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Medical Informatics In Healthcare Landscape A Strategic Analysis

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Abstract : The healthcare industry is under pressure to improve patient safety, operate more efficiently, reduce medical errors, and provide secure access to timely information while controlling costs, protecting patient privacy, and complying with legal guidelines. Analysts, practitioners, patients and others have concerns for the industry. Using the popular strategic analysis tool of strengths, weaknesses, opportunities, and threats analysis (SWOT), facing the healthcare industry and its adoption of information technologies (IT) are presented. Internal strengths supporting further industry investment in IT include improved patient safety, greater operational efficiency, and current investments in IT infrastructure. Internal weaknesses, however, include a lack of information system integration, user resistance to new technologies and processes, and slow adoption of IT. External opportunities including increased use of the Internet, a favorable national environment, and a growing call for industry standards are pressured by threats of legal compliance, loss of patient trust, and high cost of IT.

1. INTRODUCTION

The healthcare industry faces many well-recognized challenges: high cost of operations, inefficiency, inadequate safety, insufficient access to information, and poor financial performance. For years, many have called for a fundamental change in the way healthcare is delivered. And while there is yet no clear picture of what this change will be, many believe a paradigm shift in healthcare is imminent and that information technology (IT) is the catalyst.

Increasingly, IT is seen as a way to promote the quality, safety, and efficiency of healthcare by bringing decision support to the point of care, providing vital links and closing open loop systems, and allowing routine quality measurement to become reality. IT can not only reduce operating costs, but IT can also ensure a reduction in the number of medical errors. IT in the healthcare industry provides new opportunities to boost patient confidence and reinforce patient trust in caregivers and healthcare facilities. With health insurers feeling pressure from all directions (new regulations, consumers, rising medical costs), IT is an even more important asset for carriers (Balas, 2000).

When compared to other information intensive industries, healthcare organizations currently invest far

less in IT. For many years, the healthcare industry has experienced only single digit growth in terms of IT investment (Gillette, 2004). As a result, current healthcare systems are relatively unsophisticated compared to those in industries such as banking or aviation. With the many issues and variables surrounding healthcare's IT investment, a framework for better understanding of the current situation is needed before more improvements and enhancements can result. This article draws upon a comprehensive framework from the strategic planning literature to compile and summarize the major issues facing IT and the healthcare industry.

Methodology

By categorizing issues into strengths, weaknesses, opportunities, and threats, SWOT analysis is one of the top tools and techniques used in strategic planning (see Glaister & Falshaw, 1999). SWOT assists in the identification of environmental relationships as well as the development of suitable paths for countries, organizations, or other entities to follow (Proctor, 1992). Valentin (2001) suggests SWOT analysis is the traditional means for searching for insights into ways of crafting and maintaining a fit between a business and its environment. Other researchers (see Ansoff, 1965; Porter, 1991; and Mintzberg, Ahlstrand, & Lampel, 1998) agree SWOT provides the foundation to gather and organize information to realize the desired alignment of variables or issues. By listing favorable and unfavorable internal and external issues in the four quadrants of a SWOT analysis, planners can better understand how strengths can be leveraged, realize new opportunities, and understand how weaknesses can slow progress or magnify threats. In addition, it is possible to postulate ways to overcome threats and weaknesses (e.g., Hofer & Schendel, 1978; Schnaars, 1998; Thompson & Strickland, 1998; McDonald, 1999; and Kotler, 2000).

SWOT has been used extensively to aid in understanding a variety of decisions and issues including: manufacturing location decisions (Helms, 1999); penetration strategy design for export

promotions and joint ventures (Zhang & Kelvin, 1999); regional economic development (Roberts & Stimson, 1998); entrepreneurship (Helms, 2003); performance and behavior of micro-firms (Smith, 1999), and strategic planning (Khan & Al-Buarki, 1992). Hitt, Ireland, Camp, and Sexton (2001) suggest that identifying and exploiting opportunities is part of strategic planning. Thus, SWOT analysis is a useful way to profile the general environmental position of a new trend, technology, or a dynamic industry.

By using SWOT analysis, it is possible to apply strategic thinking toward the implementation of IT in healthcare. By examining the internal and external factors interacting both for and against IT in healthcare, healthcare providers and supply chain organizations can formulate a strategic IT plan for developing their information resources over the next several years. By uncovering and reviewing the issues, policy makers can enact changes to make the process of IT implementation easier while simultaneously working to change the culture to foster IT benefits for institutions and the patients and other stakeholders they serve.

