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Health Informatics: A UK and Canadian Perspective on Current and Future Challenges

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ABSTRACT

Health Informatics (HI) is an evolving field drawing in synergies from interdisciplinary domains. At the beginning, this field primarily addressed the issues relating to the application of Information Technology (IT) in healthcare delivery. Instead, HI has expanded and matured into a complete science. HI is now spread across the various facets of health science, computer science, health management, e-Health, IT, communication technologies and so forth. Many government healthcare departments across the world have accepted the importance of these facets and embarked on different strategies and plans for delivering a better healthcare delivery for the twenty first century. As a part of this initiative, developed and developing countries fast-tracked the establishment of an Electronic Health Record (EHR) since experts envisaged that this would be the core of all informatics exchange in health domain. This paper would limit itself to address the issues related to the UK and Canadian health domain. Further it provides an understanding on the current strategies being adopted in UK and Canada. Finally the discussion identifies the challenges and suggestions on the aspects that are to be considered for a successful HI program.

Keywords

Health Informatics, e-Health, Electronic Health Record.

INTRODUCTION

Contemporary healthcare delivery has been transformed from the lineage of a physician's experience and knowledge to much more dependable and consistently reliable care services delivery through Evidence Based Medicine (EBM) (Bali and Wickramasinghe, 2008). Rapid EBM delivery is possible only through the provision of required knowledge and information in a more efficient and organized manner by taking advantage of Information and Communication Technologies (ICT) breakthroughs. The influence of ICT has played a great part in furthering the ability of healthcare communication from human readable form only to system readable form (Bali and Wickramasinghe, 2008). Minimum human intervention during data, information and knowledge transfer would result in a high degree of efficiency and information quality. This can be achieved through dependable HI standards for application level communication (Duke, 2005; Jepsen, 2003). Such communications are not only between clinical experts but involve primary, secondary and tertiary stake holders within the healthcare domain (Jepsen, 2003).

Healthcare data and information are collected, stored and processed in different locations and at different times. This relevant information and data are required at the clinician's location and disposition to make critical decisions and to expedite EBM-based healthcare delivery (Jepsen, 2003). This requires dependable infrastructure, facilities and protocols to enable

seamless data, information and knowledge transfer at the system or application level. Originally, existing Hospital Information Systems (HIS) were used to provide an integrated care delivery in a clinical setting. Contemporary health domains have understood that those isolated systems cannot provide a complete mechanism for care delivery.

Physicians and specialist offices alone deliver 80% of the total care delivery in Canada (Canada Health Infoway (2007 a); it is imperative to construct a framework which strongly links primary, secondary and tertiary care. To provide a mechanism for such a complete solution, and to fulfil the desire for integrated health services, EHR has been commended as both fundamental and mandatory (Canada Health Infoway (2007 a). The spur of activities related to EHR has provided the much needed focus on HI. The survey by Medical Records Institute (2007) on electronic records indicates that enhancements to the clinical processes and quality of care are fundamental. From a centralised clinical setting like hospitals, the patient safety, clinical, administrative efficiency, economical, convenience and staff satisfaction are cited as crucial reasons for implementing EHR. In a primary care setting, the need for better clinical documentation, workflow benefits, remote access to patient's records are fundamental for effective care delivery. In addition, the embracing of technologies in healthcare (internet, digital imaging and processing, web services, mobile devices, Artificial Intelligence etc) has become a catalyst for developing HI. Many countries including UK, Canada, Australia, New Zealand, USA, Belgium, Denmark, France, Ireland, Philippines, Malaysia, China, India to name a few have initiated and are at various stages of EHR implementation (Australian Health Information Council, 2007; EHR-Implement, 2007, Canada Health Infoway, 2006; NHS Connecting For Health (2007 a). To understand how such national initiatives in HI can benefit and support better healthcare delivery, the next section provides a brief overview on the EPR-based solutions implemented in UK and Canada.

