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Information Technology Issues in Healthcare: Hospital CEO and CIO Perspectives

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Abstract:

Healthcare Information Technology (HIT) is widely regarded as a key to improving the quality of healthcare in the United States and potentially reducing its cost. Yet, its implementation is a continuous challenge for the healthcare industry. In this article, we report the results of a survey distributed to CEOs and CIOs at 1400 U.S. hospitals regarding their perceptions of the key information technology (IT) issues in healthcare. Among the top ten issues, the implementation of electronic medical records is ranked the highest. Included in the top ten are issues related to: improving healthcare quality by the use of information technology; change management, privacy, security, and accuracy of electronic records; and decision support applications. While some differences existed, we found much similarity between the views of the CEOs and the CIOs with both groups being characterized as conservative and risk-averse in their entrepreneurial orientation. No major differences were observed between urban and rural hospitals, or large and small hospitals. Given the heightened interest in healthcare IT, these results have wide implications for many stakeholders in this burgeoning industry.

Keywords: healthcare, key IT issues, Healthcare Information Technology, IT management, EHR/EMR, U.S. hospitals, CEOs, CIOs

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I. INTRODUCTION

Healthcare Information Technology (IT) is widely asserted to be one of the means for improving the quality of healthcare and potentially reducing its cost in the United States [Chaudhry et al., 2006; Dey et al., 2007; Koshy, 2005]. A recent research study [Kutney-Lee and Kelly, 2011] suggests that the implementation of a basic EHR[1] may result in improved and more efficient nursing care, better care coordination, and patient safety. There is contrary evidence as well, e.g., Furukawa et al. [2010] found that EMR increases the cost of discharge by 6–10 percent and increases RN hours per patient. Recent U.S. administrations have emphasized the utilization of computers and information technology in streamlining healthcare and reducing its staggering costs in the United States where approximately 20 percent of expenditures are related to the storing, processing, and dissemination of information [Thompson and Dean, 2009]. While calls for electronic health records, e-prescribing and other forms of health IT improvements have been sounded for more than a decade (e.g., Medicare Part D legislation), only recently has that call been supported with substantial financial incentives. For example, President Barack Obama has proposed a massive effort to modernize healthcare by making all health records standardized and electronic. The American Recovery and Reinvestment Act (Stimulus Bill), signed by President Obama on February 17, 2009, includes billions of dollars for health information technology (HIT). Yet, the implementation of IT in healthcare has been a continuous challenge in the United States with EMR adoption remaining one of the most discussed topics in the area of healthcare IT [Hagland, 2007; Angst and Aggarwal, 2009]. As Hersh [2004] points out:

> *Although the case for adoption of improved health care informatics appears quite compelling, significant barriers to its use remain …. These include cost, technical issues, system interoperability, concerns about privacy and confidentiality, and lack of a well-trained clinician informatics workforce to lead the process* (p. 2273).

While attention to the use of information technology (IT) in healthcare is accelerating, the United States is still in the early stages of achieving meaningful use of the technology. Consequently, various stakeholders such as hospitals, medical practices, physicians, and consumers face a myriad of issues and concerns related to IT in healthcare [Thompson and Dean, 2009]. In this article, we focus on one set of stakeholders: the hospitals, and report their key IT issues. Results are provided along several moderating variables, primarily CEOs/CIOs, and also urban/rural hospitals, and large/small hospitals. Our results include how organizational culture [White et al., 2003] and entrepreneurial orientation [Green et al., 2008] are associated with healthcare IT issue identification.

The key IT issues in American corporations have been periodically examined every three or four years since the early 1980s [Ball and Harris, 1982; Dickson et al., 1984]. For the past few years, they have been examined annually and are reported in the *MIS Quarterly Executive*. The latest key IS critical issues were reported for 2011 by Luftman and Ben-Zvi [2011]. Researchers have also identified critical issues within specific areas of information systems, e.g., knowledge management [Alavi and Leidner, 1999] and ERP implementation [Kumar et al., 2003]. However, these studies have focused primarily on manufacturing, finance, information technology, and service industries, to the virtual exclusion of healthcare. While there may be some similarities, it would be a stretch to equate healthcare IT issues to those in other industries, given the slow and late adoption of IT in healthcare, as well as numerous barriers including organizational culture, costs, technical issues, system interoperability, and concerns about privacy and confidentiality [Angst and Aggarwal, 2009; Baker et al., 2008; Hersh, 2004].

In spite of federal financial incentives for implementation of electronic health records through the American Recovery and Reinvestment Act (ARRA), the adoption rates in U.S. hospitals remain very low. For example, the share of the U.S. hospitals that had adopted basic or comprehensive electronic medical records was 8.7 percent and 11.9 percent in 2008 and 2009 respectively and only 2 percent of them had met the federal government's "meaningful use" criteria [Jha et al. 2010].

[1] Two acronyms appear regularly in the literature: Electronic Health Record (EHR), and Electronic Medical Record (EMR). Though they are often used interchangeably in the literature, there is a clear difference in scope. The National Alliance for Health Information Technology (NAHIT) defined EMR as an electronic record of health-related information on an individual that is created, gathered, managed, and consulted by licensed clinicians and staff *from a single organization*. An EHR is the aggregate electronic record of an individual *across more than one healthcare organization*. Thus while EMR and EHR have similar objectives (improve coordination of patient healthcare), an EHR places the further requirement of ensuring interoperability with the systems of other providers.

More positive adoption rates can be found in a select sample [Hagland, 2007], where HIMSS (Healthcare Information and Management Systems Society) leaders reported 32 percent with a fully operational system in 2007 compared to 24 percent in 2006 and 18 percent in 2005. While these year-over-year increases are rather dramatic, they substantially overstate the industry-wide adoption rate, as HIMSS leaders are more likely to be early and sophisticated adopters. *Therefore, the objective of this research is to provide an examination of the critical HIT issues from the perspective of CIOs and CEOs in the healthcare industry.*

In developing the article, we first briefly describe the importance of the healthcare industry in terms of size and economic impact, followed by a brief description of the importance of healthcare technology to this industry. Next we provide a model of factors that may serve to shape the perspectives of top managers, specifically CIOs and CEOs, on the importance of healthcare IT issues. We then describe the development of a survey to measure these perspectives and provide a set of results that we believe represent the first survey of top management perspectives of *select top level healthcare professionals focused on the importance of various healthcare IT issues*. Thus the purpose of our study is to be broad and descriptive rather than narrow and prescriptive. We seek to identify healthcare IT issues that are most important to CEOs and CIOs so that future research may tackle each issue at a more granular level with the foreknowledge of what healthcare IT practitioners regard to be of highest importance.

II. INFORMATION TECHNOLOGY IN HEALTHCARE

Healthcare costs have skyrocketed in the United States in the past two decades. Expenditures in the United States on healthcare surpassed $2.3 trillion in 2008, more than three times the $714 billion spent in 1990, and over eight times the $253 billion spent in 1980 [Centers for Medicare and Medicaid Services, 2010]. While the U.S. health system is one of the most expensive and highly-touted systems in the world, the fact is that it lags behind other advanced nations in delivering timely and effective quality care [New York Times, 2007]. While information technology is not the panacea for all of the industry's ills, it has the potential to improve the quality of care [Bates, 2002] and possibly even reduce costs [Chaudhry et al., 2006]. According to the U.S. Department of Health and Human Services states,

> *Health information technology [health IT] allows comprehensive management of medical information and its secure exchange between health care consumers and providers. Broad use of HIT has the potential to improve health care quality, prevent medical errors, increase the efficiency of care provision and reduce unnecessary health care costs, increase administrative efficiencies, decrease paperwork, expand access to affordable care, and improve population health* [http://healthit.hhs.gov/].

While currently there is much emphasis on using IT in healthcare to improve administrative processes and quality of care [Wills et al., 2010], the United States healthcare systems have been very slow in adopting IT, and healthcare is one of the last industries to take advantage of the information technology revolution. The U.S. government has recognized these problems and several past administrations have taken steps to redress the situation. The American Recovery and Reinvestment Act (Stimulus Bill) signed by President Obama in February 2009 is a major step in this direction [Thompson and Dean, 2009]. A major component of this initiative is the implementation of Electronic Medical Records (EMR) systems, as they are central to any computerized health information system. The adoption of electronic health records' by providers is being incentivized by the U.S. government to help increase the quality of care and as a means to control healthcare inflation in the long-term. Other sought-after benefits include safety, efficiency, and ability to conduct education and research [Bates et al., 2003]. While there are near-term rewards for adopting and long-term penalties for not adopting these systems and there are tangible and compelling forces for adoption, there are equally strong forces impeding adoption in the form of complex, user-based, intra-organizational and inter-organizational challenges. Collectively this force-field analysis [Lewin, 1943] leads to the view that the implementation of an EMR application in a medical practice is a difficult and expensive endeavor that is fraught with risks [VersaForm, 2008].

In this complex and turbulent environment, healthcare stakeholders such as hospitals, medical practices, physicians, and consumers face a myriad of issues related to information technology. In particular hospitals, the focus of this study, are confronted with a number of issues related to security and privacy [Meingast et al., 2006; Rindfleisch, 1997], quality of care [Bates, 2002; Ball, 2003], EHR implementation [Menachemi et al., 2007], organizational planning and integration [Ball, 2003], financial and economic benefits [Ball, 2003], safety and reducing errors [Bates et al., 2003; Ball, 2003], and decision support [Ball, 2003].