In SWOT analysis, strengths act as leverage points for new strategic initiatives, while weaknesses are limiting factors. Specifically applied to IT in healthcare, strengths should indicate areas where either IT or healthcare is particularly strong, (i.e., the technical skills of IT professionals or the quality of existing healthcare information systems). Weaknesses should display areas where either IT or healthcare requires improvement, and may range from personnel issues within IT to limited healthcare applications beyond routine transaction processing. The threats and opportunities identified during the external analysis should be both factual and attitudinal issues that must be addressed in any strategic plan being formulated, and should include both healthcare and IT issues (Martin, Brown, DeHayes, Hoffer, & Perkins, 2005). The following section presents the internal strengths and weaknesses currently confronting the implementation and proliferation of IT in healthcare.

2. INTERNAL STRENGTHS

Improved Patient Safety

Patient safety, as expressed in the Hippocratic Oath (Classical Version)"I will keep them from harm and injustice"is an underlying principle of professional healthcare throughout the world. Improving patient safety is a primary objective at all levels of the healthcare industry. The strategic initiative to increase the role of IT in healthcare can advance the cause of greater patient safety by enhancing the quality of that care. With comprehensive data available in a timely manner, healthcare providers can make better decisions about their patients' care, thereby reducing errors due to incomplete or insufficient information at the point of decision (Goldberg, Kuhn, & Thomas, 2002). Lenz (2007) agrees IT has a huge potential to improve the quality of healthcare and that this aspect has not been fully explored by current IT solutions. Advanced process management technology is seen as a way to improve IT support for healthcare processes by improving the quality of those processes.

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) established the Healthcare Information Technology Advisory Panel in 2005 to focus attention on the improvement of patient safety and clinical processes as new healthcare information systems are implemented. Members of the panel include researchers, physicians, nurses, chief information officers, educators and leaders of healthcare organizations, as well as representatives from the Office of the National Coordinator for Health Information Technology, the American Health Information Management Association, the Agency for Healthcare Research and Quality, the Veterans Health Administration, and the Healthcare Information and Management Systems Society. The panel was formed to recommend ways JCAHO's accreditation process and the widespread use of technology can be used to help re-engineer patient care delivery and result in major improvements in safety, quality and efficiency. The panel was also charged with the task of examining such topics as the effect of electronic health records on performance benchmarking and public reporting capabilities. Based on the panel's recommendations, JCAHO will evaluate its strategic plan and future direction relative to healthcare information technology (Anonymous, 2005b).

Two examples of existing information technologies and computer-based information systems contributing to improvements in patient safety through better quality of care and reduction of errors are smart cards (and/or compact discs) and computerized physician order entry (CPOE) systems. Smart cards containing a patient's entire medical history can be designed to be accessible only by devices in a hospital, doctor's office, or other medical facility. They not only eliminate the problems of lost and comprised hard copies of patient records, but also enable more secure electronic transfers of patient information to other healthcare providers and insurers (Anonymous, 1997). The technology for Java-based cards can securely support applications for multiple healthcare facilities and be combined with biometric measures for identification purposes (Sensmeier, 2004). With complete information available, physicians are able to make better decisions for the care of the patient, and order appropriate tests and treatments (Goldberg et al., 2002).

Several studies indicate medication errors are the most likely type treatment error to occur because drug therapy is one of the most widely used interventions in healthcare (Kohn, 2001). Computerized physician order entry (CPOE) systems eliminate transcription errors and can warn of allergies and drug interactions. Such systems reduce errors by more accurately dispensing the correct dosage of the correct medication for the correct patient (Bates, Teich, Lee, Seger, Kuper-man et al., 1999;Kuperman, Teich, Gandhi, & Bates, 2001; Mekhjian, Kumar, Kuehn, Bentley, Teater et al., 2002; Order Entry Rules, 2002; Scalise, 2002; Shane, 2002).

Computerized Physician Order Entry (CPOE) systems reduce medication errors by 80%, and errors with serious potential patient harm by 55% (Bates et al., 1999).

In pharmaceuticals, e-prescribing, or the electronic transmission of prescription information from the prescribing physician to a pharmacist can reduce medical errors. Since Americans receive more than three billion prescriptions yearly and pharmacists have to call these physicians 150 million times a year because they cannot read or understand the prescriptions, e-prescribing could reduce injuries from medication errors (Brodkin, 2007).

Technology-enabled improvements could also aid disease prevention and management. Other benefits could include lowering age-adjusted mortality by 18% and reducing annual employee sick days. Lieber (2007) stresses shared experiences regarding pandemic diseases can provide the best solutions and this is aided by IT solutions and global information exchange.