UK PERSPECTIVE

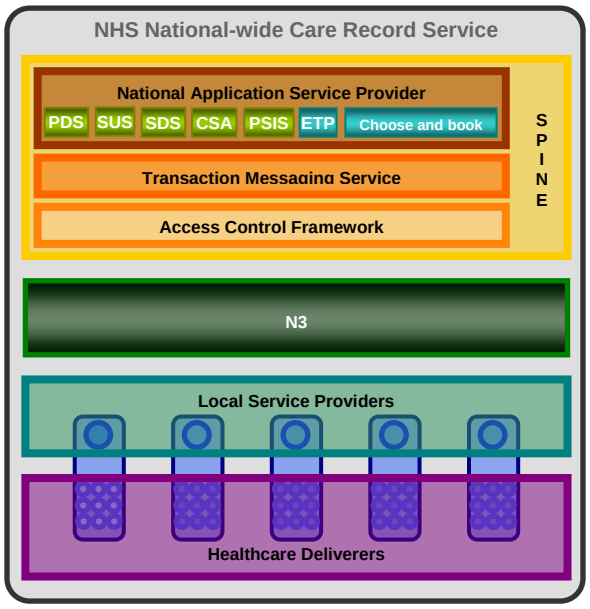

Figure 2-NHS National Care Record Services overview

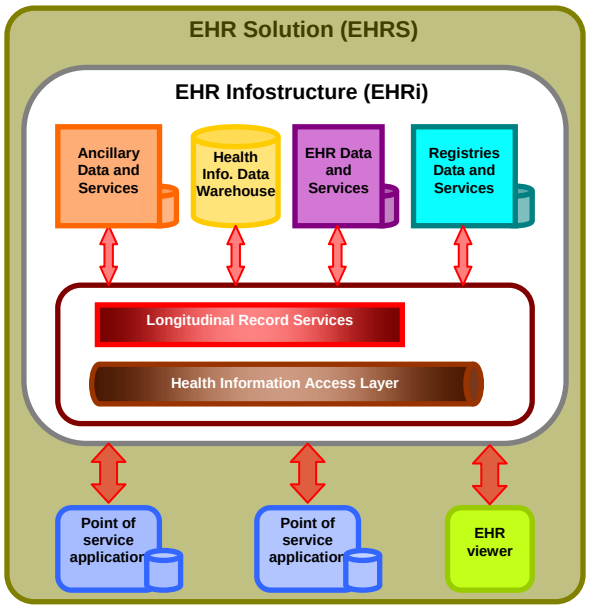

Figure 1-Canadian EHR Solution overview

The National Health Service (NHS) in the UK has been acclaimed as one of the largest and most complex healthcare organisations which has embraced technology as a tool for better care delivery (Maguire and Ojiako, 2007; Becker, 2007). The UK government passed the e-Government Interoperability Framework (e-GIF) which paved the way for electronic transmission of data across and within the various government departments. Based on these policies, in 1998 the UK's Department of Health initiated the first step towards NHS modernisation and embarked on one of the biggest health IT projects of this century (Brennan, 2005). The Connecting for Health (CFH) – under the auspices of the National Programme for Information Technology (NPfIT) - has been endowed with nearly £12 billion for implementing an integrated healthcare service (Maguire and Ojiako, 2007). One of the fundamental activities pursued by CFH is to establish national-wide NHS care record services and provide EPR for all UK nationals within a ten year period (by 2010) .

The NHS national care record service (refer Figure 1) is being implemented through a centralised database service (called the Spine), which eventually will store and provide access to nearly 50 million patient's clinical summaries (Maguire and Ojiako, 2007). In addition to this Spine would be linked to all the local health authorities and reflect local, national and global policies. To ensure data protection and confidentiality of the patients, the Spine has in-built role-based access control

mechanisms. When completed, it will allow automated clinical data upload and retrieval in a seamless manner. It will also provide a link to the complete clinical record access for detailed care delivery across the country (NHS Connecting For Health, 2007 a).

