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Electronic Medical Record System: Current Status and Its Use to Support Universal Healthcare System

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ABSTRACT

Information technology's use in the United States healthcare marketplace, known as health IT (HIT), significantly lags behind that of other industries and leaves much room for improvement. While many industries already use information technology (IT) to improve efficiency, the healthcare industry has not made any significant progress toward widespread use of HIT. Although some hospitals and physician clinics have begun using HIT, the industry as a whole is still pessimistic toward the improvement and implementation of costly HIT functions such as electronic medical records (EMR) and their interoperability in current and future healthcare systems. As federal mandate requires all healthcare providers to implement EMR system by 2014, this study suggests an integrated framework that would make EMR a vital component to ensure the success of the new universal healthcare system.

INTRODUCTION

Medical technologies are booming and are adopted at alarming rates; however, the case is not true for information technology within healthcare. The healthcare industry lags behind most mainstream industries with regard to information technologies (Burt & Sisk, 2005). Banking and hospitality industries, both of which share similarities with the healthcare industry, realized the need for information technology several years ago, committed to the technology through budgeting and planning, and have successfully implemented these technologies within various businesses.

Within healthcare, the need for information technology is well known. However, the commitment to information technology is still very limited. U.S. hospital spending on information technology should hit $4.7 billion by the end of 2009, when HIMSS Analytics, Chicago published it report in early August, 2009, the latest of such figure available. It will grow to $6.8 billion by 2014, at a compounded annual growth rate of 7.5%, the report says (Anderson, 2009). This amount still represents a small percentage of healthcare industry's revenue. However, three-quarters of companies have chosen to devote more revenues to information technology for the coming years.

There are many areas for information technology improvements in healthcare. One of the greatest areas for improvement in information technology is in the implementation of an electronic health system based on the use of electronic medical records (EMR), also known as automated medical records and many other name such as clinical data repository, computer-based patient record, computer-based patient record system, computer-based patient record-type system, computerized medical record, computerized patient record, electronic health record, electronic patient record, lifetime data repository, virtual health record, or virtual patient record. Since federal government already mandated all healthcare providers to implement EMR system,

the question confront individual healthcare provider is longer if but how and which implementation strategy to adopt (O'Brien, 2006; Thielst, 2007; Hoffmann, 2009).

In this paper, we start by reviewing the evolution of the EMR system. The adoption dilemma faced by healthcare institutions management will then be explored. Management implications of implementing EMRs will then be discussed together with an investigation into the alternative policies. As the new universal healthcare system became the law, how to ensure that the new healthcare system becomes a cost effective alternative of today's healthcare system will be the most critical challenge. A framework of integrating the EMRs of each individual healthcare providers is proposed to illustrate how EMR could be the vital foundation for the new universal healthcare system. Major findings of this study and some important directions for future study will then conclude this paper.

REVIEW OF EMR EVOLUTION

Electronic medical records are computerized medical records for individual patients which are available to all with approved access on a designated network. In general, an electronic health system with electronic medical records is openly welcome (Ilie, Van Slyke, Parikh, & Courtney, 2009; Kazley & Ozcan, 2009). In a recent study by the Markle Foundation, 72% of polled Americans favor electronic health records as long as their information was secure and their privacy was assured.

The benefits of an electronic health system with electronic medical records are well documented (Detmer & Shotliffe, 1997; Khoury, 1997; Maxwell, 1999; Ragbupathi & Tan, 2002; Morris, 2004; Anderson, 2005; Brown, 2005; Swatz, 2005; Walker, 2005; Hagland, 2006). Benefits of improvements in HIT include easier access to patients' health histories, improved patient satisfaction, improved provider satisfaction, improved patient safety through a reduction in medical errors, faster and more efficient emergency care, reduce healthcare costs by reducing duplicate testing and other administrative costs, reduction in paperwork, elimination of lost and misfiled reports, and improved quality of care as information on best-practices for treatments, drugs, or surgeries is readily shared, etc. While the benefits may appear to be numerous, the fears seem to outweigh all of the benefits combined. Fears of improvements in HIT mainly hover around costs (Hersh, 1995; Hodge, 2002; Schmitt & Wofford, 2002; Healthcare Financial Management Association (HFMA), 2005; Brown, 2005; Ma & Liu 2005). In a study published in *Medscape General Medicine*, 56 percent of physicians noted that the significant startup cost was a major barrier to their adoption of HIT (HFMA, 2005; O'Brien, 2006). As startup costs are estimated to cost the government, physicians, and hospitals $156 billion in capital investment over five years, with an additional $48 billion necessary for annual operating costs, it is obvious why cost is deemed a major barrier. Along with costs, another fear is comprised of the lack of standards for interoperability of different electronic health systems and electronic medical records programs. Table 1 in the appendix presents numerous other barriers to electronic medical record adoption (Reardon & Davidson, 2007; Spratt & Dickson, 2008; Bauer & Bozard, 2009).