When medical records are available electronically, patients too can have access to their personal health records. Five large U.S. employers have funded an institute where their current and retired employees and their families can have access to and maintain their lifelong personal health records (Five Large Companies, 2007). With access to longitudinal and comprehensive records, patient safety can continue to improve.

A recent example of IT and improved patient safety is the North Mississippi Medical Center (NMMC) in Tupelo, Mississippi. Serving 24 rural counties, NMMC is the largest rural hospital in the country and the 2006 winner of the Malcolm Baldrige National Quality Award in the Healthcare Category. NMMC's recognition was due largely to their success in utilizing IT. Patients' electronic medical records can be accessed by nurses, by partner community hospitals, by physicians in their offices, and even by specialists and primary care providers in remote sites, reducing medical errors and duplication of effort. These enhancements have earned NMMC the distinction of one of the most wired facilities in the country. The organization has a shared radiography information system for all its hospitals and clinics which reduces report preparation time. For example, patients can have a radiology procedure, see their doctor, and obtain their results the same day (Bal-drige Award Recipient, 2006; Anderson, 2007).

Greater Efficiency of Operation

Information technology, or the digital world of bits and bytes, delivers information faster, smarter, and cheaper (Conger & Chiavetta, 2006). In healthcare, IT has improved operational efficiency and increased productivity by reducing paperwork, automating routine processes, and eliminating waste and duplication. Lieber (2007) reports the use of electronic health records could save as much as $8 billion yearly in California alone through improvements in delivery efficiency.

Picture archival and communication systems (PACS) not only save providers' costs for file room, storage space and film supplies, but also decrease time spent reporting, filing and retrieving records. Web access enables physicians to view radiological images from their offices, homes, or other remote facilities. IT provides emergency rooms with tools for electronic prescriptions, order entry, provider documentation, and aftercare instructions for patients and their family. Updating electronic instructions is quick and easy. Purchasing departments are aided by the ability to buy products for specialty areas, such as anesthesia, infection control, substance-abuse programs, and home healthcare. Increased productivity and positive return on investment are seen in many areas of IT and are continuously improving (Parker, 2004b).

Three other important technological advances for improved productivity are voice-technology systems, two-way communications systems, and radio-frequency identification (RFID). Voice-technology systems can significantly reduce the time nurses and admissions personnel spend on pre-authorizations and pre-certifications required by third-party payer plans. Within six months of implementing a phone-based voice-technology system, Erlanger Hospital in Chattanooga, Tennessee, reported a greater than 50% drop in phone transaction times. Moreover, in May, 2006, after four years in operation, Erlanger reported a total payback of $920,201, decreased percentages in days denied, and the reassignment of three fulltime equivalent employees to other departments within the hospital (Bowen & Bassler, 2006). Automated two-

way communications systems for scheduling can greatly improve workflow by managing automatic appointment reminders, waiting lists, and cancellation notices. These systems call patients, and in a pleasant voice, remind them of a doctor's appointment, ask them to confirm their intention to keep the appointment, and report the information to the provider's office (Sternberg, 2005). RFID technology, particularly in the areas of human and material resources, offers healthcare facilities a way to measure and control their resources as well as the relevant workflow processes (Janz, Pitts, & Otondo, 2005).

Some healthcare providers suggest Emergency Department Information Systems (EDIS) can improve operations efficiency in this extremely time-critical area by facilitating the flow of patients through the emergency department, eliminating redundant patient records, promoting information sharing, and providing quicker access to laboratory test results and radiology films (Parker, 2004a). Because electronic medical records allow tracking of patients' conditions and medications, emergency room providers and hospitals have immediate access to detailed information; both patients and providers have a better sense of what occurred and when. Both groups also report increased satisfaction with the process. Interoperability of systems also makes patient information available across budgetary and functional units, thereby providing greater continuity of patient care (Cohen, 2005).

Lopes (2007) agrees it is more efficient when an internal medicine physician can consult with a cardiologist electronically while viewing a patient's medical work-up and history. Such systems create efficiencies, have a positive return on investment, and there are no misfiled lab results.

IT tools and software are being developed to meet the growing needs of the healthcare community. As an example, VHA, Inc. recently introduced an updated version of a Comparative Clinical Measurement tool to give member hospitals flexibility in both collecting and reporting clinical improvement data. VHA, Inc. has worked with the Joint Commission on Accreditation of Healthcare Organizations to include their measures into the new tool (VHA, 2007).

