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Understanding the end user perspective: a multiple-case study of successful health information technology implementation

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UNDERSTANDING THE END USER PERSPECTIVE: A MULTIPLE-CASE STUDY OF SUCCESSFUL HEALTH INFORMATION TECHNOLOGY IMPLEMENTATION

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ABSTRACT

The United States continues to lag behind other countries in its adoption of health information technology. A failure to increase adoption will jeopardize the nation's ability to reduce medical errors, address the rapid growth of healthcare costs, and enact effective healthcare reform. Health information technology (HIT) implementation success factors as perceived by healthcare executives and industry experts are well documented in the literature. Few studies, however, have focused on the perceptions of HIT end users such as physicians and nurses. The purpose of this exploratory case study was to describe the strategies, actions, and other factors that contribute to the successful implementation of HIT as perceived by 29 HIT end users at a 613-bed adult hospital and 7 end users at a 272-bed children's hospital. Interview data, secondary sources, and investigator observations were analyzed in three phases consistent with the core elements of qualitative data analysis and led to the emergence of eight unique themes which suggest factors that allow or inhibit HIT implementation success. These factors include (a) the end users' understanding of the implementation goals, (b) the appropriateness of the selected HIT system, (c) the usability of the system, (d) the adequacy of the supporting infrastructure, (e) the quality of the end user training, (f) the adequacy of the on-site support, (g) the resulting impact to nursing and physician workflows, and (h) the resulting quality of nursing and physician documentation. Conclusions drawn from the exploration include: (a) communication between the decision-makers and the end users was inadequate; (b) poor usability design, lack of supporting infrastructure, and lack of workflow optimization brought on serious side effects including a decrease in the quality of physician documentation, an emphasis on

financially-driven versus care-driven charting, and disruption to provider-patient and physician-nurse relationships; (c) specialized care environments require equally specialized HIT systems if they are to operate optimally; and (d) less end user training prior to implementation in favor of more post-activation on-site support and follow-up training would have represented a more effective use of resources.

Chapter One: Introduction

Background

In 2000, at a time when lower ranking causes of death such as motor vehicle accidents, breast cancer, and AIDS were receiving the greatest public attention, the Institute of Medicine (IOM) reported that medical errors cause an estimated 44,000 to 98,000 deaths per year in hospitals, making them the eighth leading cause of death in the United States (Kohn, Corrigan, & Donaldson, 2000). The IOM released a follow-up report in July of 2003, sponsored by the United States Department of Health and Human Services, illuminating the enormous potential to improve the quality of patient care through the use of health information technology (Committee on Data Standards for Patient Safety, 2003). The report outlined eight core functions that electronic health record systems should be capable of performing in order to promote greater patient safety including test results management, medication order entry management, and decision support. In November of 2003, the IOM reiterated "the vital role of information technology in designing a safer health care system" (p. 29) by calling for a standards-based national health information infrastructure to guide the collection and interchange of patient safety data (Aspden, Corrigan, Wolcott, & Erickson, 2004).

Rising public concern as a result of the IOM reports, as well as failed attempts at the state level to develop a community-wide approach to health information exchange, prompted action at the national level (Frohlich, Karp, Smith, & Sujansky, 2007). In 2002, the Joint Commission established a National Patient Safety Goals program to help healthcare organizations address patient safety concerns (Joint Commission, 2009). In 2004, former President George W. Bush signed an executive order establishing a new

position, National Health Information Technology Coordinator, charged with developing a nationwide interoperable health information technology infrastructure by 2014 (United States Government Printing Office, 2004). The former President's executive order led to the creation of the American Health Information Community (AHIC) in 2005. The AHIC was charged with making "recommendations to the Secretary of the U.S. Department of Health and Human Services on how to accelerate the development and adoption of health information technology" (United States Department of Health and Human Services, n.d., para. 1). Over the course of 25 meetings, the AHIC advanced more than 200 recommendations addressing various topics such as standards and certification, social and cultural issues, and security and privacy. Now incorporated as a public-private organization known as the National eHealth Collaborative (NeHC), the organization continues to develop a unified approach to realize the former President's vision.

Problem Statement

While more recent studies do show that the overall quality of healthcare is improving (Esimai, 2005; Hosford, 2008), the average annual rate of improvement has declined from 2.3% over the years 1994 to 2005 to a modest 1.5% over the shorter reporting period of 2000 to 2005 (Brady, Ho, & Clancy, 2008). Moreover, the United States continues to lag behind other countries in its adoption of health information technology (Chin, 2004; Jha et al., 2009). A 2006 survey of primary care physicians found that only 29% of those in the United States were using electronic medical record systems, compared to 98% in the Netherlands, 92% in New Zealand, 89% in the United Kingdom, 79% in Australia, and 42% in Germany (Schoen, Osborn, Huynh, Doty, &

Zapert, 2006). A failure to increase health information technology adoption in the United States will jeopardize the nation's ability to reduce medical errors, address the rapid growth of healthcare costs, and enact effective healthcare reform (Blumenthal, 2009; Davenport, 2007).

Purpose Statement

During his presidential campaign, Barack Obama vowed to invest 10 billion dollars a year over the first five years of his presidency to encourage broad adoption of health information technology (Obama for America, n.d.). Indeed, the recently passed American Recovery and Reinvestment Act of 2009 allocates over 20 billion dollars "to aid in the development of a robust IT infrastructure for healthcare and to assist providers and other entities in adopting and using health IT" (Healthcare Information and Management Systems Society, 2009, p. 1). Funding and incentives alone, however, will not necessarily lead to successful implementations and increased health information technology adoption. Without a solid understanding of the factors which influence the success of an implementation, healthcare organizations risk implementation failure (Goldstein & Zhang, 2009).

Health information technology (HIT) implementation success factors as perceived by healthcare executives and industry experts are well documented in the literature. Few studies, however, have focused on the perceptions of HIT *end users* such as physicians and nurses (Jensen & Aanestad, 2007). The purpose of this exploratory case study was to describe the strategies, actions, and other factors that contribute to the successful implementation of HIT as perceived by HIT end users at two California

hospitals. That is, this study sought the perspective of the HIT end user in answering the question: How is HIT successfully implemented?

Defining Success

The definition of success in the context of HIT implementation was explored at the American Medical Informatics Association's Fall 2006 Symposium. Kaplan and Harria-Salamone (2009) summarized the discussion among symposium participants as follows:

> Success may be defined as simply getting the application or system turned on, getting people to use it, and getting at least grudging acceptance, with the caveat that grudging acceptance can turn to non-acceptance. It might entail only offering even "small successes" to users. Problems are compounded in that what works for one group, such as pharmacists, may not work for another group, such as nurses, and those who gain may not be those who actually do the work. For these reasons, there is little agreement about what "success" or "failure" is. (p. 294)

Indeed, a review of the literature does not reveal a singular measure of success for technology implementations. Some consider fulfilling the goals and objectives in the project plan as an indicator of success, which "may or may not be accurate depending on the quality of the project plan" (Padilla, 2007, para. 2). For others, "the answer to how success is defined for an IT project is to be on time, on budget, with zero defects" (para. 2). Another approach is to measure success based on a costs versus benefits analysis, that is, "one totals the costs of developing a system and compares them with the dollar benefits resulting from the system" (Egeland, 2009, para. 6). While in theory, this sounds like a reasonable approach, benefits are often difficult to quantify in financial terms (Devaraj & Kohli, 2003; Egeland, 2009). Other indicators of success discussed in the literature include the level of system usage, user satisfaction, and impact on productivity and output quality (Egeland, 2009).

Ultimately, success is in the eye of the stakeholder; different people define success in different ways (Glass, 2005; Kaplan & Harria-Salamone, 2009; Padilla, 2007). For the purposes of this study and its case selection, the investigator operationally defined success as active usage of the new application or system which demonstrates at least nominal acceptance from both a technical and a cultural perspective.

Significance of the Study

A successful HIT implementation is dependent on a leadership team that demonstrates a strong understanding of the end user, yet many organizations fail to acknowledge this dependency:

> New technology is often developed and evaluated from an organizational point of view. The focus is placed on how organizational processes and activities will be supported by technology, rather than how the individual user's needs and preferences are impacted. The organization may initiate and fund the implementation of an IT project, but it is the end user who actually uses the technology to perform his or her job. (Bernstein, McCreless, & Cote, 2007, p. 22)

Moreover, little exists in the literature to help leaders develop such an understanding of their end users. By attempting to address this knowledge gap, the investigator hoped to assist healthcare organizations in the planning and execution of successful HIT implementation projects and to assist in the national effort to increase HIT adoption. As demonstrated by the recent passage of the American Recovery and Reinvestment Act of 2009, the adoption of HIT is a high priority for the United States government.

Delimitations

The specific cases explored in this study included an April 2008 HIT implementation at an adult hospital and a September 2008 HIT implementation at a children's hospital. Several factors led to the selection of these two cases: (a) both

implementation events occurred relatively recently; (b) both were convenience cases, that is, both hospitals represented populations that could be conveniently sampled by the investigator (Creswell, 2007); and (c) an exploration of two cases leading to a cross-case synthesis would likely generate richer findings than a single-case analysis (Yin, 2009).

Though technicians, therapists, social workers, and numerous other ancillary clinical staff use HIT at both hospitals, the dominant HIT end users are physicians and nurses. Interviewees were therefore selected from within the physician and nurse populations at each hospital. Interviews were conducted between January 15 and April 12 of 2010.

Definition of Terms

The term health information technology (HIT) is used throughout this study as an umbrella term intended to cover a variety of software and hardware systems used in the healthcare field. These include but are not limited to computerized physician order entry (CPOE), electronic medical record (EMR), electronic health record (EHR), and clinical information systems, as well as bar code scanners and vital sign devices.

Organization of the Study

The remainder of the study is organized in the following manner. Chapter Two presents a review of relevant literature concerned with the benefits of HIT, implementation challenges, implementation success factors, and organizational change. Chapter Three delineates the proposed research design and methodology for the study. The interview protocol as well as the sampling, data collection, and analysis procedures are described. The study findings, including a cross-case synthesis, are presented in Chapter Four. Chapter Five presents a summary of the study, a discussion of the findings

as related to the literature, conclusions, and recommendations for further research. The study concludes with a reference list and appendix.

Chapter Two: Literature Review

Introduction

The Joint Commission, an independent, not-for-profit organization that accredits and certifies more than 15,000 healthcare organizations and programs in the United States (Joint Commission, n.d.), establishes National Patient Safety Goals annually and surveys accredited healthcare organizations to ensure that the goals are implemented (Joint Commission, 2009). Indeed, a quick perusal of hospital websites reveals a common thread among their various missions, visions, and values: all are committed to providing quality patient care (Cleveland Clinic, n.d.; John Hopkins Medicine, n.d.; Mayo Clinic, n.d.; Stanford Hospital and Clinics, n.d.).

While there are many ways in which healthcare organizations can improve the quality of care that they provide, the adoption of health information technology (HIT) is arguably the most talked about in recent years. The Institute of Medicine, a longtime advocate for the adoption of HIT, recently suggested that greater use of information technologies in prescribing and dispensing medications will reduce the number of medication errors (Aspden, Wolcott, Bootman, & Cronenwett, 2007). In 2008, the Association of Perioperative Registered Nurses went as far as to publish an article that specifically outlined how information technologies could help healthcare organizations meet each Joint Commission National Patient Safety Goal (Catalano & Fickenscher, 2008).

Numerous studies and reports suggest that broader adoption of HIT will lead to greater patient safety and quality of care, yet the United States continues to lag behind other countries in its adoption of HIT (Chin, 2004; Jha et al., 2009; Schoen et al., 2006).

This chapter begins by reviewing literature that supports the implementation of HIT as a way to reduce medication administration errors and improve overall operational effectiveness. The following section attempts to account for the lag in HIT adoption by focusing on the challenges presented by HIT implementation.

HIT implementation success factors as perceived by healthcare executives and industry experts are fairly well documented. The third section of this chapter presents a review of the aforementioned literature. To establish a theoretical construct for this study, the fourth section presents a review of Kotter's (1996) eight-step process for leading organizational change. The chapter concludes with a summary.

Benefits of Health Information Technology

Health information technology (HIT) promises myriad benefits to its adopters, including but not limited to increased patient safety, improved quality of patient care, automated sharing of health information, increased productivity through improved workflows, reduced cost of services, and reduced expenses associated with paper-based records (Goldschmidt, 2005). A study of 98 Florida hospitals found that "those with the most sophisticated and mature IT infrastructures performed significantly better on the largest number of PSIs [Patient Safety Indicators]" (Menachemi, Saunders, Chukmaitov, Mathhews, & Brooks, 2007, p. 398).

Several studies, in particular, have shown that HIT adoption leads to a reduction in medication administration errors. Incidences of adverse drug events were reduced by 75% when a Salt Lake City hospital implemented a computerized physician order entry (CPOE) system (Evans et al., 1998). A similar system adopted by a Boston hospital led to a 19% reduction in medication errors and a 23% increase in the appropriate use of

medications in high-risk clinical situations (Bates et al., 1998). Studies have also shown that bar code-assisted dispensing systems, when used in conjunction with CPOE systems, reduce medical administration errors. Of the three configurations of bar code technology implemented at a 735-bed tertiary care academic medical center in 2003, "the two configurations that required staff to scan all doses had a 93% to 96% relative reduction in the incidence of target dispensing errors" (Poon et al., 2006, p. 426).

In addition to a reduction in medication administration errors, studies indicate that HIT adoption leads to operational improvements. A review of 68 studies concerning computer-based decision support systems found that 43 out of 63 studies supported HIT adoption as a means to improve physician performance and 6 out of 14 studies supported HIT adoption as a means to improve patient outcomes (Hunt, Haynes, Hanna, & Smith, 1998). Use of electronic medical record systems produced a net gain of 86,400 dollars per physician over a five year period for a group of primary care physicians studied in Boston (Wang et al., 2003). And a more recent study "combining primary survey data from Florida hospitals and secondary data from two government agencies" (p. 5) found that the adoption of clinical HIT systems led to significant gains in operational performance (Bhattacherjee, Hikmet, Menachemi, Kayhan, & Brooks, 2007).

Despite these and other studies that highlight the benefits of HIT, the recent passage of the American Recovery and Reinvestment Act of 2009, allocating over 20 billion dollars to HIT, has generated a wave of criticism. Many physicians continue to suggest that technology impersonalizes the doctor-patient encounter and impedes physicians' ability to make quality connections with their patients (Armstrong-Coben, 2009), although at least one study debunks such claims (Menachemi, Beitsch, & Brooks,

2008). Drs. Groopman and Hartzband (2009) of the Israel Deaconess Medical Center in Boston argue that the benefits of HIT fail to justify the costs of implementation, citing the potential for propagating misdiagnoses and the burden of "checking off scores of boxes on the computer screen to satisfy insurance requirements" (para. 11) as major HIT downsides. HIT proponents, and even cautious supporters, however, argue that a well-designed system utilizing automated prediction tools, statistical models, and a smart user interface developed with the end-user in mind would overcome the HIT shortcomings identified in Groopman and Hartzband's editorial (Brody, 2008; Jakulin, 2009).

