

**Information Systems in Healthcare: Trends, Issues, Barriers,
and Preparing for the Future**

by

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Introduction

The topic for this paper is the trends, issues, and barriers that are related to information systems (IS) in the healthcare sector. In this discussion, some of the most significant factors that are or will be exerting a profound influence on the healthcare industry will be highlighted. The intent of this paper is to provide a potential audience of IS and information technology (IT) professionals, students, decision makers, and educators with a brief but insightful discussion of some of the salient issues in healthcare. A set of recommendations will be offered in this paper that can benefit those who are working in these fields by providing information that can help them make informed decisions and prepare for the future.

The conclusions from this project have been derived through several forms of data collection and analysis. The bulk of the research for this paper was culled through a review and an analysis of a set of articles from some of the key professional and trade journals and industry magazines. The primary data has been supplemented by additional research from the scholarly and academic literature and a set of interviews with experienced and knowledgeable professionals in key areas of the IS industry. The key informant interviews helped to provide a more detailed understanding of some of the nuances and latest developments in these key areas as well as a unique perspective for this research paper.

The three terms, IS, IT, and healthcare that are the crux of this discussion are very complex. Each of the terms has many dimensions and implications. While it is recognized that there are definite differences and distinctions between IS and IT, and medicine and healthcare in this paper the terms will be used interchangeably. The IS/IT portion of the discussion will be focused on the aspects that are related to the health and medical data within the context of the computing and telecommunications domains. The issues that make up these domains will be discussed in terms of planning, designing, operating, maintaining, optimizing, and evaluating these systems within the context of a healthcare environment.

The term healthcare embodies a complex array of clinical, business, management, and service operations, as well as outputs and processes from a diverse set of entities that make up the entire healthcare supply chain. Many of these disaggregated entities that comprise the healthcare supply chain have been or will be linked through IS and the telecommunications infrastructure. The problems and many of the issues that have emerged or been caused by the IT revolution in healthcare will be discussed in the sections that follow.

The Problems in Healthcare

Several problem areas or common themes emerged from the literature reviews and interviews with the experts. These themes have been identified through the annual industry review, prediction, and hot trends articles that have been published in journals and magazines such as Healthcare Informatics, American Medical Informatics Association (AMIA) Yearbook, MD Computing, and InfoWorld. In addition many of the fourteen problem areas that are highlighted below have been the focus of white papers, reports, and studies by think tanks, governmental agencies, expert panels, and consulting groups. One thing, the

importance and potential of IT systems for addressing these complex and interrelated problems, is abundantly clear in each of these sources.

Among the first and most often cited problems is how far behind the healthcare industry is from other data and information-intensive industries. For example, in a 1997 article in Communications of the ACM, Raghupathi stated that "it is generally perceived that the health care industry's use of information technology (IT) is 10-15 years behind other sectors" (Raghupathi, 1997 p. 81). For a variety of very complex reasons, on the whole, the healthcare industry has been reluctant or late adopters modern IT approaches to addressing its needs.

The second problem area that is also mentioned with considerable regularity is the relatively antiquated state of the data and the systems that collect, store, and manage it in the healthcare industry. Although almost every aspect of health and medical care is based on information and data, relatively little progress has been made toward adopting the best techniques, standards, and data-based systems that are common in other data-intensive sectors of the economy. For example, the data in many healthcare systems is still not linked, updated, or converted from the legacy systems or disaggregated data repositories. Moreover, little progress has been made in several key areas including; establishing electronic patient records, operationalizing electronic clinical procedures, best practices, and evidence-based guideline databases and expert systems, developing point-of-care processing and tracking systems, and deploying decision support systems for a range of tasks that are essential for managing highly-complex and fully integrated healthcare entities.

Medical errors is a third critical problem area. For instance, the 1999 Institute of Medicine report "To Err is Human: Building a Safer Health System" concluded that 98,000 individuals die in hospitals each year because of medical errors that are due in large part to the lack of automated information systems, the outdated procedures, inadequate tracking and monitoring technologies, and the lack of consistent guidelines that would prevent undo harm to patients.