Current Investment in IT

Is there a hospital in the United States that has not already made an investment in their IT infrastructure? Probably not. In the past ten years, advances in health information technologies have occurred at an unprecedented rate and healthcare organizations have responded by increasing their IT investments " threefold" (Burke & Menachemi, 2004). Today, albeit at varying levels of sophistication, all hospitals use IT to run their core administrative and clinical application systems, that is, patient accounting, insurance billing, human resources, staff and facilities scheduling, pharmacy, laboratory results reporting, and radiology (Cohen, 2005). Most healthcare organizations in the U.S. are spending between 2.1% and 10% of their capital operating budget on IT (Conn, 2007c). Within this spending on IT, healthcare providers cite electronic health record development as a top priority followed by development and implementation of clinical IT systems to improve patient care capability (Conn, 2007b).

According to the U.S. Department of Health and Human Services (HHS), approximately 13% of the nation's 4,000+ hospitals use electronic medical records and 14% to 28% of the 853,000 U.S. physicians are wired (Swartz, 2005). A recent study reported, on average, hospitals have acquired 10.6 clinical application systems, 13.5 administrative application systems, and 50.0 strategic application systems (Burke & Menachemi, 2004). Some healthcare organizations including the Cincinnati Children's Hospital, Baylor Healthcare System in Dallas and The Heart Center of Indiana are going beyond their core systems to develop, acquire, and integrate applications for decision support, benchmarking, facilities management, and workflow processes (Cohen, 2005; Kay & Clarke, 2005).

If predictions are correct, by 2015 the electronic medical records market is expected to grow to more than $4 billion, up from $1 billion in 2005. The Kalorama Information Research firm, after studying the healthcare, diagnostics, pharmaceuticals, and medical devices markets, predicts the surge will be led by the increase in IT budgets of hospitals, physicians' offices and other U.S. healthcare organizations (Study: U.S., 2007).

Healthcare organizations, having already made investments in their computing and communications hardware and software, application software, and personnel, can leverage their existing IT investments as they expand their IT infrastructure to meet growing demands to achieve more efficient operations and more effective levels of healthcare. Whether or not the IT investments meet the ROI goals of financial departments, hospitals are going to implement IT, according to a survey by the Healthcare Information and Management Systems Society. Some 88% of hospitals have adopted electronic medical records and 24% already have them in place. Some 36% are implementing them and 28% have plans to. Only 12% lack IT plans (Greene, 2007).

3. INTERNAL WEAKNESSES

Lack of System Integration

Integrated systems offer seamless data and process integration over diverse information systems (Landry, Mahesh, & Hartman, 2005). Since a patient's treatment involves receiving services from multiple budgetary units in a hospital, information system integration should exist between the computer-based applications within a single hospital. When healthcare organizations coordinate and integrate their internal data, they can improve operations and decision making; however, most healthcare organizations are not yet at this level of system integration. Clinical, administrative, and financial systems are not linked, and as a result, many healthcare institutions are not yet maximizing their IT potential (Cohen, 2005).

Moreover, system integration need not be confined to applications within a single facility. There are many types of healthcare providers and healthcare-related agencies in the complex healthcare network. Since a patient's treatment usually involves receiving services from multiple providers and interacting with various other healthcare-related entities, information system integration should also exist between the computer-based applications of those separate agencies. Immediate benefits of information sharing between different agencies include the elimination of duplicate work in gathering and inputting the data, the immediate availability of the information, a lower probability of error, and greater convenience for the patient. Called a "vision of unsurpassed information technology integration," The Heart Center of Indiana, a joint venture between St. Vincent Health, The Care Group, and CorVasc, reports improved quality of care at lower costs through its IT partnership (Kay & Clarke, 2005).

System integration between agencies could also take increased efficiency to the industry or national level. A report issued by the Foundation of Research and Education of the American Health Information Management Association supports a fully integrated fraud management system which it believes could help address the growing problem of healthcare fraud (Swartz, 2006a).

User Resistance

User resistance, more commonly termed user acceptance in the information systems literature, is nothing new to IT. The original Technology Acceptance Model (TAM) put forth by Davis (1989) states a user's level of system acceptance is explained by two factors: the system's perceived usefulness and its perceived ease of use. Perceived usefulness is defined as the degree to which a person believes that using a particular system would enhance job performance, while perceived ease of use is defined as the degree to which a person believes that using a particular system would be free of effort. Subsequent research across a variety of research settings confirms perceived usefulness as the strongest predictor of user acceptance (Adams, Nelson, & Todd, 1992; Taylor & Todd, 1995; Venkatesh & Davis, 1996; Mahmood, Hall, & Swanberg, 2001). Some believe that IT implementations in the healthcare environment, however, encounter more resistance than in any other environment (Adams, Berner, & Wyatt, 2004).