According to Smaltz, Sambamurthy, and Agarwal [2006], CIOs are corporate executives who are particularly responsible and accountable for their firm's IT management practices. While the chief information officer (CIO) may play a number of different roles, including strategist, relationship architect, integrator, educator, utilities provider, and information steward in a healthcare setting [Smaltz, Sambamurthy, and Agarwal, 2006], it may be generally stated that the CIO is responsible for responding to the IT challenges, guided to different degrees and either directly or

indirectly by the chief executive officer (CEO). While the role of the CEO is to set the strategic direction of the firm, over time, the CIOs' role has evolved to reflect both the firm's IS infrastructure and strategy [Chun and Mooney, 2009].

Though the percentage of CIOs reporting directly to CEOs has remained relatively stable over time, the likelihood that a firm's CIO will report directly to the CEO has been shown to vary as a function of organizational type. Burke, Menachemi, and Brooks [2006], in a study of acute-care hospitals found that, in for-profit hospitals, CIOs were more likely to report to CFOs, whereas, in not-for-profit hospitals, CIOs were more likely to have higher status and to report to the CEO. These authors were further able to show that, independent of industry type, CIO tenure is consistently related to HIT capability with CIO experience a critical factor in HIT adoption. Thus a CIO can play one of several roles [Smaltz, Sambamurthy, and Agarwal, 2006] ranging from an executive focused on the firm's strategy to a technical manager focused on the tactical issues of effectively utilizing the technology. Given the nascent nature of information technology in healthcare, it may well be that the latter CIO role is more predominant at this time, but as Moghaddasi and Sheikhtaheri [2010] suggest, the increasing importance of IT to healthcare and the multifaceted roles now required to be an effective CIO may become the stepping stone to the CEO role. In any case, the congruence between the views and concerns of both executives are important, are relatively under-investigated in a healthcare setting, and are the subject of this study. Figure 1 provides an overview of the study. The study includes organizational culture, its location (urban vs. rural), size, and entrepreneurial orientation of the respondent as additional variables which can help explain the nature of the healthcare IT issues.

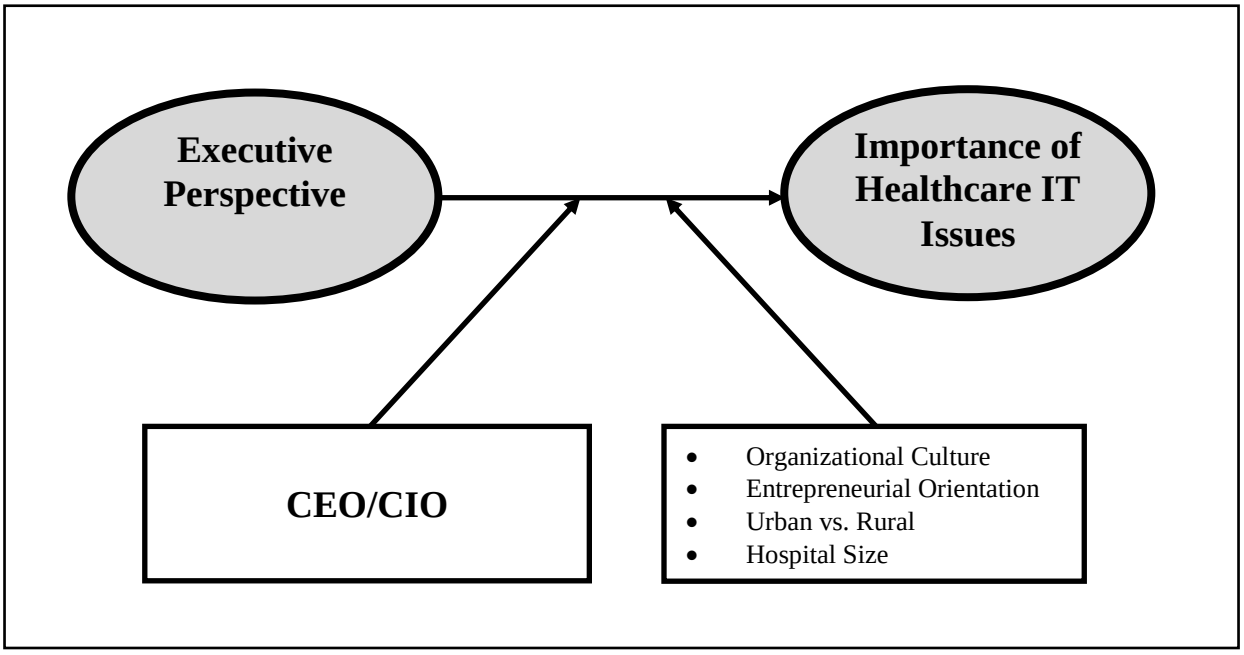

Figure 1. Study Overview

III. METHODOLOGY

The mainstream information systems literature has a long history of "key IS issues" studies dating back to the early 1980s [Ball and Harris, 1982; Dickson et al., 1984]. In the past few years, Luftman and his colleagues have conducted several studies on key IS issues and published in the *MIS Quarterly Executive* [Luftman and McLean, 2004; Luftman, 2005; Luftman and Kempaiah, 2008; Luftman et al., 2009; Luftman and Ben-Zvi, 2010]. All of these studies, including the year 2009, were consulted to develop an initial list of IT issues that may be applicable to a healthcare context. At the time of the conduct of this research and to the best of our knowledge, no comparable lists were available for healthcare IT. Therefore, we conducted a review of the healthcare IT literature, which informed our study and provided additional issues in areas such as implementation of electronic medical records, improving quality of care, reducing healthcare errors, safe work environment, healthcare supply chain, compliance with regulations, decision support systems, data quality, consumer empowerment, building regional and national databases, outsourcing, and telemedicine. While some of these issues came from the academic literature [Ball, 2003; Bates, 2002; Bates et al., 2003; Ford et al., 2009; Meingast et al., 2006; Menachemi et al., 2007; Rinddfleisch, 1997], others came from the popular press and healthcare IT-relevant websites (e.g., healthit.hhs.gov and ahrq.gov).

Once a preliminary list was compiled, it was shared and discussed with one hospital CEO, one hospital CIO, and the director of an IT healthcare consortium for their comments on completeness and clarity. Based on this consultation, the list was modified to develop a survey questionnaire. After pilot testing with five hospital IT management executives, minor changes were made. Though we believe our three-step process of literature review, consultation with practice experts, and pilot testing provides a strong foundation for this research, we offer the caveat that this list still be considered preliminary, given the nascent nature of the topical domain.

We did not seek to develop measurement scales from the healthcare IT items in this study. The purpose of our study was to develop a list of different healthcare IT issues and then to assess which of these issues industry experts gauged to be the top issues. Items that were highly similar in content were eliminated to reduce participant fatigue, and consultations with industry experts were undertaken specifically to reduce item overlap. Consequently the development of scales from the healthcare IT items would not be appropriate, given that our goal was to develop a parsimonious list of single-item issue measures.

The list of issues is displayed in Table 1. These issues were part of a larger questionnaire that was targeted to chief executive officers (CEOs) and chief information officers (CIOs) of hospitals in the United States. The respondents were asked to rate each issue for its importance on a 7 point Likert scale, where 1 represents highest importance, 7 represents lowest importance, and 4 represents moderate importance. Given the cognitive load of this exercise and for the purpose of triangulation, they were also asked to rank the top ten issues from 1 to 10.

Table 1: Issues in Healthcare Information Technology
Implementation of electronic medical records
Change management from paper to electronic medical records
Quality assurance of electronic records
System-wide approach to patient identity management
Information technology infrastructure issues
Measuring the effectiveness of IT in healthcare
Technology support for home healthcare
Managing the cost of information technology
IT human resources development
Scanning IT trends and timely implementation of selected technologies
IT support for healthcare supply chain (e.g., pharmaceuticals, pharmacies)
IT support for insurance companies
Managing the release-of-information process.
Compliance with regulations (e.g., HIPAA)
Using IT to enable consumer empowerment in healthcare
Controlling healthcare costs with information systems
IT's role in healthcare outsourcing (within the country)
IT's role in healthcare offshoring (outside the country)
Building of regional and national health databases/network
Implementation of personal health record (PHR)
Business model change to embrace IT in healthcare
Decision support systems for physicians and clinics
Decision support systems for hospital units
Decision support systems for consumers
Decision support systems for pharmacies
IT support for telemedicine (i.e., remote care and procedures)
Group collaboration systems in healthcare
Improving quality of care with information technology
Reducing healthcare errors with information technology
Utilizing IT to provide a safe work environment
Health information systems interoperability
Disaster preparedness and recovery
Security of electronic records
Privacy of electronic records

Entrepreneurial orientation was measured using three items (Appendix 1) developed by Green, Covin, and Slevin [2008]. Respondents were asked to "describe the orientation of your healthcare organization" along a scale where 1 indicated that the statement to the left best described the organization, and a 7 indicated that the statement to the right best described the organization with a score of 2 through 6 indicating the best intermediate estimate between the two poles. The first continuum was "strong emphasis on the marketing of tried and true products or services"

contrasted with "strong emphasis on R&D, technological leadership and innovation." The second continuum was "strong proclivity for low risk projects" (with normal and certain rates of return) contrasted with "strong proclivity for high risk projects" (with chances of very high returns). The third continuum was "owing to the nature of the environment, it is best to explore it gradually via cautious, incremental behavior" contrasted with "owing to the nature of the environment, bold, wide-ranging acts are necessary to achieve the hospital's objectives." Green, Covin, and Slevin reported an alpha coefficient of .84 for the full nine item scale. The coefficient for the more parsimonious three item scale deployed in this study is 0.71.