Implementation Challenges

A recent survey of all acute care hospitals that are members of the American Hospital Association (AHA) found the most commonly cited HIT implementation barriers to be "inadequate capital for purchase (74%), concerns about maintenance costs (44%), resistance on the part of physicians (36%), unclear return on investment (32%), and lack of availability of staff with adequate expertise in information technology (30%)" (Jha et al., 2009, p. 1632). The financial barriers are not altogether surprising considering that the leading countries in HIT adoption are supported by national investment in IT capacity (Schoen et al., 2006). Up until the recent passage of the American Recovery and Reinvestment Act of 2009, the United States had no national plan to financially support HIT adoption and instead "relied primarily on market-driven, individual care systems (such as Kaiser Permanente or the U.S. Department of Veterans Affairs) or physician investment to build IT capacity" (p. 568).

Moreover, as the AHA survey confirms, healthcare organizations are often unable to accurately estimate the business value of their HIT investments (Devaraj &

Kohli, 2003). Though healthcare executives appear to be paying more attention to "intangible metrics in determining the business value of IT. . . . [such as the] influence of IT on brand name, customer satisfaction, business relationships, core processes, and patients" (Solovy & Chaiken, 2003, p. 20), they continue to favor a financially driven definition of return on investment (ROI). Given such a narrow definition of ROI, the costs of HIT adoption, including the acquisition of qualified IT staff, are often difficult for healthcare organizations to justify (Thielst, 2007b).

While the AHA hospitals were less likely to cite financial barriers if they had already adopted some form of HIT, all surveyed hospitals were equally likely to cite physician resistance as a barrier (Jha et al., 2009). Indeed, physician resistance to change is a well-documented HIT adoption barrier (Freudenheim, 2004; Massaro, 2005; Poon et al., 2004). In the oft-cited case of Cedars-Sinai Medical Center, physician resistance forced the organization to unplug its computerized physician order entry system less than four months into its operation (Morrissey, 2004).

Physician resistance is often attributed to a perception that the change will disrupt current workflows, a fear of being perceived as incompetent, or a simple lack of understanding regarding the nature and purpose of the proposed change (LeTourneau, 2004). Such perceptions and lack of understanding are not unwarranted. Physicians and other healthcare professionals are routinely critical of the disruptive, inefficient, and time-consuming tasks that poorly designed systems impose (Groopman & Hartzband, 2009; Jensen & Aanestad, 2007). For older, less technology savvy physicians, particularly those with limited keyboard dexterity, moving from paper to electronic documentation is a struggle (Valerius, 2007). Some organizations have even developed

"positions such as chief medical information officer to champion and problem-solve physician processes related to this change" (p. 57).

Implementation Success Factors

Bernstein et al. (2007) posit that five constants of information technology adoption "persist regardless of the state of IT in healthcare: (1) budget, (2) supportive leadership, (3) project management, (4) implementation, and (5) end user involvement" (p. 17). A review of the literature reveals that HIT implementation success factors generally do align with one of these constants. The following section will therefore use the five constants as an organizational framework.

Budget. IT budgets are often inadequate given the investment demands of a successful HIT implementation. Budgets must allow for the acquisition of sufficiently numbered and qualified resources to ensure an appropriate distribution of work (Bernstein et al., 2007). Bernstein et al. suggest that:

> Healthcare executives should expand their definition of ROI to include both tangible and intangible qualities of value when evaluating the IT budget because the benefits of new IT will be realized by not only increased profitability or decreased costs, but also by improved patient outcomes, enhanced employee morale, and greater quality of services. (p. 23)

While tangible, financially driven metrics are more readily available and measured, "change management is only successful to the degree that healthcare leaders are able to measure and manage the intangibles" (Atchison, 1999, p. 6). To capture the intangible metrics, IT managers should assess new technologies before engaging in full-scale implementations (Sallas, Lane, Mathews, Watkins, & Wiley-Patton, 2007). Sallas et al. completed a case study involving the pilot implementation of a handheld medication administration device and found that the utilization of an iterative assessment

approach allowed IT managers to evaluate the efficacy of the project based on multiple criteria, including impact on patient outcomes and provider workflows. Sallas et al. concluded that "the most effective way to know if a technology is worth the time and effort spent to implement it, is to perform an assessment" (p. 44).

In addition to expanding their definition of ROI, IT managers must minimize costs by leveraging external resources effectively. Loppnow (2007) interviewed healthcare executives across eight different healthcare organizations nationally recognized for their successful implementation of HIT and found that all, to varying extents, relied on outside vendors to "satisfy the core functional needs of the IT infrastructure. . . . [and] concentrated [their] IT human resources on understanding clinical and operational processes, and on providing training and support to the operating units" (p. 88). Moreover, most executives agree that buying standardized off-the-shelf application solutions versus developing applications in-house is a more cost-effective approach towards implementation and ongoing maintenance (Traylor, 2006).

Supportive leadership. Physicians and other healthcare professionals see their core mission as that of providing patient care and are therefore unlikely to invest much time and effort into anything that is not perceived "as an explicit way to improve the overall patient treatment" (Jensen & Aanestad, 2007, p. 38). Without a sense of urgency, few people are willing to invest the time and effort demanded by a change project (Kotter, 1996). A successful implementation is therefore dependent on a leadership team capable of championing the need for change (Middleton, 2005). Healthcare executives and managers must provide continuous support and ensure that IT goals "are aligned with the organization's mission, values, and strategic objectives" (Bernstein et al., 2007,

p. 23). They must also possess a complete understanding of any new technology including its capabilities, limitations, and impact on existing workflows (Thielst, 2007b). The absence of a technology-grounded leadership team can lead to the inappropriate outsourcing of IT functions that are best managed internally, such as organizational strategy development and execution (Blair, 2005).

A leadership survey conducted by the Healthcare Information and Management Systems Society and Hewlett-Packard asked over 1000 healthcare IT executives to name the most important skill required of today's healthcare chief information officer. Business strategy development was named by 49% of the respondents (Simpson, 1995). Similarly, when Loppnow (2007) interviewed healthcare executives across eight different healthcare organizations nationally recognized for their successful implementation of HIT, he found the establishment of a clear organizational vision supported by a strong, persistent, committed, and determined leadership team to be essential to the success of any HIT implementation. Moreover, Loppnow found the strategic integration of operational and IT goals, and the ability of the leadership team to situate new technologies as enabling tools in the delivery of patient care, to be critical success factors. These findings are consistent with current change leadership literature. Both Kotter (1996) and Atchison (1999) stress the importance of aligning organizational values and goals, developing a well-crafted organizational vision, and assembling a strong guiding coalition to communicate the vision and lead the change process.

Project management. In a survey of 77 healthcare executives, project management was identified as the most important HIT knowledge area (Lang, 2003). Similarly, audits conducted by executives at ten different healthcare organizations to

determine how well seven major executive management principles were carried out revealed that the "employment of effective project management in system development" (p. 231) received the highest mean score (Austin, Hornberger, Shmerling, & Elliott, 2000). The "organizations studied [understood] the importance of well-structured project management teams for the implementation of individual information systems" (p. 236). That is, in addition to supportive leadership, HIT implementations demand a structured approach to project management if they are to be successful. IT managers must establish and monitor realistic project goals that consider budget constraints, scheduling, and quality, and must also ensure accountability by assigning specific tasks and deadlines to each member of the project team (Bernstein et al., 2007).

Conceding a poor project management success rate, the IT department at the Los Angeles County Department of Mental Health completed a project management training program and adopted a five phase management methodology prior to embarking on a series of projects including the implementation of a medical professional credentialing system (Damaré, 2008). As they moved into the project execution phase, the organization's chief information officer commented:

> Our training provided a clear starting point on how to elicit requirements, then how to staff and build a project plan and clearly define who does what. Considering we were severely understaffed at the start of the project, so far, we have kept it on schedule and within budget. (p. 49)

Similarly, the Centers for Medicare and Medicaid Services recognized the value of a structured methodology and developed a lifecycle framework in 2004 to support IT implementation projects (Centers for Medicare and Medicaid Services, 2010). "A carefully defined project outcome, appropriate project governance structure, and

rigorous adherence to a structured systems development methodology are particularly critical management tools for assuring return on investment" (Freed, 2006, p. 26).

Implementation. Implementation is defined by Bernstein et al. as an "essential component of project management. . . . [that] involves the actual production and performance assessment phases of integrating new systems and processes" (2007, p. 21). As with project management, the implementation process should be structured. All new technologies should "undergo preliminary testing in the context of the workplace" to ensure compatibility with existing systems (Bernstein et al., 2007, p. 23).

Sallas et al. (2007) completed a case study involving the pilot implementation of a handheld medication administration device and found that the utilization of a context-aware iterative assessment approach informed the ongoing implementation process by allowing IT managers to evaluate the impact of the device on patient outcomes and provider workflows. In contrast, organizations that fail to adequately test new technologies risk implementation failure. In a qualitative study based on semi-structured interviews examining the halted implementation of an electronic medical record system at Kaiser Permanente Hawaii, twenty three individuals reported substantial system design problems that may have been avoided with early testing (Scott, Rundall, Vogt, & Hsu, 2005).

End user involvement. Bernstein et al. suggest that organizations should "foster end user involvement throughout the entire scope of the integration process because the end users are the individuals who will be using the new technology to perform their job" (2007, p. 23). Without end user involvement, the project team runs the risk of overlooking critical workflow elements and usability issues (Thielst, 2007a; Valerius,

2007). Moreover, end user involvement leads to greater understanding of the need for change, and a shared commitment to the goals of the project and the vision of the organization (Jensen & Aanestad, 2007).

The involvement of physicians, nurses, and other stakeholders emerged as a major success factor when Loppnow (2007) interviewed healthcare executives across eight different healthcare organizations nationally recognized for their successful implementation of HIT. Loppnow found that organizations commonly formed a clinical informatics committee consisting of representative physicians, nurses, ancillary staff, and operations personnel to provide input into the implementation design process. Similarly, a study of ten different healthcare organizations found that most of the organizations employed a user-driven implementation approach where end users served as members of decision-making committees and project development teams (Austin et al., 2000).

Kotter's Eight-Step Change Model

As alluded to throughout this chapter, HIT implementation is, at its core, an organizational change leadership and management challenge. Though there are numerous organizational change models described in the literature, Kotter's (1996) eight-step process for leading organizational change is perhaps one of the more widely recognized.

Step one: establishing a sense of urgency. A common error made by senior management is to push forward with a change effort without first establishing a sense of urgency within the organization (Kotter, 1996). Simply mandating a change is not sufficient. According to Kotter, if senior management does not clearly communicate and

illustrate the urgency of the issue or problem at hand, the organization will see little reason to support the change effort. “The likelihood that the new behaviors and desired routines will be valued and adopted is higher when the target group acknowledges the need for change” (Seijts, 2006, p. 180). Too much organizational *complacency*, as Kotter (1996) terms it, leads to resistance and ultimately, a failed change effort.

Step two: creating the guiding coalition. Another common error made by organizations is to “conclude that the kind of leadership that is so critical to any change can come only from a single larger-that-life person” (Kotter, 1996, p. 51). Kotter suggests that “a strong guiding coalition is always needed – one with the right composition, level of trust, and shared objective” (p. 52). While individuals generally do not possess all the characteristics necessary to successfully lead a change effort, the right team of individuals will collectively possess the necessary characteristics and power required. This is not to say, however, that change efforts require no leader. Rather, organizations should identify an internal champion, someone other than the Chief Executive Officer (CEO), to “handle the day-to-day details and work with the guiding coalition to stay on target for periodic measurable achievements” (Atchison, 1999, p. 25).

Step three: developing a vision and strategy. According to Kotter (1996), a good vision is essential for three reasons. First, a good vision simplifies a complex change project by clearly stating the direction of the change. Second, it motivates the organization to act in the desired direction, despite the challenges and inconveniences the desired direction might present at first. Third, a good vision quickly and efficiently helps to coordinate the actions of many. “Vision refers to a picture of the future with

some implicit or explicit commentary on why people should strive to create that future" (p. 68) and "strategy provides both a logic and a first level of details to show how a vision can be accomplished" (p. 75).

Step four: communicating the change vision. "The real power of a vision is unleashed only when most of those involved in an enterprise or activity have a common understanding of its goals and direction. That shared sense of a desirable future can help motivate and coordinate the kinds of actions that create transformations" (Kotter, 1996, p. 85). In order to effectively communicate the change vision, Kotter (1996) suggests that communications be presented using simple and concise language that is free of any esoteric or technical jargon. Communications should make use of metaphors, analogies, or examples where appropriate. Kotter also recommends the use of multiple communication channels and repetition.

Step five: empowering employees for broad-based action. "Major internal transformation rarely happens unless many people assist. Yet employees generally won't help, or can't help, if they feel relatively powerless. . . . The purpose of stage five is to empower a broad base of people to take action by removing as many barriers to the implementation of the change vision as possible" (Kotter, 1996, p. 102). Barriers often manifest themselves as organizational structures, systems, or management styles that are not aligned with the change vision. If a change requires employees to master a new skill set, acquisition of that skill set can become a barrier as well if left unaddressed.

Step six: generating short-term wins. According to Kotter (1996), short-term wins are important for several reasons. First, they help justify the short-term costs of the change effort. They also boost morale and motivation. Short-term wins provide tangible

data that reinforce the change vision and demonstrate for senior management that the change effort is on track. They stand in the face of resistors. Finally, short-term wins help pick up the momentum; spectators become active participants in the change effort.

Step seven: consolidating gains and producing more change. Kotter extends the following warning: "Whenever you let up before the job is done, critical momentum can be lost and regression may follow" (1996, p. 133).

Step eight: anchoring new approaches in the culture. "Anchoring a new set of practice in a culture is difficult enough when those approaches are consistent with the core of the culture. When they aren't, the challenge can be much greater" (Kotter, 1996, p. 154).

Kotter's Model in Action

Numerous organizations have successfully led change using Kotter's (1996) eight-step model. Kotter's own internet site presents several case studies (Kotter International, n.d.). Red Robin, the national restaurant chain, successfully reduced the time needed for its new restaurants to normalize – achieve normal rates of return, profitability and productivity – from three years to four months using Kotter's model. Similarly, Norfolk Southern successfully improved its safety and operations standards, reducing its number of workplace injuries by 97%, using Kotter's model.

A third case study presented on Kotter's internet site, and also published independently, concerns Centrelink, a service delivery agency for the Australian Government established in 1997. Centrelink "underwent extensive change, seeking to build a management capacity by positioning itself and interacting with organizations in its complex environment, and aligning management systems in support of its objectives"

(Halligan, 2008, p. 1). Kotter's eight-step model played a significant role in the approach undertaken by the organization's CEO, Sue Vardon.

> Vardon chose this model for the Centrelink transition on the basis of its comprehensiveness and applicability. The model was almost tailor made for the Centrelink transition and beyond, and Vardon used it to great effect. It contained highly relevant guidelines for a CEO faced with the external and internal environments of a public service agency in transition. (p. 70)

Vardon developed a vision and assembled a guiding coalition to lead the change. The guiding coalition instituted "short-term cycles of action and reflection by accelerating the pace of change and applying their combined business experience and judgment to problems as a team" (Halligan, 2008, p. 73). The coalition reinforced the vision, removed barriers, created opportunities for short-term wins, and helped anchor new approaches in the organizational culture. "As a consequence, the organization was able to claim that, in time, it became more customer centered, service delivery conscious, client oriented and performance focused" (p. 81).

