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Effective Implementation of Electronic Medical Record Systems: Insights from a Longitudinal Case Study

Research-in-Progress

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ABSTRACT

Academic and practitioner literature are abound with both successful and failed implementations of Electronic Medical Record (EMR) systems. Deployment of EMR systems is often accompanied by economic, technical, organizational and cultural challenges. Drawing upon the literature on organizational change, we argue that change readiness capacity in a health organization facilitates in mitigating the challenges arising in effective implementation of EMR. We report preliminary observations from our on-going research study based on a longitudinal case investigation of EMR implementation at NorthShore University Health System. We propose a preliminary model of change readiness, along with evidence from our case analysis.

Keywords

Electronic Medical Record, Change Readiness, Organizational Change, Case Study, EMR implementation

INTRODUCTION

In recent years, the transition from a traditional paper system to an electronic medical record (EMR) system has become a strategic priority for many healthcare organizations. Adoption and implementation of EMR systems has been widely touted as a critical imperative for systematically reducing medical errors and improving quality of healthcare delivery (Hillestad, 2005; Kopell, 2005). Implementing EMRs can, over time, improve the care delivery process, lead to accurate medical information, thus enhancing patient safety for both smaller health practices (Spruell et al. 2010) as well as larger hospitals (Abraham and Junglas, 2011). Recognizing the importance of EMRs, the US government has also taken several steps such as the Health Information Technology for Economic and Clinical Health (HITECH) act to facilitate EMR implementation in US healthcare organizations.

Despite the potential benefits of EMR systems, implementing them poses significant economic, organizational and cultural challenges to most healthcare organizations. US Department of Health and Human Services estimates the failure rates of EMR deployment to be between 30 and 50 percent. In a survey conducted by Medical Records Institute, nearly 19% of respondents indicated de-installation of EMR systems (Conn, 2007). Another study by AC group - a healthcare IT advisory firm - estimated the EMR failure rates to be as high as 73%. Academic literature (Spetz et al. 2009), trade press and health care web portals are abound with examples of failed EMR implementations (Rauber, 2009).

While it is imperative for healthcare organizations to deploy EMR systems, their high rate of failure has raised significant concerns among healthcare executives, information systems managers and academics. Extant MIS research has identified several issues that could derail EMR implementation. These factors include physician resistance (Lapointe and Rivard, 2005), inadequate change management (Davidson and Chismar, 2007), complexities in redesigning business processes (Abraham and Junglas, 2011) and work flows (Winston and Medlin 2011), and lack of clinical leadership (Spetz et al. 2009).

Change readiness has been identified as a key construct determining the success of several IT implementations such as ERP, large scale IT systems and EMR systems. Building upon prior research, we seek to understand and document key factors that help healthcare firms build change readiness capabilities for effective EMR implementation. We draw upon the notion of 'change readiness' from organizational change literature to theoretically examine these factors. We seek to complement the current body of knowledge by providing insights from a longitudinal case study of a successful EMR implementation, by specifically focusing on how Northshore University Health System (Northshore) built its change readiness capacity in order to implement its EMR system.

This research is organized as follows. We provide a brief overview of the theoretical foundation pertaining to organizational change. We then provide details of the case study, followed by a brief discussion on our on-going efforts to unearth the change readiness factors we observed from the case study.

EMR SYSTEMS AS AGENTS OF ORGANIZATIONAL CHANGE

An electronic medical record (EMR) is a health information system where healthcare providers record detailed information on patient encounters including patient demographics, medical history, summaries of assessment of health conditions, treatments and lab tests. Some of these systems typically support computerized order entry by care givers and decision support. Some EMR systems also have modules or features for scheduling appointments, do billing activities and generate reports. Healthcare providers use EMR systems to record details pertaining to their practice, treatments and encounters. EMR systems can cover a range of functions such as back office operations, electronic billing, e-prescribing, practice management and also health information pertaining to the patient. EMR systems, therefore, represent a suite of functionality, built around a common database of patient health information. A healthcare organization can decide to adopt specific modules of EMR or can implement selected modules in a sequence.