To measure organizational culture, we used the instrument development by White, Varadarajan, and Dacin [2008]. The instrument (Appendix A) provides four sets of statements in four grouping with the generic headings Category 1 through Category 4. The statements capture multiple but potentially unrelated facets of organizational culture (e.g., organizational goals, leadership style, operational emphasis). Respondents were asked to "Distribute 100 points among the four category headings depending on how similar the description is to your hospital." The sets of statements measure four types of organizational cultures: Adhocracy, Clan, Hierarchy, and Market. Because this measure is a constant sum measure, the four resulting variables are ipsative, and thus coefficient alpha was not calculated for this measure.

An extensive database of hospital CIOs and CEOs was compiled from various sources, but predominately the Dorenfest Instutute for Health Information (DIHI). The DIHI database, accessible from the HIMSS Foundation website (www.himss.org/foundation/histdata_about.asp), describes the database in the following way:

> *The Dorenfest Institute provides detailed historical data about information technology (IT) use in hospitals and integrated healthcare delivery networks…. This information is available at no charge to universities, students under university license, U.S. governments (local, state and federal), and governments of other countries that will be using the data for research purposes…. This product contains all integrated healthcare delivery systems (IHDSs) that own at least one short term, acute care, non-federal hospital with at least 100 beds. The database provides a comprehensive picture of healthcare delivery in the United States.*

The DIHI database is an attractive database for academic research for at several reasons. First, it includes the names and e-mail addresses of CEOs and CIOs which are not available in some databases. Second, the database is free as compared to the relatively high costs of some databases. Third, the DIHI places some parameters on sample inclusion beyond simply calling the organization a hospital. Fourth, database endorsement by HIMSS is suggestive of rigorous oversight which cannot be as easily inferred from some private provider databases.

Questionnaires were mailed in April 2009 to CIOs and CEOs in 1400 hospitals (of the many thousand hospitals) in the United States. To be sure we were capturing responses at the CEO and CIO level, we included the item "Your Job Title" on the survey, with respondents given the choices of the following options: CIO, CEO, CFO, IS Manager, or Other (please specify). Though CMIO (Chief Medical Information Officer) was not a selection, we believe that if CMIOs completed the survey, they most likely identified with the CIO designation. Reminders were sent in May 2009 to the mailed survey, including e-mailing those who did not respond with a request to complete the survey online on a website. Collectively, these efforts yielded a total of 177 responses. While low response rates are endemic to healthcare IT research [Hikmet and Chen, 2003], we believe our results are reliable, as we received a fairly good representation from different types of hospitals, e.g., hospitals of different sizes, different ownerships, and both urban and rural locations. The sample characteristics are shown in Table 2. Note that of the total responses, sixty-nine are from CEOs, 100 from CIOs. Where row totals are less than the overall sample size (e.g., eight respondents did not indicate whether they were a CEO or a CIO), the differences are explained by missing data for that variable.

Table 2: Sample Characteristic

Total Sample Size	N = 177	
Respondent Type	CEO	CIO
Sample Size: CEO and CIO	69	100
Years in healthcare management: average	29.2	19.2
Years in current position, average	10.5	7.9
Type of hospital: community, government, university, for-profit	47,17,1,2	94,2,2,2
Hospital location: rural/urban	47/21	46/54
Number of employees: average	1832	3470
Hospital number of beds: average	217	759

IV. TOP MANAGEMENT ISSUES IN HEALTHCARE IT

The average ratings of each issue by the CEOs and CIOs were computed. An overall average for each issue can be computed over all respondents, but it may give a misleading picture, as there are more CIOs than CEOs in the sample. To weigh the ratings of the CEOs and CIOs equally, an average of the averages of the CEOs and CIOs was computed to get an overall average. The top ten issues based on the overall average are shown in Table 3. The three averages are also shown in Table 3. Note once again that the Likert scale ranged from 1 to 7 and a lower average represents a higher ranking. A brief background and interesting observations about each of the top ten issues are provided below.

Table 3: The Top Ten Healthcare IT Issues

Rank	Issue	CEO Average Rating	CIO Average Rating	Overall Average: Average of CEO and CIO Ratings
1	Implementation of electronic medical records	1.70	1.36	1.53
2	Reducing healthcare errors with information technology	1.59	1.53	1.56
3	Change management from paper to electronic medical records	1.91	1.52	1.72
4	Privacy of electronic records	2.00	1.63	1.81
5	Improving quality of care with information technology	1.90	1.76	1.83
6	Quality assurance of electronic records	2.07	1.71	1.89
7	Security of electronic records	2.25	1.66	1.95
8	Health information systems interoperability	2.16	1.92	2.04
9	Decision support systems for hospital units	2.13	2.05	2.09
10	Decision support systems for physicians and clinics	2.12	2.09	2.10

Implementation of Electronic Medical Records

The implementation of electronic medical records was rated at the top of the list of the most important healthcare IT issues by our combined sample of CEOs and CIOs (note that CEOs ranked it #2 and CIOs ranked it #1). Electronic medical/health record (EMR/EHR) systems are central to any computerized health information system. While adopting an EHR system has become a high priority for many medical practices, they are still slow in fully implementing these systems [Menachemi et al., 2007]. As an example, while 56 percent of acute care units [Ford et al., 2008] are in the process of changing from paper records to electronic records, only 5 percent of small ambulatory-care offices are in the process of conversion. The percentage of office-based physicians with a fully functional EHR system was projected to increase to 10 percent by 2010, but adoption remains slow [Hsiao et al., 2010]. This rather anemic adoption rate upon first review seems surprising considering the many potential benefits of adoption including not only financial incentives, but administrative efficiencies, cost savings, and enhanced quality, while also avoiding longer term punishments for failure to adopt. However, a more nuanced review of the interoperability challenges along with the strong professional cultural tradition regarding the role of the physician [Katz and Kahn, 1966] reveals the systemic complexity of implementing electronic medical records.

This systemic complexity frequently results in frequent EHR implementation failures ranging from running over-budget or over-schedule, to not meeting all of the business requirements, to outright project abandonment [Kaplan and Harris-Salamone, 2009]. Hospitals, in particular, struggle with EHR implementations that result in higher costs per discharge and higher nurse staffing levels [Furukawa et al., 2010]. EHR implementation failure can be related to a number of moderating factors including size [Greenhalgh et al., 2009], for-profit vs. non-profit status [Heeks, 2006], and organizational culture [Kaplan and Harris-Salamone, 2009], especially when there is a disconnect in priorities between the CEO and the CIO [Simon, 2010]. Since most organizations are aware that they do not manage complexity well [Uhl-Bien et al., 2007; Marion and Uhl-Bien, 2007], it is not surprising that healthcare organizations avoid implementing a change when efficacy for that change is low despite the sizeable benefits that could be derived from a successful implementation. Given that experts advise careful planning, equipment selection, and staff training and warn that, even then, adopters may lose productivity for a time [Versaform, 2008], serves to reinforce adoption reluctance.

Reducing Healthcare Errors with Information Technology

Anecdotal instances of misdiagnoses, accidents, and deaths frequently appear in the popular press. The number of deaths in U.S. hospitals due to medical errors is alarmingly high. Estimates of deaths due to medical errors range from 44,000 to 98,000 people a year in U.S. hospitals [Hayward and Hofer, 2001]. Information technology has the potential to reduce errors and improve patient safety, due to improved and efficient record keeping, as well as being able to provide access to more current and remote patient records. At the same time, there are unintended

consequences and dangers of increasing certain types of errors. In fact, a new term has been coined by Weiner et al. [2007] to refer to such errors as *e-iatrogenesis*. They define *e-iatrogenesis* as patient harm caused at least in part by the application of health information technology. As Ash et al. [2004] identify, these errors fall into two categories: those in entering and retrieving information, and those in the communication and coordination processes. Weiner et al. [2007] point out that an e-iatrogenic event can be associated with just about any aspect of an HIT system, and it may involve errors of commission or omission. Furthermore, these events may fall into technical, human–machine interface, as well as organizational domains. Healthcare IT professionals need to be fully aware of these issues and devote special attention to such errors in the system design and implementation phases.

Change Management from Paper to Electronic Records

Lorenzi and Riley [2003] point out that many healthcare IS implementations are less than completely successful. Technical shortcomings are only part of the reason; the more important issue is change management [Baker et al., 2008]. Change management is the process of assisting individuals and organizations in passing from an old way of doing things to a new way of doing things [Lorenzi and Riley, 2003]. Resistance to change is a common phenomenon in all organizations and, according to one classical management theory [Lewin, 1947], requires attention to three stages of change: unfreezing, the change itself, and refreezing. Baron et al. [2005] point out that change management is one of the issues that needs to be addressed in the successful implementation of electronic medical records. They noted that soon after implementation, there is a period of decreased competence and increased effort; the expectations during this period need to be a carefully managed. Ilie [2009] notes that various influence tactics can be used during EMR implementation, which could translate in compliant use, committed use, or resistance to EMR, depending on the tactics employed.

