

Barriers to Implementing eHealth: A Multi-dimensional Perspective

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Abstract. This paper strives to identify barriers that hamper eHealth implementation from different perspectives. The benefits offered by eHealth and the need for eHealth preparedness is first discussed. This is followed by a discussion on the integral components of a robust eHealth infrastructure. Then, the barriers to eHealth such as technical interoperability issues, lack of holistic approach and technology disconnect are explained in detail. Finally, solutions to promote better adoption of eHealth through government policies, standardisation and training are also discussed.

Keywords. eHealth, implementation barrier, technical interoperability, eHealth preparedness

Introduction

eHealth refers to the use of health information systems and communication tools to improve management and delivery of healthcare, by making electronic medical records remotely accessible and facilitating proactive patient participation [1]. eHealth can deliver healthcare to geographically remote locations, by facilitating remote access to critical medical data. eHealth has the potential to reduce overall costs by eliminating redundancy of diagnostic testing, travel expenses accumulated by rural patients travelling to urban hospitals, and reducing emergency cases by promoting regular check-ups [2]. eHealth, once adopted on a large scale, will also accumulate useful data for medical research and contribute towards financial planning for healthcare. Thus, eHealth aims to help patients, physicians, hospitals and governments optimally utilise the healthcare system.

In developed countries, healthcare costs are increasing and making healthcare unaffordable. More than forty million people in the USA are uninsured and cannot afford medical treatment [3]. Even in countries where universal healthcare is in place, fiscal pressure has called for changes to make healthcare more efficient [2]. An efficient healthcare system would reduce patient exclusion based on social inequalities, by increasing stakeholder participation. eHealth would contribute to these objectives as its self-service model would promote stakeholder participation by being more accessible.

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Information technology has been successful in optimising performance and reducing costs in sectors such as banking and engineering [4]. Implementation of health information systems improves organisational efficiency by optimising business processes and improving decision making by generation of accurate and reliable data. Furthermore, various studies have found that eHealth systems have enhanced treatment outcomes, reduced clinical visits and increased hospital efficiencies [5-7]. Hospitals that maintain electronic health records have also been successful in reducing medical error rates [8-9].

eHealth not only holds a lot of potential to relieve the overburdened healthcare system, but can also contribute to health-related behaviour modification and long-term management of chronic illnesses [10]. It can make healthcare accessible to populations that previously did not have financial means or geographical access to modern medicine. Implementation of eHealth will require a dedicated information system tailor-made for the medical field, due to increased privacy concerns surrounding medical data, time-critical nature of treatment and varying skill levels of stakeholders. Thus, an electronic health information system needs to integrate the following:

- a) *Comprehensive planning, regulatory, and legislative framework* to identify resources necessary to operate a fully-functional, medical information system.
- b) *Indicators* to represent targets such as inputs, outcomes, and health status in health information systems, which is critical to develop a strategy [11].
- c) *Data sources* such as health records based on census and surveys; institution-based data recorded by medical organisations such as patient records.
- d) *Data management* framework to securely handle the data storage, sources, analysis, flow, and quality assurance.
- e) *Information processing tool* to transform raw data into information that will influence evidence-based decision making.
- f) *Information dissemination* to enable health-related information to be easily available and accessible to decision makers, facilitators and other stakeholders.

The implementation of eHealth faces several barriers such as aversion to change, legal complications, privacy concerns, technology disconnect, security issues and technical barriers [12]. As proper implementation of eHealth can deliver affordable yet better quality healthcare, it is critical to address these issues. As eHealth is a relatively nascent field, implementation issues are expected like any newly surfacing technology¹². This study seeks to understand such implementation issues in eHealth.

1. Methods

A literature review was conducted by analysing peer-reviewed journal articles published in academic journals in the period 2000-2014. *Google Scholar* was used for this research, as it is capable of finding relevant articles published in various journals. Keywords such as 'eHealth', 'eHealth implementation barriers' and 'eHealth technical issues' were used to identify relevant articles. Out of hundreds of search results, thirteen full text publications were selected for further analysis based on keyword relevance; another eleven resources were used to gather background information.

2. Barriers in implementing eHealth

eHealth can improve quality of healthcare, reduce medical errors, and lower healthcare costs [13-14]. This section discusses barriers that affect smooth implementation of eHealth.