This programme has been entrusted to five public-private partnerships called clusters covering the whole country. Each cluster would operate with the Local Service Provider (LSP). All the care deliverers are connected to the LSP and, in turn, they are all connected to the Spine through the N3 network (National Network for NHS). N3 provides a fast and reliable broadband networking service, similar to the earlier "NHSnet". N3 is a virtual private network connecting all the care entities to deliver the nation-wide care record services through the Spine. This infrastructure connects nearly 18,000 NHS sites together. The Spine acts as a gateway for the Care Record Services (CRS) and connects the local IT services to the national services (NHS Connecting For Health, 2007 b).

The Spine itself offers a secure access control framework by authenticating the user based on their privileges and maintains a log for all the transactions across the network. This layer on the Spine not only provides a role-based access control, but only allows access to those patients' records who have given consent for sharing their clinical record. The Transaction Messaging Service (TMS) resolves the request to the proper recipient service and also assists in transferring the responses back to the requestor. The Spine Directory Service (SDS) provides a user directory which maps the information location and checks the authentication of the user before the information request is forwarded. A Clinical Spine Application (CSA) service provides a web-based access to the Spine for manipulating the CRS to those end users who are not connected through the LSP (NHS Connecting For Health, 2007 a).

The Spine also holds anonymous data about the patients for care analysis and reporting through Secondary Uses Service (SUS). The Personal Spine Information Services (PSIS) is the database warehouse which holds the clinical summary of the patient. The demographic data of all the patients, including the unique NHS number, is provided by the Personal Demographic Service (PDS). Apart from these services, the Spine also provides a means for Electronic Transcription Service for drug-related services, where the request from the care deliverers is communicated to the pharmacies. This service also adds the drug transaction for the patients into the CRS. A "choose and book" mechanism allows the primary care deliverers to book and/or cancel clinical appointments at the patient's convenience (NHS Connecting For Health, 2007 a).

CANADIAN PERSPECTIVE

The Canadian federal government, based on the recommendations from the Advisory Committee on Health Infostructure (ACHI), commenced the adoption of EHR in 1999. In accordance with the ACHI's recommendation, a not-for-profit organization - Canada Health Infoway Inc (CHI) - was created in 2001with an investment of $500 million (Advisory Committee on Health Infostructure, 1999; Canada Health Infoway, 2008). In 2003, $600 million was granted and another $100 million in 2004 was budgeted to speed up the EHR implementation process (Advisory Committee on Health Infostructure, 1999; Canada Health Infoway, 2008). CHI is an independent, government-funded organization which has been entrusted to collaboratively implement Electronic Health Record Solution (EHRS) in Canada.

The CHI's goal states that: "by 2010, every province and territory and the populations they serve will benefit from new health information systems that will help modernize the Canadian healthcare system. Further, 50 per cent of Canadians will have their electronic health record readily available to the authorized professionals who provide their healthcare services" (Canada Health Infoway, 2007 b). The pan-Canadian framework for EHRS system is expected to be completed by 2015 (Canada Health Infoway, 2007 a). Each jurisdiction would have at least one EHRS and some may have more than one interconnected EHRS. Each EHRS is a stand-alone structure which has EHR Infostructure (EHRI) connected to the Point of Service (POS) (Canada Health Infoway, 2006) (refer to Figure 2). POS is the origin and application of data and/or information to/from the EHRI. They are existing software applications at the delivery end of care. The local authority retains the responsibility for the collected data; only a summary is transferred to the central repository.

The connectivity layer is placed above this POS and is termed as Health Information Access Layer (HIAL). This layer provides a communication bus (electronic) to enable abstraction and independence from the other layers of the EHRS. It can create anonymous data based on the type of request and acts as a gateway. HIAL is extensible and provides a platform to cater to many POSs simultaneously in a secure way. It also mandates the privacy of the records, access control, data encryption/decryption, enforcing clinical rules and policies etc. The Longitudinal Record Service (LRS) acts as a repository holding metadata of the services offered by the EHRI. It also maintains indexes for easy and accurate retrieval, resolves and maps the requested data either at the local level or across the interconnected EHRSs (Canada Health Infoway, 2006).