We use an organizational change lens to understand EMR implementation. Organizational change is a deliberate effort in an organization's structure, systems, processes or product-market orientation aimed at improving the organizational objectives (Lines, 2005). The organizational change can be driven by internal or external factors that can act as catalyst for change. Since deployment of EMR systems requires significant capital investments, necessitating fundamental changes to the workflows, business processes and cultural fabric of a healthcare provider, we choose an organizational change lens to examine EMR implementation. The primary drivers for EMR implementation could come from within, such as improvement of patient safety or controlling costs, or can be triggered by external factors such as government regulations or competitive necessity.

When discussing organizational change, researchers have often distinguished between planned change and emergent change (Van de Ven and Poole, 1995). Planned change represents envisioning a future state, crafting and executing a well-defined plan for achieving that state. Planned change views organizational change as a linear and mechanistic process with very few interventions. However, several healthcare organizations face an onslaught of changes caused by regulations, internal forces as well as environmental pressures. In such circumstances, change often follows an evolutionary process demanding constant adaptation and reconfiguration. Since change is often emergent and unanticipated, scholars have recommended building change readiness capabilities in order to effectively manage the organizational change process and achieve desired organizational goals (Armenakis et al. 1993; Neves, 2009).

Change readiness represent a fundamental capability that encompasses a number of underlying factors such as a deep understanding on the motivations for change, mobilizing support for the change effort from stakeholders across the entire organization, encouraging wide participation in the change process and enacting the change. The change readiness also implies being open to external actors in enacting and supporting the organizational change.

In this research, our intent is to understand how Northshore University Health System built its change readiness capability in order to effectively implement its EMR system. We use a single-case study, with a grounded-theory approach, as it is best suited to examine change processes.

CASE CONTEXT AND DATA COLLECTION

Northshore University Health System is an integrated healthcare delivery system encompassing four hospitals and a medical group, serving patients in the Chicago metropolitan area. Employing over 8000 people, Northshore has over 70 offices and 800 primary and specialty care physicians.

Primary data for our case study was collected through semi-structured, in-depth interviews with the CIO and other key IS managers at Northshore. We also gathered secondary data through published reports, media interviews, internal documents and presentation material available at Northshore.

Case Study Overview: EMR Implementation at NorthShore University Health System

NorthShore hospital had a strong commitment to provide excellent service to its customers. This was materialized in its 1996-2001 strategic plan which mentioned the hospital's primary objective was to be "The best place to receive care. Any patient using the organization's services should be able to move from the physician's office, to a hospital service, to an ambulatory service and receive the same high quality of care at every facility because physicians would have access to complete, accurate and up-to-date patient information".

In line with the plan, NorthShore decided to implement an integrated electronic medical record system (EMR) throughout its hospitals and offices in March 2001. . It wanted a system that covered the needs of hospital and the offices at the same time. Northshore system comprised of four hospitals and 75 offices, therefore a comprehensive system covering the entire enterprise would be more beneficial than a smaller system with partial coverage. As the CIO noted:

“We wanted one system that will cover both hospitals and offices....more and more care is given to the office settings....if you look at electronic medical record as a patient longitudinal healthcare record, most of the data is coming from the offices and not from the hospitals.. And most people contact the doctors in their offices and not in the hospitals. So we decided that [to have an EMR system that supported both hospital and office needs.]”

The internal IS team at Northshore had established a strong track record of developing and deploying several IS applications. Long before deciding to implement an EMR system, NorthShore had deployed several home-grown applications to automate various processes. The internal IS team had developed ClinicPath - a system to speed up order entry product that allowed physician to enter medication automatically. Other similar applications included Horizon Patient Folder (HPF) – an electronic application that automated the charting process and digitalized other documents related to patients, and Picture Archiving Communication Systems (PACS) – an electronic application that digitalized all medical films. HPF shortened the physician’s time to sign off a patient’s chart upon her/his discharge which also made the hospital able to bill the patient immediately (previously it took weeks to bill the patient). Furthermore, HPF also allowed physicians to view, correct, and complete patients’ charts online, from any place at the physicians’ convenience, which saved a lot of physician’s time and effort. Whereas for the PACS, it reduced the physicians’ time and physical work to get access to patients medical films since they could be accessed online; it eased the way to pull back old films and compare them side by side; and it eliminated the risk of losing the films. The experiences in managing HPF and PACS applications had provided rich experience to the IS team on the clinical processes, but also enhanced the visibility and credibility of the IS unit among other organizational stakeholders. As the CIO noted:

“Those two projects [HPF and PACS] were very important to us. If they had gone badly,...they [the management, physicians, and radiologist] would probably not had the confidence in the IT unit to pull it off.”

