Healthcare Information Systems Opportunities and Challenges

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INTRODUCTION

The prognosis for successful healthcare information systems (HIS) implementation is really great. It is expected to increase legibility, reduce medical errors, shrink costs and boost the quality of healthcare (Jha et al., 2010; Blumenthal & Tavenner, 2010). Healthcare information technology (HIT) implementers and promoters continue to espouse these benefits as opportunities for the transformation of the healthcare sector. Nevertheless, the journey to this ideal is fraught with challenges. These challenges range from issues arising from the very nature of healthcare information, to the issues pertaining to healthcare information technology and its users.

This article discusses the opportunities and challenges that lie within healthcare information technology and systems as a whole. In the proceeding sections, the following themes are examined more closely: a quick view of the evolution of HIS and current trends, opportunities and challenges within HIS, and finally, some lessons learned are discussed. These themes relate issues that touch HIT standards and stardardization, electronic health records, healthcare technology adoption and implementation, resistance to healthcare technology, policy issues, and privacy/security.

There exists a potential for healthcare information systems to significantly increase the overall quality of health (Blumenthal & Tavenner, 2010). This is evidenced by the investments that are currently being pumped into the HIT development and adoption (Blumenthal & Tavenner, 2010; Department of Health and Human Services, 2010). Nevertheless, for HIS to deliver its promise, there are significant hurdles that must be dealt with stemming from the interaction of HIT system users, HIT itself and the policies that regulate healthcare information systems use.

BACKGROUND

Healthcare information systems refers to such systems that are used to process data, information and knowledge in healthcare environments (Haux, Winter, Ammenwerth, & Brigl, 2004). While healthcare information systems and health information systems are often used today to refer to the same concept, a series of terms have been used in the evolution of this phenomenon from its early foundations in the 1960s. Though there is no clear consensus in literature until lately, the term *health information systems* is analogous to various primitive forms of this concept such as hospital information systems. Similarly, terms such as *computerized patient records*, *electronic medical records*, and the more current *electronic health records* have come to be commonly used almost interchangeably. Though the exact meanings may differ, all represent a progression in the development of healthcare information technology. Haux (2006) discusses major evolutionary developments from the primitive *hospital information systems* to the *health information systems* as we know them to date. In the following paragraphs important trends are discussed in a bid to provide a perspective to this article.

- **Trend 1: From Paper-Based Systems to Computer-Based Systems:** Meanwhile health data and information in the past have been created and stored mainly on paper, there has been a clear migration from paper to computer-based systems (Haux et al., 2002). This ability means that more data can be processed and stored through the use of modern information technologies to yield better knowledge. The future of healthcare information systems looks towards a near "paperless" era.

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- **Trend 2: From Local to Global Information Systems:** While earlier healthcare information systems were limited to departmental units (e.g. radiology, or laboratory) or just within a healthcare practice system (e.g. hospital or clinic) (Linberg, 1968), modern healthcare systems target regional, national and even a global reach.
- **Trend 3: From Healthcare Professionals to Patients and Consumers:** Originally, healthcare information systems were designed to be used by mainly physicians and administrative staff (Ball, 1971; Ball et al., 1994), but it was later passed on to be used by nurses. Since then, the trend has shifted to involve more patient input.
- **Trend 4: From Using Data for Patient Care to Research:** Over the years, patient data has been used beyond patient care management to a more general use involving research in healthcare (Leiner, Haus, Haux, & Knaup, 2002; Kuhn & Guise, 2001) and even education.
- **Trend 5: From Technical to Strategic Information Management Orientation:** Haux (2006) has noted that while computer-supported information systems from the 1960s to the 1990s focused on problems resulting from the technical aspects of the systems, concerns about the organizational problems, social issues and change management aspects became more relevant at the turn of the millennium.
- **Trend 6: From Numeric Data to More Complex Forms of Data:** Not only has the technology that support *health information systems* advanced in technological complexity, the data that is being received and processed has also become complex. From numeric data through alphanumeric data to imaging and even molecular data (Maojo & Martin-Sanchez, 2004).

Health Information Systems Infrastructure and Information Flows

Health information technology consists of a wide range of networking technologies, clinical databases, electronic medical/health records, and other specific biomedical, administrative and financial technologies that generate, transmit and store healthcare information. In the diagram below, a generic model of information flows that typify health information systems infrastructure is presented, and a brief discussion of the application of this model is highlighted in Figure 1.

In the model shown in Figure 1, all information from healthcare providers (hospitals, clinics, emergency rooms, small offices, multispecialty groups, etc.) are entered into an electronic health record. This information is then networked to regional and national databases through electronic exchange. Data flows from EHRs and regional registries are then channeled into standards for prevention and treatment, which can be further processed to yield information for decision-making and decision-support. At each of these levels, appropriate information technologies are used to undergird data flow. The implications of this type of technological architecture are many-fold. First, it raises issues of the encryption of data. The United States Health Insurance Portability Accountability Act (HIPAA) has set in place the privacy and security policies to provide guidance. Second, the standards for data transmission and sharing over networks requires that all EHR developers all use the same standard—the HL7 standard. Third, given data transmission standards, data definition standards are equally important. They ensure that data communicated is read and understood by others. Fourth, with data coming from diverse healthcare sources, data quality control then becomes critical. Lastly, this model infrastructure means that regional and national databases with ability to hold, manipulate and produce useful information for decision-making.

Shortliffe and Sondik (2006) discuss a practical application of a health information system like the one above in cancer information surveillance. In this example, information from EHRs are processed and used in a manner that improves cancer-related decision-making to bring about an improved quality care for cancer patients. Hence, using health information technology to monitor, manage and control cancer care.

Summarily, the healthcare information systems arena has changed and is changing. These changes offer unique opportunities as well as challenges never before seen. Whether opportunities or challenges, both of these phenomena cut through technological, organizational and human factors. In fact, the interaction between these factors are responsible for providing a more informative and rich lens for understanding the current and future landscape of health information systems. Like