Electronic Health Records (EHR) *Meaningful Use*: Implications on EHR Definition, Implementation and Critical Success Factors

Abstract

Electronic health records (EHR) are here to stay. With the advent of the *meaningful use* requirement by the United States government, EHR adoption and implementation are no longer a choice, but a mandate. This government-mandated roadmap for EHR carries along serious implications on the EHR definition and critical success factors on its implementation. This paper is a conceptual framework that models the journey to *meaningful use:* it examines the intent, content and context factors involved in the generation of its outcomes. Finally, a look at the challenges that lie ahead is also made. The findings suggest that while this EHR roadmap has clearly brought definitional and content order to previous chaos in literature, it still possesses inherent challenges in its future. EHR Policy makers, software vendors, and *meaningful users* of this system would fine these results of particular importance in understanding the very nature of EHRs.

Keywords: Electronic health records; Meaningful Use; health IT; critical success factors; standards

Introduction

On July 13, 2010, the United States administration put into motion an ambitious five-year transition plan from a paper health record system to an electronic health record (EHR) system. This EHR framework was just a final step in the journey that started in 2004 with its mention in the State of the Union address by President Bush and a subsequent adoption of ten-year plan through the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 (HHS Press Release, 2010; Center for Health Statistics, 2005). This was a significant

landmark for the United States health care systems. It was a clear commitment to a no-return-to-paper-records era. The policy reforms brought along with it not only a health care practice shift, but have garnered concern from all the stakeholders of the healthcare system. This signal of change now affects all: from health care users, to health care professionals; from health IT software vendors to researchers; and from policy-makers to policy-enforcers.

The Organization for Standardization (ISO) has defined EHR to mean a repository of patient data in digital form, stored and exchanged securely, and accessible by multiple authorized users. It contains retrospective, concurrent, and prospective information and its primary purpose is to support continuing, efficient and quality integrated health care (as quoted by Hayrinen, Saranto & Nykanen, 2008). This paper discusses the significance of EHR definition later, but it suffices at this point to mention that many other definitions and related concepts such as electronic medical records (EMR); computerized patient records (CPR) exist (Amatayakul, 2004, Sanchez, Savin & Vasileva, 2005).

The advent of the U.S. Department of Health and Human Services (HHS) ruling on the *meaningful use* of EHR set forth both a definition and standards by which to judge an EHR system. According to these regulations, vendors can ensure that their systems match up to the required capabilities; and providers be assured that the system they acquire will help them achieve "meaningful use" objectives and a five-year plan national initiative to adopt and use electronic health records (HHS Press Release, 2010).

An Overview of *Meaningful Use*

In this section a synthesis of the *meaningful use* criteria content is done. They are classified into: definitions; EHR adoption and implementation specifications; and finally, EHR standardization/certification stipulations. The reason for this summarization process was to

synthesize relevant aspects of the *meaningful use* as it relates to subject of the study. Many more aspects of *meaningful use* are covered in original document; but all these are beyond the scope of this research.

1. *Definitions*

Two sets of definitions are of interest in this investigation: technology-related definitions and user-related definitions. For the sake of orderliness and easy comparison, these definitions have been summarized and tabulated in Table 1a and Table 1b below.

2. *Adoption and implementation*

Under the "adopt, implement, or upgrade certified EHR technology" rule, providers who meet this standard in the first year of participation—summarized as engaged in efforts to ''adopt, implement, or upgrade'' certified EHR technology—will be compensated. In subsequent years of participation, they must then demonstrate ''meaningful use of certified EHR technology through a means that is approved by the State and acceptable to the Secretary of Department Health and Human Services (DHHS, 2010a,b). Hence, while the first year targets efforts towards adoption, the subsequent years target actual implementation. Here, implementation is defined as adopting, implementing or upgrading certified EHR technology as the process by which providers have installed and commenced utilization of certified EHR technology capable of meeting meaningful use requirements; or expanded the available functionality and commenced utilization of certified EHR technology capable of meeting meaningful use requirements at the practice site, including staffing, maintenance, and training. The DHHS further stipulates deliverables by stating that health institutions and clinicians must in subsequent years demonstrate meaningful usage by having to attest to having adopted, (that is, acquired and installed) or commenced utilization of

(that is, implemented) certified EHR technology; or expanded (that is, upgraded) the available functionality of certified EHR technology and commenced utilization at their practice site.