Fourth, fraud, waste, and abuse have been cited as major problem areas by a host of congressional committees and governmental oversight agencies, watchdog groups, and experts in the industry. A variety of experts have stated that at least 5% to 20% of the \$1.1 trillion that was spent on healthcare the United States in 2000 could have been saved by information systems that were properly designed and used extensively.

Privacy, confidentiality, and security is the fifth problem area that is a highly-charged issue for many, especially for those individuals who are concerned about their personal medical information and the physicians and healthcare practitioners who are charged with maintaining the sanctity of the doctor-patient relationship. For example, a 1999 study by IBM found that 88% of Americans rated privacy for healthcare companies as very important and 78% of those who went online took some form of action to protect themselves. Further, physicians consistently rate concerns about privacy and security of medical information as a significant deterrent to moving forward with electronic medical records. However, one of the most influential forces for change has been the Health Insurance Portability and Accountability Act (HIPPA) of 1996. This legislation has mandated the creation of a

systemic approach to ensuring security, privacy, and confidentiality of data in the electronic workplace and the on-line world.

The poor performance by many parts of the healthcare system is the sixth problem area that was identified in the literature. Several governmental agencies, expert panels, and consumer and watchdog groups have given healthcare entities poor grades on many of the report card evaluation projects that have been conducted. The reports conclude that the healthcare system is not meeting the needs of the stakeholders and consumers at an acceptable level or in an efficient way. All of the reports reach the conclusion that well-designed and widely-deployed information systems could improve the performance ratings of these institutions.

Another significant problem area, that is often not given enough consideration by the IT and business communities, is the unique philosophical principles on which the healthcare system is based. The culture on which medical care is founded is a humanistic approach, where "the patient is always first", "spare no expense", and "do no harm" reflect the fundamental operating principles. This philosophical orientation is often a source of conflict between IT systems designers developers, who are used to working in the business and for-profit sector and are unfamiliar with or not grounded in the mentality and working environment of medical care community. Kurzweil labeled this conflict as the techies versus the humies.

The eighth problem area is cost, in terms of the capital expenditures, the total cost of ownership, and the return on investment (ROI). Cost has become a significant barrier because the industry is already so far behind, the amount needed to purchase and sustain systems is so great, and the ROI data is often unavailable or is equivocal. Moreover, many of those who made the early efforts to move toward modern integrated information systems were burdened with solutions that were poorly designed, overly expensive, that did not have adequate support and evaluation systems, and that did not meet the needs or match culture of healthcare organizations.

The ninth problem is the lack of in-house or domain-specific expertise and training. This problem is often amplifies the effect of many of the other problems mentioned previously. The IT positions in the healthcare sector require a unique perspective, tacit knowledge, and at times a special set of skills in order to function optimally in that environment. However, given that the IT pay scale in healthcare organizations is generally less than in many other sectors of the economy, recruitment and retention of qualified and experienced staff is a major problem for the industry.

Three major factors have implications for a variety of policy and legislation-related problems were identified in the literature and the expert interviews. First, several highly complex legislative programs such as the National Partnership for Reinventing Government program from 1993 - 2000, the HIPAA regulations of 1996, the Medicare and drug coverage programs, and the Balanced Budget Act of 1997 have been instituted to streamline or make government more efficient. Second, the fact that the government is the largest sponsor of healthcare means that it is a major stakeholder and many experts contend that it has become a substantial barrier to progress in the healthcare/IT arena. Third, because very few members of Congress

have any medical or IT training or background and recruitment of talented and knowledgeable individuals into relatively poorly-compensated public service positions is difficult, there is a genuine lack of expertise among individual on Capitol Hill who really understand the nuances as well as big picture in these areas.