A fourth case study, presented by Hayes and Richardson (2008), illustrates several shortcomings of Kotter's model. The case study concerns Rhythm, a software development company in Dublin that transitioned to a new software development process known as Scrum. According to Hayes and Richardson (2008),

> the steps outlined by Kotter were beneficial when implementing the Scrum process at Rhythm. However, there were aspects relating to agile development and software engineering in general that were either overlooked or not given enough consideration. Likewise, there were elements of the framework that were unnecessary or did not warrant as much attention as Kotter advised. (p. 169)

Kotter's model assumes a top-down approach, whereas "at Rhythm, the change project was introduced by middle management. As a result, one of the first steps conducted in the change project required gaining the support and approval of senior and

corporate management teams" (Hayes & Richardson, 2008, p. 169). Additionally, Kotter's model does not call for a pilot project, an undertaking "that worked extremely well for Rhythm as it helped to eliminate stress and apprehension and allowed the team to become self-organized, self-managed and self-directing" (p. 169). On the other hand, Kotter's steps concerning the development of a vision, the communication of that vision, and the generation of short-term wins, all worked well for Rhythm.

> Following Kotter's model was a beneficial starting point for implementing a change project and although it wasn't entirely suitable; its use prevented the Rhythm team in Dublin from making some of the customary mistakes that organizations often make during change projects. Without using Kotter's model, the organization may have faced difficulty in implementing agile development. (p. 169)

Summary

Despite the numerous benefits of HIT, healthcare organizations are slow to adopt. Adoption barriers include the cost of implementation and maintenance, the difficulty in defining return on investment, and physician resistance. Success factors, as perceived by healthcare executives and industry experts, include the allocation of an appropriately sized budget, consistently supportive leadership, structured project management, adequate implementation testing, and end user involvement.

While success factors as perceived by healthcare executives and industry experts are fairly well understood, success factors as perceived by HIT end users are not well defined in the literature. This study sought the perspective of the HIT end user in answering the question: How is HIT successfully implemented? Due to the subjective nature of this research question, the study adopted a qualitative approach. In defining qualitative research, Creswell (2003) wrote:

> Individuals seek understanding of the world in which they live and work. They develop subjective meanings of their experiences – meanings directed toward certain objects or things. These meanings are varied and multiple, leading the researcher to look for the complexity of views rather than narrowing meanings into a few categories or ideas. The goal of the research, then, is to rely as much as possible on the participants' views of the situation being studied. (p. 8)

Therefore, this study attempted to qualitatively describe the strategies, actions, and other factors that contribute to the successful implementation of HIT as perceived by HIT end users.

Chapter Three: Methodology

Introduction

Despite the wide recognition of health information technology (HIT) as a key enabler in the quest to improve the quality of healthcare, the United States continues to lag behind other countries in its adoption of HIT (Chin, 2004; Jha et al., 2009; Schoen et al., 2006). The recently passed American Recovery and Reinvestment Act of 2009 allocates over 20 billion dollars "to aid in the development of a robust IT infrastructure for healthcare and to assist providers and other entities in adopting and using health IT" (Healthcare Information and Management Systems Society, 2009, p. 1), however, funding and incentives alone will not necessarily lead to successful implementations and increased HIT adoption (Goldstein & Zhang, 2009).

HIT implementation success factors as perceived by healthcare executives and industry experts are well documented in the literature. Few studies, however, have focused on the perceptions of HIT *end users* such as physicians and nurses (Jensen & Aanestad, 2007). The purpose of this exploratory case study was to describe the strategies, actions, and other factors that contribute to the successful implementation of HIT as perceived by HIT end users. That is, this study sought the perspective of the HIT end user in answering the question: How is HIT successfully implemented?

Following the organizational structure suggested by Roberts (2004), this chapter presents the research methodology that guided this study. The first section introduces and describes the rationale for the proposed research design. This is followed by a description of the data sources, sampling procedures, and instrumentation used. The data collection and analysis procedures are discussed next, followed by a discussion of

protective measures related to the participation of human subjects. The chapter concludes with a discussion of the study's methodological limitations.

Research Design

The case study research methodology was used to describe the strategies, actions, and other factors that contribute to the successful implementation of HIT as perceived by HIT end users. This method was used because the investigator sought to explain *how* an organizational process worked (Yin, 2009). Moreover, the investigator had "clearly identifiable cases with boundaries and . . . [sought] to provide an in-depth understanding of the cases" (Creswell, 2007, p. 74).

The organizational process explored in this study was HIT implementation. The specific cases explored included an April 2008 HIT implementation at an adult hospital, hereafter referred to as Hospital A, and a September 2008 HIT implementation at a children's hospital, hereafter referred to as Hospital B. Several factors led to the selection of these two cases: (a) both implementation events occurred relatively recently; (b) both were convenience cases, that is, both hospitals represented populations that could be conveniently sampled by the investigator (Creswell, 2007); and (c) an exploration of two cases leading to a cross-case synthesis would likely generate richer findings than a single-case analysis (Yin, 2009).

Data Sources

Hospital A is consistently ranked among the top hospitals in the nation by U.S. News and World Report. Located in California, the 613-bed adult hospital supported over 20,000 admissions and 40,000 emergency patient visits in 2008. In April of 2008, Hospital A implemented a new inpatient electronic health record system developed by

Epic Systems Corporation. Though the initial launch was not without its challenges, the implementation was considered a success by the organization.

Hospital B, also located in California, is an internationally recognized children's hospital. In fiscal year 2008, the 272-bed hospital supported over 80,000 days of inpatient care, 134,000 clinic visits, and 5,000 births. In September of 2005, the hospital successfully implemented Cerner Corporation's electronic health record system across the majority of its inpatient units. In September of 2008, the Pediatric Intensive Care Unit (PICU) at the hospital jumped onboard by implementing the Cerner system as well.

The April 2008 Epic implementation at Hospital A, and the September 2008 Cerner implementation in the PICU at Hospital B, constituted the two cases explored in this study. As is typical with case study research, the investigator drew upon multiple data sources to develop case descriptions and identify case-based themes (Creswell, 2007). Using multiple sources of data strengthened the construct validity of the study (Yin, 2009). "Any case study finding or conclusion is likely to be more convincing and accurate if it is based on several different sources of information, following a corroboratory mode" (p. 116).

Primarily, the study drew upon interview data. The investigator expected guided conversations with HIT end users at both hospitals to reveal important insights into the recent HIT implementations. According to Yin (2009), interviews are an essential source of evidence when dealing with human affairs or behavioral events. "Well-informed interviewees can provide important insights into such affairs or events" (p. 108).

Factual details related to the HIT implementation events were culled from secondary sources such as press releases, news articles, and internal presentations (Yin,

2009). These sources were used as appropriate to help contextualize and corroborate the interview data. Additionally, the investigator, an employee at Hospital A and a direct participant in the 2008 Epic implementation, contributed observational data to the case study. The participant-observation technique allowed the investigator to "perceive reality from the viewpoint of someone 'inside' the case study rather than external to it" (p. 112).

Sampling Procedures

The target population at Hospital A included approximately 2,164 attending physicians, 894 resident physicians, and 1,471 registered nurses. The target population at the Hospital B PICU included approximately 23 attending physicians, seven critical care fellows, and 75 registered nurses. The investigator employed several sampling strategies to select interviewees from each respective population that could "purposefully inform an understanding of the research problem" (Creswell, 2007, p. 125). The investigator began by narrowing the sample based on several criteria (Miles & Huberman, 1994). Though numerous ancillary staff including technicians, therapists, and social workers use HIT at both hospitals, the dominant HIT end users are physicians and nurses. Others were less likely to contribute useful insights and were therefore excluded. The investigator further narrowed the sample by excluding any individuals hired *after* the respective implementation events. Individuals that did not personally experience the implementation events were also less likely to contribute useful insights.

To ensure the selection of a sample that captured a proportional representation of attending physicians, resident physicians, and nurses at each hospital, the investigator stratified the respective populations by role. This stratified purposeful sampling strategy allowed the investigator to look for differences between physician and nurse perceptions

(Miles & Huberman, 1994). Physicians meeting the established sampling criteria were identified with the assistance of the Office of Medical Staff Services. Nurses meeting the established sampling criteria were identified with the assistance of the Chief Nurse Scientist at each respective hospital.

The investigator employed a convenience sampling strategy to select specific interviewees, that is, the investigator selected individuals consistent with the sampling criteria from whom he could easily collect data (Creswell, 2007). To recruit physicians, the investigator initially reached out to those with whom he was familiar. When unable to identify a sufficient number of willing participants, invitations were sent to randomly selected physicians. Nurses were recruited with the assistance of the Chief Nurse Scientist and Nurse Managers at each respective hospital. All invitations to participate in the study were sent via e-mail and included a description of the study's purpose, the estimated time commitment for the participant, the participant's rights, and an assurance of confidentiality.

While quantitative sampling logic and the typical criteria regarding sample size do not apply to qualitative research (Yin, 2009), the investigator recognized that the certainty of the captured understanding would grow with the sample size. To obtain a maximally clear understanding of the cases, the investigator conducted as many interviews as required until "successive interviews/observations . . . both formed the basis for the creation of a category and confirmed its importance" (p. 330), thereby achieving theoretical saturation (Bryman & Bell, 2003).

Instrumentation

Qualitative research typically employs a loosely structured approach to interviewing (Bryman & Bell, 2003). “Interviewers can depart significantly from any schedule or guide that is being used” (p. 342). Nevertheless, Creswell (2007) suggests that investigators develop and use an interview protocol including approximately five open-ended questions. Therefore, the investigator conducted interviews using a semi-structured interview guide. As is consistent with an in-depth case study interview, interviewees were prompted to offer both factual details as well as their opinions regarding the implementation events (Yin, 2009). The investigator invited each interviewee “to propose her or his own insights into certain occurrences and . . . [used] such propositions as the basis for further inquiry” (p. 107).

The initial interview questions (see Table 1) aimed to represent a narrowing of the central research question (Creswell, 2007). The questions were developed with Kvale’s (1996) nine question types in mind, and written in such a way as to allow interviewees a fair amount of freedom in how they could respond. According to Bryman and Bell (2003), leading questions should be avoided and “the formulation of the research question(s) should not be so specific that alternative avenues of enquiry that might arise during collection of fieldwork data are closed off” (p. 348).

As suggested by Yin (2009), the interview questions were further refined through pilot testing. The investigator conducted a mock interview with the assistance of two colleagues. The first colleague, a physician, served as the interviewee. The second colleague served as an observer and took notes. The colleagues provided feedback regarding the clarity and appropriateness of the questions asked, and more generally, the

investigator's interviewing skills. As a result, the interview questions were revised (see Table 2) to avoid leading the participant, ensure ease of comprehension, and maximize the quality of data collected.

Table 1

Initial Interview Guide

Question Type	Question
Introducing	Please tell me about your experience with the HIT implementation that took place in 2008.
Follow-up	To what extent were you involved in any of the implementation activities, for example the planning, design, and/or "Go-Live" support activities?
Indirect	To what extent were your colleagues (and other end users) involved in any of the implementation activities?
Follow-up	What training did you receive?
Probing	How do you think the implementation went overall?
Follow-up	What do you believe went well?
Follow-up	What do you believe could have been done better?
Probing	What role did leadership personnel, including supervisors, managers, directors, and executive administrators, play during the implementation project?
Probing	How well was the organization's goal communicated to you?
Direct	In what way(s) has the new system impacted the overall quality of patient care you are able to provide?
Follow-up	Can you share some specific examples?
Direct	What do you believe should be done differently the next time the organization engages in an HIT implementation project?

Table 2

Revised Interview Guide

Question Type	Question
Introducing	Please tell me about your experience with the transition to Epic/Cerner that took place in 2008.
Follow-up	To what extent were you involved in any of the implementation activities, for example the planning, design, testing, and/or "Go-Live" support activities?
Probing	How do you think the implementation went overall?
Follow-up	What do you believe was done well?
Follow-up	What do you believe could have been done better or differently?
Follow-up	What training did you receive and what did you think of it?
Probing	Can you describe how the organization's goal was communicated to you?
Probing	Can you describe how the organization's leadership team managed the transition?
Direct	In what way(s) has the new system impacted (positive or negative) the overall quality of patient care you are able to provide?
Direct	Would you characterize the implementation as "successful"? Why or why not?
Follow-up	How do you define "successful"?
Probing	What do you believe needs to be done to ensure 100% success the next time the organization engages in an HIT implementation project?
Follow-up	Anything else you would like to add?

Data Collection Procedures

The investigator used an interview protocol, that is, "a predesigned form used to record information collected during an observation or interview" (Creswell, 2007, p. 135). The protocol (see Figure 1) included: (a) a section for recording demographic information to be used to contextualize responses, (b) a prompt to review a description of the study and the interviewee's rights with the interviewee, (c) a prompt to review the Information Sheet with the interviewee, (d) the interview questions, and (e) a prompt to thank the interviewee and reiterate that the interviewee's identity would be kept confidential. As recommended by Creswell (2007), adequate recording procedures were followed. A digital voice recorder was used to capture an audio recording of each interview.

Document collection followed a less rigid protocol. As is consistent with case study research, systematic searches for relevant documents occurred at the investigator's convenience (Yin, 2009). In addition to internet searches for publicly available documents such as press releases and news articles, the investigator arranged access to securely examine internal documents such as staff announcements, slide presentations, and project plans. All documents, interview transcripts, and notes were stored in a password-protected case study database such that both the investigator and other authorized persons could easily retrieve them at a later time. As Yin (2009) suggests, "a case study database markedly increases the reliability of the entire case study" (p. 119).

INTERVIEW PROTOCOL

Study Title: Understanding the End User Perspective: A Multiple-Case Study of Successful HIT Implementation

Principal Investigator / Interviewer: Bardia Behravesh

Date/Time/Location of Interview:

Subject Demographics	
Role/Dept:	**Years Experience in Healthcare:**
Hospital A/B:	**Years Experience w/ HIT:**
ID Code:	**Super User (Yes/No):**

Project Summary *(read aloud to subject)*
Before we begin, let me start by telling you a little about myself, this project, and your rights as a participant. I work here at the medical center and I'm also working on a doctorate through Pepperdine University. This project is my dissertation research.

I became interested in HIT in my previous role here at the medical center working on the Epic project. In reviewing the literature around HIT implementation, I noticed that the vast majority focused on the perceptions of healthcare executives and industry experts. So I decided to design a study that would look at physician and nurse perceptions of HIT implementation. Specifically, the purpose of the study is to understand what physicians and nurses perceive to be the factors that influence the success of health information technology implementations.

This interview will last roughly 20-30 minutes. I will ask series of open-ended questions prompting you to reflect upon the recent health information technology implementation that occurred in your workplace. You have the right to refuse to answer any question.

With your permission, I will record the interview, however, you do have the right to refuse audio recording of the interview. The recording will be transcribed and then destroyed. Your name and any other information which may lead to your personal identification will be omitted from the interview transcript and all presented and published data resulting from the study. Your participation is voluntary and your decision whether or not to participate in this study will not affect your employment. You have the right to withdraw from the study at any time.

(review the Information Sheet with the subject, then ask for permission to begin recording)

Questions

1. **Please tell me about your experience with the transition to (Epic / Cerner) that took place in 2008.**
   1.1. To what extent were you involved in any of the implementation activities, for example the planning, design, testing, and/or "Go-Live" support activities?