2.1. Technical interoperability

Technical interoperability is a critical issue, as older electronic medical record systems were not designed to work in a network environment [15]. Software developers have not found an affordable way to bridge these technological gaps [16]. Moreover, regulations pertaining to health information systems are stringent, due to the sensitive nature of medical data [17]. Data in a medical information system comes from different sources including administrative data, health statistics and medical records. As data from different streams will have to be correlated, analysed and processed to generate relevant reports, the data will have to be standardised to make it relevant and useable. Following are the issues involved in integrating various data sources in a single system:

Administrative data: This includes data generated by patient interaction with healthcare facilities such as hospitals and pharmacies [18]. This data is used by administrators and policymakers to track resource utilisation, treatment outcomes and cost. To integrate this data into an eHealth system, the data will have to contain a consistent set of identifiers. By having standardised identifiers, the data can be utilised in different activities such as reimbursement, policy making and developing strategy.

Clinical Data: This includes data generated from patient medical records maintained by hospitals, which includes medical history and diagnostic test results [19]. Clinical data is used to determine procedure appropriateness, clinical outcomes and assess quality of care. As different medical cases have varying degrees of diagnosis validity, reliability and procedure codes, it is practically complex to categorise all relevant cases within a particular diagnosis code. While categorising responses to a certain treatment, diagnosis codes may not be able to indicate the broad range of disease severity or exact response to the illness treatment [20].

Enrolment data: Enrolment data, generated by hospitals, is used by health insurance providers or governments to determine eligibility criteria and coverage costs¹². Enrolment data can also help determine the rate at which diseases occur and are treated, thereby determining performance of healthcare plans and organisations.

2.2. Lack of Holistic Approach

While designing and implementing a health information system, developers and stakeholders need to pursue a holistic approach. The data stored and generated by an eHealth system will be used by stakeholders from various health-allied sectors such as insurance and pharmaceuticals. As most of these health-allied sectors lack systemic thinking and shared visions, they operate in isolation and thus the delivery of their services is not standardised. Lack of standardisation among hospitals also makes it harder to develop a uniform health information system that can standardise treatments, medical processes and operations. As the cost benefits of eHealth have not been fully

understood by senior management in the healthcare industry, it has led to inadequate resource allocation for designing and implementing a health information system [20].

2.3. Technology Disconnect

Recent developments in medicine have led to rapid changes in diagnostic tests, treatments and medications. So, developers of health information systems have to develop a system that would evolve dynamically with such changes, which complicates the design process. During the design and implementation of an eHealth system, the potential users and other stakeholders should be involved in defining system functional requirements and testing the system. However, as medical staff and physicians are overworked, they lack time and motivation to get involved in the eHealth software development process [21]. Furthermore, failure to effectively communicate the potential benefits of eHealth is also a reason for lack of motivation [22]. Thus, developers find it hard to understand exact functional requirements of eHealth, which reduces efficiency of system [21].

3. Overcoming implementation barriers

Different countries have varying internet adoption rates, healthcare budgets and healthcare policies. Thus, every country will have to analyse its macro-level issues, unique strengths and limitations to develop country-specific strategies [23]. However, having a framework to assess a country's eHealth preparedness is a common necessity [24]. Governments, hospitals and developers will have to implement various initiatives and incentives to overcome the aforementioned barriers. Failure to follow a gradual approach may affect every day functioning, which is unacceptable.

Hospitals have to implement standard operating procedures in their day-to-day operations, which will simplify computerisation of medical data. Non-profit organisations and academic research institutions should work with hospitals to certify eHealth applications, to ensure that they securely and efficiently manage medical data. Governments that have difficulty enforcing eHealth will have to weed out legal hassles, which will inspire confidence among physicians as well as consumers. Hospital support staff has to be trained to use eHealth applications and also assist physicians in eHealth adoption.

4. Conclusion

Various aspects of eHealth were briefly discussed to understand the significance of successful eHealth implementation. It was found that technical interoperability factors like data incompatibility are one of the most important barriers to eHealth implementation. Furthermore, it was found that the failure of governments and hospital managements to adopt a holistic approach, coupled with lack of technology awareness makes eHealth implementation even more complicated. Various solutions to improve interaction between physicians, support staff and software developers were discussed to overcome implementation barriers pertaining to technology disconnect. The importance

of training and standardisation of hospital procedures were also found to be critical to improve eHealth implementation.