When the decision to replace the silo systems with an integrated EMR system was proposed, the experience and knowledge of home-grown clinical systems helped physicians and radiologists’ to understand and assimilate the concept of an integrated, organization-wide EMR system. Further, there was a strong commitment from senior leadership for the new EMR system. The management realized the importance of physician engagement in the implementation process. EMR implementation was regarded as a clinical project, instead of a technical one. The senior management recognized the importance of engaging physicians right from the initial stages of the effort:

“...[physicians] are very important to the organization obviously. They bring in your patient....So they are not only your customer, they are sales representatives, bringing in business. Interesting relationship, very important to you....They were the ones who were going to get the biggest change... We were afraid we put this [EMR system] in and they would say ‘well, we will go down the street and practice, because I do not want to go through this’. So we had to get their support.” - CIO

The hospital management had maintained a very good long term relationships with the physicians. The physicians had a strong involvement in the organization. A Medical Informatics Committee – consists of physicians – has long been established to support the technology adoption process, and was a part of Medical Informatics department which served as the link between the operations end-users and the IS department.

During the vendor selection process, NorthShore realized there were only two vendors who were potentially capable to develop the EMR system even though none of them had a full EMR system at that time. One of the vendors - EPIC gained better trust from NorthShore’s management. The management was convinced by Epic’s management structure and reputation, hence decided to purchase EPIC EMR product in June 2001. It was decided to pursue a collaborative approach between Epic and NorthShore, whereby some of the modules will be developed on mutual knowledge exchange.

NorthShore planned to implement the EMR using a big bang approach. Otherwise it was considered risky to keep multiple sets of data associated with multiple systems on place. The management believed that the benefits could not be realized until the implementation was completed. Therefore, their initial plan was to take a big bang way of implementation; one hospital at a time, starting with its Glenbrook hospital. The plan changed to a two-step implementation approach due to the delay in integrating the CPOE (Computerized Physician Order Entry) system. The first NorthShore’s hospital to implement the EMR was Glenbrook which was in March 2003, followed by Evanston hospital in July 2003, and Highland Park hospital in December 2003.

During the inception phase of the EMR system, the physicians were required to make a total use of the system. Otherwise they could not practice at the hospital anymore, and their patients would be taken care of by the corresponding departments so that the patients' health needs were not abandoned.

“Our Professional Staff [physicians] were very involved from the beginning, from the selection process. And they very soon passed the rule that said – If you are going to treat patients at the hospital you have to use the EMR –[otherwise] we will call their chairman of the department to come and take care of the patients.” - CIO

A mandatory training was enforced to help them learn the EMR system. A “herd community” training concept was deployed.

“It required 16 hours of classroom training tutoring [on] how to use the system.... we have this concept called herd community. If you put in a new doctor, he walks in today. He starts practicing today. We don't put him through 16 hours of class room training. He gets 8 hours of class room and 8 hours online. And then he gets into the herd because everyone knows how to use it. He can ask his buddies how to use it.” – EMR manager

NorthShore's Human Resource department had a Chief Learning Officer (CLO) who was responsible for all the information technology trainings. She coordinated a hospital based trainers and worked closely with the nurses and IS department to prepare and conduct trainings.

“...[we] have a training officer that works as an HR, and she was a major part of our project from the very beginning. And she does all training here such as IT training. That is training on how to do the evaluations, how to manage staff, all training activities ...she managed all that process.... she is trained in how to train the doctors.... she will teach [the nurses] how to train the doctors as opposed to teaching kids. They usually help each other and eventually they were very good....[Nevertheless] they got to work with us [IS team] to know what's going to be trained, they come to us to get sample screen printouts and stuff like that.... They have done a good job....They were very important to us. And they continue to be important. We need them, [even though] they are not a part of our [IS] department.” - CIO

IS department did not only work closely with the HR department. Instead, many people had a lot of knowledge and involvement in the use of the technologies in their own departments. IS department benefited from their IT knowledge. Technology adoption is not only an IT thing, even though IT is still in control.

“Many departments have a lot of knowledge and involvement. Even if it's something as simple as controlling security they are much involved in it. In some cases they have more than what they could do but they have to still follow our change control and all those kind of things. So we are still in control... it's a way to expand our staff without having to add more people in our department unnecessarily.”

