insurance, pharmacies, HMO etc.	Depending on insurance, pharmacies, HMO etc.
<b>Canada</b>				
(Health Infoway)	Issued by provinces as opposed to federal government 33 million citizens.	Depending on province, dumb card with or without photo (magnetic strip or paper)	Informational – e.g. name, date of birth, sex, province and personal health number.	All Canadian Health Infoway Applications, e.g. Adverse Drug Events prevention etc.

(Bartlett & Boehncke, 2008).

#### 4 Smart Cards in Slovenia

In Slovenia, the National Health Insurance Company originally implemented a smart card as part of their patient record system to allow for the reimbursement of health care services and reporting on services rendered by the hospital (Cripps, Standing and Prijatelj, 2011). The health insurance smart card system was implemented in September 2000 and was aimed at supporting insurance related procedures, in a flexible and open manner across the whole health sector. The smart card technologies provided a real-time Electronic Data Interchange (EDI) based environment for a set of applications in the medical sector and served as a form of authentication, for storage of minimal data sets and as pointers to appropriate data sets in a network (Trcek *et. al*, 2001).

In 2010 and 2011, interviews were completed with a variety of respondents including software developers, hospital administrators, representatives of the National Health

Insurance Company and political representatives. As part of these interviews the implementation of the smart card was discussed. According to the interviews conducted the card is still only used as a key to access records on a database only and very limited data is kept on the cards. As part of the implementation of EHRs in Slovenia, the Federal government put out a number of tenders for the supplier of EHRs based on geographic regions within Slovenia. This has led to the development of a number of unique health record systems within a single country based around IT vendors. This proliferation of systems has stifled attempts for a truly interoperable record system. Even with the development of a centralised database linked to a single health information portal, the information held on an updated version of the Slovene Health Insurance Card will only be summary in nature (Drnovšek, Giest and Dumortier, 2010).

## 5 Issues around Implementation of Smart Cards

From the literature reviewed, a number of recurrent issues associated with the implementation of smart cards were identified including data quality, consistency, security and data management, patient identification, interoperability and information exchange between systems, scalability of local systems to national platforms, cost and finally the emergence of new technology.

### Data Management Issues

A study in Taiwan, one of the early adopters of smart cards, highlights some of the issues experienced around data management. The study focused on how drug allergy histories were recorded. Results revealed that the drug allergy histories were incomplete in many cases, and the format used to record a patient's drug allergy history was not consistent, hence impacting the reliability of the system (Huei, *et al.*, 2011).

An ongoing concern is the security of the data stored on the smart card and the risk that data on the smart card can be read without authentication (Dichiu, Irina and Valentin, 2012; Tuffs, 2010). In the German case, these security concerns have further hampered the implementation of the smart cards as data protection experts were concerned patients' data online or on the cards could be accessed illegally and compromise individual privacy. This was also complicated by the healthcare providers' unwillingness to purchase special technical equipment and saying that the smart health card was impractical (Tuffs, 2010).

One of the key ways that these security concerns have been addressed, is through the ability to uniquely identify electronically citizens/patients, healthcare professionals, healthcare providers, and pharmacies. Stroetmann *et al.*, (2011) found in their study that the use of patient identifiers were present in the ehealth strategies in most European countries (26) in 2010, the next challenge was the adoption of professional identifications (IDs) which lagged behind most countries. Approaches to the issue of patient identifiers included using the same ID as existing citizen registers, creating specific patient IDs for electronic health service or the use of a single national citizen ID

that harks back to the socialist times of Eastern Europe.

In all the literature reviewed as part of this paper very little has focussed on the patient, who is the end customer of any form of electronic records system. It is suggested that the use of smart cards allows for the sharing of information that can lead to better outcomes for patients. *“It’s about delivering better health services. It’s about ensuring that people don’t steal your identity, it’s about trying to ensure that we get better value for taxpayers’ dollars”* (Kerr, 2006). The German Medical Association echoes the focus on the patient, and not just the technical and financial issues of smart cards. *“We must abandon discussions of the health card that focusses entirely on technical and political issues and must turn towards its medical applications,”* said Franz-Joseph Bartmann, IT expert. The card should be more practical to use, he said, and it should include possibilities for tele-consultation and monitoring (Bourlioufas, 2010).

### **Lack of Interoperability**

Even with the use of identifiers and single patient ID, most of the ehealth services provided by such smart card systems are not available abroad and many may not even be interoperable between different regions within the same country. The exchange of information often still relies on paper print outs even when smart cards are used. A number of countries, such as Slovenia are looking at developing a national summary patient record, with detailed patient records still being held by the primary health care provider (Cripps, Standing and Prijatelj, 2011). In countries where patient clinical data is electronically available (i.e. on smart cards or through networks), there is still little international access to the patient’s clinical data, even in an emergency situation, due to the lack of data standards (Hass & Sembritzki, 2006; Bartlett & Boehncke, 2008).

To create ubiquitous and secure access to health data across jurisdictional boundaries, an all-embracing ehealth infrastructure is indispensable. This would however, require agreement on rules and processes, competence centres and supporting organisational structures, secure, unique identification of patients, health professionals and service provider entities, security and data privacy, regulation of technical and semantic standards. While Bartlett & Boehncke (2008) suggest the more agencies and individuals that have access to the network, the greater is the value to each of them. The down side of this concept of universal access is that it makes it more difficult for the control of data and higher the risk of breaches of privacy. The enormous cost of providing an all-encompassing secure system has limited the effectiveness of both government and the private sector to achieve the goal of a universally accessible system.