2. **How do you think the implementation went overall?**
   2.1. What do you believe was done well?
   2.2. What do you believe could have been done better or differently?
   2.3. What training did you receive and what did you think of it?
   2.4. Can you describe how the organization's goal was communicated to you?
   2.5. Can you describe how the organization's leadership team managed the transition?

3. **In what way(s) has the new system impacted (positive or negative) the overall quality of patient care you are able to provide? (Can you share some specific examples?)**

4. **Would you characterize the implementation as "successful"? Why or why not?**
   4.1. How do you define "successful"?
   4.2. What do you believe needs to be done to ensure 100% success the next time the organization engages in an HIT implementation project?
   4.3. Anything else you would like to add?

(Thank the subject for participating in the interview; reiterate that his/her identity will be kept confidential; and offer to provide him/her with a summary of the study findings.) ☐ **Summary Requested**

Figure 1: The protocol followed during each interview.

Data Analysis

The data analysis occurred in three phases consistent with the core elements of qualitative data analysis (Creswell, 2007). To begin, the investigator reviewed the documents, observations, and interview transcripts in the case study database to identify major organizing ideas. This coding phase involved "reducing the data into meaningful segments and assigning names for the segments" (p. 148). As suggested by Creswell, these code names represented information that the investigator expected to find, surprising information, or conceptually interesting or unusual information. Initially, codes were noted on document and transcript margins. Upon a second pass, codes were transferred to an electronic spreadsheet to facilitate further analysis.

Following the coding phase, the investigator identified patterns and combined codes into broader categories or themes. Throughout this classification phase, the investigator looked for multiple sources of evidence to support each emerging category and noted any evidence of multiple perspectives within a given category (Stake, 1995). Using the constant comparative method developed by Glaser and Strauss (1967), the investigator attempted "to 'saturate' the categories – to look for instances that [represented] the category and to continue looking (and interviewing) until the new information obtained [did] not further provide insight into the category" (Creswell, 2007, p. 160).

In the final phase, the investigator completed a cross-case synthesis. The cross-case synthesis treated each case as a separate study (Yin, 2009). The investigator created an electronic spreadsheet that displayed the data from the individual cases by category.

The investigator then examined each table for cross-case patterns which illuminated similarities and differences between the cases.

To ensure that the final account of each case was internally valid, the investigator employed several strategies. First, the investigator made use of multiple sources of data. Through a process of triangulation, the investigator corroborated evidence from different sources to identify categories (Creswell, 2007). Where multiple interviewees provided similar responses to the same question, or where interview responses matched data gleaned from case documents, categories were defined. To further ensure the internal validity of the findings, the investigator solicited the assistance of a peer reviewer to provide "an external check of the research process, much in the same spirit as inter-rater reliability in quantitative research" (p. 208). The peer reviewer questioned the data analysis methods employed by the investigator as well as his interpretations of the data (Lincoln & Guba, 1985). A written account of these debriefing sessions was kept by the peer reviewer and the investigator.

Human Subjects Protection

The investigator requested permission to recruit subjects at both hospitals in September 2009. The Chief of the Medical Staff at each hospital granted permission to interview physicians and directed the investigator to the Office of Medical Staff Services to obtain a list of all medical staff. Similarly, the Chief Nursing Officer at each hospital granted permission to interview nurses and directed the investigator to work with the Chief Nurse Scientist to recruit subjects. Furthermore, the investigator's research proposal was approved by the hospitals' Institutional Review Board on October 2, 2009

and the Pepperdine University Institutional Review Board on December 16, 2009 (see Appendix).

Each subject was interviewed privately by the investigator in a location and at a time of the subject's choosing. Each subject was interviewed once only for approximately 15 to 30 minutes. Subjects had the right to refuse to answer any question and the right to refuse audio recording of the interview.

The investigator securely stored the recorded interviews on his password-protected laptop computer until transcribed. Once the transcriptions were completed, all audio recordings were deleted. Names and any other information which could lead to the personal identification of subjects were omitted from all notes and transcripts. Each subject was assigned an identification code based on role and organization. For example, the first nurse interviewed at Hospital B was identified as *BRN-1* throughout the case study database and all reported findings. The key to this code was kept as a separate file on the investigator's password-protected laptop computer. Subjects were informed that their individual privacy would be maintained in all presented and published data resulting from the study, and that collected data would be kept in a secure manner for five years at which time the data would be destroyed.

The probability and magnitude of harm or discomfort anticipated in the research were of minimal risk, that is, they were not greater in and of themselves than those ordinarily encountered in daily life. The potential risks associated with participation in the study included feeling anxious, uncomfortable, bored, or fatigued during the interview. In the event that a subject felt anxious or uncomfortable, the subject had the right to refuse to answer any question and the right to discontinue participation. In the

event that a subject felt bored or fatigued, the subject had the right to request a break and the right to discontinue participation. The investigator could not and did not guarantee or promise that subjects would receive any direct benefit from participation in the study. Subjects were informed, however, that the benefit of their participation to the profession may include a greater understanding of what is required to plan and execute a successful health information technology implementation project.

Subjects were informed that their participation was voluntary and that they had the right to discontinue participation at any time without penalty or loss of benefits to which they were otherwise entitled. Their decision whether or not to participate in the study did not affect their employment. If they decided to participate and found they were not interested in completing the interview in its entirety, they had the right to discontinue at any point without being questioned about their decision.

Limitations

"Qualitative researchers are interested not in prediction and control but in understanding" (Pinnegar & Daynes, 2007, p. 4). The investigator aimed to understand and provide an accurate account of each case. Moreover, the investigator aimed to produce externally valid research by describing what could be learned from the case exploration, particularly as it relates to the planning and execution of successful health information technology implementations.

It should be noted, however, that "interviewees' responses are subject to the common problems of bias, poor recall, and poor or inaccurate articulation" (Yin, 2009, p. 108). As is consistent with most exploratory case study research, the study findings should not be generalized to other cases (Creswell, 2007). Any attempt to generalize the

study findings to a broader theory must be tested through replication of the findings in additional cases (Yin, 2009). Nevertheless, by understanding the experiences within a single organization, lessons can be learned that could be of value to other organizations embarking on similar change projects.

Chapter Four: Results

Introduction

This exploratory case study sought to describe the strategies, actions, and other factors that contribute to the successful implementation of health information technology (HIT) as perceived by HIT end users. That is, this study sought the perspective of the HIT end user in answering the question: How is HIT successfully implemented? Using the case study methodology described in Chapter Three, the investigator interviewed twenty-nine end users that experienced the April 2008 HIT implementation at Hospital A, and seven end users that experienced the September 2008 HIT implementation in the Pediatric Intensive Care Unit (PICU) at Hospital B. Table 3 provides a summary of the interview participants including their respective hospitals, roles, departments, years of experience in healthcare, and years of experience with HIT.

All interviews were conducted between January 15 and April 12 of 2010. Ten interviews were conducted in the offices of the respective participants, eleven interviews were conducted in the investigator's office, fourteen interviews were conducted by telephone, and one interview was conducted in a hospital sitting area. The interviews ranged from 15 minutes to 30 minutes in length. The investigator took hand-written notes during all interviews. With one exception, all interviews were also recorded using a digital voice recorder and personally transcribed by the investigator. The transcripts, along with the notes taken during the unrecorded interview, were then analyzed as described in Chapter Three.

Table 3

Interview Participants

				Years of Experience[a]	
Narrative ID	Hospital	Role	Department/Unit	Healthcare	HIT
AMD-1	A	Attending	Surgery	23	18
AMD-2	A	Resident	Surgery	3.5	3.5
AMD-3	A	Attending	Surgery	26	26
AMD-4	A	Attending	Psychiatry	15	15
AMD-5	A	Attending	Anesthesia	29	15
AMD-6	A	Attending	Obstetrics & Gynecology	11	11
AMD-7	A	Attending	Medicine	13.5	13.5
AMD-8	A	Resident	Surgery	7	7
AMD-9	A	Resident	Medicine	2.5	2.5
AMD-10	A	Resident	Medicine	2.5	2.5
AMD-11	A	Attending	Psychiatry	41	23
AMD-12	A	Resident	Medicine	2.5	2.5
AMD-13	A	Attending	Emergency Medicine	8	8
AMD-14	A	Resident	Surgery	2.5	2.5
AMD-15	A	Resident	Surgery	4.5	4.5
AMD-16	A	Resident	Medicine	2.5	2.5
AMD-17	A	Resident	Surgery	7.5	7.5
AMD-18	A	Resident	Psychiatry	3.5	3.5
ARN-1	A	Nurse	Emergency	30	2
ARN-2	A	Nurse	Neurology	30	3
ARN-3	A	Nurse	Cardio Thoracic ICU	29	15
ARN-4	A	Nurse	Ostomy and Wound Care	17	11
ARN-5	A	Nurse	Endoscopy	25	15
ARN-6	A	Nurse	Cardiac Care Unit	30	25
ARN-7	A	Nurse	Intermediate Cardiac Care	30	30
ARN-8	A	Nurse	Intermediate ICU	5	5
ARN-9	A	Nurse	Intermediate ICU	3.5	3.5
ARN-10	A	Nurse	Intermediate ICU	42	6
ARN-11	A	Nurse	Med/Surg/Trauma ICU	13	13
BMD-1	B	Attending	Pediatrics	7	7
BMD-2	B	Attending	Pediatrics	32	27
BMD-3	B	Fellow	Pediatrics	6.5	6.5
BRN-1	B	Nurse	Pediatric ICU	8	4
BRN-2	B	Nurse	Pediatric ICU	3	1.5
BRN-3	B	Nurse	Pediatric ICU	4	1.5
BRN-4	B	Nurse	Pediatric ICU	3	1.5

[a]Refers to years of experience since medical or nursing school.

This chapter presents the findings from each of the two case studies. Each case study description begins with a brief introduction to the case. This introduction is followed by a summary of the themes that emerged during the analysis of the interview data. The chapter concludes with a cross-case synthesis.

Hospital A

Hospital A is a 613-bed hospital supported by approximately 2,164 attending physicians, 894 resident physicians, and 1,471 registered nurses. In April of 2008, the hospital implemented a new inpatient electronic health record system developed by Epic Systems Corporation. Though the initial launch was not without its challenges, the implementation was considered a success by the organization. To develop this case study description, the investigator reviewed several internal communications and presentations, and interviewed eight attending physicians, ten resident physicians, and eleven registered nurses. The investigator's personal observations as a participant in the implementation were also considered.

Preparation for the implementation began in late 2005. Various workgroups composed of physicians, nurse managers, information technology analysts, and members of the hospital administration were assembled to guide the implementation project and make key decisions. The hospital adopted an implementation methodology prescribed by Epic Systems Corporation which called for a series of Design, Build, and Validate (DBV) sessions. A subset of nurses and physicians, designated as Subject Matter Experts (SMEs), attended these DBV sessions. Together with information technology analysts and consultants from Epic, the SMEs made decisions about how the system would need to be customized. The necessary customizations were then built into the model system

and validated. The DBV sessions ran roughly from October 2006 through May of 2007. The DBV sessions were followed by several cycles of system testing and additional system build.

End user training began in late November of 2007. Nurses received 16 hours of classroom training over two days. Attending physicians received either two hours of online training followed by six hours of classroom training, or five hours of online training followed by three hours of classroom training, depending on their preference. Resident physicians received two to six hours of online training depending on their specialty.

Originally, the system was to be activated in late January of 2008. After several adjustments to the activation schedule to accommodate additional testing and preparation, the system was finally activated on April 25, 2008. Activation was followed by four weeks of twenty-four-by-seven on-site support provided by information technology staff and a team of Epic-experienced consultants contracted by the hospital. For ease of identification, the on-site support team wore green and red shirts branded with the hospital's logo; green shirts supported the physicians and red shirts supported nursing staff. In addition, a subset of nurses and physicians served as Super Users. These Super Users underwent additional training prior to activation so that they could support their colleagues. While nurse Super Users were released of their clinical duties and considered *out of the count* for the first two weeks following activation, physician Super Users saw patients and assisted colleagues concurrently. Five of the physicians and four of the nurses interviewed by the investigator served as Super Users.

All but one of the 29 interview participants characterized the implementation as successful. The investigator found the participants' definitions of success to be particularly noteworthy. When asked if she would characterize the implementation as successful, nurse ARN-1 responded: "Was it successful? Yes I would say it was in a way. I mean we implemented it and people started using it. No one died. Usually that's the key thing". Thirteen other participants responded similarly, that is, from their perspective, the implementation was successful because it did not cause any adverse events and it did not generate a revolt.

Analyzed further, however, a multi-dimensional definition of success began to emerge. Surgical resident AMD-15 had the following to say:

> Patient care didn't grind to a halt, so in that respect it was a success. And there weren't mass revolts or people refusing to use it. Did it make me go out and want to recommend [Epic] to other people, no, I don't think it was that successful.

Indeed, over half of the participants stated that the implementation could have gone better. Participants AMD-1, AMD-2, and ARN-10 stated that they do not believe the system has improved patient care. ARN-6 stated that the impact of the system on patient care is neutral at best. AMD-14, AMD-17, and ARN-8 stated that the implementation was a step in the right direction, but they also noted that there is room for improvement in terms of the usability of the system and how efficiently the system is used by different areas of the hospital. And AMD-3 and ARN-6 thought that the implementation was successful overall, but they cautioned that the current system does not function efficiently for all areas of the hospital.

Further analysis of the interview data led to the emergence of six themes which suggest factors that allow or inhibit HIT implementation success.

On-site support. The interview participants almost uniformly identified the presence of on-site support during the initial weeks as a critical success factor. Psychiatry attending AMD-4 recalled "that there was no impediment to asking for help" because there was so much on-site support available. For surgical resident AMD-8, on-site support "was the right way to spend the resources. It was good to have people walking around in a green or red shirt and that would be the person to go to for help". Medicine resident AMD-10 agreed with his colleague, stating that "the one thing that really succeeded in the transition was having on-site support. The green shirts were hugely successful in helping with the transition". Psychiatry attending AMD-11 "thought it was pretty cleverly handled by the administration" to have people "on the unit wearing different colored shirts to help [end users] learn the system". Medicine resident AMD-12 stated that "the best thing was having support staff everywhere". And for Surgical resident AMD-14, having a

> huge cadre of support staff at your beck and call for two weeks straight to troubleshoot . . . made it as smooth a transition as I could imagine. . . . And they had a lot of residents and physicians from other places where Epic was implemented as part of the support team. There are some things that you can only talk about with another medical person in terms of figuring things out, so that was good. . . . I think the two weeks of support was critical.

ARN-2 attributed the success of the implementation to the Super Users, stating that "they were able to help with the ongoing questions" and that "it was a good idea to invest in them". Similarly, ARN-6 stated having the Super Users around all the time was a good thing, and "the red shirts helped too". For ARN-9, the Super Users were critical:

> The Super Users were prepared very well so they could help us out well. And they kept us really updated, when they were going to roll it out, what the troubles were, and so we were never surprised by it.

ARN-8 echoed his colleagues, stating that “the fact that there was so much support after the launch” made the success possible. Similarly, ARN-1, ARN-5, and ARN-10 attributed the success of the implementation to the on-site support. The study investigator witnessed first-hand the need and appreciation for on-site support personnel while serving on the on-site support team. End users kept him busy during each of his support shifts and never failed to express their gratitude for his assistance.