The healthcare-related literature suggests physician resistance is a key weakness existing in the doctor's office and at the hospital. Consistent with Davis' (1989) principle of perceived usefulness, physician acceptance of new IT systems at the hospital is linked to the system's impact on patient safety (Rhoads, 2004), while physician acceptance of new IT at their office largely depends on cost (Chin, 2005). Healthcare literature suggests nurse acceptance of new IT has steadily improved as applications demonstrate increased support of the practice of nursing and improvement of patient safety resulting from the reduction of human error (Sensmeier, 2005; Simpson, 2005).

A study of 12 critical access hospitals found barriers to health information technology included funding, staff resistance to change, staff adaptation to IT and workflow changes. Other user resistance was noted by the time constraints on small staff, facility and building barriers, and lack of appropriate IT support. While all agree that IT will improve safety and reduce errors, barriers to implementation are numerous and must be addressed (Hartzema, Winterstein, Johns, de Leon, Bailey, McDonald, & Pannell, 2007).

Slow IT Adoption

Traditionally, healthcare has been slow to adopt IT and has lagged significantly behind other industries in the use of IT (Ortiz & Clancy, 2003; Adams et al., 2004). A 2005 report from the National Academy of Engineering and the Institute of Medicine agrees healthcare's failure to adopt new strategies and technologies has contributed to the list of problems now associated with the industry: thousands of preventable deaths a year, outdated procedures, billions of dollars wasted annually through inefficiency, and costs rising at roughly three times the rate of inflation. Lack of competition, resistance to change, and capital costs are among the major causes for healthcare's slowness to adopt IT (Hough, Chen, & Lin, 2005).

There are signs of progress, however, which offer promise of accelerated change. Many hospitals and physician groups are now digitizing their medical records and clinical data (Hough et al., 2005). As noted earlier, some hospitals like Cincinnati

Children's Hospital, Baylor Healthcare System in Dallas, and The Heart Center of Indiana have adopted IT at advanced levels (Cohen, 2005; Kay & Clarke, 2005). These hospitals are models for the industry, forging a path for other healthcare organizations to follow, and emerging as healthcare leaders in IT whose techniques can be benchmarked, emulated and implemented. As the healthcare technologies are developed to greater sophistication and functionality, it will be possible for other healthcare organizations to "leapfrog" over the slow, expensive evolutionary learning process experienced by the leaders (Conger & Chiavetta, 2006).

The following section outlines external opportunities and threats facing IT and healthcare. Specific opportunities are the Internet, the national environment, and industry standards. Key threats include legal compliance, loss of patient trust, and the costs of IT systems, training, implementation, and support.

4. OPPORTUNITIES

The Internet

Across the industry, healthcare facilities and providers are in various stages of incorporating the Internet into their operations to allow new ways to communicate with the general public, specific patients, patient groups, physicians, other providers, and employees. Notable Web-based services include public Web sites, various telemedicine applications for targeted patient audiences, physician portals, physician education sites, and facility intranets which serve an organization's internal audiences. Generally, there is an increased focus throughout the healthcare industry to improve all Web-based applications (Sternberg, 2004).

Through their public Web sites, hospitals and other healthcare agents provide medical information to the general public (Natesan, 2005). E-Health Web portals offer healthcare services and education to people with chronic conditions and to their caregivers (Moody, 2005). Through various telemedicine initiatives, the healthcare industry has reached significant numbers of people living in rural areas, providing access to expert advice and reducing their health risks (Harris, Donaldson, & Campbell, 2001). Web-based patient support systems educate patients and allow them better participation in their own care. Patients can research detailed information for their particular conditions, medications, and treatments to understand what is happening and to reduce their anxiety. Online surgery videos and graphics can be presented in user-friendly formats to assist patients in procuring information. The Internet has also had a major impact in the delivery of information and education to healthcare professionals (Kiser, 2001). Numerous organizations have Web sites for disseminating new medical information to physicians. Various Web-based physician education services have been established. Some hospitals offer physician portals allowing physicians to access patients' medical records, lab results, and radiological images and reports from their offices, homes, or other remote locations (Cohen, 2005).