Table 1a: Review of important Meaningful Use EHR terminology

Technology-related definitions	
EHR term	Definition
Qualified EHR	An electronic record of health-related information on an individual that: (A) Includes patient demographic and clinical health information, such as medical history and problem lists; and (B) has the capacity: (i) To provide clinical decision support; (ii) to support physician order entry; (iii) to capture and query information relevant to health care quality; and (iv) to exchange electronic health information with, and integrate such information from other sources.
EHR Module	Any service, component, or combination thereof that can meet the requirements of at least one certification criterion adopted by the Secretary*. Examples of EHR modules include, but are not limited to, the following: • An interface or other software program that provides the capability to exchange electronic health information; • An open source software program that enables individuals' online access to certain health information maintained by EHR technology; • A clinical decision support rules engine; • A software program used to submit public health information to public health authorities; and • A quality measure reporting service or software program.
Complete EHR	Encompasses EHR technology that can perform all of the applicable capabilities required by certification criteria adopted by the Secretary* and distinguish it from EHR technology that cannot perform those capabilities. Complete EHRs are expected to have capabilities beyond those addressed by certification criteria adopted by the Secretary*.
Certified EHR technology	A Complete EHR or a combination of EHR Modules, each of which: (1) Meets the requirements included in the definition of a Qualified EHR; and (2) has been tested and certified in accordance with the certification program established by the National Coordinator as having met all applicable certification criteria adopted by the Secretary*.

*U. S. Department of Health and Human Services

Table 1b: Review of important Meaningful Use EHR terminology

User-related definitions	
Meaningful Use	The use of certified EHR technology in health practice to achieve the goals of improved health care quality, efficiency and patient safety
Meaningful user	A qualified health practitioner using certified EHR technology to achieve health care that is patient centered, evidence-based, prevention-oriented, efficient, and equitable.

3. Standardization/Certification stipulations

A third and important aspect of the meaningful use requirements has to do with standards. Here, attempts were made to standardize the various component subsystems that integrate into the bigger system. It is worth mentioning at this point that the standards below fit only into Stage 1 of the meaningful use of EHR which principally deals with data capture, data storage, data retrieval and reports generation from multiple departments within the health institution. This is achieved through the Computerized Patient Order Entry (CPOE) system. Stage 2 of meaningful use criteria builds on Stage 1 to exchange patient care summaries to support transitions across unaffiliated providers, settings and EHR systems. Finally, stage 3 focuses on decision support for national high priority conditions, patient access to self management tools, access to comprehensive patient data through robust, patient-centered health information exchange and improving population health.

The DHHS also adopted standards closely related with the four categories recommended by the Health Information Technology Standards Committee. These comprised: first, a vocabulary standards (i.e., standardized nomenclatures and code sets used to describe clinical problems). Second, content exchange standards (i.e., standards used to share clinical

information). Third, transport standards (i.e., standards used to establish a common, predictable and communication protocol across systems), and lastly, privacy and security standards (i.e., authentication, access control and transmission security) (DHHS, 2010).

Statement of Problem

Many EHR projects have been started and are ongoing in many countries. Canada, Australia, England, Finland and the United States are but few examples (Hayrinen, Saranto & Nykanen). In Europe the largest proportions of general practitioners using electronic medical records (EMR) are Sweden (90%); The Netherlands (88%); Denmark (62%); The United Kingdom (58%); Finland (56%); and Austria (55%). Further statistics state that only five percent of general practitioners in Portugal; nine percent in Spain and seventeen percent in Greece are using electronic EMR (Sanchez, Savin & Vasileva, 2005). And though the United States stands out as a nation in which health care information technologies are well advanced, paper health records still persist in hospitals and primary care (Jha et al., 2006; Saleem et al., 2009; Sanchez, Savin & Vasileva, 2005). Many have studied the adoption of EHR and have highlighted impediments and other factors that are likely to speed up adoption and implementation (Ludwick & Doucette, 2009; Ford, Menachemi & Phillips, 2005); while others have suggested involvement of policy makers in stepping up adoption (Baron, Fabens, Schiffman & Wolf, 2005). The United States government's formulation and adoption of the meaningful use of EHR technology final ruling came as a stitch in time to put some order in this situation.