Privacy of Electronic Records

With electronic patient databases, the traditional rights to personal privacy may be compromised [Gostin, 1997; Angst and Aggarwal, 2009]. Although Health Insurance Portability and Accountability Act (HIPAA) Privacy laws have been enacted, the management of privacy concerns is still a big issue [Raths, 2010]. While paper records provide an inherent level of privacy because of difficulties in record location and retrieval, electronic records provide for instantaneous access from anywhere and at any time. As Rindfleisch [1997] points out, our medical records contain a great amount of sensitive information, such as fertility and abortions, emotional problems, sexual behaviors and diseases, substance abuse, and physical abuse. Uncontrolled access to this kind of data can be harmful to the patient. By linking several databases, this problem is further compounded. Physicians, other healthcare professionals, and healthcare organizations must be vigilant in protecting patient privacy and confidentiality [Hersh, 2004; Wills et al, 2010], and this issue becomes substantially more challenging with increasing computerization of health records. There are currently several rules and regulations governing healthcare, including the American Health Insurance Portability and Accountability Act (HIPAA) and various state regulations. However, these regulations must be adapted in the context of electronic records. Issues that need to be resolved include access rights to data; what, how, when, and where data is stored; data analysis rights; and governing policies [Meingast et al., 2006].

Improving Quality of Care with Information Technology

Fortunately, most people in the healthcare industry realize that information technology provides a major opportunity for improving quality of care. Computerization of processes that are error-prone, new and emerging technologies, and decision support systems may improve quality, as well as support quality measurement [Bates, 2002]. Chaudhry et al. [2006] have demonstrated the efficacy of health information technologies in improving quality and efficiency. At the same time, they state that whether and how other institutions can achieve similar benefits, and at what costs, are unclear. The American Hospital Association [2010] asserts that certain health information technologies, such as computerized physician order entry (CPOE), computerized decision support systems, electronic health records, and bar coding can improve quality of care as well as reduce errors. Newer technologies combined with instant access to relevant patient data from different sources and locations provide the tools necessary for effective patient care. Other promising developments include patient health record (PHR) which empowers the consumer, and telehealth which provides specialized services in remote areas and ensures continuity of care [Gagnon et al., 2006].

Security of Electronic Records

In addition to being a concern for both CIOs and CEOs, security of electronic medical records constitutes a major regulatory compliance issue. Security must be in compliance with the *security rule* of the Health Insurance Portability and Accountability Act (HIPAA). There are five guiding principles of HIPPA's security rule: scalability, comprehensives, technological neutrality, consideration of both external and internal security threats, and risk analysis [HIPPA, 2010]. Scalability ensures that compliance with security does not depend on the size or scope of the medical entity; it requires that covered entities (CE), regardless of their size, must comply with rules. Comprehensiveness requires for a CE to develop a "comprehensive" approach to all aspects of electronic medical

records' security. Neutrality of the technology provides flexibility to a CE in determining the most appropriate technology, and the onus is on the CE to justify the technology that is used. The CE is required to protect its data from both internal and external security threats, to regularly conduct security risk analysis and to provide appropriate documentation. In addition, the security rule requires the CE to be in full compliance; partial compliance is not acceptable. There are a number of other key concepts to assure the security of medical records. One requirement is the establishment and formal documentation of security processes, policies, and procedures. Another is the "reasonableness" requirement. Reasonableness requires the CE to certify and document that *reasonable* measures have been taken to protect electronic medical records. Finally, CEs must provide regular security training, awareness to its workforce, and it must revise its security policies and procedures as needed.

Quality Assurance of Electronic Records

Quality medical records have been associated with good care, whereas lack of quality has proven disastrous [Lyons and Payne, 1974]. As a result, the value of a high-quality electronic medical record justifies the investment in information technology to support it. The quality of medical records is influenced by a number of factors. For example, poor documentation of the type of data collected may lead to incompleteness of medical records. Documentation of the medical records needs to be accurate, complete, timely, and legible, and its source should be of high quality and free of errors. This can be a pervasive issue, as Pyper et al. [2004] found in their study—70 percent of patients found at least one error or omission (although a majority of the errors and omissions were trivial and included such items as missing postcodes or outdated telephone codes). Data entry errors due to system edits or inappropriate forms designs can impact the quality of medical records. Other sources of errors in medical records are clerical transcription mistakes, incorrect reporting by patients [Wagner and Hogan, 1996], transposing numbers, incorrect interpretations, lack of adequate system knowledge, policy or procedural problems, erroneous standards and conventions, and poor communication among stakeholders. Achieving high-quality medical records is essential yet complex. To achieve it, the development and use of standard definitions, documentations, and procedures play an important role. It is critical to establish objective criteria for medical records' quality metrics, develop formal procedures to measure the performance of these metrics, and develop and recommend actions to correct any identified problems.

Health Information Systems Interoperability

As Hersh [2004] points out, the majority of healthcare data, whether paper-based or electronic, are stored in different geographic locations and thus trapped in proprietary silos. As a result, a patient may have a physician or health provider with an advanced EHR system, but, if that patient requires care elsewhere across town or in another city or state, there is little likelihood the information from that advanced system will be accessible. The second care facility will then have to make decisions with either incomplete information or have to order a new battery of tests. In a highly mobile society, the need to link and share patient data from various systems at different geographical locations is thus paramount. Furthermore, the integration of patient data from various sources is necessary for research purposes. The problems of integrating data are manifold and include such challenges as technology infrastructure, industry capacity, security, and common standards [Brailer, 2005]. At the present time, there are scores of EHR systems and vendors in the U.S. alone. In fact, there is a danger that the widespread adoption of stand-alone EHRs may lead to a proliferation of dissimilar sets of standards, which may make interoperability and data integration extraordinarily difficult if not impossible [Raths, 2010]. Even within a single medical institution, the lack of standards, or ironically, far too many standards, creates huge data quality and integration challenges. Other challenges stem from the fact that patient data sets are large, complex, heterogeneous, hierarchical, time series based, nontraditional, and originate from a verity of sources with differing levels of quality and format. Further, data sources may have incomplete, inaccurate, and missing elements; some may be erroneous due to human and equipment error; and the data may lack canonical consistencies within and between sources [Ciosa et al, 2002].

Decision Support Systems for Hospital Unit, Clinics, and Physicians

Decision Support Systems are becoming increasingly critical in the daily operation of today's organizations, including healthcare facilities and hospitals. Clinical decision support systems (CDSs) are designed to improve clinical and medical decision making and have been shown to improve healthcare practitioners' performance and patient care [Amit et al., 2005; Hunt et al., 1998; Johnston et al., 1994]. Wong et al. [2000] describe CDS systems as having "the potential to minimize practice variation and improve patient care" (p. 240). Perreault [1999] outlines four key functions of clinical decision support systems. Administrative support functions of CDS support clinical coding and documentation, authorization of procedures, and referrals. Second, support for managing clinical complexity is provided and includes tracking orders, referrals follow-up, and preventive care. Third, support for cost control is provided by allowing for efficient monitoring of medication orders and avoiding duplicate or unnecessary tests. The fourth function includes providing support for clinical diagnosis and treatment plan processes and promoting use of best practices, condition-specific guidelines, and population-based management.

In essence, CDS are "active knowledge systems which use two or more items of patient data to generate case-specific advice" [Wyatt and Spiegelhalter, 1991, p. 274]. Clinical DSs are typically designed to integrate a medical knowledge base, patient data, and an inference engine to generate case specific advice. However, medical decision making as an integral part of developing efficacious disease control and treatment is a challenging, complex, and multifaceted process. To achieve this goal, the system needs to be presented with high-quality, non-fragmented historic patient data as the fundamental ingredient of robust analysis. These are not easily achievable goals; they require attention to numerous issues such as data quality, integration, interoperability, diverse standards, heterogeneous data formats, and system design. While some commercial products have begun to appear in the market, clearly we are still at the beginning stages and much work remains to be done.

V. CEO AND CIO PERSPECTIVES

It is instructive to examine the importance of healthcare IT issues separately from the perspectives of CEOs and CIOs. Table 4 shows the top five and bottom five issues for CEOs, and Table 5 does the same for the CIOs.

Table 4: IT in Healthcare Issues for CEOs

Top Five Issues	Rank	Bottom Five Issues	Rank
Reducing healthcare errors with information technology (1.59)	1	IT's role in healthcare offshoring (outside the country) (5.51)	34
Implementation of electronic medical records (1.70)	2	IT's role in healthcare outsourcing (within the country) (4.43)	33
Improving quality of care with information (1.90)	3	Technology support for home healthcare (4.03)	32
Change management from paper to electronic medical records (1.91)	4	IT support for insurance companies (3.71)	31
Privacy of electronic records (2.00)	5	Scanning IT trends and timely implementation of selected technologies (3.54)	30

The CEO views and CIO views are largely consistent. There is agreement on four of the five top issues and four of the five bottom issues. This is an important finding as there seems to be a relatively good alignment between perceptions of business and IT priorities in the healthcare industry. IT alignment with business has been a perennial concern in the IS literature.

Since 1994, the lack of alignment has been ranked the #1 or #2 issue by IT executives across all industries [Luftman and Ben-Zvi, 2010, 2011; Luftman et al., 2009; Luftman and Kempaiah, 2008; Luftman and McLean, 2004]. Furthermore, Luftman and Kempaiah [2007] have examined the capabilities and components of business-IT alignment and the relationship of alignment with organizational performance.