The data repositories in the EHRI offer services related to Shared Health Record (SHR), Drug Information Service, Diagnostic Imaging Service, and Laboratory Services. The SHR stores the clinical summary of each patient's healthcare events, interventions and encounters for future retrieval. The Drug Information System contains the details of all the

prescriptions and logs drug dispensing activities for a specific patient. The Diagnostic Imaging Service provides a platform for managing imaging process, including clinical image capture, analysis, reports for each patient and updates the health record. The Laboratory Services enable the EHRS to offer laboratory management, assists in obtaining and distributing results and updates the health record. An EHR Viewer is provided for those care deliverers who do not have access to the EHRS through a POS. EHR Viewer does not support any local database but provides complete access to the EHRI via HIAL (Canada Health Infoway, 2006).

S#	Description	UK	Canada
1	Project name	National Care Record Services	Electronic Health Record Solution
2	Agency responsible	Connecting for Health (CfH)	Canadian Health Infoway (CHI)
3	Proposed date of completion	2010	2015
4	Investments (app.)	$24 billion (£12 billion)	$1.2 billion
5	Population covered (app.)	60 million (UN projection for 2005-6)	33 million (UN projection for 2005-6)
6	Surface area (land)	0.25 million square kilometers (app.)	10 million square kilometers (app.)
7	Logical local entity responsible for EHR	Clusters	Provinces
8	Significant architectural layers	Healthcare deliverers, Local service providers, N3 and Spine	Point of service, Health information access layer and Services layer
9	Challenges already faced	Funding, micro and macro level challenges	Funding and macro level challenges to certain extent only
10	Challenges yet to be faced	Micro level	Funding, micro and macro level
11	Partially accomplished services	Choose and book, EPS, GP2GP transfer, N3, NHS mail, PACS (Picture Archiving and Communications System), NHS Care Record Services	Registries, Diagnostic imaging, Drug Information System, LIS, EHR, Infostructure, Telehealth, Public Health Surveillance

Table 1 - Comparative overview of UK and Canadian EHR project

CURRENT AND FUTURE CHALLENGES

Many of the developed countries have unilaterally accepted that EHR is the way to deliver better healthcare (Noseworthy, 2004). Currently the legacy of delivering care by a single physician has been replaced by a group of health specialists (Advisory Committee on Health Infostructure, 1999; Canada Health Infoway, 2006, 2007 a, 2007 b). This joint care delivering process relies on proper communication between these entities for reliable and consistent EBM. Such communications are not possible without the use of ICT in healthcare. Generic communication strategies cannot provide a ready-made solution for health informatics. A focused and specialized approach is crucial for the success of such endeavors. The initiatives pursued by many countries across the globe have converged and furthered this cause by adopting EHR unilaterally (Martin, Mariani and Rouncefield, 2007). The earlier section briefly gave a synopsis of the functionality of an EHR solution envisioned for both UK and Canada (Canada Health Infoway, 2007 a; NHS Connecting For Health, 2007 a, 2007 b).

As such major IT-based initiatives are ambitious in both scale and coverage, new techniques and technologies are being formulated to solve evolving challenges. The UK's NHS, which is a pioneer in this field, had committed considerable resources to make rapid strides in this cause. By its sheer commitment, it is redeveloping the HI landscape (Maguire and Ojiako, 2007). A variety of challenges in HI are being met and resolved, both at the macro and micro level (Vishwanath and Scamurra, 2007; Wickramasinghe, Bali and Geisler, 2007). Canada almost started a similar EHR initiative along the same timeframe. The federal government has funded the project and supported its earlier completion. Canada's program is relatively slower in its implementation and the huge infrastructure that has to be provided across the country and the dispersion of population has not made the project delivery any easier. An overview of the EHR project being pursued in UK and Canada is listed in Table 1.