The "meaningful use" of EHR has been described as a turning point (HHS Press Release, 2010). In its two companion final rules, one defines the minimum requirements that providers must meet through their use of certified EHR technology while the other identifies standards and certification criteria for EHR technology. About $27 billion is expected to be spent on

implementing this program over the next ten years. While eligible professionals may receive up to $44,000 under the Medicare and $63,750 under Medicaid programs, hospitals may receive as much as millions for implementing a user certified EHR technology (HHS Press Release, 2010). One could argue that this present roadmap addressed some of the critical problems in EHR technology development literature that has persisted for years namely: the lack of a generally accepted definition, the lack of standards, and the adoption/implementation challenges (Hayrinen, Saranto & Nykanen, 2008; Shortliffe, 1998; Amatayakul, 2004; Jha et al., 2006; Ford et al., 2006; Rector, Nolan & Kay, 1991; Baron Fabens, Schiffman & Wolf 2005). However, if not for anything else; the money being invested into this initiative is a call for concern. Even so, the full implications of this government roadmap are yet to be fully examined.

In this research piece, it is argued that the EHR roadmap is a significant landmark in U.S. health care system and the vendors of health IT systems. These actors would have to radically change or fine-tune their standards and actions to fit into the current framework. However, this study argues further that regardless of promise of this laudable roadmap, challenges and unanswered questions still persist in the current guidelines. Specifically, this study explores and identifies the merits of the new framework while examining strategic implications that should affect adoption and implementation of EHR in the future.

To address the problem, this paper aims at developing a theoretical framework that captures the present picture of the EHR systems, while projecting into the future. The goal is achieved by reviewing and building critical and relevant EHR literature. First, a contextual foundation is laid by looking at the evolution of EHR. Then, the EHR meaningful use roadmap is discussed. The intent-content-context factor model is then constructed from this novel framework. A discussion on the differences in the new and former "order" is made; and an

assessment of outcomes are highlighted. Critical success factors that influence EHR adoption and implementation are then considered using the DeLone and McLean (1992; 2003) model. The model is validated using the systems theory and the contingency theory (see Luthans & Stewart, 1977). The assessment of the model done using the Composite Index measure of effectiveness proposed by Otieno et al. (2008)

Model Development

To properly model EHR developmental process, it is important to take a step back and to look at its evolution. Hence, before a model is proposed, the following aspects are captured first: EHR evolution, the meaningful use roadmap, EHR strategy and outcomes.

The evolution of EHR

The idea of EHR started in the 80s under the name computer-based records (CPR), which became known as electronic medical records (EMR) in the mid 90s to what we now know as electronic health records (Sanchez, Savin & Vasileva, 2005). While EMR and EHR are sometimes used interchangeably, there exists a difference. EMRs may not be interoperable (with other EMRs) outside the "home" enterprise. The term EHR implies a level of interoperability with other EMRs. The emphasis of "health" rather than "medical" record in EHR is to specify its longitudinal nature across time and providers (AMA, 2010). The Institute of Medicine's landmark report in 1991 (IOM, 1991) called for the achievement of paperless records in the ten years. Though this call did not start right away, and hardly received popularity—it could be argued that it was an important foundation for the government roadmap of 2010—nearly a decade later.