Table 5: IT in Healthcare Issues for CIOs

Top Five Issues	Rank	Bottom Five Issues	Rank
Implementation of electronic medical records (1.36)	1	IT's role in healthcare offshoring (outside the country) (5.64)	34
Change management from paper to electronic medical records (1.52)	2	IT's role in healthcare outsourcing (within the country) (4.75)	33
Reducing healthcare errors with information technology (1.53)	3	IT support for insurance companies (4.34)	32
Privacy of electronic records (1.63)	4	Technology support for home healthcare (4.10)	31
Security of electronic records (1.66)	5	Group collaboration systems (3.48)	30

In our sample, minor differences were observed between the views of the CEOs and CIOs, with the nature of these differences consistent with the roles they play in the organization. The CEOs are more focused on the quality of care, while CIOs place more emphasis on technological issues, such as the security of the electronic records. Similarly the bottom five issues are also revealing. Overall information technology outsourcing, especially offshoring, is huge in practically all business and industry. For example, according to the Global Insight report, IS offshoring from the U.S. is expected to double to $250 billion by the year 2015. However, it is still at a nascent stage in healthcare and has not demanded much attention from the CIOs or the CEOs at this time. Other areas which are not on their radar screen are IT for home health and IT support for insurance companies.

Entrepreneurial Orientation and Culture

The above results can be interpreted in light of the current orientation of healthcare facilities and their executive management. As was pointed out earlier, the U.S. has been slow in adopting information technology in healthcare, and healthcare is the last industry to embrace information technology. How fast and how successful this transition will be and what measures can be taken to ensure success depends on the underlying culture of the participants in this process [Baker et al., 2008; Raths, 2010]. Using valid measurement instruments, the entrepreneurial orientation of the hospital executives as well as the culture of their institutions were captured. Figure 2 shows their entrepreneurial orientation.

Two observations can be made. First, the senior management tends to be conservative and risk averse ($p < .03$ for the three items as a scale). These executives prefer to try only tried and low-risk projects and not willing to embark on ambitious and risky projects. Second, while both groups are conservative, the CEOs are slightly more willing to take any risks.

These observations are reinforced by the cultural profile of the hospitals (Table 6) based on the perceptions of the CEOs and the CIOs. To the extent these results are representative of the entire country, it appears that a majority of healthcare providers function on the basis of personalized family-oriented service to their consumers. Only a fourth of them appear to be dynamic and entrepreneurial.

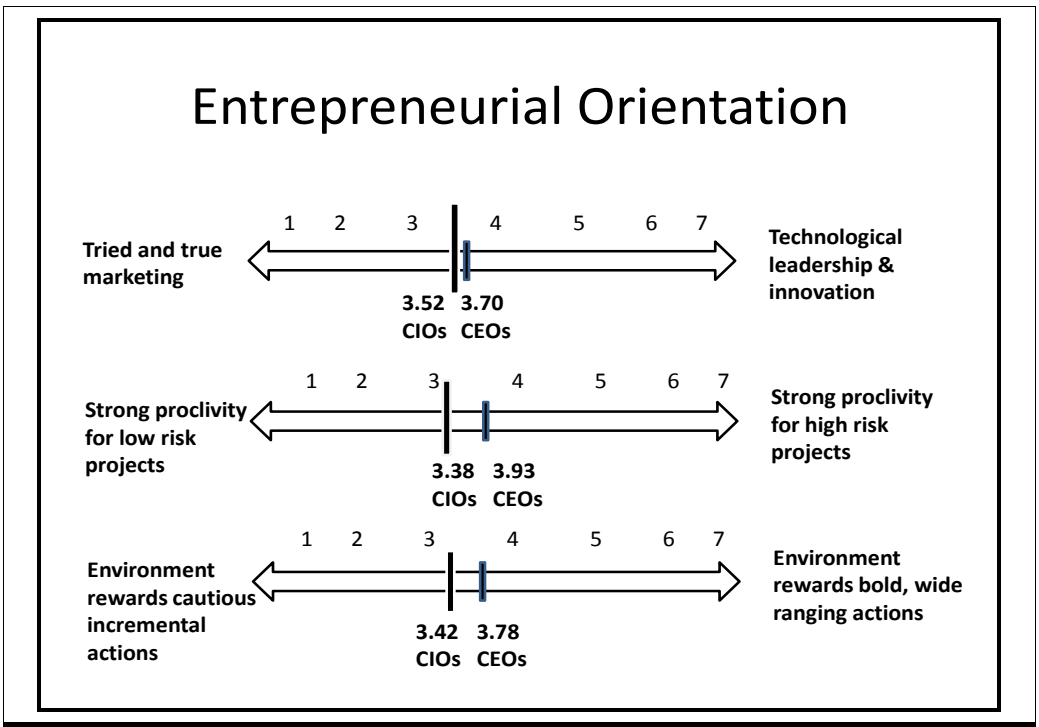

Figure 2. Entrepreneurial Orientation of CEOs and CIOs

Table 6: Hospital Culture

	CEOs	CIOs
Personal—Extended Family	48%	39.9%
Dynamic and Entrepreneurial	24.8%	24.5%
Formalized and Structured	14.2%	20.5%
Production Oriented	13%	15.1%

VI. PERSPECTIVES OF URBAN AND RURAL HOSPITALS

We segmented the sample into urban and rural hospitals, as differences in the quality of care, access, and available resources between rural and urban hospitals have been long documented (e.g., Comer and Mueller, 1995; Sheikh and Bullock, 2001). Of the 177 responses, ninety-three were from rural hospitals, seventy-five were from urban hospitals and nine had missing information. Once again, we compiled results for CEOs and CIOs separately, and then averaged them. The difference between rural and urban responses does not substantially change the Top Ten list of key issues, but the order changes somewhat for the rural and urban hospitals, as shown in Table 7 (the first

ten issues are listed in the overall original order). We have also listed the next five issues in the table, as some of them appeared in the top ten when categorizing by CEOs and CIOs within urban and rural areas.

It is noteworthy that the changes in the order of importance between rural and urban hospitals indicate that privacy of electronic records and security of electronic records are more important in rural hospitals. An explanation offered by a participant at a recent forum [Palvia, 2010] suggested that people are more concerned about privacy in small communities because of "*everyone knowing everyone else*" and the likelihood of gossip and rumors. In urban hospitals, issues related to implementation of electronic medical records, although received similar *rankings* as in rural areas, received higher absolute *ratings*, meaning urban hospitals have a more pressing need for EMR implementation.

Table 7: Key IT issues of Urban and Rural Hospitals

	Rural Ratings and Ranks			Urban Ratings and Ranks		
Issue	Average of CEO and CIO	CEO Average n = 47	CIO Average n = 44	Average of CEO and CIO	CEO Average n = 21	CIO Average n = 54
Implementation of electronic medical records	1.62 (1)	1.74	1.50	1.48 (2)	1.62	1.30
Reducing healthcare errors with information technology	1.65 (2)	1.74	1.56	1.43 (1)	1.29	1.56
Change management from paper to electronic medical records	1.80 (4)	1.98	1.61	1.66 (3)	1.81	1.50
Privacy of electronic records	1.75 (3)	2.05	1.44	1.89 (6)	1.94	1.84
Improving quality of care with information technology	1.92 (7)	1.98	1.86	1.73 (4)	1.71	1.74
Quality assurance of electronic records	1.91 (6)	2.15	1.66	1.86 (5)	1.90	1.81
Security of electronic records	1.89 (5)	2.26	1.52	2.06 (8)	2.29	1.83
Health information systems interoperability	2.04 (8)	2.28	1.80	2.00 (7)	1.90	2.09
Decision support systems for hospital units	2.09 (9)	2.13	2.05	2.14 (11)	2.14	2.13
Decision support systems for physicians and clinics	2.16 (10)	2.15	2.16	2.08 (9)	2.05	2.11
Managing the cost of information technology	2.16 (10)	2.09	2.23	2.12 (10)	1.90	2.33
Compliance with regulations	2.23	2.47	1.98	2.56	2.67	2.44
System-wide approach to patient identity mgmt.	2.37	2.38	2.36	2.42	2.29	2.54
Controlling healthcare costs with IT	2.55	2.65	2.45	2.26	2.38	2.13
IT infrastructure issues	2.50	2.57	2.43	2.59	2.67	2.50

There are other interesting observations when examining CIOs and CEOs for lower ranked issues. In urban areas, the CEOs are more concerned about managing the cost of information technology, while the CIOs want to control healthcare costs with the use of IT. This is an interesting perspective; it seems that each stakeholder is more concerned about the other stakeholder's costs. Furthermore, in the rural areas, the CIOs seemed to be more concerned about compliance with regulations.

VII. DIFFERENCES BY SIZE OF HOSPITAL

Another factor of interest to medical researchers is hospital size [Baker et al., 2004; Banerjee et al., 1991]. As pointed out by Keeler et al. [1986], larger, teaching, and urban hospitals have better quality than smaller, non-teaching and rural hospitals. To investigate the effect of hospital size on key IT issues, the number of hospital employees was used as a measure of size. There were eleven responses that did not indicate size. The median number of employees in the remaining sample was 1375. The largest eighty-three hospitals above the median were grouped into the category "Large," and the smallest eighty-three hospitals below the median were grouped into the category "Small." As before, we compiled results for CEOs and CIOs separately and then averaged them. Once again, the size of the hospitals did not change the items that were on the Top Ten list, but the order did change. Table 8 lists the first ten issues in the overall original order; it also includes the next five issues, as some of them appeared in the top ten when categorizing by CEOs and CIOs.