The Internet is also redefining communication channels between doctors and patients, as well as between healthcare providers and other healthcare-related agencies. DeShazo, Fessenden, and Schock (2005) suggest the top two emerging trends in healthcare are (1) online patient/physician communication and (2) secure connectivity and messaging among hospitals, labs, pharmacies, and physicians. Advances in home technology coupled with the aging of the baby-boom generation have created the demand for better communications with patients about their on-going care and monitoring. Improving the communication between the patient's at-home technology and the provider's technology is also a growth opportunity. Based on the adequacy of information transmitted to the healthcare provider, the physician saves appointment times and patients are freed from excessive office visits, thereby lowering transaction costs (Flower, 2005).

The Internet and other advances in IT have enabled new models for electronic delivery of a variety of healthcare services. Kalyanpur, Latif, Saini, and Sarnikar (2007) describe the market forces and technological factors that have led to the development of Internet-based radiological services and agree the Internet has provided the platform for cost-effective and flexible radiological services. Wells (2007) agrees the practice of evidence-based medicine requires access to the Internet, mobile devices, and clinical decision-support tools to assist practitioners in improving preventable medical errors.

Favourable environment

There is growing support worldwide for the utilization of more IT in healthcare (Caro, 2005). Reports from Australia, Great Britain, India, Italy, and Norway, for example, document local, regional and national healthcare projects and initiatives utilizing IT (Sharma, 2004; Grain, 2005; Marino & Tamburis, 2005; Bergmo & Johannessen, 2006; Fitch & Adams, 2006).

In the U.S., more funds are being made available in the form of grants and demonstration projects by the Federal government to encourage greater adoption of IT in healthcare. In 2004, officials of the U.S. Department of Health and Human Services (HHS) disclosed a ten-year healthcare information

infrastructure plan, the "Decade of Health Information Technology," to transform the industry from a paper-based system to an electronic one. More than 100 hospitals, healthcare providers, and communities in 38 states were awarded $96 million over three years to develop and use IT for healthcare. Awards were focused on communities and small and rural hospitals. Five states, Colorado, Indiana, Rhode Island, Tennessee, and Utah, were awarded $25 million over five years to develop secure statewide networks for accessing patient medical information. The National Opinion Research Center at the University of Chicago was awarded $18.5 million to create a National Health Information Technology Resource Center to provide technical assistance, tools, and a best-practices repository as well as provide a focus for collaboration to grantees and other federal partners. In all, HHS awarded nearly $140 million in grants to promote the use of IT, develop state and regional networks, and encourage collaboration in advancing the adoption of electronic health records (Swartz, 2005).

In 2005, the Agency for Healthcare Research and Quality, part of HHS, awarded over $22 million in grants to 16 institutions in 15 states to aid in implementing healthcare IT projects emphasizing patient safety and healthcare quality. The grants were designed to encourage the sharing of information among providers, labs, pharmacies, and patients, with the specific goal of decreasing medication errors and duplicate testing. Eleven of the 16 grants were awarded to small and rural communities (Anonymous, 2005c).

Seamless support of information flow for healthcare processes that are increasingly distributed requires the ability to integrate heterogeneous IT systems into a comprehensive system (Lenz, Beyer, & Kuhn, 2007).

System standards resulting in a greater level of systems integration is a pressing need. Conn (2007a) reports the compromise reached by two rival standards groups for data communications standards can help to bridge the gap between physicians' offices and hospitals in the electronic health record systems they use. The Continuity of Care Document standard combines the independent works by two standards development organizations on creating electronic summaries of care for discharged patients.

5. External Threats

Legal compliance

The Health Insurance Portability and Accountability Act (HIPAA), enacted by Congress in 1996, is the most significant Federal legislation affecting the U.S. healthcare industry since the Medicare and Medicaid legislation of 1965. Title I of HIPAA legislates improved portability and continuity of health insurance coverage for American workers. Title II addresses "administrative simplification" requiring the development of standards for the electronic exchange of personal health information (PHI). Administrative simplification requires rules to protect the privacy of personal health information, the establishment of security requirements to protect that information, and the development of standard national identifiers for providers, health insurance plans, and employers. Two significant sections of HIPAA are (1) the Privacy Rule and (2) the Security Rule.

The Privacy Rule legislates in detail the collection, use, and disclosure of personal health information. To be in compliance with the Privacy Rule, covered entities must notify individuals of uses of their PHI, keep a record of all disclosures of PHI, and document and disclose their privacy policies and procedures. Covered entities must have designated agents for receiving complaints and they must train all members of their workforce in proper procedures.