The vision of EHR came through the desire to have a system that could provide longitudinal data that is available to clinicians in legible way to enable them take informed

decisions. By doing this, health professionals will achieve workflow efficiencies and even cost reduction in health delivery. The overarching vision of EHR has been echoed throughout time from the very inception of the idea (Sanchez, Savin & Vasileva, 2005; Jha et al., 2006; Hayrinen, Saranto & Nykanen, 2008). Hence, we argue that the "intent" or goal of the EHR technology has remained fairly stable throughout its history. Shortliffe (1999) states additional motive such a system as being a competitive advantage tool of a provider group against the other; hence, viewing this technology as a strategic planning utensil. Given this outlook, early adopters of the automated systems sought to bypass the error-plagued and inefficient paper system. Hence, in the 80s "feeder" systems were developed. These functioned more like clinical workstations capable of handling clinical issues like order entry, results reporting, access to transcribed reports, telemedicine applications, and decision support. Additionally, these workstations handled administrative and financial information (e.g. material management, personnel, and payroll); research (e.g. analyses, quality assurance, clinical trials, etc.), scholarly information (e.g. digital libraries); and even office automation (e.g. spreadsheets, word processes) (see Shortliffe, 1999). These clinical work stations then evolved into the electronic medical records that we now know to be accessible, confidential, secure and acceptable to health care professionals and patients and even containing other non-patient-specific information.

There are several terms used to describe electronic tools that came to replace paper records. The use of these terms in different places and at different times to mean different things reveals the confusion that has persisted for years in nomenclature. The globally accepted generic term for vision of electronic patient care systems is EHR though the use of computer-based patient records (CPR) persists in some circles (Sanchez, Savin, Vasileva, 2005). This is evidenced by a number of works that have focused on finding consensus on the potential

meaning of the terms (e.g. Jha et al., 2006 and Erstad, 2003). Though a thorough discussion on EHR terminology evolution is beyond the scope of this paper, it would be important at this point to a three key terms that have leaved through this progression. Computer-based patient records (CPR) became popular in the 1980s. This term became progressively replaced in the 1990s by a term electronic medical records; which, has evolved to what we now know as electronic health records.

The EHR Meaningful Use Roadmap

The Meaningful Use framework timeline is summarized in Figure 1 below. It consists of three important stages.

Stage 1 (beginning in 2011): focuses on electronic capturing of health information in coded format; using the information to track key clinical conditions and communicating this information for care coordination purposes.

Stage 2 (beginning in 2013): builds on Stage 1 criteria to encourage the use of health IT for continuous quality improvement at the point of care and the exchange of information across diverse health care units.

Stage 3 (beginning in 2015): focuses on promoting improvements on quality, safety and efficiency; and also decision support on national priority conditions.

Summarily, Meaningful Use as defined by the U.S. Department of Health and Human Services is using certified EHR technology to improve quality, safety, efficiency, and reduce health disparities. Additionally, it has as purpose to engage patients and families in their health care; improve care coordination, population and public health while maintaining privacy and security. Finally, Meaningful Use has three main components. These are: the use of certified EHR in a meaningful manner (e.g. e-prescribing); electronic exchange of health information to

improve quality of health care; and the use of certified EHR technology to submit clinical quality measures and other mandated measures.