Changes in the order that are noteworthy include (1) quality assurance of electronic records was more important for large hospitals and (2) privacy of electronic records was more important for small hospitals. Examining the absolute ratings alone, it is apparent that, while the ranks are similar, the large hospitals rate just about all issues higher in terms of their importance, compared to the small hospitals. In other words, while the large and small hospitals face similar issues related to IT, the degree of severity is higher for larger hospitals.

Table 8: Key IT Issues of Small and Large Hospitals						
	Small Hospital Ratings and Ranks			Large Hospital Ratings and Ranks		
Issue	Average of CEO and CIO	CEO Average n = 44	CIO Average n = 37	Average of CEO and CIO	CEO Average n = 21	CIO Average n = 59
Implementation of electronic medical records	1.60 (1)	1.77	1.43	1.47 (1)	1.62	1.32
Reducing healthcare errors with information technology	1.60 (1)	1.66	1.54	1.47 (1)	1.43	1.50
Change management from paper to electronic medical records	1.79 (4)	1.89	1.68	1.67 (3)	1.90	1.44
Privacy of electronic records	1.75 (3)	1.90	1.60	1.86 (6)	2.11	1.60
Improving quality of care with information technology	1.79 (4)	1.84	1.73	1.82 (5)	1.86	1.78
Quality assurance of electronic records	1.92 (6)	2.11	1.73	1.80 (4)	1.90	1.69
Security of electronic records	1.97 (7)	2.32	1.62	2.01 (8)	2.24	1.68
Health information systems interoperability	2.00 (8)	2.18	1.81	2.00 (7)	2.10	1.90
Decision support systems for hospital units	2.14	2.09	2.16	2.08 (9)	2.24	1.92
Decision support systems for physicians and clinics	2.11 (9)	2.07	2.14	2.12 (10)	2.19	2.05
Managing the cost of information technology	2.11 (9)	1.98	2.24	2.18	2.14	2.22
Compliance with regulations	2.17	2.34	2.00	2.57	2.86	2.27
System-wide approach to patient identity management	2.47	2.39	2.54	2.25	2.24	2.25
Controlling healthcare costs with IT	2.52	2.47	2.57	2.33	2.67	1.98
IT infrastructure issues	2.45	2.52	2.38	2.56	2.76	2.36

When the results by CEOs and CIOs are broken down, some differences can be observed. Managing the cost of information technology is important for both small and large hospital CEOs, while controlling healthcare costs with IT is important for large hospital CIOs. This result is similar to that observed for urban and rural hospitals. The obvious explanation is that most large hospitals are in urban areas and small hospitals are in rural areas. In the same vein, compliance with regulations was a concern for small hospital CIOs.

VIII. CONCLUSIONS

This research is most likely the first formal attempt to capture information technology issues in the healthcare industry. Thirty-four issues were compiled based on the literature and consultation with key individuals. These were rated by a national sample of hospital CEOs and CIOs, and a ranked list was compiled. Among the top ten issues, the implementation of electronic medical records is ranked the highest. The Top Ten list includes issues related to: implementing electronic medical records; improving healthcare quality by the use of information technology; change management, privacy, security, and accuracy of electronic records; and decision support applications. We hope that future research will seek to develop multi-item scales that tease out specific dimensions of the broad critical issues identified in this study.

While some differences exist, we found much similarity between the views of the CEOs and the CIOs with both groups being characterized as conservative and risk-averse in their entrepreneurial orientation. Interestingly again, except for minor variations, no major differences were observed between urban and rural hospitals and between large and small hospitals. These group-wise comparisons indicate some robustness of our findings. Given the current and future role of IT in healthcare, these results should be further examined carefully by different stakeholders, i.e., healthcare providers, vendors, consumer groups, and governmental agencies [Thompson and Dean, 2009]. It would also be worthwhile to replicate such studies in the future to trace the trends and affect the evolution of healthcare IT in the U.S.

REFERENCES

Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the article on the Web, can gain direct access to these linked references. Readers are warned, however, that:

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Aggarwal, R., G. Gao, C. DesRoches, and A.K. Jha (2010) "The Digital Transformation of Healthcare: Current Status and the Road Ahead," *Information Systems Research* (21)4, pp.796–809.

Alavi, M., and D. Leidner (1999) "Knowledge Management Systems: Issues, Challenges, and Benefits," *Communications of the Association for Information Systems* (1) Article 7, pp. 1–36.

American Hospital Association (2010) "Advancing Excellence in Patient Care: Health Information Technology," www.aha.org/aha_app/issues/HIT/index.jsp (current Aug. 2, 2010).

Angst, C.M., and R. Aggarwal (2009) "Adoption of Electronic Health Records in the Presence of Privacy Concerns: The Elaboration Likelihood Model and Individual Persuasion," *MIS Quarterly* (33)2, June, pp. 339–370.

Ash, J.S., M. Berg, and E. Coiera (2004) "Some Unintended Consequences of Information Technology in Health Care: The Nature of Patient Care Information System-related Errors," *Journal of the American Medical Informatics Association* (11)2, Mar.–Apr., pp. 104–112.

Baker, J., J. Song, D. Jones, and E. Ford (2008) "Information Systems and Healthcare XXIX: Information Technology Investments and Returns—Uniqueness in the Healthcare Industry," *Communications of the Association for Information Systems* (23) Article 21, pp. 375–392.

Baker, R.G., P.G. Norton, V. Flintoft, R. Blais, A. Brown, J. Cox, E. Etchells, W.A. Ghali, P. Hébert, S.R. Majumdar, M. O'Beirne, L. Palacios-Derflingher, R.J. Reid, S. Shep, and R. Tamblyn (2004) "The Canadian Adverse Events Study: The Incidence of Adverse Events Among Hospital Patients in Canada," *Canadian Medical Association Journal* (170)11, May 25, pp. 1678-1686.

Ball, L., and R. Harris (1982) "SMIS Members: A Membership Analysis," *MIS Quarterly* (6)1, Mar., pp.19–38.

Ball, M.J. (2003) "Hospital Information Systems: Perspectives on Problems and Prospects, 1979 and 2002," *International Journal of Medical Informatics* (69), pp. 83–89.

Banerjee, S.N., T.G. Emori, D.H. Culver, R.P. Gaynes, W.R. Jarvis, T. Horan, J.R. Edwards, J. Tolson, T. Henderson, W.J. Martone, and National Nosocomial Infections Surveillance System (1991) "Secular Trends in Nosocomial Primary Bloodstream Infections in the United States, 1980–1989," *The American Journal of Medicine* (91)3, Supplement 2, Sept. 16, pp. S86–S89.

Baron, R.J., E.L. Fabens, M. Schiffman, and E. Wolf (2005) "Electronic Health Records: Just Around the Corner? Or over the Cliff?" *Annals of Internal Medicine* (143)3, Aug. 2, pp. 222–226.

Bates, D.W. (2002) "The Quality Case for Information Technology in Healthcare," *BMC Medical Informatics and Decision Making* (2), p. 7.

Bates, D.W., M. Ebell, E. Gotlieb, J. Zapp, and H.C. Mullins (2003) "A Proposal for Electronic Medical Records in U.S. Primary Care," *Journal of the American Medical Informatics Association* (10)1, Jan./Feb., pp. 1–10.

Brailer, D.J. (2005) "Interoperability: The Key to the Future Health Care System," *Health Affairs* (5)19, Winter, pp. 19-21.

Burke, D., N. Menachemi, and R.M. Brooks (2006) "Health Care CIOs: Assessing Their Fit in the Organizational Hierarchy and Their Influence on Information Technology Capability," *Health Care Manager* (25)2, pp. 167–172.

Centers for Medicare and Medicaid Services, Office of the Actuary, National Health Statistics Group (2010) "National Health Care Expenditures Data," www.cms.gov/NationalHealthExpendData/ (current Jan. 2010).

Chaudhry, B., J. Wang, S. Wu, M. Maglione, W. Mojica, E. Roth, S.C. Morton, and P.G. Shekelle (2006) "Systematic Review: Impact of Health Information Technology on Quality, Efficiency, and Costs of Medical Care," *Annals of Internal Medicine* (144), pp. E-12–E-22.

Chun, M., and J. Mooney (2009) "CIO Roles and Responsibilities: Twenty-five Years of Evolution and Change," *Information & Management* (46)6, Aug., pp. 323–334.

Ciosa, K.J., and W. Mooree (2002) "Uniqueness of Medical Data Mining," *Artificial Intelligence in Medicine* (26), pp. 1–24.

Comer, J., and K. Mueller (1995) "Access to Health Care: Urban-Rural Comparisons from a Midwestern Agricultural State," *The Journal of Rural Health* (11)2*,* Mar., pp. 128–136.

Dey, P.K., S. Hariharan, and W. Ho (2007) "Managing Healthcare Technology in Quality Management Framework," *International Journal of Technology Management* (40), pp. 45–68.

Dickson, G.W., R.L. Leitheiser, M. Nechis, and J.C. Wetherbe (1984) "Key Information Systems Issues for the 1980's," *MIS Quarterly* (8)3, pp. 135–148.

Ford, E.W., A. McAlearney, M.T. Phillips, and N. Menachemi (2008) "Computerized Physician Order Entry (CPOE) Adoption in U.S. Hospitals: Can the Federal Mandate Be Met?" *International Journal of Medical Informatics* (77)2, pp, 539-545..