The Security Rule complements the Privacy Rule and presents three types of security safeguards designated as administrative, physical, and technical. For each type, the Rule identifies various security standards and names (1) required implementation specifications which must be adopted and implemented as specified in the Act and (2) addressable implementation specifications which are more flexible and can be implemented by the covered entities as deemed appropriate.

Covered entities face potentially severe penalties for failure to comply with the complex legalities of HIPAA and this has caused much concern throughout the industry. Physicians, medical centers, and other healthcare providers have experienced increased paperwork and cost to incorporate the requirements of this legislation into their current methods of operation. Future adoptions of new information technologies will be subject to its specifications as well (American College of Physicians, 2006).

Loss of patient Trust

The Institute of Medicine (IOM) of the National Academy of Sciences released a report in 1999 that caused much attention to be focused on the U.S. healthcare industry. The report stated medical errors caused between 44,000 and 98,000 preventable deaths annually, and medication errors alone caused 7,000 preventable deaths (Kohn, Corrigan, & Donaldson, 1999). Within two weeks of the report's release, Congress began hearings and the President ordered a government-wide feasibility study for implementing the report's recommendations for (1) the establishment of a Center for Patient Safety, (2) expanded reporting of adverse events, and (3) development of safety

programs in healthcare organizations. According to a study by Healthgrades, a leading healthcare ratings organization, during the period 2000-2002 the estimated number of accidental deaths per year in U.S. hospitals had risen from the 98,000 reported by the IOM in 1999 to 195,000 (Shapiro, 2006).

On July 29, 2005, President Bush signed into law the Patient Safety and Quality Improvement Act, establishing a federal reporting database. This was the first piece of patient safety legislation since the 1999 IOM report. Under this act, hospitals voluntarily report "adverse patient events" to be included in the database, and "patient safety organizations" under contract with the Federal government, analyze the events and recommend improvements. The reports submitted by the hospitals remain confidential and cannot be used in liability cases. The most recent Health-grades report (April 7, 2007) covering the period 2003-2005, indicates that patient safety incidents have increased over the previous period to 1.16 million among the 40 million hospitalizations covered under the Medicare program.

Healthcare must utilize all available means to maximize patient safety and retain patient trust. Healthcare is an information intensive industry and the delivery of high quality healthcare depends in part on accurate data, available at the point of decision. Handwritten reports, notes and orders, non-standard abbreviations, and poor legibility all contribute to substantial errors and injuries (Kohn et al., 1999). A doctor needs to know a patient's medical history, ancillary providers need to be able to read the doctor's orders and patients need to be able to understand what the doctor expects of them. IT solutions are available that address many of the data accuracy and availability problems in healthcare records (Poston, Reynolds, & Gillenson, 2007); however, the level of adoption for these technologies is not impressive. For example, a 2005 report predicts that by the end of 2007, only 59% of all medical groups will have implemented an Electronic Health Record (EHR) system (Gans, Kralewski, Hammons, & Dowd, 2005). And although Computerized Physician Order Entry (CPOE) systems reduce medication errors by 80% (Bates et al., 1999), a 2004 survey by Leapfrog found only 16% of hospitals, clinics, and medical practices expected to be utilizing CPOE by 2006.

Cost

One of the most immediate barriers to widespread adoption of technology is the high cost of implementation. A report by the Annals of Internal Medicine estimated that a National Health Information Network (NHIN) would cost $156 billion in capital investment over five years and $48 billion in annual operating costs. Approximately two-thirds of the capital costs would be needed to acquire the functionalities and one-third for interoperability. The present level of spending is only about one-fourth of the amount estimated for the model NHIN. While an NHIN would be expensive, $156 billion is equivalent to 2% of annual healthcare spending for 5 years (Kaushal et al., 2005). Industry reports from Datamonitor, Gartner, and Dorenfest & Associates predict increased spending on IT by healthcare providers at an annual rate of between 10% and 15% (Broder, 2004). A study conducted by Partners Healthcare System, Boston, concluded that a national healthcare information system would cost $276 billion, take 10 years to build, and require another $16.5 billion annually to operate. However, the study also concluded that such a system would save U.S. hospitals $77.8 billion annually because of more efficient communication (Anonymous, 2005a).

According to a study by RAND Health (Health Information Technology, 2005), the U.S. healthcare system could save more than $81 billion annually, reduce adverse healthcare events, and improve quality of care if it were to widely adopt health information technology. Patients would benefit from better health and payers would benefit from lower costs; however, some hospitals fear loss of revenue due to reduced patient length of stay. A recent study in Florida suggests that this fear may be unfounded. The results of the study suggest that there is a significant and positive relationship between increased levels of IT use and various measures of financial performance. The results indicated that IT adoption is consistently related to improved financial outcomes both overall and operationally (Menachemi, Burkhardt, Shewchuk, Burke, & Brooks, 2006).