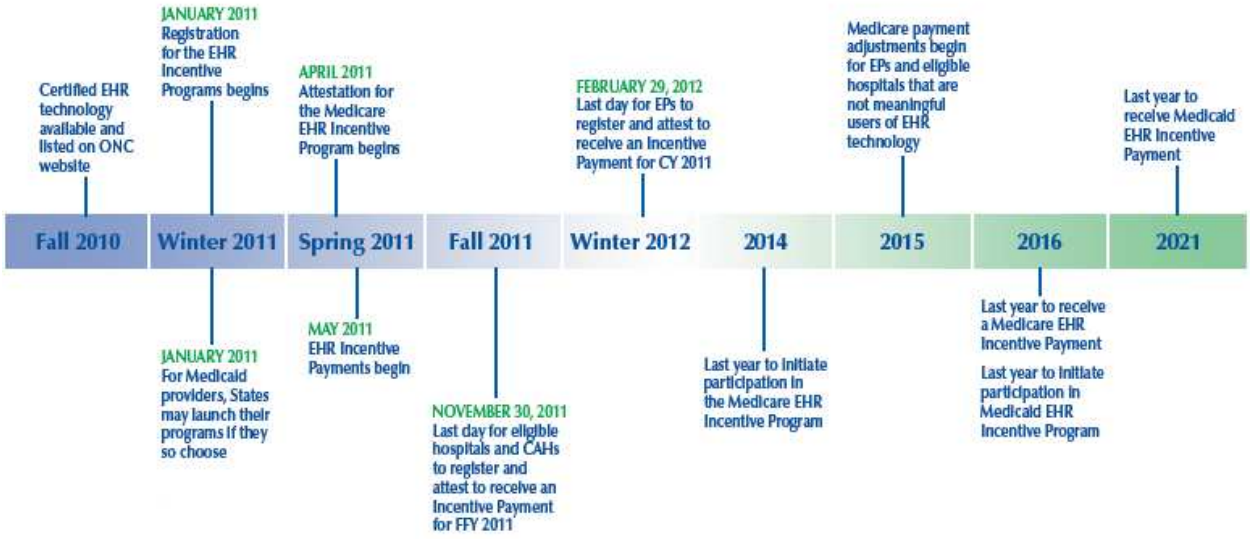

Figure 1: The Meaningful Use Timeline (CMS, 2010)

EHR Strategy and Outcomes

The EHR framework is for a descriptive purpose contains three key elements namely: intent, context and content. By *intent*, is meant the goals of the EHR technology. The context refers to the environment that carries the technology. Lastly, the *content* refers to the capabilities of the EHR system itself. The proper combination of these three components would constitute the strategy. The outcomes this strategy would then determine the success of the implementation process of the EHR technology.

Research Model

The proposed model comprises four components linked together by a single-phase simple process fashion. These components trace and describe the phases through which present EHR framework now functions. The model depicts the transition from obscurity to a clearly defined system components yielding out desired outputs. In the preceding portion of the paper, each

component is studied in the light of existing literature. The full model is presented in Figure 2 below.