Ford, E.W., N. Menachemi, L.T. Peterson, and T.R. Huerta (2009) "Resistance Is Futile: But It Is Slowing the Pace of EHR Adoption Nonetheless," *Journal of the American Medical Informatics Association* (16)3, pp. 274-281

Furukawa, M.F., T.S. Raghu, and B.B.M. Shao (2010) "Electronic Medical Records, Nurse Staffing, and Nurse-sensitive Patient Outcomes: Evidence from California Hospitals, 1998–2007," *Health Services Research*, (45)4, pp. 941–962.

Gagnon, M-P., J. Duplantie, J-P. Fortin, and R. Landry (2006) "Implementing Telehealth to Support Medical Practice in Rural/remote Regions: What Are the Conditions for Success?" *Implementation Science*, pp. 1-18.

Garg, A.X., N.K.J. Adhikari, and H. McDonald (2005) "Effects of Computerized Clinical Decision Support Systems on Practitioner Performance and Patient Outcomes: A Systematic Review," *JAMA* (293)10, Mar. 9, pp. 1223–1238.

Gostin, l. (1997) "Health Care Information and the Protection of Personal Privacy: Ethical and Legal Considerations," *Annals of Internal Medicine* (127)8, pp. 683–690.

Green, K.M., J.G. Covin, and D.P. Slevin (2008) "Exploring the Relationship Between Strategic Reactiveness and Entrepreneurial Orientation: The Role of Structure–Style Fit," *Journal of Business Venturing* (23), pp. 356–383.

Greenhalgh, T., H. Potts, G. Wong, P. Bark, and D. Swinglehurst (2009) "Tensions and Paradoxes in Electronic Patient Record Research: A Systematic Literature Review Using the Meta-narrative Method," *Milbank Quarterly* (87)4, pp. 729–788.

Hagland, M. (2007) "Clinical Is King: This Year's HIMSS CIO Survey Found That Using Clinical IT to Improve Patient Safety Was Top-of-mind," *Healthcare Informatics* (24)6, pp. 16–17.

Hayward, R.A., and T.P. Hofer (2001) "Estimating Hospital Deaths Due to Medical Errors: Preventability Is in the Eye of the Reviewer," *JAMA* (286), pp. 415–420.

Heeks, R. (2006) "Health Information Systems: Failure, Success and Improvisation," *International Journal of Medical Informatics* (75), pp. 125–137.

Hersh, E. (2004) "Health Care Information Technology: Progress and Barriers," *JAMA* (292), pp. 2273–2274.

Hikmet, N., and S.K. Chen (2003) "An Investigation into Low Mail Survey Response Rates of Information Technology Users in Healthcare Settings," *International Journal of Medical Informatics* (72)1, 2003, pp. 29–34.

HIPPA Security Rule, http://www.hhs.gov/ocr/privacy/hipaa/administrative/securityrule/ (current Aug. 2010).

Hsiao, C., E. Hing, T. Socey, and B. Cai (2010) "Electronic Medical Record/Electronic Health Record Systems of Office-based Physicians: United States, 2009 and Preliminary 2010 State Estimates," *National Center for Health Statistics*, http://www.cdc.gov/nchs/data/hestat/emr_ehr_09/emr_ehr_09.htm (current Jan. 2012).

Hunt, D.L., R.B. Haynes, S.E. Hanna, and K. Smith (1998) "Effects of Computer-Based Clinical Decision Support Systems on Physician Performance and Patient Outcomes: A Systematic Review," *JAMA* (280), pp. 1339–1346.

Ilie, V. (2009) "How to Influence Physicians to Use Electronic Medical Records (EMR)? Social Influence Tactics and Their Effects on EMR Implementation Effectiveness," Working Paper, *McDowell Research Center*, University of North Carolina, Greensboro.

Jha, A.K., C.M. DesRoches, P.D. Kralovec, and M.S. Joshi (2010) "A Progress Report on Electronic Health Records in U.S. Hospitals," *Health Affairs* (Millwood) (29), pp.1951–1957.

Johnston, M.E., K.B. Langton, R.B. Haynes, and A. Mathieu (1994) "Effects of Computer-based Clinical Decision Support Systems on Clinician Performance and Patient Outcome: A Critical Appraisal of Research," *Annals of Internal Medicine* (120)2, pp. 135–142.

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

Katz, D., and R.L. Kahn (1966) *The Social Psychology of Organizations,* New York, NY: John Wiley and Sons.

Keeler E.B., L.V. Rubenstein, and K.L. Kahn (1986) "Hospital Characteristics and Quality of Care," *JAMA* (268), p. 1709.

Koshy, R. (2005) "Navigating the Information Technology Highway: Computer Solutions to Reduce Errors and Enhance Patient Safety," *Transfusion* (45), pp. 189S–205S.

Kumar, V., B. Maheshwari, and U. Kumar (2003) "An Investigation of Critical Management Issues in ERP Implementation: Empirical Evidence from Canadian Organizations," *Technovation* (23)10, Oct., pp. 793–807.

Kutney-Lee, A., and D. Kelly (2011) "The Effect of Hospital Electronic Health Record Adoption on Nurse-assessed Quality of Care and Patient Safety," *Journal of Nursing Administration* (41)11, Nov., pp. 66–72.

Lewin K. (1943) "Defining the Field at a Given Time," *Psychological Review* (50), pp. 292–310.

Lewin, K. (1947) "Frontiers in Group Dynamics," *Human Relations* (1), pp. 2–38.

Lorenzi, N.M., and R.T. Riley (2003) "Organizational Issues = Change," *International Journal of Medical Informatics* (69), pp. 197–203.

Luftman, J. (2005) "Key Issues for IT Executives 2005," *MIS Quarterly Executive* (4)2, June, pp. 269–286.

Luftman, J., and T. Ben-Zvi (2011) "Key Issues for IT Executives 2011: Cautious Optimism in Uncertain Economic Times," *MIS Quarterly Executive* (10)4, Dec., pp. 203–212.

Luftman, J., and T. Ben-Zvi (2010) "Key Issues for IT Executives 2010: Judicious IT Investments Continue Post-Recession," *MIS Quarterly Executive* (9)4, Dec., pp. 263–273.

Luftman, J., and R. Kempaiah (2007) "An Update on Business-IT Alignment: 'A Line' Has Been Drawn," *MIS Quarterly Executive* (3)6, (6)3, Sept., pp. 165-177.

Luftman, J., and R. Kempaiah (2008) "Key Issues for IT Executives 2007," *MIS Quarterly Executive* (7)2, pp. 99–112.

Luftman, J., R. Kempaiah, and E.H. Rigoni (2009) "Key Issues for IT Executives 2008," *MIS Quarterly Executive* (8)3, pp. 151–159.

Luftman, J., and E.R. McLean (2004) "Key Issues for IT Executives," *MIS Quarterly Executive* (3)2, pp. 89–104.

Lyons, T.F., and B.C. Payne (1974) "The Relationship of Physicians' Medical Recording Performance to Their Medical Care Performance," *Medical Care* (12)8, pp. 714–720.

Marion, R., and M. Uhl-Bien (2007) "Paradigmatic Influence and Leadership: The Perspectives of Complexity Theory and Bureaucracy Theory," in Hazy, J.K., J.A. Goldstein, and B.B. Lichtenstein (eds.), *Complex Systems Leadership Theory: New Perspectives from Complexity Science on Social and Organizational Effectiveness,* Mansfield, MA: ISCE Publishing, pp. 143–159.

Meingast, M., T. Roosta, and S. Sastry (2006) "Security and Privacy Issues with Health Care Information Technology," *Proceedings of the 28th IEEE EMBS Annual International Conference*, New York, NY, Aug. 30–Sept. 3.

Menachemi, N., E.W. Ford, L.M. Beitsch, and R.G. Brooks (2007) "Incomplete EHR Adoption: Late Uptake of Patient Safety and Cost Control Functions," *American Journal of Medical Quality* (22)5, pp. 319–326.

Moghaddasi, H., and A. Sheikhtaheri (2010) "CEO is a Vision of the Future Role and Position of CIO in Healthcare Organizations," *Journal of Medical Systems*, (34)4, Dec., pp. 1121–1128.

New York Times Editorial (2007) "World's Best Medical Care?" Aug. 12.

Palvia, P. (2010) "Critical Issues in Healthcare Information Technology: Hospital CEO and CIO Perspectives," Featured speech, *NC HIMSS Fall Breakfast Meeting*, Sept. 13, Grandover Resort, Greensboro, NC.

Perreault, L., and J. Metzger (1999) "A Pragmatic Framework for Understanding Clinical Decision Support," *Journal of Healthcare Information Management* (13)2, pp. 5–21.

Poon, E.G., A.K. Jha, M. Christino, M.M. Honour, R. Fernandopulle, B. Middleton, J. Newhouse, L. Leape, D.W. Bates, D. Blumenthal, and R. Kaushal (2006) "Assessing the Level of Healthcare Technology Adoption in the United States: A Snapshot," *BMC Medical Informatics and Decision Making* (6)1, pp. 1–9.

Pyper, C., J. Amery, M. Watson, and C. Crook (2004) "Patients' Experiences When Accessing Their On-line Electronic Patient Records in Primary Care," *The British Journal of General Practice* (54)498, Jan., pp. 38–43.

Raths, D. (2010) "The Six Toughest Policy Issues: Health IT Leaders, and Policy-Makers Grapple with Change on Several Fronts," *Healthcare Informatics* (70)4, pp. 70–72.

Rindfleisch, T.C. (1997) "Privacy, Information Technology, and Health Care," *Communications of the ACM* (40)8, Aug., pp. 93-100.