System usability. System usability issues were a dominant theme throughout most of the interviews. Ten physicians and four nurses described the system as either user-unfriendly or unintuitive. Eleven physicians and four nurses described the searching and filtering capabilities of the system as inadequate. Nurse ARN-8 stated that while

> There is so much information being poured into it, there is no real facility for searching and finding what you want. . . . It’s the twenty-first century. We should be able to search the data. We should be able to sort the data. We should be able to filter any way we want.

Surgical resident AMD-14 echoed this concern, noting that “there are so many obvious ways that you could improve it in terms of searching for stuff and organizing things that it’s a shame they don’t do it”. AMD-4, AMD-8, and AMD-14 stated that the system should allow for greater personalization, and AMD-3, AMD-5, and S10 noted that correcting data entry errors is very difficult.

Seven participants stated dissatisfaction with the system’s ability to meet the specific needs of a protocol, their workflow or their unit. Medicine resident AMD-9 stated that “in terms of physician workflow, things are clearly missing” and psychiatry attending AMD-11 noted that “for people that are doing a lot of medication management . . . it’s not a terribly helpful system. . . . In general, none of these systems are set up for psychiatry”. Emergency Medicine attending AMD-13 stated that

> It really needs to be a separate system for the ED that integrates with the hospital system and not a hospital system that you try to tweak to make work for the ED because our practice pattern does not fit any other practice pattern.

Similarly, Cardiac Care Unit nurse ARN-6 stated that the system does not work well for a critical care environment and Endoscopy nurse ARN-5 noted that her unit has specific needs which the system does not support in a way that flows easily.

Four of the eleven nurses interviewed expressed dissatisfaction with the system's interface for documenting care plans. ARN-9 described the care plans as "a little unwieldy" and difficult to modify and individualize. Both ARN-7 and ARN-8 noted that the inefficient design results in double-charting. ARN-7 recalled:

> They kept on saying how easy care planning was going to be, you just make a few clicks and you have your care plan. . . . It's not individualized enough. People just click on things willy-nilly that don't actually pertain to the patient condition. The care plan doesn't actually drive care. . . . Information doesn't flow from the documentation flowsheet to the care plan or visa versa. Like documenting in the flowsheet that we're suctioning [the patient] every two hours, you have to separately go into the care plan to say that you've cleared the airway every hour and click that the goal met this shift.

Seven physicians and one nurse stated that the system seems to be designed for billers and coders, not clinicians. As surgical resident AMD-15 summarized:

> It's certainly not very easy to use, and it's frustrating that it seems to be designed from the perspective of the financial people or the bean counters or whatever, and not really in terms of the clinical people that take care of patients, write orders, and have to use this thing to get patients what they need.

End user frustration with the usability of the system was personally observed by the study investigator while he served on the on-site support team. He assisted a countless number of end users that had unsuccessfully attempted to navigate the system to locate the information they required.

Physician documentation. Another significant theme centered around the system's impact on the quality of physician documentation. Nine of the eighteen physicians interviewed reported that the implementation adversely affected the quality of physician documentation. Prior to the implementation, progress notes were dictated. Notes are now typed directly into the system, a task which is far more time-consuming in comparison to dictation. As surgical attending AMD-3 explained:

> Some of us are good typists and others of us are not. If you're not a good typist, then you don't really want to say much in your note and so you end up letting certain things slide. . . . I think you end up communicated less well.

Moreover, the system-generated templates appear to do more harm than good. Medicine resident AMD-9 stated that "so many things are pre-populated, that the notes contain irrelevant information, making the note really long and obstructing the important information". Medicine attending AMD-7 echoed the resident, adding that

> There's a lot of copying that happens and a lot of it isn't relevant data. I don't think people are going through to read it as carefully as one should when copying and it's just a matter of how much time people have when writing the notes.

Medicine resident AMD-12 stated that some physicians are abusing the copy and paste functionality, therefore generating "notes that are not reflecting at all what's happening from day to day". Surgical resident AMD-15 concurred:

> Our progress notes aren't as good, less concise and less useful to other people, even to ourselves, because template-driven progress notes include a lot of garbage. . . . So notes become longer but contain less information and are less readable.

Shortly after activation, while serving on the on-site support team, the study investigator assisted a physician dealing with this very problem. The physician wanted to insert a specific set of lab results into his progress note. The system, however, only

allowed him to insert a generic summary of recent lab results containing additional data irrelevant to the focus of the progress note.

Nursing workflow. The system's impact on the nursing workflow also emerged as a significant theme. Nine of the eleven nurses interviewed reported that the increased charting requirements as a result of the implementation are pulling them away from patient care. According to ARN-2, "there's a lot of charting now. There's at least two and a half hours of charting for every eight hour shift, and that takes away from patient care". ARN-3 concurred:

> Just because the system can do something doesn't mean we should be doing something with it. They keep adding more and more and more things for us to chart, to the point where it pulls us farther and farther away from the patient. . . . These are new things that we didn't chart before Epic, like care plans we were charting every 24 hours and all of the sudden we need to do it every 12 hours.

Nurse ARN-11 reported going from spending about five to ten percent of her time charting to roughly 40 percent of her time charting. Nurse ARN-3 shared:

> Relatives and patients in the ICU, when I used to work there, they would tell me that we spend more time with the computers now than with the patients. I have to agree with that. It does take you away from patient care a bit. Charting is more labor intensive.

Nurse AMD-5 stated that now nurses "focus 80 percent of their time on their computer and less time with their patients. . . . [Their] main focus now seems to be worrying about the charting". Nurse ARN-7 was particularly vocal about this issue, recalling a recent visit by a Joint Commission surveyor:

> The surveyor actually came out, and I was there, this is not hearsay, and out of her mouth said "this system gets in the way of patient care". . . . The reason I'm so upset about it is that some of us at the bedside and managers have been saying this over and over to no avail and it's very frustrating. . . . [Administrators] need to examine that more closely. And examine what they want nurses to be. Do they want nurses to be [loggers] of information, or do they want them – I mean it's not either or, we have to have documentation, but the emphasis has to be patient care.

Training. Another dominant theme centered on dissatisfaction with the end user system training. Eight participants found the training to be boring, too long, or simply not helpful. Seven participants stated that the training came too far ahead of activation – by the time the system was activated, several months later than originally planned, they had forgotten what they had learned. Indeed, the organization's decision to delay the activation of the system occurred well after end user training had begun. While providing on-site support, the study investigator observed that many end users, as a result of the delay, had not retained what they had been taught during their classroom training.

Six participants stated that the training did not adequately address the needs of their specialty or specific workflow. Fourteen participants found that the training, while useful as an introduction, did not fully prepare them to work with the new system. Anesthesia attending AMD-5

> found it very unhelpful because it related to a lot of things you would do on the floor. I think if I were an internist it would have been more useful. . . . And by the time it was actually implemented, the training had been so far in advance that I really had to learn on the job. . . . They can tell you how to log in and how to open things, and you kind of remember that stuff, but then you actually learn how to use it by using it.

For surgical resident SMD 8, the training "was good for the general issues . . . but for the most part, for the nitty-gritty, [he] just [liked] trying it and being able to ask for help". According to medicine resident AMD-9, "you can't learn everything in a couple-hour lecture; you need to be actually doing it in real-time in order for it to stick". Medicine resident AMD-12 agreed with his colleague:

> Clearly a lot of work was put into [the online tutorial] but the end utility to the user was minimal. . . . I think beyond a very modest degree of making you

> familiar with how the screens work. . . . I think all medicine residents would say that they really learned by just troubleshooting as they used the live system for the first time. I think that before going live and using it on actual patients, people had little to no practical training.

Several of the nurses interviewed made similar statements. For ARN-1, the training "was very generic" and "should have been tailored to the actual workflow". For ARN-2, "training on the computers and practicing practical things without the patient . . . [did not] translate at all. Once [nurses] are on the unit with patients, it's a lot different". And for ARN-8, the depth of the training was insufficient:

> There wasn't enough of it. It didn't go deep enough. . . . It was more like recipes. . . . "In order to document this, go here". In order to document that, zap, you go to a completely different place. And so, there is no cohesiveness that is apparent until you start to use the software for a length of time.

Six participants stated that they would have preferred a phased approach to training or some other form of follow-up. As ARN-10 explained:

> I don't think there was enough follow-up afterwards. . . . Our suggestion at one point was that people have a formal class maybe six months after go-live, after they've been charting for awhile, so that they can then know enough to ask questions on stuff that they didn't absorb enough to even know how to ask questions on.

Similarly, attending physician AMD-13 stated that "the initial training was adequate, but . . . there was no follow-up training". He would have preferred "training, real world practice, and then more training potentially to answer any questions and optimize" his usage of the system.

Implementation goals. Another theme identified by the investigator centered on the participants' understanding of the implementation goals. Specifically, thirteen physicians and three nurses saw the implementation as inevitable; the organization was simply keeping up with the times. AMD-3 stated that "part of it is that we have to do it

because that's the move the country is making for healthcare, period". AMD-4 got the sense that the organization was "going to the twenty-first century and this was what [it was] supposed to do". AMD-5 asked "It's inevitable isn't it? If you haven't got one you better get one soon". AMD-6 stated that "if you work in medicine, you know what the goals are. . . . The goals are very straight forward". AMD-7 stated that "it's pretty obvious that in this day in age you can't have a major medical center without an EMR". For AMD-8, it's "just one of those things that at the end of the day you knew it had to be done sometime".

AMD-10 "saw that the nation needed to go this way. . . . It really didn't need to be explained". AMD-11 "figured everyone's doing it" and AMD-12 thought the goal "was relatively self-evident". AMD-13 stated that the staff "all understand that all the records are going to transition that way". AMD-14 stated that the organization's goal "was sort of implicit" and "almost self-apparent" and AMD-17 understood "that at some point all hospitals are going to be required to have EMRs". AMD-18 stated that it's "the future of medicine and the direction we're going in". The message ARN-1 got was that "a lot of hospitals are doing it and we should too" and ARN-4 stated that "there's a big push by the government to do this". And lastly, ARN-10 stated that "everyone understands that it's the wave of the future. It's not even future anymore, it's now".

Moreover, several participants stated their belief that the organization was perhaps not entirely forthcoming about its goals. As AMD-15 explained:

> [One goal] that nobody really talked about . . . and I think drives a lot of this is billing and coding. I have some knowledge of how that stuff works and subsequently, a lot of the workshops have been dealing with what words to use in your medical records so that billers and coders can code efficiently, so we get paid for hospitalizations, and so that our severity of illness looks appropriate, and so that our outcomes will look appropriate for the case complexity we see.

Similarly, AMD-3 felt the organization was not entirely forthcoming:

> I guess for me personally, I would rather have the institution just tell me why they're doing it. If it's business decision, it's a business decision. I don't want them to sugarcoat it. . . . I think the hospital did this for billing reasons . . . . Most of us are skeptical and don't really believe what we're told in these situations.

Based upon the study investigator's personal observations while serving on the implementation project team, the organization's goals were far from transparent. He gathered that the organization desired to make both quality and operational improvements by establishing a single integrated hospital-wide clinical information system. To his knowledge, however, specifics beyond this generalization were not explicitly communicated.

Hospital B

Hospital B is a 272-bed hospital supported by approximately 835 medical staff and 2,599 nursing, ancillary, support, and administrative staff. In September of 2005, the hospital successfully implemented Cerner Corporation's electronic health record system across the majority of its inpatient units. Subsequent phases saw the system activated in higher acuity units. In October of 2007, the Neonatal Intensive Care Unit (NICU) began using the system, and in September of 2008, the Pediatric Intensive Care Unit (PICU) jumped onboard. The Cardiovascular Intensive Care Unit (CVICU) is expected to follow suit in September of 2010.

This case study focused on the September 2008 implementation that occurred in the PICU. The PICU is supported by approximately 23 attending physicians, 7 critical care fellows, and 75 registered nurses, among other ancillary and support staff. Additionally, 6 pediatric residents rotate through the unit on a monthly basis. To develop

the case study description, the investigator reviewed several internal communications and presentations, and interviewed two attending physicians, one fellow, and four registered nurses.

Preparation for the implementation began in February of 2008. A workgroup including PICU nurses, physicians, the unit manager, an information technology analyst, and members of the Clinical Informatics Department was assembled to review the system and identify customizations that would be required to support the implementation. To familiarize staff with the key components of the system, a number of brief sessions were delivered at the bedside and at the nurses' station on the unit. Formal training began in late July 2008. Nurses received 16 hours of training over two days. Attending physicians and fellows received one hour of training.

The system was activated on September 7, 2008. Activation was followed by six weeks of twenty-four-by-seven on-site support provided by Super Users – nurses and physicians that had received additional training in order to support their colleagues. For the initial week, there were five nurse Super Users out of the count providing support. This number was reduced by one each week, with only one Super User out of the count during weeks five and six. Several physicians from Cerner Corporation provided physician support during rounds for two weeks, there was an extra resident on-site for two weeks, and the Medical Director for Clinical Informatics rounded daily for three weeks. Two of the interview participants, BMD-3 and BRN-4, served as Super Users.

The interview participants uniformly characterized the implementation as successful. As with the previous case, the investigator found their definition of success to be particularly noteworthy. Both attending physician BMD-2 and nurse BRN-2

characterized the implementation as successful because patient care was not adversely affected. BRN-2 characterized the implementation as successful because everybody "was able to transition and actually use the charting system even though there were people who believed they couldn't do it or were very reluctant to". Nurse BRN-1 echoed this characterization, stating that "everybody is comfortable with it" and "using it".

Analyzed further, however, a multi-dimensional definition of success began to emerge. Attending physician BMD-1 shared that while the "data would suggest that patient safety has been improved, [she is] not completely convinced of that". Similarly, BMD-2 found it hard to say if the system had improved patient care. While BRN-2 acknowledged that the system will allow for more efficiency in the long run, she also noted that improvements are needed. Similarly, nurses BRN-3 and BRN-4 agreed that while the implementation was successful in some areas, improvements are needed in others.

Further analysis of the interview data led to the emergence of five themes which suggest factors that allow or inhibit HIT implementation success.

On-site support. The interview participants almost uniformly identified the presence of on-site support during the initial weeks as a critical success factor. For attending physician BMD-1:

> It was really helpful to have people in the unit that were from Cerner or that were much more trained and adept in the system when it was implemented. . . . Otherwise our workflow that day would have been a disaster. It would have taken us so much longer to round. . . . It was good to have Super Users.

Fellow BMD-3 echoed her colleague, stating that the Super Users and other on-site support personnel were critical to the success of the implementation. She did note, however, that while there was a lot of support for nursing staff, there was very little

support for physicians. More physician support, she said, “could have made the transition go even smoother”.

All four nurses interviewed by the investigator corroborated these findings. BRN-1 thought the Super Users “really helped” and BRN-2 recalled that “there were a lot of Super Users. . . . [It] was nice because we didn’t have to worry about having to sit there and figure it out”. BRN-3 and BRN-4 were similarly pleased with the number of Super Users and other on-site personnel. However, like BMD-3, BRN-4 felt that “the doctors were left high and dry” and would have benefited from having as much support as did the nurses. She recalled one day in particular when one of the resident physicians sat at the computer for 14 hours and wrote orders because the attending physicians, unable to enter the orders themselves, were offloading the responsibility onto the resident.