As cost barriers are powerful, it is clear why adoption rates are so slow. According to an article in HR Magazine (Babcock, 2005), at most, only 10 percent of the medical community is currently equipped with or utilizing an electronic medical system. Due to the major barriers preventing the rapid adoption of the electronic health information system, the Department of

Health and Human Services Office of the National Coordinator for Health Information Technology has taken the initiative to develop standards for which they will offer over $30 million in contracts. Contracts will be awarded to those companies who can: 1. Develop and evaluate a process to establish standards that would make electronic health records interoperable; 2. Develop a compliance certification process for interoperability; 3. Design a prototype national health information network architecture; and 4. Evaluate state laws and business policies on privacy and security, and develop plans to address any issues of concern (Lamont, 2005; Reardon & Davidson, 2007; Miller & Tucker, 2009).

Those companies interested in pursuing HIT include Allscripts Healthcare Solutions, Amicore, Cerner Corporation, Eclipsys Corporation, General Electric Company's GE Healthcare Information Technologies, iMedica, International Business Machines Corporation, IDX Systems Corporation, Siemens, Hewlett-Packard Company, Medical Manager Health Systems by Web MD, Misys Healthcare Systems, NextGen Healthcare Information Systems, Physician Micro Systems, and Xerox Corporation (Kleaveland, 2001).

EMR ADOPTION DILEMMA

A major concern regarding electronic medical records stems from the uncertainty or disagreement on the appropriate core components of electronic medical records as the core components have typically been drawn from marketing campaigns of products rather than from well-defined classifications. From the table 2 in Appendix, it is clear that there are numerous authoritative topologies that have been identified regarding the core functions of electronic medical records that are not necessarily synonymous. Therefore, it is important to realize that these topologies were selected based on the specificity of their definitions and their efforts to classify electronic medical records. As seen in Table 2, Peter Waegemann's topology was selected as the baseline to compare the other five topologies. This topology, including recording information, accessing information, order entry, decision support, sharing of information and interoperability, unique patient identification, security and authentication, and audition, was selected because it provides the most modern functional categorization of electronic medical records (Coiler, 2000; Brailer & Terasawa, 2003; iHealth Reports, 2003a).

Actual, scientific adoption rates of electronic medical records are unknown due to the lack of effective study designs. All studies thus far have given unreliable data due to a lack of controls, detailed methodology, and the presence of biases. Therefore, it is important to be cautious when reviewing data regarding electronic medical records adoption data. Because there have been no truly accurate studies, the numbers in Tables 3 and 4 in the appendix present current and planned in-patient and physician office electronic medical records adoption must be reviewed with great prudence.

As depicted in Tables 3 and 4 in the appendix, it is clear that there have been more studies regarding the adoption of electronic medical records in physician offices. These studies predict there will be increasing rates of adoption within physician offices within the next two years. Because it is generally accepted that these trends are accurate, it is interesting to identify the rates of adoption by the different physician specialties. Table 5 in the Appendix presents information regarding the adoption rates for internal medicine, multi-specialty, family, specialty, and pediatric practices.

While it is clear that electronic medical records are becoming more prevalent in physician offices as opposed to inpatient settings, it is important for Americans to realize that the United States is still greatly lagging behind other countries with regard to electronic medical records adoption rates. Those countries exhibiting the greatest adoption rates are in Eastern Europe. Table 6 in the appendix presents specific information on international adoption rates of electronic medical records (iHealth Reports, 2003a; Gelinas, 2006).

From this table, it can be concluded that a major reason the United States lags in adoption rates of electronic medical records systems is due to the fragmented, multi-payer, non-centralized, healthcare system. Thus, it is important to hone in on this fragmentation in an effort to determine how to best adapt electronic medical records to fit the American's unique healthcare situation.

Within the United States, several factors influencing the adoption of electronic medical records have been identified. In general, these influences can be grouped into two different categories: administrative and clinical. According to the article, major administrative influences of electronic medical records adoption are:

1. Need to share comparable patient data among different sites within a multi-entity healthcare delivery system.
2. Need to improve clinical documentation to support appropriate billing service levels.
3. Requirement to contain or reduce healthcare delivery costs.
4. Need to establish a more efficient and effective information infrastructure as a competitive advantage.
5. Need to meet the requirements of legal, regulatory, or accreditation standards.