### **Cost of Implementation**

Hailed as the most expensive health project in the world, Germany’s ehealth system based on the use of a patient smart card is already four years behind schedule. The proposed smart card was intended to replace the present membership cards of the health insurance companies and is supposed to make about 700 million handwritten prescriptions redundant, thereby saving most of the cost of its introduction. The cost blow-out has seen Germany delayed the implementation of the ehealth card system, which has so far cost the health insurance companies and its government a total of 1.5 billion euro (\$2.3 billion) (Bourlioufas, 2010).

On the other side of the Atlantic, the Canadian province of Ontario had a \$1 billion



(Canadian dollars) spending blow-out in the program to introduce electronic health records in the province. The Auditor General's report found for all the expenditure there was little of value to show for it. The health minister of Saskatchewan concluded that electronic health records "takes a lot of time, a lot of investment, a lot of people," (Bourlioufas, 2010). Quebec has backtracked on a proposal to use medicare cards that provide instant access to a patient's medical history. The cards were expected to save about \$45 million a year by combating fraud (Pinker, 2002).

The National Health Service (NHS) in the UK has been constantly plagued with problems with the implementation of ehealth. The program, running since 2002, has an estimated budget of more than £12.7 billion and is constantly beset with time delays; with some claiming the program is five years behind schedule (Bourlioufas, 2010).

In Australia, (a country without the level of public health infrastructure and coverage of most European countries), there are regular reports of the ever-increasing costs associated with pursuing ehealth systems (Dearen, 2012).

### **New Technologies**

Considering the issues faced by many countries in the adoption of smart cards. Is there a place for such cards in the ehealth system? The current proliferation of mobile technology, that in the business sector is threatening to replace the current credit/debit smart cards, may in the health sector make a plastic smart card obsolete (Husain, 2012). Mhealth has the potential to go beyond just patient data to supporting integrated applications and data in areas such as patient diagnostic and treatment support, health care provider training and communications support, remote patient data collection, patient education and awareness, remote patient monitoring, disease epidemic outbreak tracking, and compliance with evidence-based treatment and care (Ratzan, 2010; Istepanian and Zhang, 2012).

According to Constantinescu et al. (2012) the prevalence of mobile devices in healthcare settings is increasing with most practitioners owning at least one mobile device, such as a Smart Phone. Through smart devices the traditional boundaries of patient records are diminishing as technologies allow for the extended reach of hospital infrastructure and provide on-demand mobile access to medical multimedia data. The interoperability of these devices and their mobile nature means that they are superior to a smart card which requires a terminal or a computer system to access the data.

In a recent article from the eHealth News.eu website (2012), it was suggested that the advent of smart phones and tablets has allowed technology to leap frog from the first to the third generation in electronic health systems. This has required the development of 'plug'n play' ecosystems for data in to order push the revolution of smart personal Health devices (Smith, 2012).

## **6 Will Australia be a Smart Health Card country?**

The authors' suggest the combination of the issues concerning the implementation of smart cards and the complexity of the Australian health system would not support their successful implementation. Part of the implementation of health smart cards centre on patients being emancipated partners in their health care but this can only happen if there is secure data and trust in the system (Pharow, Blobel & Hildebr, 2008). While these concepts of unity and trust are strong in a centralised culture such as Scandinavia; within the Australian context there are major concerns over privacy and security of patient data. Smith (2012), states that currently the responsibility for the security of the Personally Controlled eHealth Record (PCEHR) has been placed upon the patient.

Australia has no identity card or single number system to build on for the smart card. At this point in time patients have to opt into the proposed new PCEHR and will be charged for the establishment of their record. The current lack of privacy legislation in Australia to manage electronic health records has been criticised by a number of medical and consumer organisations (Dearne, 2011a; 2012b).

A lack of a consistent approach in the implementation of ehealth systems by all levels of the Australian health system means any opportunity for an interoperable smart card has long gone (Australian Health Ministers' Advisory Council, 2008). The proliferation of medical software systems and IT vendors already operating in the Australian health system suggests that any form of standardisation and interoperability is still a long way off (Dearne, 2011b).

Rather than solving the financial issues facing the health system around managed care, specialised medicine, thin financial margins, identity fraud, difficult insurance claims and government demand for secure, portable and confidential patient information. The experiences, particularly of national smart card systems, are that smart cards have only added to the financial burden (Industry Focus, 2007). "The further you go down the path, the harder it is to understand the role smart cards play," [John Quinn] says. "They do fit for portability, capacity and capability. But we haven't seen a business driver, in other words, people saying we can do this faster by using smart cards" (Anonymous, 2006). If smart cards increase cost then it is unlikely that they would be adopted in Australia, as there is regular commentary in the media concerning the cost of the implementation of ehealth and budget blow-outs (Dearne, 2012a). According to Smith (2012), there has also been a shift in opinion with the implementation of PCEHRs, in particular the lack of credibility and faith that it will deliver any real benefits to the Australian health system.

## **7 Conclusion and Further Research**

There has been very little academic research around the use, benefits and drawbacks of the cards from the clinicians and patients' perspective in countries that have already adopted smart cards. If smart cards are to be pursued in the context of an emerging ehealth system such as in Australia, then the collection of data and case studies of effective implementation of the cards is required to make some form of reasonable judgement about their place in the ehealth system. At this point the case for their use seems unclear and inadvisable in the Australian context.

The complexities of the implementation of ehealth including; privacy and security, health IT interoperability, deployment and adoption of health IT, and the Public v Private Interface creates significant barriers for the implementation of any new technology (Friedmana, et. al. 2009). These issues are magnified in the Australian context with the inability of ehealth systems to achieve interoperability within a multilayered health sector and adequate data security. This would not bode well for implementation of a national smart card in the context of the Australian health system. Discussion around the use of smart cards may have in fact passed with the emergence of new mobile technology emanating from the business sector. The speed at which current technology is being adopted suggests that centralised implementation of a smart card in the health system may be obsolete (Constantinescu *et al*, 2012).

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