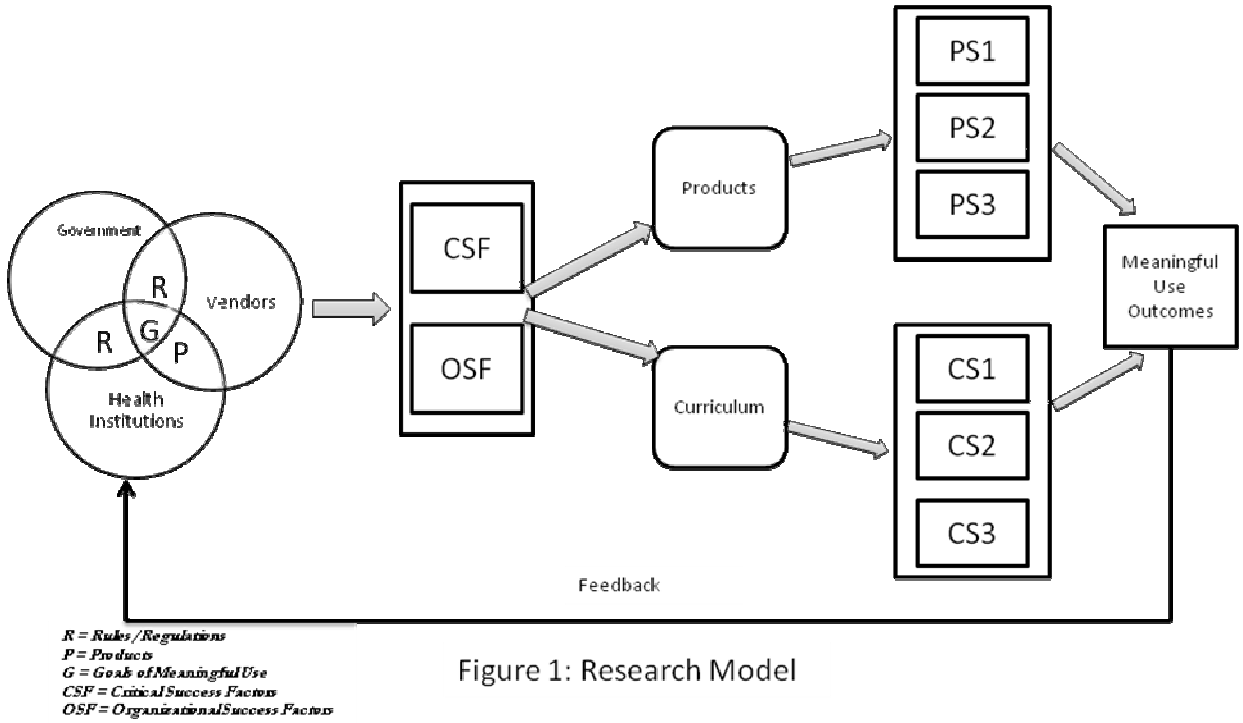

Figure 1: Research Model

Desperate systems

This component is descriptive of many of the systems prior to the Meaningful Use. First they lacked a clear and consistent definition and standards (Amatayakul, 2004; Shortliffe, 1999; Jha et al., 2006). The EHR meaning was more or less an "automated" health tool. It contents varied from practice to practice and was used rather as a competitive advantage tool (Shortliffe, 1999). However, some other systems were well developed and loaded with key functionalities, albeit few and unstandardized. Components like e-prescribing and computerized records are but a few examples. This disjointed and lack of connectivity in the systems is the main reason this study has described it as a desperate systems.

EHR Roadmap

This component has been well described in the preceding sections. Nevertheless it is worth mentioning that it comprises three main components expressed in three stages of the U.S. government road map (Amayakul, 2004; Sanchez, Savin & Vasileva, 2005). Stage 1 performs the main role of data capture; Stage 2 dealing with information sharing; and Stage 3 dealing with decision support.

EHR Strategy

The EHR strategy specified in the Meaningful Use is summarized to be comprised of intent, context and content. Before the advent of *meaningful use*, the intent and context were fairly clear. The vision was to build a system that will achieve certain common goals. Here these goals are referred to hear as intent. The intent of the EHR has been articulated throughout literature to mean the availability and legibility of patient data that can be stored securely and retrieved in a longitudinal manner that permit for quality health care decisions (Erstad, 2003; Ford, Menachemi & Phillips, 2006; Ludwick & Doucette, 2009). Another component that has not changed much over the years has been *context*. The context of the EHR technology has been described as primary, secondary and tertiary health care facilities (Hayrinen, Saranto & Nykanen, 2008). In the present EHR context, it has been looked upon as hospitals (in-patient facilities); ambulatory practice; and emergency. The EHR content has been the area of the greatest transformation in the current framework. Many researchers had called a consistence of structure and content. While some focused on the subject of building standards (Hayrinen, Saranto & Nykanen, 2008), others focused on functionalities built into the technology (Jha et al., 2006), and others proposed a content that is consistent with what the clinician has heard, seen, thought and done(Rector, Nolan and Kay, 1991). Smith and Kalra (2008) looked at the content from the perspective of hardware,

access controls, and information security. Nevertheless the content elaborated in the *meaningful use* criteria was comprehensive enough to cover the main aspects. Hence, meaningful use stipulated standards and standardization criteria (see introduction), networking and databases.

Assessment Modeling

The assessment modeling component deals with the outcomes of the intent-context-content strategy. It assesses whether the strategy is successful by checking the outputs. The promise of EHR is clear: reduction of improved health care, lowered costs, increased efficiency, (Jha et al., 2006; Poissant, Pereira, Tamblyn & Kawasumi, 2005; Dorr et al., 2006) and enhanced privacy and security (Federal Register, 2010). While many researchers have argued that computer-based patient record implementation benefits far outweigh the clinical, workflow, administrative and revenue challenges (e.g. Erstad, 2003); others have been more pessimistic from the evaluation of some current implementation. Poissant et al. (2005) from their systematic review of the impact of the of EHR suggest that computerized provider order entry (CPOE) was found to be inefficient—increasing the work time from 89% to 328.6%—of physicians' time per working shift. The study further suggests that decreased documentation is even not likely to be realized. Though the Poissant et al. (2005) study has limitations in generalizations, it is still an important caution note. Hence, it is proposed that here that an assessment model to check the effectiveness of desired outcomes be added as an important component of this model. Only then can we be sure that the EHR promise is being delivered. In fact Otieno et al. (2008) have even gone further to propose a composite index for assessment of EHR effectiveness. The development and improvement of such indices could prove helpful in completing this EHR model.