The eleventh problem area that was identified for this paper is related to improving efficiencies of the business process. Because of issues related to the other problem areas mentioned previously such as lack of experience with and deployment of integrated data, tracking, and management systems, the lack of point-of-sale and point-of-care systems, and the paucity of decision-support and management systems in the industry there many instances of gross inefficiencies within the healthcare system. Very few efforts have been made to implement business process reengineering (BPR) projects in healthcare, in part because of the magnitude and complexity of the problem.

Change is the twelfth problem area. There are many reasons why change comes much more slowly to the healthcare industry than other sectors of the economy. Yet, change is fundamental to the industry's efforts to migrate from paper based and manual processes to automated and electronic IT-based solutions. The relentless pace of change that is characteristic of the IT industry is very unsettling to an industry that has had very limited available resources, has been very conservative, and because of the many "life or death" situations has been slow to change.

There are a host of factors related to the thirteenth set of problems, the human factors issues. Many of the problems in this area are also related to issues mentioned previously. However, the lack of input in the design and implementation process, the large number of late or reluctant adopters in healthcare, the numerous and high-profile disastrous experiences with poorly designed and tested or unsuitable systems and applications, and technophobia are among the most significant IT-related human factors problems that beset healthcare.

The fourteenth problem that was identified for this paper is related to the "digital divide". This issue impacts individuals, organizations, and the host of mid-sized and small entities such as the "mom and pop" type of businesses that make up the healthcare supply chain. Many hospitals and service providers are not yet connected to a robust information infrastructure that would allow them to do all that is required in a fully integrated and reformed healthcare system. Moreover, many consumers who could benefit greatly from access and care in remote venues such as home, at work, in school, public access sites, and ambulatory and outpatient sites do not have ubiquitous, stable, or easy access points.

The problems mentioned in this section are numerous, highly complex, and interrelated. These fourteen problems will be discussed in terms of the trends and solutions offered by the IT industry in the sections that follow.

Common, Current, and Emerging Trends

Most of the major trends and themes in this section were identified through four primary sources, the Healthcare Informatics magazine predictions for 1999 through 2001, from a sampling of the 1998 to 2001 annual Healthcare Information

and Management Systems Society (HIMSS) survey series, the 1999 to 2000 the Pulse surveys, and a frequency analysis from several professional and trade magazine. Eight crosscutting themes that were identified by comparing and distilling the data from those sources are expanded upon, discussed, and summarized below.

Healthcare Informatics magazine is the first source of IT trends. For the last three years the magazine has published a list of nine trends that they feel will be prominent in the industry. The hot trends for 1999 to 2001 are displayed in the table below. Although nine trends have been listed for each year, there is no indication whether there is any significance associated with the placement on the list. Over the last three years, only security and wireless technologies were mentioned in all three issues, although security was listed in 2000 and 2001 as data security. Three trends, ASP's, supply chain management, and convergence were included in the list for 2000 and 2001. Other trends such as continuous speech recognition, network computing and thin clients, object technologies, data warehousing, enterprise computing, and even the Internet were listed in 1999, however, they have failed to make the list again. This observation reinforces the fact that the pace of change technology in the healthcare sector is rapid and relentless.

Table 1. Healthcare Informatics Magazine: Nine Hot Technology Trends

February 2001	February 2000	February 1999
Data security	Application service providers (ASP)'s	Internet
Wireless	Data security	Continuous speech recognition
Application service providers	XML	Wireless technology
Integration	Supply chain management	Security
Disease management	Workflow automation	Network computing and thin clients
Workflow	Wireless	Components and object technology
Customer relationship management	Interactive technologies	Telemedicine
Supply chain management	Artificial intelligence	Data warehousing
Convergence	Convergence	Enterprise computing

The HIMSS surveys provided a second source of trends and issues. Several themes emerged from a sampling of the annual leadership surveys from 1998 to 2000. First, when asked to name the five leading business issues the respondents chose HIPAA compliance (70%), improving operational efficiencies (60%), cost pressures (55%), E-Health (44%), and Medicare cutbacks (38%). Interestingly, improving quality of care was ranked only sixth (35%).