System usability. System usability issues were a dominant theme throughout all of the interviews. Attending physician BMD-1 described the system as “non-intuitive”, noting that learning simple tasks, like setting up a patient list, require a five-minute explanation. Attending physician BMD-2 stated that consult notes are not organized in an intuitive way and the system does not facilitate the generation of daily progress notes. Nurse BRN-3 recalled not being able open a patient’s chart in the system because another provider was already using the chart. And nurse BRN-4 noted that the system does not allow her to easily document that there has been no change in her patient’s status over the last hour, leading to redundant charting which “can be quite arduous”.

Several participants spoke of the lack of “situational awareness” provided by the system. Prior to the implementation, according to fellow BMD-3, providers relied on a

paper flowsheet to “obtain a quick glimpse of the patient’s status throughout the day”. The new system failed to provide this quick glimpse and “it was difficult for the fellows and attendings to figure out where to get information”. As BMD-1 explained it:

> Patients used to have flow-sheets that you could look at all the vital pieces of information, . . . their vital signs, the specific continuous infusions, the medications they’re on, ventilator support, certain important laboratory studies, intake and output, and so on. So essentially I could pick up a piece of paper and look at a trend of information I needed. That information is really difficult for me to access.

BRN-3 corroborated this shortcoming of the system, stating that the information needed to develop “the whole picture of what’s going on” can be challenging to find, whereas “when [they] were on paper, [they] had giant flow-sheets and [they] could visually see all the pieces of information”.

BMD-2 indicated that they are still working on a solution to the flowsheet problem. According to BMD-3, they tried to implement iAware, an enhancement provided by Cerner Corporation to address this issue, but it “came so much later that it wasn’t very successful as people found workarounds to get info they needed”.

Nurse BRN-4 also saw the lack of an adequate “snapshot of what’s going on with [the] patient” as a problem. While she acknowledged that the iAware solution was an improvement, she also noted that narrative comments entered into the system by the nurses do not appear on the flow-sheets that the physicians print out. According to BRN-4:

> That dialogue is very useful to doctors when they come to the bedside . . . and pull open the flow-sheet. . . . Maybe it’s just the tactile feeling of being able to see and understand what’s going on, and that the nurse felt was important enough to actually write a note about.

BRN-4 felt the system "was as nurse-friendly as it could be" when initially implemented, but nevertheless, felt it changed "the entire culture of how [nurses] are reporting and documenting". Only after four to five months of use did she feel comfortable working with the system. Nurse BRN-1 echoed these statements, explaining that while everyone is now comfortable with the system, improvements are needed if the system is to become more nurse-friendly.

Physician workflow. Another significant theme centered around the implementation's impact on the physician workflow. Prior to the implementation, physicians regularly visited their patients' bedsides to review the chart and write orders. Now, post-implementation, chart review and order entry is typically done from a computer located away from the bedside. Five of the seven participants reported that this change in workflow adversely affects the relationship between physicians and their patients, as well as communication between physicians and nurses.

Fellow BMD-3 stated that the "physicians go to the bedside less often because, instead of going into the patient's room, they go to the front desk to find a computer, enter a bunch of orders", after which they must "still remember to go to each nurse and let them know what [they've] ordered. . . . It does impair some of the physician interaction with nurses and patients". Nurse BRN-3 corroborated this finding, stating that there is "less communication between the physicians and the nurses as far as order entry" and "even a problem with doctors putting in wrong orders on wrong patients because they sit at a desk and just put in orders". Nurse BRN-4 further elaborated on this, explaining that previously, physicians would actually have to come into the room to review the chart and write an order:

> They [couldn't] be sitting at the desk and be removed from the patient looking at values and labs and figures that come up on the computer, which is very important and it's useful to be able to do that in a satellite area, but if you're making decisions about the care of a patient on an hourly basis, you need to be able to come to the bedside and look, because there are times that you might draw a lab or have a figure that isn't relevant to what's really going on and you have to understand the whole picture.

This account paralleled the account by attending physician BMD-1, who explained that "very few times [does she] have to go to the patient's bedside anymore." She gets all the information she needs from the computer and puts in the orders at the computer. "So there's much more limited actual examination of the patient and therefore limited physician-patient interaction". Moreover, she has started to notice that this new workflow is impacting team dynamics, "because every single person on the team . . . [is] looking at the computer screen all the time rather than being engaged in the discussion that's happening".

This impact to the workflow appears to be exasperated by the fact that accessing patient information and entering orders is more time-consuming than it was prior to implementation, meaning less time spent at the bedside. For attending physician BMD-1:

> The system is so incredibly slow, that it slows down our work rounds, and there are so many constant reminders of things being outside the parameter, that having to always justify something you're doing outside of the parameter in order to actually put your order in is very frustrating.

Attending physician BMD-2, who also cares for patients in the paper-based Cardiovascular ICU, corroborated this finding when he stated that "it seems that the overall workflow is faster with paper versus POE". Similarly, BMD-3 noted that the system "definitely slows physician workflow" and that "it would be really helpful if physicians could enter orders by the bedside. It would facilitate frequent checking on the patient and more interaction with nursing. The current setup does not allow this".

System selection. Concerns regarding the selection of the system and its appropriateness for a critical care environment also emerged as a theme. Four of the seven interview participants suggested that perhaps the Cerner system was not the best choice for the PICU. Attending physician BMD-2 explained that in 2005:

> The director of the ICU at the time and I spent a lot of time looking at software and devices that would make life a lot easier in the ICU. I understood the institution's desire to have a system-wide solution, but I was looking at best of breed and was very disappointed that we didn't buy the ICU solution that we had come to recommend.

Instead of selecting the solution best suited for the ICU and integrating that with the solution best suited for the rest of the hospital, a decision was made to go with Cerner hospital-wide. This decision, according to BMD-2, was made despite the fact that "a lot of the stuff that Cerner had promised [them] for the ICU was not developed yet". Indeed, as discussed earlier, the iAware enhancement was not available at the time of initial implementation, leaving the physicians and nurses without the situational awareness previously provided by the paper flowsheet.

Several major issues at implementation seemed to support the idea that perhaps Cerner was not the right choice. Fellow BMD-3 noted that "there were a couple pieces of equipment that were specific to the PICU that were a little bit hard to figure out how to integrate with CPOE". Nurse BRN-3 recalled that when the system was initially implemented, it often froze or simply shut off when a large number of infusions were being charted or when she attempted to open an information-rich patient chart:

> It doesn't work well for critical care because the patients are sicker, there's a lot more information that needs to be charted more frequently. . . . There were all these things that came up that really prohibited and effected patient care, especially in the ICU – which is really all I can speak for – but a lot of the explanations I got from other people were like "well it works on the general care floors, it should work for you guys".

Though she acknowledged that recent upgrades have helped, nurse BRN-4 echoed her colleague's concerns stating that "in the beginning it was very difficult to chart on a sick patient because once you got a certain amount of information in the computer it was really slow and difficult to upload". Similarly, nurse BRN-2 noted that the system can sometimes take a long time to load up a chronic patient's chart because the chart contains so much information. She stated that "if [the hospital] could decrease the amount of delay that it can sometimes have with chronic patients, it would be better. . . . [Hospital B] may need to look into better software".

Implementation goals. Another dominant theme centered on the participants' understanding of the implementation project goals. Attending physician BMD-1 could not recall the goals ever being communicated. She suggested that perhaps "they thought it was self-evident that the whole country is moving towards an EMR and so [Hospital B] should do the same". Similarly, nurse BRN-2 could not remember if the organization had explicitly communicated the goals:

> Oh, I don't remember. Most people, well most of the hospitals are using electronic charting. I think they probably want to be up-to-date with other hospitals. . . . In the long run, I think they are hoping for better efficiency and better patient care.

Like her colleague, nurse BRN-3 thought it was simply a reflection of the times. "Pretty much every other hospital was on computerized charting except [Hospital B]". BRN-4 "understood that professionally it's something that all hospitals should be moving toward". She could not recall hearing of any specific organizational goals, and assumed "innovation in patient safety" was the primary goal. BMD-3 was the only interview participant to applaud the organization's efforts to "improve buy-in" by

communicating the goals of the project, though she conceded only understanding pieces of the overall vision at first. The more she got involved with the design of the system, the better she understood the goals.

Cross-Case Synthesis

The hospital-wide HIT implementation at Hospital A directly impacted approximately 2,164 attending physicians, 894 resident physicians, and 1,471 registered nurses, among other ancillary and support staff. The HIT implementation at Hospital B, on the other hand, was limited to the Pediatric Intensive Care Unit (PICU) and directly impacted approximately 23 attending physicians, seven critical care fellows, and 75 registered nurses, among other ancillary and support staff.

Prior to the implementation at Hospital A, physician documentation was either hand-written or dictated. However, the organization had already been using an HIT system to facilitate electronic order entry and nursing documentation. Four interview participants stated that the transition to the new system was “cushioned” by their previous experience. The PICU at Hospital B, on the other hand, was completely paper-based prior to the implementation. The shift to electronic order entry and nursing documentation – physician documentation remains paper-based – represented an entirely new experience for many of the end users, including three of the nurses interviewed by the investigator.

The HIT implementation cases explored in this study, though significantly different in scope, shared some thematic similarities. In both cases, interview participants almost uniformly identified the presence of on-site support during the initial weeks as a critical success factor. Unintuitive and user-unfriendly system design

emerged as a central theme in both cases as well. Interview participants also shared a similarly weak understanding of their respective organization's implementation goals. Most simply assumed that by adopting electronic medical records, the organizations were moving forward, entering the twenty-first century, and keeping up with the rest of the country. The participants essentially saw the implementations as inevitable.

Despite the radical shift from paper-based to electronic nursing documentation, disruption to the nursing workflow did not emerge as a significant theme throughout the interviews with the Hospital B nurses. The Hospital A nurses, however, clearly feel that the new system demands a disproportionate amount of their time, pulling them away from their patients. The converse is true among the physicians. While disruption to physician workflow did not emerge as a significant theme among the Hospital A physicians, it did among the Hospital B physicians. Both the Hospital B physicians themselves and their nurse counterparts stated that the physicians are spending less time at the bedside and more time at the computer as a result of the implementation. They maintained that this shift disrupts both the physician-patient relationship as well as the physician-nurse relationship. Moreover, the situation is exasperated by the absence of physician-accessible computers at the bedside.

Another theme which emerged out of the Hospital B case centered on HIT system selection. Four of the seven interview participants expressed concerns regarding their system's ability to function effectively in their specialized care environment, suggesting that perhaps the Cerner system was not the best choice for the PICU. While three Hospital A interview participants – two critical care nurses and one emergency

medicine physician – echoed similar concerns, the overall case study data did not warrant the identification of a theme.

Two themes were unique to the Hospital A case. The first centered around the system's impact on the quality of physician documentation. Nine of the eighteen physicians interviewed reported that the implementation adversely affected the quality of physician documentation. In the Hospital B PICU, physician documentation remains paper-based and was not impacted by the implementation. Therefore, a parallel theme did not emerge from the Hospital B case.

The second unique theme centered on dissatisfaction with the end user system training. The majority of the Hospital A interview participants found the training to be boring, too long, inadequate in addressing the needs of their specialty or specific workflow, helpful only as an introduction, or simply not helpful at all. While the Hospital B interview participants did discuss their impressions of the system training they had received, subsequent data analysis did not produce any significant thematic similarities.

A summary of the major findings and how they relate to the literature, conclusions, and recommendations are presented in the next chapter.

Chapter Five: Conclusions and Recommendations

Introduction

The United States continues to lag behind other countries in its adoption of health information technology (Chin, 2004; Jha et al., 2009). A 2006 survey of primary care physicians found that only 29% of those in the United States were using electronic medical record systems, compared to 98% in the Netherlands, 92% in New Zealand, 89% in the United Kingdom, 79% in Australia, and 42% in Germany (Schoen et al., 2006). A failure to increase health information technology adoption in the United States will jeopardize the nation's ability to reduce medical errors, address the rapid growth of healthcare costs, and enact effective healthcare reform (Blumenthal, 2009; Davenport, 2007).

Health information technology (HIT) implementation success factors as perceived by healthcare executives and industry experts are well documented in the literature. Few studies, however, have focused on the perceptions of HIT *end users* such as physicians and nurses (Jensen & Aanestad, 2007). The purpose of this exploratory case study was to describe the strategies, actions, and other factors that contribute the successful implementation of HIT as perceived by HIT end users at two hospitals. That is, this study sought the perspective of the HIT end user in answering the question: How is HIT successfully implemented?

The case study research methodology was used because the investigator sought to explain *how* an organizational process worked (Yin, 2009). Moreover, the investigator had "clearly identifiable cases with boundaries and . . . [sought] to provide an in-depth understanding of the cases" (Creswell, 2007, p. 74). The specific cases explored

included an April 2008 HIT implementation at a 613-bed adult hospital (Hospital A) and a September 2008 HIT implementation in the Pediatric Intensive Care Unit (PICU) at a 272-bed children's hospital (Hospital B), both located in California.

Primarily, the study drew upon interview data. The investigator employed several sampling strategies to recruit participants from each respective population that could "purposefully inform an understanding of the research problem" (Creswell, 2007, p. 125). The investigator interviewed twenty-nine end users that experienced the April 2008 HIT implementation at Hospital A, and seven end users that experienced the September 2008 HIT implementation at Hospital B. Factual details related to the HIT implementation events were culled from secondary sources such as press releases, news articles, and internal presentations. The investigator's personal observations as a participant in the Hospital A implementation were also considered when appropriate.

All interviews were conducted between January 15 and April 12 of 2010 and ranged from 15 minutes to 30 minutes in length. The investigator took hand-written notes during all interviews. With one exception, all interviews were also recorded using a digital voice recorder and personally transcribed by the investigator. The transcripts, along with the notes taken during the unrecorded interview, were then analyzed in three phases consistent with the core elements of qualitative data analysis (Creswell, 2007). To begin, the investigator reviewed the interview transcripts and secondary sources to identify major organizing ideas. Following this coding phase, the investigator identified patterns and combined codes into broader categories or themes. Using the constant comparative method developed by Glaser and Strauss (1967), the investigator attempted

to saturate the categories. In the final phase, the investigator completed a cross-case synthesis.

Major Findings

Analysis of the interview data led to the emergence of eight unique themes across both cases which suggest factors that allow or inhibit HIT implementation success. In the following section, these themes are reviewed and related to Kotter's (1996) eight-step change model as appropriate.

Implementation goals. Across both cases, interview participants shared a similarly weak understanding of their respective organization's implementation goals. The participants essentially saw the implementations as inevitable. Most participants simply assumed that by adopting electronic medical records, their organizations were moving forward, entering the twenty-first century, and keeping up with the rest of the country. Several of the Hospital A physicians interviewed suggested that their organization was perhaps not entirely forthcoming about their goals, namely those related to increasing the efficiency of billing and coding. While the investigator was unable to conclusively assess how this lack of communication impacted the success of the respective implementations, he thought it a noteworthy finding that the participants were largely unimpressed by their respective organizations' efforts to communicate the change vision.