Lopes (2007) agrees that fully integrated electronic medical records systems can replace paper records and allow hospitals and physicians to share medical information electronically to improve response and lower costs from duplication. However, the adoption of such systems is slowed by the high cost of new technology, the complexity of the systems, training, and an unwillingness to adapt work processes to include new information technologies.

DISCUSSION

Table 1 summarizes the current SWOT analysis of IT implementation in the healthcare industry in the U.S. The healthcare industry faces multi-faceted challenges to improve patient safety and assure information security while containing costs and increasing productivity. The key area for addressing these concerns is more investment in IT to facilitate the flow of information and offer access to providers and

partners along the healthcare supply chain, reduce medical errors, and increase efficiency. Implementation of IT networks to achieve the required level of information and data communications is complicated by the variety of systems already used by provider organizations as well as the lack of system integration within provider organizations.

Various benchmarking studies are helping to educate healthcare providers about IT expenditures and offer comparison reports on expenditures. The availability of systems far exceeds the budget of most organizations to adopt them. However, the improved revenue cycles and cost-benefit offered by IT investments are becoming easier to quantify in faster turnaround and processing of patient-related transactions, shared data, reduced duplication of efforts, and increased provider and customer satisfaction.

Information technology can help take the paper chart out of healthcare, and eliminate error, variance and waste in the care process. IT can help connect the appropriate persons, knowledge, and resources at the appropriate time and location to achieve the optimal health outcome, increase customer service and patient care with industry leading medication fill rates and timely deliveries, cut operation costs through advanced warehouse management, reduce internal labor costs, and improve enterprise efficiencies of healthcare organizations, all through tightly integrated applications.

Strengths

- Improved Patient Safety
- Greater Efficiency of Operation
- Current Investment in IT

Weaknesses

- Lack of System Integration
- User Resistance
- Slow IT Adoption

Opportunities

- The Internet
- Favourable External Environment
- Industry Standards

Threats

- Legal Compliance
- Loss of Patient Trust
- Costs

CONCLUSION

IT can ultimately transform the healthcare industry. Along with improved safety and greater patient trust, adopting IT in healthcare can only improve current conditions and help the United States improve healthcare in general. Concerns remain about how smaller practices can afford the costs of new systems that require them to move their paper medical records to electronic media. These costs and start-up expenses mean an unequal playing field for small practices versus larger healthcare systems with more money to spend on IT integration.

Areas For Future Research

IT applications in healthcare are reaching the growth phase of the lifecycle. The strengths, weaknesses, opportunities, and threats at this stage of the life cycle are clear, but few solutions have been proposed. Research is needed to forecast the SWOT issues as IT in healthcare moves from growth to maturity. Case studies in both large and small physician practices as well as in large and small healthcare systems are needed to better understand the IT implementation time-frame and costs. Studies that address ways to overcome human barriers to implementation are also needed.

Using the supply chain model, the healthcare information system needs to be studied as to access and applicability for other providers including pharmacists, dieticians, insurance companies, home health service and equipment providers, and other vendors to healthcare. If the healthcare system it to be truly integrated, these additional players must be included. Protection of patient medical information, access to information, data security, and assurances of privacy should also be studied. International suppliers and other options for outsourcing should be investigated as a cost containment strategy.

With the growing body of patient-related medical and healthcare data, other applications should be studied. Data is available to postulate ways to improve lifelong health and reduce the incidences of various diseases and ailments. Such data mining should be studied by those in the management information systems area to determine cause and effect and recommend changes. As employers seek to contain healthcare costs of their employees, such data can aid in more active involvement in reducing health risks and making lifestyle changes (i.e., smoking cessation programs, dietary counseling, healthy cafeteria food, work-place gyms).

Choosing the best approach to implement IT systems in healthcare settings is also an area for further study. These systems should meet healthcare goals in addition to functionality and integration criteria.

Involving physicians and other clinicians in selecting IT systems can increase their support and lessen their resistance to technology. In fact, the more stakeholders are involved in IT selection and implementation planning, the greater their acceptance and rate of adoption will be.

Studies in IT implementation outside the healthcare industry need to be reviewed and analyzed to determine where other industries have had success in implementation or have developed tools that could aid the healthcare arena. Human resource studies of executive ownership and accountability can help the healthcare industry better prepare physicians and other practice managers to overcome the user resistance to IT.

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