Two questions on the survey asked about the organizational IT priorities over the next 12 months and in the next two years. The average for the top priority ratings were deploy internet technology, (62%), upgrade security to meet HIPAA (53%), upgrade network infrastructure (37%), and integrate systems in a multi-vendor environment (37%). Interestingly, as a priority, recruiting and retraining high quality IT staff jumped from 17% in 1998 to 37% in 2000. However, when staff recruitment was rated as a significant barrier it rose from 2% (1998), to 23% (1999), and it fell to 15% in 2000.

The 2000 survey asked the respondents which technologies their organizations are planning to use currently and in the next two years. Their responses for currently and in two years respectively, were high speed networks 86% and 3%, intranet 78% and 14%, client-server systems 77% and 4%, data security systems 76% and 10%, and wireless information appliances 39% and 29%. When the same questions was posed in 1998, the replies were voice recognition (31%), wireless applications (18%), web-enabled appliances (14%), and handheld PDA's (12%). Clearly, the technology focus may change dramatically over a two-year period.

Finally, when asked to list the most important healthcare applications over the next two years, the respondents chose clinical information systems (71%), web-based applications (70%), clinical data repository (65%), business/decision support systems (53%), and point-of-care clinical decision support (50%).

The third set of themes and issues was derived from the Pulse survey series in 1999 and 2000. In three separate samples in 2000 the respondents chose, reduced reimbursement levels (71%), improved operating efficiency (62%), and cost pressures (62%) as the most significant challenges in healthcare in the next two years. They listed web-based applications (63%), the computerized patient record (62%), and security/privacy as the most important applications in healthcare in the next two years. Difficulty recruiting and retaining high quality IT staff (22%), proving IT quantifiable benefits/return on investment (21%), the lack of a strategic IT plan (22%), and the lack of adequate financial support (18%) were the most commonly mentioned barriers to implementing IT in healthcare organizations.

In two Pulse samples taken in 1999, compliance issues (50%), recruiting and retraining staff (49%), and alignment of IT goals with organizational goals (46%) were listed as the top three challenges facing organizations. The hot technologies that were most frequently selected from the list were the computer-based patient record (49%), web-enabled applications (42%), and data warehousing (39%).

A fourth set of top issues and trends were identified through a frequency count of the article topics from a random set of professional and trade journals and magazines during the years 1998 to 2000. Although this survey was not conducted in a systematic or scientific manner, several interesting points were found in the data that is summarized in the table below. In this survey there were eleven articles that dealt with security and privacy and the issues and the solutions that are related to it. Workflow and integrating systems as was the topic of nine articles. The use of the Internet in healthcare was the topic of seven articles.

Table 2. Article Topic Themes and Issues in Selected Healthcare Journals and Magazines 1998-2000

Issues/themes 1998-2000	Number /rank
Security/privacy - biometrics, PKI, fingerprint, smartcards	11 #1
Workflow/integrated systems	9 #2
The Internet in healthcare	7 #3
Wireless/handhelds/devices	6 #4
Medical/clinical patient record	6 #4
E-commerce/health	5 #6
Standardization	5 #6
IT issues	5 #6
Artificial Intelligence/Expert Systems	5 #6

A great deal of data has been presented in this section, although a detailed analysis of it is beyond the scope of this paper. However, the eight important themes that emerged from the four sources will be summarized below.

Two themes, security and wireless were consistently named as hot topics in the four sources. Much of the attention to security is being driven by need to comply with the HIPPA regulations and the need to satisfy consumer demands for secure records and transactions in the electronic marketplace and digital working environment. The appeal of untethered computing, the proliferation of mobile handheld appliances, and the exponential gains in transmission speeds are among the most significant forces that are driving wireless technologies.

The Internet and web-enabled applications and services is the third critical force in the future of healthcare. This theme is reflected in data about the requirements for upgrading to a high-speed network and communications infrastructure and the attention that is being given to e-commerce.