In conclusion, it can be said that the transition to the present outlook of EHR systems has been quite a journey from some disjointed, unstandardized desperate systems through a

government mandated roadmap to an improved EHR strategy that can be assessed for the delivery outcomes.

Validation of the Proposed Model

The proposed model can be validated by three sets of theories namely: the general systems theory (GST), the process theory and the contingency theory. At a general level, the model above is consistent with the general systems theory. This theory assumes that the components interrelate with each other to generate a larger entity. The components of the model define what von Bertalanffy—who coined the term general systems theory —described as "elements in standing relationship" (Bertalanffy, 1951). Hence, the proposed model fits into the GST in a manner that agrees with model as a:

> "skeleton of science in the sense that it aims to provide a framework or structure of systems on which to hang the flesh and blood of particular disciplines and particular subject matters in an orderly and coherent corpus of knowledge." (Boulding, 1956)

Hence, desperate systems, EHR roadmap, EHR strategy and assessment modeling fit in as "elements" or subsystems of the larger EHR system. This model could also be viewed as a set of inputs that are processed to yield particular outcomes (e.g. Forbus, 1993). However, not only does this model satisfy the GST or process theory but it is also consistent with contingency theories. One of these theories postulates for example that the organizational performance is contingent on the internal and external environments of the organization. When EHR implementation in hospitals, clinics and emergency practices is viewed in the light of the contingency theory, the assessment modeling or outcomes of the EHR model are seen to be contingent on the EHR internal and external context environments. The internal environment may include organizational culture and user environment (van der Meijden, Tange, Troost & Hasman, 2003) while the external environment will include the government-mandated

regulation. Further credence of the a contingency model is lent by the study of Devaraj and Kohli (2000) whose longitudinal study of IT payoff in the health care industry showed, for instance, that the impact of technology is contingent on business process reengineering practiced in these contexts. Hence we find sufficient validation for the proposed model in literature.

Model Assessment

The proposed model suggests an assessment modeling as a component. In fact, this is the component that measures the impact of the implementation of the EHR roadmap. The component reveals the evaluation point of the entire model. We contend that this model can be assessed using existing frameworks like the DeLone and McLean (1992; 2003). In this framework originally proposed in 1992 and revised in 2003, the authors argue that the success of any information systems can be measured through six key dimensions. These dimensions are system quality, information quality, user satisfaction, usage, impact on individual, impact on organization. *System quality* defines the information system processes and their attributes itself. *Information quality* measures the information input/output attributes. *Information use* measures the system consumption of end-user. *User satisfaction* measures the response to information system output and attributes by end-user. *Individual impact* measures end-user behavior based on the effect of information and attributes. *Organizational impact* measures the organizational performance as affected by the information output and its attributes.

Researchers that have used the DeLone and McLean framework have either looked at the impact of individual measures by studying the relative importance and implicit mention of these criteria in the implementation studies (e.g. Hayrinen, Saranto & Nykanen, 2008) or have a developed an composite index based on this framework (e.g. Otieno et al., 2008). The Otieno et al. (2008) model was also developed from the DeLone and McLean model using four key

components namely: system quality, information quality, user satisfaction and usage. In using the DeLone-McLean framework directly, weighted score method can be used in which each sub-dimension is rated multiplied by a predetermined weight, totaled and compared against a company standard. The weights can be determined through Delphi technique using subject matter experts. On the other hand, if the composite index technique is used. Still a benchmarking index must be developed against which to score the quality of the entire implementation framework. Hence, it is believed that any of these frameworks can be used to assess this model.

Discussion, Implications and Future Research

The proposed model above draws attention to some key issues for discussion. It presents the EHR roadmap as a central tool, not only for comparison with the past, but also as a reference for the future. In this section, the Meaningful Use criteria is re-examined in the light of its merits, and challenges. Because of the relative newness of the EHR technology, it may be difficult to tell what would be considered as potential impediments to achieving *meaningful use*. However, in this discussion, we look at EHR technology adoption and implementation in the light of the adoption and implementation of a similar technology—the Enterprise Resource Planning technology (ERP). ERP is to business community what the EHR is becoming for the healthcare industry. The two are similar in several aspects: (1.) they integrate all business units into a larger more complex unit; (2.) they have the potential of giving the user a strategic advantage; (3.) they can lower costs; (4.) and possess a high system quality (Klaus, Rosemann & Gable, 2000; Shortliffe, 1999). The significance of this similarity is that critical success factors in the implementation of ERP systems are likely to be very closely related to that of EHR systems, at least generically.