Both steps one and four of Kotter's (1996) eight-step process for leading organizational change are relevant in this context. Step one is concerned with establishing a sense of urgency. According to Kotter, if senior management does not clearly communicate and illustrate the urgency of the issue or problem at hand, the

organization will see little reason to support the change effort. “The likelihood that the new behaviors and desired routines will be valued and adopted is higher when the target group acknowledges the need for change” (Seijts, 2006, p. 180). While the study finding suggests that the United States government and the media have already established a nationwide sense of urgency, healthcare organizations should beware of organizational complacency. Too much organizational complacency leads to resistance and ultimately, a failed change effort (Kotter, 1996).

Step four of Kotter’s (1996) eight-stage process is concerned with communicating the change vision. Both organizations clearly failed to effectively communicate the change vision. “The real power of a vision is unleashed only when most of those involved in an enterprise or activity have a common understanding of its goals and direction. That shared sense of a desirable future can help motivate and coordinate the kinds of actions that create transformations” (Kotter, 1996, p. 85). In order to effectively communicate the change vision, Kotter suggests that communications be presented using simple and concise language that is free of any esoteric or technical jargon. Communications should make use of metaphors, analogies, or examples where appropriate. Kotter also recommends the use of multiple communication channels and repetition.

System selection. Another key finding supported across both cases, but particularly Hospital B, centered on system selection. While a particular HIT system might function effectively in a general care environment, it might not do so well in a specialized care environment such as an intensive care unit or emergency department. The Hospital B interview participants did not view the Cerner system as the best choice

for the PICU. Instead of selecting a system better suited for a critical care environment – and integrating that system with the general care system – the organization chose to tweak the general care system in an attempt to make it work for the PICU. This strategy resulted in a system that did not entirely meet the needs of its end users and, ultimately, detracted from the perceived success of the implementation.

Step three of Kotter's (1996) eight-step process for leading organizational change is particularly relevant to this finding. Step three is concerned with developing a vision and strategy. "Vision refers to a picture of the future with some implicit or explicit commentary on why people should strive to create that future" (p. 68) and "strategy provides both a logic and a first level of details to show how a vision can be accomplished" (p. 75). A strategic mistake, such as selecting an inappropriate HIT system, could undermine the change vision.

System usability. System usability issues were a dominant theme throughout most of the interviews across both cases. Roughly half of the interview participants described their system as unintuitive or user-unfriendly. The usability issues identified range from not being able to effectively search through and sort medical records to not being able to effectively document patient information due to data entry limitations. For specialized care areas such as the Emergency Department and the Cardiac Care Unit, usability issues particularly abound because the systems are not designed with their unique workflows in mind. Collectively, the system usability issues detracted from the perceived success of the two implementations.

This finding is consistent with the fifth step of Kotter's (1996) eight-step process for leading organizational change:

> Major internal transformation rarely happens unless many people assist. Yet employees generally won't help, or can't help, if they feel relatively powerless. . . . The purpose of stage five is to empower a broad base of people to take action by removing as many barriers to the implementation of the change vision as possible. (p. 102)

A poorly designed HIT system can quickly become a barrier in and of itself. When "processes are seriously at odds with the new vision, you must deal with that fact directly. Dodging the issue disempowers employees and risks undermining the change" (p. 111). Healthcare organizations must align HIT systems to the vision. If end users are unable to do their jobs effectively, the likelihood of improving the quality of patient care is diminished. Bernstein et al. suggest that organizations should "foster end user involvement throughout the entire scope of the integration process because the end users are the individuals who will be using the new technology to perform their job" (2007, p. 23). Without end user involvement, the project team runs the risk of overlooking critical workflow elements and usability issues (Thielst, 2007a; Valerius, 2007).

Training. The majority of the Hospital A interview participants described the system training they received as boring, too long, inadequate in addressing the needs of their specialty or specific workflow, helpful only as an introduction, or simply not helpful at all. Participants would have preferred a phased approach to training or some other form of follow-up, such as a formal class six months post-implementation focused on optimizing their use of system. The poorly executed pre-implementation training and the lack of follow-up clearly detracted from the perceived success of the implementation.

This finding as well is consistent with the fifth step of Kotter's (1996) eight-step process. Lack of appropriate training represents yet another barrier which disempowers end users. Often

> training is provided, but it's not enough, or it's not the right kind, or it's not done at the right time. . . . People are given a course before they start their new jobs, but aren't provided with follow-up to help them with problems they encounter while performing those jobs. (p. 108)

Kotter (1996) suggests two reasons why organizations often fall into this trap; they either conduct an inadequate needs assessment or they choose not to invest the necessary time and money to get the job done right:

> We often don't think through carefully enough what new behavior, skills, and attitudes will be need when major changes are initiated. As a result, we don't recognize the kind and amount of training that will be required. . . . Second, we sometimes do recognize correctly what is needed, but when we translate that into time and money, we are overwhelmed by the results. (p. 108)

On-site support. Interview participants almost uniformly identified the presence of twenty-four-by-seven on-site support during the initial weeks following activation as a critical success factor. At Hospital A, the on-site support was provided by information technology staff and a team of Epic-experienced consultants contracted by the hospital. In addition, a subset of nurses and physicians served as Super Users. These Super Users underwent additional training prior to activation so that they could support their colleagues. Hospital B relied on Super Users as well. In addition, several physicians from Cerner Corporation provided physician support during rounds for two weeks, there was an extra resident on-site for two weeks, and the Medical Director for Clinical Informatics rounded daily for three weeks.

This finding is consistent with the fifth step of Kotter's (1996) eight-step process for leading organizational change. "The purpose of stage five is to empower a broad base of people to take action by removing as many barriers to the implementation of the change vision as possible" (p. 102). This includes removing any barriers which limit skill acquisition. For most end users, mastering a new HIT system is not likely to happen

overnight. Twenty-four-by-seven on-site support empowers end users to learn on-the-job. If they get stuck or have a question, help is within an earshot.

Physician workflow. The Hospital B implementation's negative impact on physician workflow is another significant finding of this study. Prior to the implementation, the physicians regularly visited their patients' bedsides to review the chart and write orders. Post-implementation, the physicians are spending less time at the bedside and more time at the computer, disrupting both the physician-patient relationship as well as the physician-nurse relationship. Part of the problem is system usability; it takes longer to enter orders electronically. However, another part of the problem is the lack of physician-accessible computers at the bedside. This lack of supporting infrastructure detracts from the perceived success of the implementation.

This finding too is consistent with the fifth step of Kotter's (1996) eight-step process. Lack of supporting infrastructure, like poor usability, is yet another example of a barrier which impedes success if ignored. "Dodging the issue disempowers employees and risks undermining the change" (p. 111).

Nursing workflow. The Hospital A implementation's negative impact on nursing workflow is another significant finding of this study. Increased charting requirements as a result of the implementation are demanding a disproportionate amount of the nurses' time and pulling them away from patient care. Moreover, the impetus for increasing the charting requirements is not clear to the nurses. From the nurses' perspective, the often feel they are asked to document additional information simply because the system allows for that information to be documented. In other words, the additional charting

requirements are not necessarily driven by a patient care need. This lack of workflow optimization detracts from the perceived success of the implementation.

This finding is consistent with the fifth step of Kotter's (1996) eight-step process. The current workflow is at odds with the new vision. This lack of alignment represents yet another barrier which disempowers end users. Healthcare organizations must align workflow processes to the vision. If end users are unable to do their jobs effectively, the likelihood of improving the quality of patient care is diminished, and ultimately, the success of the implementation is undermined.

Physician documentation. Perhaps the most alarming finding to emerge from this study is that the Hospital A implementation is adversely affecting the quality of physician documentation. Prior to the implementation, progress notes were dictated. Notes are now typed directly into the system, a task which is far more time-consuming when compared to dictation. Studies have shown that "the average encounter takes three to four times as long to document in an EMR as it does to dictate" (Nuance Communications Corporation, 2008, p. 4). As a result, many physicians are not typing as much as they would otherwise dictate, or are resorting to the use of shortcuts such as cutting and pasting, dramatically reducing the quality of the documentation. The Hospital A physicians are not alone in this regard. Other physicians have reported "that EMRs slow them down and prevent them from documenting care in a manner that accurately depicts the patient encounter" (Nuance Communications Corporation, 2008, p. 2).

Once again, the fifth step of Kotter's (1996) eight-step process for leading organizational change sheds some light on the situation. In this context, the key barrier is

lack of time; however poor system usability, inadequate typing skills, and cultural resistance like play a role as well. Some organizations have addressed these barriers by adopting speech recognition technology, allowing physicians to return to the more familiar mode of dictating while still reducing transcription expenses (Nuance Communications Corporation, 2008).

Conclusions

While all but one of the thirty-six physicians and nurses interviewed across both cases characterized their respective implementations as successful, in most instances, this characterization was given with reservations. The participants conceded that the implementations did not cause any adverse events, nor did they generate any revolts, but they also maintained that the implementations could have gone better. With this tenuous declaration of success in mind, analysis of the interview data led to several conclusions:

1. Communication between the decision-makers and the end users was poor in terms of expressing both the goals of the respective implementations, and the rationale for selecting the chosen HIT system.
2. Poor usability design, lack of supporting infrastructure, and lack of workflow optimization brought on serious side effects including a decrease in the quality of physician documentation, an emphasis on financially-driven versus care-driven charting, and disruption to provider-patient and physician-nurse relationships.
3. Intensive care units and other specialized care environments require equally specialized HIT systems if they are to operate optimally; the one system fits all strategy is detrimental to patient care.

4. Less end user training prior to implementation in favor of more post-activation on-site support and follow-up training would have represented a more effective use of resources.

The implications made by these conclusions are that (a) the quality of care that end users are able to provide their patients has been compromised, (b) end users are unable to utilize their respective systems in an optimal manner, (c) end user job satisfaction is at risk, (d) patient satisfaction is at risk, and (e) the organizations are at risk – the declining quality of physician documentation in particular represents a serious liability.

Recommendations for Future HIT Adopters

Loppnow (2007) interviewed healthcare executives across eight different healthcare organizations nationally recognized for their successful implementation of HIT with the purpose of understanding what they perceived were the factors that enabled their success. One of his observations stuck in the mind of this investigator:

> The researcher realized in reviewing the transcripts and coding the interview results that all 14 participants presumed a level of technical proficiency in their implementation efforts. While some interviewees mentioned this issue indirectly in the discussion of persistence in the face of occasional problems, it was evident that every interview participant took technical proficiency for granted as an element of success. The researcher concludes that in the absence of technical proficiency, the organization could not fulfill the vision, nor could it enable operational strategies, so technical capability of the organization and/or its vendors appears to be a "given" in the perceptions of the interview participants and not worthy of discussion as a success factor.

Of the eight unique themes which emerged out of this multiple-case study, five are directly related to technical proficiency. This begs the question: Do healthcare executives truly see technical proficiency as a given, or are they underestimating its importance?

By attempting to understand successful HIT implementation from the *end user* perspective, lessons were learned that could be of value to other organizations embarking on similar change projects. In particular, the investigator gleaned the following implementation guidelines:

1. Clearly communicate the goals of the implementation.
2. Consider the unique needs of specialized care areas as you select an HIT system.
3. Design wisely because usability does matter.
4. Provide the infrastructure necessary to support the implementation.
5. Provide the right training at the right time.
6. Provide plenty of on-site support during the initial weeks following activation.
7. Optimize workflows to ensure the HIT system does not get in the way of patient care.

Recommendations for Further Research

Much of the qualitative material extrapolated in this study could be focused upon in a more quantitative fashion. A study might be undertaken in which an analysis of the degree to which end users perceive an implementation as successful is correlated with the findings of this study. Additionally, further research could be conducted to understand success factors as perceived by other types of end users such as nursing assistants, technicians, billers, and coders.

Furthermore, a study might be undertaken in which the quality of dictated physician documentation is compared to the quality of computer-entered physician

documentation. Finally, further research could be conducted to explore the advantages and disadvantages of a phased end user training model.

REFERENCES

Armstrong-Coben, A. (2009, March 5). The Computer Will See You Now. *The New York Times*. Retrieved March 28, 2009, from http://www.nytimes.com/2009/03/06/opinion/06coben.html

Aspden, P., Corrigan, J. M., Wolcott, J., & Erickson, S. M. (Eds.). (2004). *Patient Safety: Achieving a New Standard for Care*. Washington D.C.: National Academies Press.

Aspden, P., Wolcott, J., Bootman, J. L., & Cronenwett, L. R. (Eds.). (2007). *Preventing Medication Errors: Quality Chasm Series*. Washington D.C.: National Academies Press.

Atchison, T. A. (1999). Managing Change. *Frontiers of Health Services Management, 16*(1), 3-29.

Austin, C. J., Hornberger, K. D., Shmerling, J. E., & Elliott, M. W. (2000). Managing Information Resources: A Study of Ten Healthcare Organizations. *Journal of Healthcare Management, 45*(4), 229-239.

Bates, D. W., Leape, L. L., Cullen, D. J., Laird, N., Petersen, L. A., Teich, J. M., et al. (1998). Effect of computerized physician order entry and a team intervention on prevention of serious medication errors. *Journal of the American Medical Association, 280*(15), 1311-1316.

Bernstein, M. L., McCreless, T., & Cote, M. J. (2007). Five Constants of Information Technology Adoption in Healthcare. *Hospital Topics, 85*(1), 17-25.

Bhattacherjee, A., Hikmet, N., Menachemi, N., Kayhan, V. O., & Brooks, R. G. (2007). The Differential Performance Effects of Healthcare Information Technology Adoption. *Information Systems Management, 24*(1), 5-14.

Blair, R. (2005). The Future of CIOs. *Health Management Technology, 26*(2), 58-59.

Blumenthal, D. (2009). Stimulating the Adoption of Health Information Technology. *The New England Journal of Medicine, 360*(15), 1477-1479.

Brady, J., Ho, K., & Clancy, C. M. (2008). Slowed Progress in Improving Quality and Minimizing Disparities. *Association of Perioperative Registered Nurses Journal, 87*(5), 1007-1009.

Brody, H. (2008, December 23). Are electronic medical records more trouble than worth? *The Grand Rapids Press*. Retrieved March 28, 2009, from http://www.mlive.com/health/index.ssf/2008/12/are_electronic_medical_records.html

Bryman, A., & Bell, E. (2003). *Business Research Methods*. New York: Oxford University Press.

Catalano, K., & Fickenscher, K. (2008). Complying With the 2008 National Patient Safety Goals. *Association of Perioperative Registered Nurses Journal, 87*(3), 547-556.

Centers for Medicare and Medicaid Services. (2010, March 4). *Overview System Lifecycle Framework*. Retrieved June 23, 2010, from http://www.cms.gov/SystemLifecycleFramework/

Chin, T. (2004). Technology valued, but implementing it into practice is slow. *American Medical News, 47*(3), 12-13.

Cleveland Clinic. (n.d.). *Our Mission and History*. Retrieved January 30, 2009, from http://my.clevelandclinic.org/about/overview/mission_history.aspx

Committee on Data Standards for Patient Safety. (2003). *Key Capabilities of an Electronic Health Record System: Letter Report*. Retrieved June 23, 2010, from http://www.nap.edu/catalog.php?record_id=10781

Creswell, J. W. (2003). *Research Design* (2 ed.). Thousand Oaks, CA: Sage Publications.

Creswell, J. W. (2007). *Qualitative Inquiry and Research Design* (2 ed.). Thousand Oaks, CA: Sage Publications.