Cost is the fourth theme that was listed as a significant as a barrier as well as a major a business and management issue. Closely related to cost are two other themes, efficiency and ROI. First, the cost/benefit ratio can be altered by improving the efficiency of the organization. This can be accomplished by a more efficient execution of the business processes and by faster, better, and cheaper delivery of products and services. Second, cost can be tracked by metrics that can establish the factors that are most influential for a positive return on investment.

The alignment of the IT and organizational goals is the seventh theme that emerged from the data. IT and healthcare professionals and decision makers are faced with a tremendously difficult and complex task of trying to keep the goals in synch, given all of the changes, barriers, and issues that are taking place in the industry today.

Finally, the phenomenal pace of change is the eighth theme that was found in this analysis. This impact and relentlessness of this theme was reflected in all areas of IT and healthcare.

Solutions through IS and IT

A variety of IT-based solutions were suggested as ways to address the problems that were identified in the first section as well as the trends that were highlighted subsequently. A brief discussion of solutions in five areas will be presented in this section.

First, a great deal of healthcare is based on data and information. Properly designed information systems enable healthcare managers and providers to have access to all of the relevant data and information they need to do their job effectively and efficiently. However, as was stated previously, it is not as though today's healthcare environment is lacking for the necessary data or information. The problem is that it is often only available in paper form, it resides in legacy systems, it has not been converted to standardized data formats, or it is stored in data systems that are not connected. Moreover, the immense stores of knowledge within healthcare organizations and the supporting fields has not been captured, stored, and engineered into systems that can be accessed and queried electronically.

Several concepts, systems, and applications have been developed to resolve this problem. First, a variety of companies such as Oracle, Microsoft, HBOC, Sybase, 3M, IBM, and Peoplesoft have developed sophisticated data management approaches, database systems, and applications that allow for the capture, collection, storage, and management of enterprise-wide as well as fully integrated data systems throughout the entire healthcare supply chain. Data systems allow healthcare institutions and providers to establish lifelong electronic medical and health records for patients and clients for clinical as well as business and management purposes. These electronic records are designed to be cumulative and they can be easily accessed and distributed among authorized providers along the continuum of care. Standardized query languages allow users to probe the data for a variety of business, management, and clinical tasks. Data warehousing and mining techniques allow users to explore large amounts of data to identify patterns and trends.

Second, many businesses, organizations, and more recently the government have devoted a great deal of effort, attention, and resources to understanding the problems and developing viable solutions that are appropriate for the Electronic and Information Age. The security, privacy, and confidentiality of health and medical records and information is one of the "project killer" issues in the healthcare arena. Access, control, and authentication systems and techniques such as encryption systems, biometrics, PKI, SSL, HL7 standards, and intelligent monitoring agents are a few of the approaches that have been put in place to ensure that data and information in the healthcare workplace is secure. Moreover, these technologies, when properly designed, implemented, and used have proven to be superior to the conventional security approaches that are in place in the traditional manual and paperbound healthcare environments. However, unfortunately, healthcare organizations rarely research, purchase, enforce, monitor, and upgrade their systems to the standards that are required for today's state-of-the-art systems.

A systems and object-oriented (OO) approach to systems design is the third solution area that is relevant to this topic. It is clear that in the future all healthcare entities will be moving toward a fully integrated and connected supply chain. That transformation will require systems that are able to seamlessly interact with each

other. Several leading-edge healthcare organizations such as Kaiser Permanente, Humana Healthcare, and hospitals and their affiliated entities such as Columbia, Duke, Stanford, Harvard, Yale, Indiana, UCLA, and the Oregon Health Sciences University have developed or implemented the components and modules for modern fully-integrated healthcare systems. Several branches of the military have developed and implemented components of a full-spectrum global healthcare system. Often OO design approaches are used to rapidly develop and deploy elements, components, and modules of a system. These system objects are reusable and they may be made available to other institutions that want to follow a similar development path rather than try to reinvent the wheel for themselves. Both of these systems design concepts contribute to the greater efficiencies that are derived from the economies of scale and the exponential benefit that achieved by leveraging the technology.