References

- [1] Detmer D, Bloomrosen M, Raymond B, Tang P. Integrated personal health records: transformative tools for consumer-centric care. *BMC Med Inform Decis Mak*. 2008; 8(1):45.
- [2] Alvarez RC. The promise of e-health: a Canadian perspective. *eHealth Int*. 2002; 1(1):4.
- [3] Garson A. The US Healthcare System: problems, principles and potential solutions. *Circulation* 2010; 101(16):2015-2016.
- [4] Kramer WJ, Jenkins B, Katz RS. The Role of the Information and Communications Technology Sector in Expanding Economic Opportunity. MA: Harvard University; 2007.
- [5] Pollak VE, Lorch JA. Effect of electronic patient record use on mortality in end stage renal disease, a model chronic disease: retrospective analysis of nine years of prospectively collected data. *BMC Med Inform Decis Mak*. 2007; 7(1): 38.
- [6] Garrido T, Jamieson L, Zhou Y, Wiesensthal A, Liang L. Effect of electronic health records in ambulatory care: retrospective, serial, cross sectional study. *BMJ*. 2005; 330(7491):581.
- [7] Wang SJ, Middleton B, Prosser LA, Bardon CG, Spurr CD, Carchidi PJ. A cost-benefit analysis of electronic medical records in primary care. *Am J Med*. 2003; 114(5):397-403.
- [8] Koppel R, Metlay JP, Cohen A, Abaluck B, Localio AR, Kimmel SE. Role of computerized physician order entry systems in facilitating medication errors. *Jama*. 2005; 293(10):1197-1203.
- [9] Blaya JA, Fraser HS, Holt B. E-health technologies show promise in developing countries. *Health Affairs* 2010; 29(2).
- [10] Ghatak A, Hazlewood JG, Lee TM. How private health care can help Africa. *The McKinsey Quarterly* 2008.
- [11] National eHealth Collaborative Initiative [Internet]. Challenges and Barriers to Successful HIE Implementation. Available from <http://www.nationalehealth.org/challenges-and-barriers-successful-hie-implementation>
- [12] Wickramasinghe N, Schaffer JL. Realizing value driven e-health solutions. US: IBM Center for the Business of Government; 2010.
- [13] Lang M, Melia A. The Implementation of Electronic Healthcare Records within the Irish Health Service: An Analysis of User Attitudes. Paper presented at the Irish Social Science Platform Annual Conference; 2009; Galway: Ireland.
- [14] Vesely A, Zvarova J, Peleska J, Buchtela D, Anger Z. Medical guidelines presentation and comparing with Electronic Health Record. *Int J Med Inform*. 2006; 75(3):240-245.
- [15] McGinn CA, Grenier S, Duplantie J, Shaw N, Sicotte C, Mathieu L, Leduc Y, Légaré F, Gagnon MP. Comparison of user groups' perspectives of barriers and facilitators to implementing electronic health records: a systematic review. *BMC Medicine*. 2011; 9(1):46.
- [16] Greenhalgh T, Stramer K, Bratan T, Bryne E, Mohammad Y, Russell J. Introduction of shared electronic records: multi-site case study using diffusion of innovation theory. *BMJ*. 2008; 337.
- [17] Heinonen TA. Risk management system for medical standalone software. Tampere University of Technology; 2011.
- [18] McGlynn AE, Damberg LC, Kerr AE, Brook HR. Health Information System: Design Issues and Analytic Applications. Rand Publishers; 2000.
- [19] Marshall NM. Dying to know: public release of information about quality of health care. Rand publishers; 2000.
- [20] Anderson J. Social, ethical and legal barriers to e-health. *Int J Med Inform* 2007; 76(5).
- [21] Dennis A, Wixom BH, Roth RM. System Analysis and Design. New Jersey: John Wiley & Sons; 2009.
- [22] Mair FS, May C, O'Donnell C, Finch T, Sullivan F, Murray E. Factors that promote or inhibit the implementation of e-health systems: an explanatory systematic review, *Bull World Health Organ* 2012; 90(5):357-364.
- [23] Kummervold PE, Chronaki CE, Lausen B, Prokosch HU, Rasmussen J, Santana S, et al. eHealth Trends in Europe 2005-2007: a population-based Survey, *J Med Internet Res*. 2008; 10(4).
- [24] Li J, Seale H, Ray P, Rawlinson W, Lewis L, MacIntyre R. Issues Regarding the Implementation of eHealth: preparing for future influenza pandemics. *Interact J Med Res*. 2012; 1(2).