Simon, P. (2010) "How Not to Run an IT Project: A Case Study," *Business Intelligence* (10)1, pp. 1–17.

Smaltz, D.H., V. Sambamurthy, and R. Agarwal (2006) "The Antecedents of CIO Role Effectiveness in Organizations: An Empirical Study in the Healthcare Sector," *IEEE Transactions on Engineering Management* (53)2, pp. 207–222.

Sheikh, K., and C. Bullock (2001) "Urban-Rural Differences in the Quality of Care for Medicare Patients with Acute Myocardial Infarction," *Archives of Internal Medicine* (161), pp. 737–743.

Thompson, S.M., and M.D. Dean (2009) "Advancing Information Technology in Healthcare," *Communications of the ACM* (52)6, pp. 118–121.

Uhl-Bien, M., R. Marion, and B. McKelvey (2007) "Complexity Leadership Theory: Shifting Leadership from the Industrial Age to the Knowledge Era," *The Leadership Quarterly* (18)4, pp. 298–318.

Versaform (2008) "Electronic Medical Records Implementation Made Easy," *8.5.08*.

Wagner, M.M., and W.R. Hogan (1996) "The Accuracy of Medication Data in an Outpatient Electronic Medical Record," *The Journal of the American Medical Informatics Association* (3), pp. 234–244.

Weiner, J.P., T. Kfuri, K. Chan, and J.B. Fowles (2007) "'e-Iatrogenesis': The Most Critical Unintended Consequence of CPOE and Other HIT," *Journal of American Medical Information Association* (14)3, pp. 387–389.

White, J.C., P.R. Varadarajan, and P.A. Dacin (2003) "Market Situation Interpretation and Response: The Role of Cognitive Style, Organizational Culture, and Information Use," *Journal of Marketing* (67), pp.63–79.

Wills, M.J., S. Sarnikar, O.F. El-Gayar, and A.V. Deokar (2010) "Information Systems and Healthcare XXXIV: Clinical Knowledge Management Systems—Literature Review and Research Issues for Information Systems," *Communications of the Association for Information Systems* (26) Article 26, pp. 565–597.

Wong, H.J., M.W. Legnini, and H.H. Whitmore (2000) "The Diffusion of Decision Support Systems in Healthcare: Are We There Yet?" *Journal of Healthcare Management* (45)4, pp. 240–249, Discussion, pp. 249–253.

Wyatt, J., and D. Spiegelhalter (1991) "Evaluating Medical Expert Systems: What to Test, and How?" in Talmon, J., and J. Fox (eds.), *Knowledge-based Systems in Medicine: Methods, Applications and Evaluation,* Heidelberg, Germany: Springer Verlag, pp. 274–290.

APPENDIX A: HEALTHCARE INFORMATION TECHNOLGY MANAGEMENT: KEY ISSUES SURVEY

(Relevant portions of the questionnaire are shown below.)

The use of information technology in healthcare provides tremendous opportunities for improving care and reducing costs. In this research, we are trying to identify the key information technology (IT) issues for healthcare CIOs and CEOs. This baseline survey will set the stage for a detailed examination of specific issues. Results from the study will assist in focusing your attention on critical areas of concern as we modernize our health systems. The completion of the survey takes no longer than 10 minutes.

We have identified the following issues based on a review of the literature and discussions with healthcare experts. Please rate each issue on a 7-point scale. Circle 1 if the issue is extremely important, 4 if it is moderately important, and 7 if it is not important at all. Please provide your rating in the middle Rating column. Do not use the rightmost column labeled "Top 10 Rank" at this time.

IT in Healthcare Issue	Rating High Low	Top 10 Rank
Implementation of electronic medical records	1 2 3 4 5 6 7	
Change management from paper to electronic medical records	1 2 3 4 5 6 7	
Quality assurance of electronic records	1 2 3 4 5 6 7	
System-wide approach to patient identity management	1 2 3 4 5 6 7	
Information technology infrastructure issues	1 2 3 4 5 6 7	
Measuring the effectiveness of IT in healthcare	1 2 3 4 5 6 7	
Technology support for home healthcare	1 2 3 4 5 6 7	
Managing the cost of information technology	1 2 3 4 5 6 7	
IT human resources development	1 2 3 4 5 6 7	
Scanning IT trends and timely implementation of selected technologies	1 2 3 4 5 6 7	
IT support for healthcare supply chain (e.g., pharmaceuticals, pharmacies)	1 2 3 4 5 6 7	
IT support for insurance companies	1 2 3 4 5 6 7	
Managing the release-of-information process	1 2 3 4 5 6 7	
Compliance with regulations (e.g., HIPAA)	1 2 3 4 5 6 7	
Using IT to enable consumer empowerment in healthcare	1 2 3 4 5 6 7	
Controlling healthcare costs with information systems	1 2 3 4 5 6 7	
IT's role in healthcare outsourcing (within the country)	1 2 3 4 5 6 7	
IT's role in healthcare offshoring (outside the country)	1 2 3 4 5 6 7	
Building of regional and national health databases/network	1 2 3 4 5 6 7	
Implementation of personal health record (PHR)	1 2 3 4 5 6 7	
Business model change to embrace IT in healthcare	1 2 3 4 5 6 7	
Decision support systems for physicians and clinics	1 2 3 4 5 6 7	
Decision support systems for hospital units	1 2 3 4 5 6 7	
Decision support systems for consumers	1 2 3 4 5 6 7	
Decision support systems for pharmacies	1 2 3 4 5 6 7	
IT support for telemedicine (i.e., remote care and procedures)	1 2 3 4 5 6 7	
Group collaboration systems in healthcare	1 2 3 4 5 6 7	
Improving quality of care with information technology	1 2 3 4 5 6 7	
Reducing healthcare errors with information technology	1 2 3 4 5 6 7	
Utilizing IT to provide a safe work environment	1 2 3 4 5 6 7	
Health information systems interoperability	1 2 3 4 5 6 7	
Disaster preparedness and recovery	1 2 3 4 5 6 7	
Security of electronic records	1 2 3 4 5 6 7	
Privacy of electronic records	1 2 3 4 5 6 7	
*If you would like to add more issues, please write them below and provide a rating in the middle column.		

Please go back to the above list, select the top ten most important issues, and rank them from 1 to 10, where 1 is the most important and 10 is the least. Place your rank in the rightmost column above. Remember, you do not need to rank all issues, just the top ten. It may be helpful to consider only those you previously rated between 1 and 3 in the middle column.

Hospital Culture

Distribute 100 points among the four categories depending on how *similar* the category description is to your hospital.

Category I *Points:* _____

- My hospital is a very dynamic and entrepreneurial place. People are willing to stick their necks out and take risks.
- The head of my hospital is generally considered an entrepreneur, an innovator, or a risk taker.
- The glue that holds my hospital together is a commitment to innovation and development. There is an emphasis on being first.
- My hospital emphasizes growth and acquiring new resources. Readiness to meet new challenges is important.

Category II *Points:* _____

- My hospital is a very personal place. It is like an extended family. People seem to share a lot of themselves.
- The head of my hospital is generally considered a mentor, sage, or a father or mother figure.
- The glue that holds my hospital together is loyalty and tradition. Commitment to this hospital runs high.
- My hospital emphasizes human resources. High cohesion and morale in the hospital are important.

Category III *Points:* _____

- My hospital is a very formalized and structured place. Established procedures generally govern what people do.
- The head of my hospital is generally considered a coordinator, an organizer, or an administrator.
- The glue that holds my hospital together is formal rules and policies. Maintaining a smooth-running institution is important here.
- My hospital emphasizes permanence and stability. Efficient, smooth operations are important.

Category IV *Points:* _____

- My hospital is very production oriented. A major concern is with getting the job done, without much personal involvement.
- The head of my hospital is generally considered a producer, a technician, or a hard driver.
- The glue that holds my hospital together is the emphasis on tasks and goal accomplishment. A production-orientation is commonly shared.
- My hospital emphasizes competitive actions and achievement. Measurable goals are important.

Please circle the numbers in the following scales which best describe the orientation of your healthcare organization. Circle "1" if the statement on the left best describes your situation. Circle "7" if the statement on the right best describes your situation. Circle 2, 3, 4, 5, or 6 if you are in between.

1. In general, the top managers of my hospital favor:
   A strong emphasis on the marketing of tried and true practices — 1 2 3 4 5 6 7 — A strong emphasis on R&D, technological leadership and innovation
2. In general, the top managers of my hospital have:
   A strong proclivity for low-risk projects (with normal and certain rates of return) — 1 2 3 4 5 6 7 — A strong proclivity for high risk projects (with chances of very high returns)
3. In general, the top managers of my hospital believe that:
   Owing to the nature of the environment, it is best to explore it gradually via cautious, incremental behavior. — 1 2 3 4 5 6 7 — Owing to the nature of the environment, bold, wide-ranging acts are necessary to achieve the hospital's objectives.

Your job title (circle one): CIO CEO CFO IS Manager Other_____

Number of employees in the hospital: ____

Number of beds in the hospital: ____

Hospital ownership (circle one): Government Military University Community Not-for-profit For-profit

Location (circle one): Urban Rural

Service type (circle one): General medical/surgical Specialized
Psychiatric Long-term care
Rehabilitation Other

Do you have an approved physician teaching or residency program? Yes No

Is the hospital part of a larger hospital system? Yes No

Is the hospital being managed by an external firm? Yes No

Your number of years in healthcare management ____
Your number of years in the current position ____

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