In 2004, a year after EPIC implementation at its three hospitals, NorthShore won the Davies Award for its excellence in EMR implementation methods and value derived from the use of EMR. Furthermore, in 2008, Evanston, Glenbrook, and Highland Park hospitals were three out of 15 US hospitals that reached the highest stage – stage 7 – of the HIMSS Analytics EMR Adoption Model scale. The other 12 winners were healthcare facilities of Kaiser Permanente group in California [**Error! Reference source not found.**].

Skokie hospital merged with NorthShore in January 2009. After successful EMR implementation at its three previous hospitals, NorthShore was ready to use a big bang approach at Skokie in December 2009. Well-EMR-trained nurses from Highland Park hospital were sent to Skokie hospital to train the local staff.

“So [we] did a lot of videos for the first type of flows and then sort of testimonials from the nurses...It is nice to have the peers talking to them. This was the first hospital that went on live and we had it on tapes with bunch of people saying we used Epic today....It is tough today to walk in and say you want to do all of that. We could do that in Skokie; we did do all of that in Skokie at one time [big bang]. But that's because, you know, we have trained people who have done it already. And we had many of their staff members, doctors who already practiced at Highland park, Glenbrook, Evanston. So they were doing and we could flood the place with extra help for couple of weeks to give them confidence.... Part of the [implementation] issue is not the technology; it's the coverage to give the support. You got to have lot of people around to help....”

As of 2010, NorthShore had about a million office visits in EPIC and around 60,000 admissions per year. The system is in use by 100% of medical staff at NorthShore [**Error! Reference source not found.**].

PRELIMINARY INSIGHTS FROM THE CASE STUDY

By carefully examining the NorthShore's experiences, we identified three primary factors that helped Northshore build its change readiness capability (i) Systemic Knowledge, (ii) Senior Management's Oversight (iii) Partnership Governance. We

elaborate on each of these factors by defining them and identifying its con deriving its variables based on the context of EMR implementation at NorthShore.

Systemic Knowledge

We defined systemic knowledge as technical and business knowledge possessed by key players in the organization that was crucial in EMR implementation. At NorthShore, the key players were the decision makers of the EMR project (senior management), the executor of the project (IS team), and the main users of the system (e.g. physicians, radiologist, and nurses). Three variables can be derived for the system knowledge construct which are the *senior management's IT and business knowledge*, *IS team's business knowledge*, and *functional managers' IT knowledge*.

Senior management's IT and business knowledge

The senior management at Northshore had great knowledge on the potential benefits of an integrated EMR system. The management knew exactly what kind of EMR that they wanted to implement at the hospital. Their decision to have an EMR system that covered both the hospital and the office's needs showed that they understood the business need and the technical aspects that could transfer the needs into realization. This reflected their knowledge in both IT and business domains.

IS team's business knowledge

IS team had strong business management knowledge that complemented its technical capability. The team's ability to take role as application developer for ClinicPath and to successfully manage the implementation of patient folder and picture archive systems proved their excellent technical and management knowledge. The successful experiences, in turn, helped senior management, physicians, and radiologists build their confidence on the IS team in implementing the EMR.

Clinical Users' IT knowledge

NorthShore's clinical and professional staff (e.g. physicians and radiologists) had sufficient IT knowledge based on their successful experiences operating the HPF and PACS. These helped them build their own self confidence in their ability to operate the EMR system. The management did not find a difficult time to educate the professional staff with the benefit and operational aspects of the EMR since the staff had already been familiar with its concept.

Senior Management's Oversight

Senior Management's Oversight is defined as imperative actions that management took to support the EMR implementation. Two variables can be derived for the senior management's oversight construct which are the *champion of key EMR decision*, and *direct participation in EMR implementation*.

Champions for EMR project

The senior leadership at Northshore was the active champion of EMR. Their championship transcended to other echelons of the organizational hierarchy, thus gaining a widespread support for the EMR across the enterprise. The decision to implement EMR throughout the hospitals and offices was the first fundamental management decision caused NorthShore play a leadership role in the revolution of medical care. Decisions supported by the higher level management bring strong impact down to the operational level and potentially leads to success.

Another vital decision the management made was adjusting the big bang approach to accommodate the delay in CPOE integration. Instead of delaying the implementation, the management decided to go with a strategic two-step implementation approach. This decision successfully maintained the momentum of the implementation from both the vendor and the users at NorthShore.