First, we contend that the *Meaningful Use* framework presents the merit of a more defined; less confounding; more standardized terminology and system; and an incentive for EHR adoption and implementation. By a more defined and less confounding system, it is meant that EHR can be discussed across the board with some consensus in communication and terminology. From the roadmap, understanding is gained as to what is certified EHR technology is, and what the meaningful use of EHR technology measures. This alone, has become the solution to the huge terminology in literature heretofore. Additionally, the meaningful use also specifies the standards of the system at all four levels namely: vocabulary standards (i.e., standardized nomenclatures and code sets used to describe clinical problems), content exchange standards (i.e., standards used to share clinical information), transport standards (i.e., standards used to establish a common, predictable and communication protocol across systems), and privacy and security standards (i.e., authentication, access control and transmission security) (Federal Register, 2010). The stipulations of the capabilities of certified EHR is overhauling the software vending industry, and setting new standards of practice. Finally, with the Federal incentive program for *Meaningful Users* means that the cost-related implementation setbacks are abated and that EHR adoption is greatly increased.

Second, the *meaningful use* framework model also comes along with unanswered questions. This framework represents "unfinished standard" business. To date, only Stage 1 of these rules has had established standards, even though interoperability standards have still not been established. Hence, for Stages 2 and 3, the standards are yet to be determined. According to the guiding rules, the requirements may continue to change until to reflect the experience with the adoption and implementation realities. This implies therefore that the roadmap is somehow flexible.

Finally, there are some implications of this framework that have nothing to do with the merits, nor the unanswered questions, but just the challenges that will need to be looked into keenly. To look into this, lessons from ERP adoption and implementation were used. It has been established throughout the history of ERP implementation that failure has been encountered more often than not (Finney & Corbett, 2007; Nah & Delgado, 2006). Some researchers even suggest failure rates of up to 25% (Hong & Kim, 2002). Hence, by learning from the implementation of a similar technology like the ERP, we can possibly perceive critical factors for success of EHR implementation. This is particularly crucial because, implementation does not always equal use (in this case "meaningful" use).

Consistent with literature on adoption and implementation of ERP systems, we propose that successful EHR will be contingent on: (1.) business plan and vision, (2.) change management (3.) communication, (4.) team composition, (skills; compensation), (5.) project management, (6.) top management support and championship, and (7.) system analysis, selection and technical implementation (Nah & Delgado, 2006). In summary, the EHR success is dependent of both organizational and organizational culture and user involvement (van der Meijden et al., 2003).

The EHR roadmap is a critical milestone in the health care system of the United States of America. The proposed model, consistent with the general system theory model, the process theory and the contingency theory, is very comprehensive and robust. It has its merits in that it can be improved upon. Because it captures the key components of the EHR system, it can be argued that it would prove useful to policy-makers, vendors, top level management, and customers. Even researchers—and, in fact, all important stakeholders in the EHR adoption and

implementation will find this framework critical to understanding the positioning of EHR systems as of today.

The research has limitations. The government roadmap is not yet written in concrete; hence, changes to this roadmap may also change the modeling of various components of this current model. As the EHR technology develops, the intent-context-content factors may change and this framework will need a more cautious interpretation. However, as it stands, the current framework fosters understanding in EHR technology more akin to the U.S. health care than other health care systems in other EHR technology participating nations.

The proposed model is at best conceptual. Conceptualization of constructs, testing and validation needs to be done. This would be a potential area for future research. The model identifies a set of variables for the intent-context-content factors, and suggests critical success factors. However, these variables in themselves are far from being exhaustive. Further research would be helpful in finding additional variables and/or even increasing the depth of knowledge in the already identified variables; and their relationships with one another.

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