Moreover, both these countries have unilaterally supported the use of Health Level 7 (HL7) version 3 as the EHR delivering standard. The HL7 v3 standard is still developing and hence it is reported to be unstable (Smith and Ceustersc, 2006). Because of these shortcomings within the communication standard, there has been hesitancy from local care authorities regarding the availability of informatics implementers and the availability of trained experts for maintaining the system. Some have even started to use HL7 v2 as it was more stable, offering as it did off-the-shelf solutions with readily available experts. In addition, a sizeable amount of funds have been allocated and spent on pre-EHR IT solutions by many local care providers. The interoperability with the national consensus also has to be addressed to avoid wastage of earlier investments.

This not only has slowed down the EHR solution implementation schedule but also has expanded the work content considerably in providing new interfaces for seamless clinical communication with existing systems (Martin et al. 2007).

Both these countries pursue a publicly funded health delivery process, hence it was easy to gain the consensus, commitment and support necessary from the resource perspective, still they re plagued by macro-level challenges (Vishwanath and Scamurra, 2007; Wickramasinghe et al., 2007). The main obstacle was the delay to the actual plan envisaged during the project's inception. Coupled with this, the project cost doubled from £6 billion to £12 billion in the UK (Department of Health, 2006). Such obstacles and delays have raised doubts in the minds of global policy makers and government entities about the validity of the initiatives. The overview of the EHR in both the countries is similar in design, but the intricacies would definitely be different, owing to the uniqueness of the health industry at the local level (Hersh and Williamson, 2007; Clarke, Rooksby, Rouncefield, Procter and Slack, 2006; Oliver and Roderer, 2006).

Micro level challenges are also widespread (Vishwanath and Scamurra, 2007; Wickramasinghe et al., 2007). Strong humanistic challenges came from the care deliverers themselves (Mc Donald, 1997; Wickramasinghe et al., 2007). Many were reluctant to part with data for which they were the custodians. Some were worried about the distributed nature of clinical data which might create security and confidentiality issues on patient's data. Some clinicians were unwilling to use ICT for care delivery (Vishwanath and Scamurra, 2007). In addition, their disinclination to change has created friction in adopting the informatics strategy. In its reports, the CHI has stated that it had experienced strong resistance from primary care deliverers. Lack of training and time to acclimatize to the new system takes time and effort from the clinical staff (Vishwanath and Scamurra, 2007).

In addition to this, each and every area in healthcare has its own unique identity; hence, any future EHR solution strategy should also address these issues. In comparison to the UK, Canada has not yet focused on the implementation at the delivery end of the spectrum which is where apprehensions can cause serious delays. Also, the number of appropriately trained HI personnel is limited. To enable and train more professionals in health informatics, proper curricula at graduate and specialist levels are to be pursued (Oliver and Roderer, 2006; Bali and Wickramasinghe, 2006). This will not only support the implementation of EHR solutions but will also produce health professionals with academic-based knowledge to tackle the real-time issues related to HER when these professionals join the future healthcare teams. Even HI standards such as HL7 have to proactively involve academics in developing the standards. Close association with academics not only increases the efficacy in developing the HI standards but also would provide academics with an opportunity to align their efforts to share their knowledge and draw strength from their domain.

CONCLUSION

The earlier sections enumerated the similarities of the proposed EHR-based solution in the UK and Canada. It also identified some of the challenges and hurdles which are to be solved for a smooth transition from a disparate, non-communicating healthcare system to a distributed, yet shared, and common national care delivery system. This paper calls for close cooperation between countries which are at different phases of EHR implementation (Bali and Wickramasinghe, 2006; Day and Norris, 2007). This would assist in not only achieving a consensus for a global EHR, but also facilitate in delivering a mature HI domain that could feed on each other. Prototyping EHR projects are a good initiating point but success at this level should not breed overconfidence. The lessons learned in the NHS UK and CHI Canada need to be shared globally and the knowledge disseminated would mitigate wasted resources. Current and future EHR policy makers also have to deliberate further about the barriers associated with the utilization of the system being implemented. Future HI predicaments and issues (both technical and non technical, such as social, cultural and economic facets) of EHR implementation can also be identified and taken into account whilst devising strategies.

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