Fourth, the Internet has spawned a whole new class and generation of healthcare solutions. The Internet has made a host of new solutions possible and many of these solutions are becoming increasingly popular and they are penetrating and diffusing through the healthcare system. Consumers, who are playing a much more proactive role in their own care, now have access to the best information and latest scientific research through Internet websites such as the National Library of Medicine and the Journal of the American Medical Association. A few of the most important benefits for healthcare providers and practitioners are that they can communicate effectively with each other or their patients, exchange records electronically, get updates on the latest medical and healthcare and medical research, access the best-practices and evidence-based guidelines for treating or preventing medical conditions, and they can track epidemiological trends through the Internet. The Internet has made it possible to provide remote monitoring, surveillance, diagnosis, treatment, and care through a host of telemedicine initiatives and telehealth and home-healthcare services. Electronic commerce conducted over the Internet is another class of solutions that has revolutionized how healthcare will be conceptualized in the future. The Internet affords everyone the opportunity for equal access to the best and most efficient care, from anywhere, and at any time.

The fifth and final class of solution that emerged from the research for this paper was the development, use, and potential for artificial intelligence (AI) in healthcare. Although the thought of using expert systems and AI in healthcare frightens many people who do not understand it, these technologies have been used successfully in many areas of healthcare for several decades. For example, expert systems have been used, and generally outperform general practitioners, in a variety of well-defined diagnostic situations. Many of the modern and sophisticated expert system for management and business decision support systems are based on and use rule-based algorithms and inference engines. Speech recognition, data mining, and software agents are other forms of AI that have made remarkable progress and significant contributions to the field of medicine and healthcare. Many experts predict that intelligent software agents will play a significant role in all areas of healthcare and that someday we will all have a personal health valet that will help us to live a high quality, long, and prosperous life.

It would be a mistake to leave the reader with the impression that these solutions are not without substantial costs and downsides. Some of the negative aspects of healthcare in a modern Information Age will be covered in the discussion section.

Discussion

A very complex array of problems, trends, and solutions have been presented in this paper. There are several important points that can be made with respect to those areas. First, with respect to adoption and integration of IT in healthcare, the healthcare sector as a whole is well behind the other data and information-intensive sectors of the economy. There are many forces and reasons why this is so, and why it must change. However, it would be foolhardy to suggest, demand, or expect this situation to change overnight. A more prudent approach would be to develop a comprehensive national agenda for change, and then develop a strategic multi-phased plan to accomplish the goals. An incentive program must be developed to prod healthcare entities to move in that direction. Further, it must be remembered that health is among the things that people value most highly in their lives. They are unwilling to accept changes that they feel might compromise the current system that they generally feel meets their needs. Moreover, healthcare practitioners realize that they often deal in life-and-death situations. Consequently, they are often reluctant to try things that they feel might put their patients at risk.

Second, healthcare is considered a high touch profession. IT is known as a high-tech industry. Many healthcare professionals are reluctant to use high-tech approaches to care because they feel that it compromises the provider-patient relationship. Many practitioners are fearful that technology will be used to replace them.

Third, few healthcare practitioners are aware of what is going on in the IT industry, and IT professionals are woefully unfamiliar with the nuances of the healthcare environment. Most healthcare professionals received little or no training in computers and informatics in school. They are not aware of the trends in IT and they have not been trained to think in terms of technology-based systems and solutions. A great deal could be done to develop cross-pollination among these professions through innovative training programs, incentive systems, and demonstration projects.

There are a host of downsides that are associated with the adoption of IT in healthcare. First, there is substantial financial, professional, and organizational risk involved in adopting and deploying IT systems.

Second, healthcare is an industry whose resources are strapped. Many people are reluctant or unwilling to redeploy resources to other areas even when long-term benefits can be promised.