Direct participation in EMR implementation

The management believed that a successful implementation did not always the results of doing well with the technology, but also related to the support that was available to use the technology. In line with this believe, the management sent well-trained nurses to provide training for Skokie hospital. The benefits were two folds: successful training, and relationship building. The management direct participation in providing resources when required contributed to earning these two benefits.

Another aspect that facilitated the senior management direct participation was the fact that most of the key people served quite long terms in the organization. This created trust among them which in turn smoothed the process of participation.

IS Governance

IS governance refers to structural arrangements among the business, IS and vendor units to effectively implement the EMR. IT describes the authority sharing and decision making accountability that were shared by key stakeholders in EMR efforts. Two variables can be derived for the IS governance construct which are the *vendor strategic partnership*, and *teams/committee partnership*.

Vendor strategic partnership

Choosing the right vendor is one of the important factors that lead to successful implementation. Maintaining the good relationship with the vendor is not less important. NorthShore has successfully transformed the rigid vendor-client relationship to a flexible one. Rather than taking a arms-length contractual approach, Northshore decided to pursue a partnership approach whereby collaborative learning and product development was done in a mutually beneficial manner. It was proved when the vendor did not meet the deadline of CPOE integration that would have allowed NorthShore to take the big bang approach of EMR implementation; instead of penalizing the vendor, NorthShore adjusted its approach to meet deadline. This brought positive impact to their relationship with the vendor.

Teams/committee partnership

The physicians were closely embraced since the early stage of the EMR implementation. This helped in getting them comply with the policy to use the technology in their work at NorthShore. Furthermore, the physicians had a strong involvement in the organization as reflected by the existence of Medical Informatics Committee. This helped minimizing EMR implementation avoidance from the physicians.

NorthShore organizational departments strategically work with each other to support technology implementation. The collaboration between IS team and human resource management team successfully supported the EMR training for the users. This unique relationship clearly has been fruitful. The IT department collaboration with other departments resulted in the delegation of IT related work to the departments. The technical capability of other departments helped them solves local technical problem without involving the IS team. This partnership has successfully reduced the work load of the IS team and prepared them to contribute their skill s to a more complex problem.

Our observations from the case study are summarized in Figure.1.

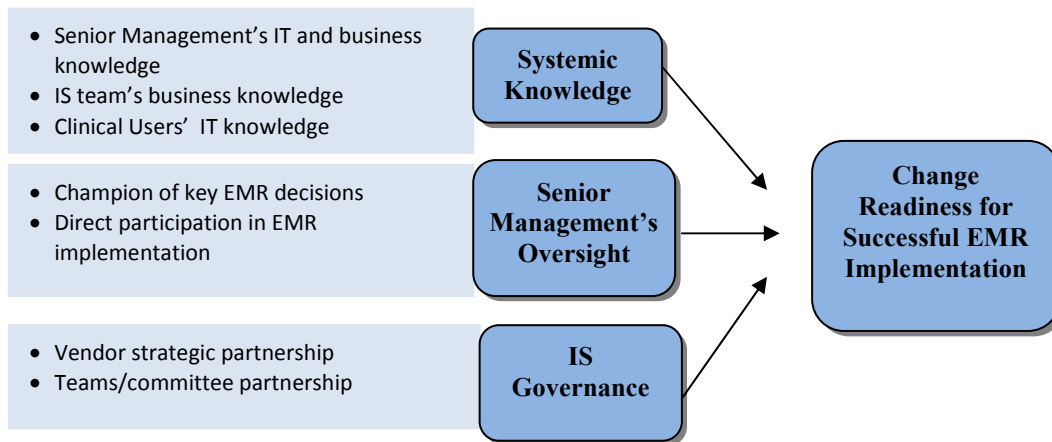


Figure 1. Building Change Readiness for Effective EMR Implementation: A Preliminary Framework

CONCLUSIONS AND STATUS OF RESEARCH STUDY

This research seeks to take a change readiness approach to understand successful implementation of EMR systems. Based on a longitudinal case study of EMR implementation at NorthShore, we identified a few factors which, we believe, contribute to change readiness capabilities in healthcare organizations. The observations we shared in this paper are preliminary insights on what we believe are the salient change readiness factors that lead to successful EMR implementation in large hospital settings. We are undertaking further qualitative analysis of our longitudinal case data to unearth additional factors that could be associated with effective EMR implementations.

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