Damaré, B. (2008). Workplace Learning to Improve IT Project Management. *The Public Manager, 37*(4), 45-50.

Davenport, K. (2007, May 29). Navigating American Health Care: How Information Technology Can Foster Health Care Improvement. *Center for American Progress*. Retrieved September 13, 2009, from http://www.americanprogress.org/issues/2007/05/pdf/health_it.pdf

Devaraj, S., & Kohli, R. (2003). Performance Impacts of Information Technology: Is Actual Usage the Missing Link? *Management Science, 49*(3), 273-289.

Egeland, B. (2009, November 21). Defining Implementation Success or Failure. *Project Management Tips*. Retrieved April 23, 2010, from http://pmtips.net/defining-implementation-success-failure/

Esimai, G. (2005). Lean Six Sigma Reduces Medication Errors. *Quality Progress, 38*(4), 51-57.

Evans, R. S., Pestotnik, S. L., Classen, D. C., Clemmer, T. P., Weaver, L. K., Orme, J. F., et al. (1998). A computer-assisted management program for antibiotics and other antiinfective agents. *The New England Journal of Medicine, 338*(4), 232-238.

Freed, D. H. (2006). Certain Death: Ten Predictors of Hospital Information System Failure. *The Health Care Manager, 25*(1), 26-33.

Freudenheim, M. (2004, April 6). Many Hospitals Resist Computerized Patient Care. *The New York Times*. Retrieved May 30, 2009, from http://www.nytimes.com/2004/04/06/business/many-hospitals-resist-computerized-patient-care.html

Frohlich, J., Karp, S., Smith, M. D., & Sujansky, W. (2007). Retrospective: Lessons Learned From The Santa Barbara Project And Their Implications For Health Information Exchange. *Health Affairs, 26*(5), 589-591.

Glaser, B. G., & Strauss, A. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Chicago: Aldine Publishing Company.

Glass, R. L. (2005). IT Failure Rates - 70% or 10–15%? *IEEE Software, 22*(3), 112.

Goldschmidt, P. G. (2005). HIT and MIS: Implications of Health Information Technology and Medical Information Systems. *Communications of the ACM, 48*(10), 69-74.

Goldstein, J., & Zhang, J. (2009, January 22). Waste Feared in Digitizing Patient Records. *The Wall Street Journal*. Retrieved March 28, 2009, from http://online.wsj.com/article/SB123258818514104775.html

Groopman, J., & Hartzband, P. (2009, March 12). Obama's $80 Billion Exaggeration. *The Wall Street Journal*. Retrieved March 28, 2009, from http://online.wsj.com/article/SB123681586452302125.html

Halligan, J. (2008). *The Centrelink Experiment*. Retrieved April 27, 2010, from Australian National University, E Press Web site: http://epress.anu.edu.au/centrelink_citation.html

Hayes, S., & Richardson, I. (2008). Scrum Implementation Using Kotter's Change Model. In P. Abrahamsson, R. Baskerville, K. Conboy, B. Fitzgerald, L. Morgan & X. Wang (Eds.), *Agile Processes in Software Engineering and Extreme Programming* (Vol. 9, pp. 161-171). Limerick, Ireland: Springer Berlin Heidelberg.

Healthcare Information and Management Systems Society. (2009). *The American Recovery and Reinvestment Act of 2009 Summary of Key Health Information*

Technology Provisions. Retrieved February 28, 2009, from http://www.himss.org/content/files/HIMSS_SummaryOfARRA.pdf

Hosford, S. B. (2008). Hospital Progress in Reducing Error: The Impact of External Interventions. *Hospital Topics, 86*(1), 9-19.

Hunt, D. L., Haynes, R. B., Hanna, S. E., & Smith, K. (1998). Effects of Computer-based Clinical Decision Support Systems on Physician Performance and Patient Outcomes. *Journal of American Medical Association, 280*(15), 1339-1345.

Jakulin, A. (2009, March 12). Electronic medical records and what statistics can do. *Statistical Modeling, Causal Inference, and Social Science*. Retrieved March 30, 2009, from http://www.stat.columbia.edu/~cook/movabletype/archives/2009/03/electronic_medi_1.html

Jensen, T. B., & Aanestad, M. (2007). How Healthcare Professionals "Make Sense" of an Electronic Patient Record Adoption. *Information Systems Management, 24*(1), 29-42.

Jha, A. K., DesRoches, C. M., Campbell, E. G., Donelan, K., Rao, S. R., Ferris, T. G., et al. (2009). Use of Electronic Health Records in U.S. Hospitals. *The New England Journal of Medicine, 360*(16), 1628-1638.

John Hopkins Medicine. (n.d.). *John Hopkins Medicine Mission*. Retrieved January 30, 2009, from http://www.hopkinsmedicine.org/about/mission.html

Joint Commission. (2009, December 28). *Facts about the National Patient Safety Goals*. Retrieved January 30, 2009, from http://www.jointcommission.org/PatientSafety/NationalPatientSafetyGoals/npsg_facts.htm

Joint Commission. (n.d.). *About Us*. Retrieved January 30, 2009, from http://www.jointcommission.org/AboutUs/

Kaplan, B., & Harria-Salamone, K. D. (2009). Health IT Success and Failure: Recommendations from Literature and an AMIA Workshop. *Journal of the American Medical Informatics Association, 16*(3), 291-299.

Kohn, L. T., Corrigan, J. M., & Donaldson, M. S. (Eds.). (2000). *To Err Is Human: Building a Safer Health System*. Washington D.C.: National Academy Press.

Kotter International. (n.d.). *Case Studies*. Retrieved April 27, 2010, from http://www.kotterinternational.com/OurWork/CaseStudies.aspx

Kotter, J. P. (1996). *Leading Change*. Boston: Harvard Business School Press.

Kvale, S. (1996). *Interviews: An Introduction to Qualitative Research Interviewing*. Thousand Oaks, CA: Sage Publications.

Lang, R. D. (2003). Healthcare Information Management Systems Concentration Curriculum Choices: Evaluating the CIO Perspective. *Journal of Information Systems Education, 14*(4), 373-380.

LeTourneau, B. (2004). Managing Physician Resistance to Change. *Journal of Healthcare Management, 49*(5), 286-288.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry*. Beverly Hills, CA: Sage Publications.

Loppnow, B. G. (2007). "Chief integration officer": A study of success factors in the implementation of clinical information technology (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database. (AAT 3249893)

Massaro, T. A. (2005). Introducing Physician Order Entry at a Major Academic Medical Center: Impact on Organizational Culture and Behavior. In J. Anderson & C. Aydin (Eds.), *Evaluating the Organizational Impact of Healthcare Information Systems* (2 ed.). New York: Springer.

Mayo Clinic. (n.d.). *Mission and Values for Mayo Clinic*. Retrieved January 30, 2009, from http://www.mayoclinic.org/about/missionvalues.html

Menachemi, N., Beitsch, L. M., & Brooks, R. G. (2008). Computers in the Exam Room, What Will Your Patients Think? *Journal of the Florida Medical Association, 91*(3), 20-24.

Menachemi, N., Saunders, C., Chukmaitov, A., Mathhews, M. C., & Brooks, R. (2007). Hospital Adoption of Information Technologies and Improved Patient Safety: A study of 98 Hospitals in Florida. *Journal of Healthcare Management, 52*(6), 398-409.

Middleton, B. (2005). Achieving the Vision of EHR - Take the Long View. *Frontiers of Health Services Management, 22*(2), 37-42.

Miles, M. B., & Huberman, M. (1994). *Qualitative Data Analysis: An Expanded Sourcebook* (2 ed.). Thousand Oaks, CA: Sage Publications.

Morrissey, J. (2004). Harmonic divergence. *Modern Healthcare, 34*(8), 16.

Nuance Communications Corporation. (2008). *Speech Recognition: Accelerating the Adoption of Electronic Medical Records*. Retrieved March 21, 2010, from http://www.nuance.com/healthcare/pdf/wp_healthcare_MDEMRadopt.pdf

Obama for America. (n.d.). *Barack Obama and Joe Biden's Plan to Lower Health Care Costs and Ensure Affordable, Accessible Health Coverage For All*. Retrieved January 30, 2009, from http://www.barackobama.com/pdf/issues/HealthCareFullPlan.pdf

Padilla, R. (2007, February 25). Define success in order to achieve success. *TechRepublic*. Retrieved April 23, 2010, from http://blogs.techrepublic.com.com/tech-manager/?p=276

Pinnegar, S., & Daynes, J. G. (2007). Locating Narrative Inquiry Historically: Thematics in the Turn to Narrative. In D. J. Clandinin (Ed.), *Handbook of Narrative Inquiry: Mapping a Methodology*. Thousand Oaks, CA: Sage Publications.

Poon, E. G., Blumenthal, D., Jaggi, T., Honour, M. M., Bates, D. W., & Kaushal, R. (2004). Overcoming Barriers To Adopting And Implementing Computerized Physician Order Entry Systems In U.S. Hospitals. *Health Affairs, 23*(4), 184-190.

Poon, E. G., Cina, J. L., Churchill, W., Patel, N., Featherstone, E., Rothschild, J. M., et al. (2006). Medication Dispensing Errors and Potential Adverse Drug Events before and after Implementing Bar Code Technology in the Pharmacy. *Annals of Internal Medicine, 145*(6), 426--434.

Roberts, C. M. (2004). *The Dissertation Journey*. Thousand Oaks, CA: Corwin Press.

Sallas, B., Lane, S., Mathews, R., Watkins, T., & Wiley-Patton, S. (2007). An Interative Assessment Approach to Improve Technology Adoption and Implementation Decisions by Healthcare Managers. *Information Systems Management, 24*(1), 43-57.

Schoen, C., Osborn, R., Huynh, P. T., Doty, M., & Zapert, J. P. (2006). On The Front Lines Of Care: Primary Care Doctors' Office Systems, Experiences, And Views In Seven Countries. *Health Affairs, 25*(6), 555-571.

Scott, J. T., Rundall, T. G., Vogt, T. M., & Hsu, J. (2005). Kaiser Permanente's experience of implementing an electronic medical record: a qualitative study. *British Medical Journal, 331*(7528), 1313-1316.

Seijts, G. H. (2006). *Cases in Organizational Behavior*. Thousand Oaks, CA: Sage Publications.

Simpson, R. L. (1995). Trends in health-care compting according to CIOs. *Nursing Management, 26*(8), 20-21.

Solovy, A., & Chaiken, B. (2003). ROI under scrutiny: The radical redefinition of a core concept / reply. *Frontiers of Health Services Management, 19*(3), 17-28.

Stake, R. (1995). *The Art of Case Study Research*. Thousand Oaks, CA: Sage Publications.

Stanford Hospital and Clinics. (n.d.). *Administration*. Retrieved July 15, 2009, from http://stanfordhospital.org/aboutUs/Administration.html

Thielst, C. B. (2007a). Effective Management of Technology Implementation. *Journal of Healthcare Management, 52*(4), 216-219.

Thielst, C. B. (2007b). The Future of Healtcare Technology. *Journal of Healthcare Management, 52*(1), 7-9.

Traylor, P. S. (2006, February 13). To build or to buy IT applications? *InfoWorld*. Retrieved July 15, 2009, from http://www.infoworld.com/d/applications/build-or-buy-it-applications-676

United States Department of Health and Human Services. (n.d.). *American Health Information Community*. Retrieved July 14, 2009, from http://healthit.hhs.gov/portal/server.pt?open=512&objID=1199&parentname=CommunityPage&parentid=11&mode=2&in_hi_userid=10882&cached=true

United States Government Printing Office. (2004, April 30). *Executive Order 13335 - Incentives for the Use of Health Information Technology and Establishing the Position of the National Health Information Technology Coordinator*. Retrieved October 5, 2008, from http://edocket.access.gpo.gov/2004/pdf/04-10024.pdf

Valerius, J. D. (2007). The Electronic Health Record: What Every Information Manager Should Know. *Information Management Journal, 41*(1), 56-59.

Wang, S. J., Middleton, B., Prosser, L. A., Bardon, C. G., Spurr, C. D., Carchidi, P. J., et al. (2003). A Cost-benefit Analysis of Electronic Medical Records in Primary Care. *The American Journal of Medicine, 114*(5), 397-403.

Yin, R. K. (2009). *Case Study Research Design and Methods* (4 ed. Vol. 5). Thousand Oaks, CA: Sage Publications.

APPENDIX

IRB Approval

PEPPERDINE UNIVERSITY

Graduate & Professional Schools Institutional Review Board

December 16, 2009

[redacted]

Protocol #: E1209D08
Project Title: ***Understanding the End User Perspective: A Multiple-Case Study of Successful Health Information Technology Implementation***

Dear Mr. Behravesh:

Thank you for submitting your application, *Understanding the End User Perspective: A Multiple-Case Study of Successful Health Information Technology Implementation,* for exempt review to Pepperdine University's Graduate and Professional Schools Institutional Review Board (GPS IRB). The IRB appreciates the work you and your faculty advisor, Dr. Monica Goodale, have done on the proposal. The IRB has reviewed your submitted IRB application and all ancillary materials. Upon review, the IRB has determined that the above entitled project meets the requirements for exemption under the federal regulations (45 CFR 46 - http://www.nihtraining.com/ohsrsite/guidelines/45cfr46.html) that govern the protections of human subjects. Specifically, section 45 CFR 46.101(b)(2) states:

> (b) Unless otherwise required by Department or Agency heads, research activities in which the only involvement of human subjects will be in one or more of the following categories are exempt from this policy:
>
> **Category (2) of 45 CFR 46.101**, research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: a) Information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and b) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

In addition, your application to waive documentation of consent, as indicated in your *Application for Waiver or Alteration of Informed Consent Procedures* form has been **approved**.

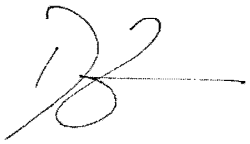
Your research must be conducted according to the proposal that was submitted to the IRB. If changes to the approved protocol occur, a revised protocol must be reviewed and approved by the IRB before implementation. For any proposed changes in your research protocol, please submit a **Request for Modification Form** to the GPS IRB. Because your study falls under exemption, there is no requirement for continuing IRB review of your project. Please be aware that changes to your protocol may prevent the research from qualifying for exemption from 45 CFR 46.101 and require submission of a new IRB application or other materials to the GPS IRB.

A goal of the IRB is to prevent negative occurrences during any research study. However, despite our best intent, unforeseen circumstances or events may arise during the research. If an unexpected situation or adverse event happens during your investigation, please notify the GPS IRB as soon as possible. We will ask for a complete explanation of the event and your response. Other actions also may be required depending on the nature of the event. Details regarding the timeframe in which adverse events must be reported to the GPS IRB and the appropriate form to be used to report this information can be found in the

Pepperdine University Protection of Human Participants in Research: Policies and Procedures Manual (see link to "policy material" at http://www.pepperdine.edu/irb/graduate/).

Please refer to the protocol number denoted above in all further communication or correspondence related to this approval. Should you have additional questions, please contact me. On behalf of the GPS IRB, I wish you success in this scholarly pursuit.

Sincerely,



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Ms. Ann Kratz, Human Protections Administrator
Dr. Doug Leigh, Chair, Graduate and Professional Schools IRB
Ms. Jean Kang, Manager, Graduate and Professional Schools IRB
Dr. Monica Goodale
Ms. Christie Dailo