Several other negative factors such as technophobia, fear of losing jobs, patient risk, compromised security, confidentiality, and privacy are a few of the forces that must be taken into account when evaluating the full costs versus benefits of IT systems. Unfortunately, there are many examples of the consequences that have occurred because of the negative impact of IT systems in healthcare.

Recommendations

In light of the problems and trends that were outlined in the previous sections, the following set of recommendations are offered as possible steps and solutions that could be implemented in the healthcare industry. Because many of the problems are so complex and interrelated, in many instances, there will be considerable overlap between the individual recommendations.

- **Best systems** - The most important and probably most obvious recommendation is that IS development teams must work more closely with the end user populations to create systems that address the problems cited above in the best way possible. In the systems development process designers must carefully analyze all of the relevant factors in the healthcare environment and really get to know the users and their issues in order to come up with the best and most practical solutions possible. In most instances, initially the most sophisticated, powerful, and highest-tech option will not be the best option.
- **Create awareness** – There has been a substantial effort to increase the level of awareness about the problems, issues, and barriers to progress by the professional organizations, leaders in the industry, governmental panels, and think tanks. These efforts must continue and the results must be taken to targeted groups of decision makers and influential groups in order to facilitate the process of change.
- **The business case** – In the long term, proving the worth in a business case will be among the most influential steps in the process. In order to secure the long-term support and commitment of decision makers, which is of paramount importance to the success of IT projects, executives and managers must be able to see that there is an acceptable level of RIO in the future. However, the value that modern IT systems can add to organizations can be assessed in a variety of ways and astute IT and healthcare professionals must be able to make the case with a variety of metrics.
- **The evaluation plan** – The evaluation plan is closely related to the business case. Savvy IT managers must insist that the evaluation plan is an integral part of the overall system design. They must be able to measure the value and worth of systems with an array of metrics that reflect how well the systems function, how it impacts the workers and their working environment, and what and how well it contributes to the organizational goals as well as for those along the healthcare supply chain.
- **Training and education** – The lack of practical experience, technical expertise, and champions within the organization has severely hampered the diffusion of IT in the healthcare arena. Many employees in the healthcare field do not receive adequate exposure to IT concepts and tools as part of their initial professional training. Therefore, they are often not aware that IT can address many of the problems they face or they do not understand why or which systems

work best in different situations. Consequently, the systematic IT analysis and design process has not been part of the normal way of thinking or it has not considered a critical tool within the working environment. Many experts have called for make IT courses part of licensure and continuing education unit (CEU) process by requiring or at least offering courses for recertification. Others have suggested that tracts should be developed in IS/IT educational and training programs in institutions of higher learning that focus on healthcare.

- Staff recruitment and retention – Finding and keeping talented IT professionals who really understand the healthcare environment has been a major problem. Managers and human resource departments must come up with creative ways to resolve this problem. Since it will not always be possible to pay top salaries, they should look at for other ways to compensate IT professionals in with packages that emphasize monetary incentives as well as other means that are related to a rewarding, high quality, and attractive working environment.
- Incentives and motivation – Unfortunately very little progress will be made unless there are adequate incentives to implement IT systems. Innovators and innovative demonstration projects, skunkworks, and other hybrid approaches should be rewarded.
- Research - High quality research into all of the areas cited in this paper is warranted. It is also vitally important the results of the research are widely disseminated through the academic, professional, and trade journals, magazines, conferences, and websites.

Resources

Websites:

1. Healthcare Informatics Magazine - <http://www.healthcare-informatics.com/>
2. HIMSS Leadership Surveys
http://www.himss.org/survey/2000/detailed_frame.html
3. MD Computing Magazine <http://www.mdcomputing.com/>
4. Pulse survey questions <http://www.healthcare-informatics.com/expo/pulse.htm>
5. This paper is accessible through the following URL
<http://www.american.edu/academic.depts/cas/health/nchf/pubsindstudy1.html>