As the administrative influences were just listed, it is important to also include the clinical influences of electronic medical records adoption. Clinical influences include:

1. Improve ability to share patient record information among healthcare practitioners and professionals within the enterprise.
2. Improve quality of care.
3. Improve clinical processes or workflow efficiency.
4. Improve clinical data capture.
5. Reduce medical errors.
6. Provide access to patient records at remote locations.
7. Facilitate clinical decision support.
8. Improve employee/physician satisfaction.
9. Improve patient satisfaction.
10. Improve efficiency via pre-visit health assessments and post-visit patient education.
11. Support and integrate patient healthcare information from Web-based personal health records.
12. Retain health plan membership.

As the positive influences are numerous, the barriers must also be taken into consideration. The barriers were presented earlier in the report in Table 1. As financing is the top barrier, it is critical to prove the clinical and administrative influences will ultimately cover the extensive

costs of initial adoption of electronic medical records. Other important barriers to overcome include physician resistance, time barriers resulting from increased time to enter orders and patient histories, and teaching barriers introduced by "cookbook medicine" created by drop-down menus.

"Overall, the barriers to electronic medical records adoption are large, and even though progress is being made, the barriers of cost and physician resistance are substantial and enduring. In many ways, the physician resistance and cost barriers are interdependent. The policy challenge in many ways is not to make the benefits of electronic medical records more compelling, but to make the barriers less challenging" (Brailer & Terasawa, 2003).

As Brailer and Terasawa enriched this paper with data regarding electronic medical records adoption rates surprisingly higher in physician offices than in hospitals, it is important to be aware of a few lessons learned from physician practices. All information presented in the next section is drawn from iHealth Reports – Electronic Medical Records: Lessons from Small Physician Practices that was prepared in October 2003 by the University of California, San Francisco (iHealth Reports, 2003a, 2003b).

Lessons learned from implementing electronic medical records in physician offices include:

1. Initial electronic medical records financial costs are substantial, while the benefits vary.
2. Physician electronic medical records users differ in the benefits reaped as different physicians use the systems differently.
3. Five types of electronic medical records users were identified: viewers (minimal interaction), basic users (enter only a limited amount of data), strivers (use & customize systems to gain maximum efficiency for their own use), arrivers (previous strivers who have taken the electronic medical records systems even further & have reorganized their exam room & office workflows), and system changers (individuals benefiting the most from electronic medical records systems with regard to time savings per patient, use of customized electronic forms, extensive changes in workflow, etc.).
4. Technology differences explain only some differences in benefits as most users use identical electronic medical records programs but each reaps different benefits (Miller & Sim, 2004; Øvretveit, Scott, Rundall, Shortell, & Brommels, 2007).

From these lessons, five recommendations have been made for physician groups.

1. It is important to identify a champion who will fully endure the implementation and success of an electronic medical records system.
2. It is vital to obtain physician commitment to use the electronic medical records system. As physician resistance is one of the greatest barriers, it is useless to devote human and fiscal capital into a project that will go unused.
3. Maximize electronic data exchange by arranging commitments from labs and vendors and billing and scheduling software.
4. Arrange comprehensive support to address all technical and process issues as there typically is not an electronic medical records expert.

5. Motivate physicians through incentives to use the electronic medical records systems.

Finally, it is important to know and understand the most often used capabilities of electronic medical records systems in physician offices. The most often used capabilities are viewing, documenting, ordering, messaging, care management/follow-up, analysis and reporting, patient-directed, and billing and scheduling.

As product costs are decreasing and practical experience with electronic medical records systems has made the potential return on investment easier to calculate, new studies are raising the stakes on avoiding outpatient medical errors, and payors are pressing providers to document quality by dangling incentives, now is the time for physicians to purchase electronic medical records systems.

To help physicians choose the best electronic medical records systems for their practices have been identified, the following steps are proposed.

1. List high-priority needs.
2. List the electronic medical records systems product features most likely to meet those needs.
3. Factor in future requirements.
4. Write up a simple request for a proposal from each vendor.
5. Make the commitment to having physicians enter data to ensure the success of the investment.
6. Choose either keyboard and mouse or stylus and touch screen for data entry according to physician preference.
7. Test-drive each system using common scenarios to ensure the system meets the unique needs of your practice.
8. Obtain three physician references from each vendor and take site visits to these locations.
9. Score competing candidates by attaching weights to the various priority features for your organization.
10. Settle on a purchase plan that is most cost-effective and inclusive.
11. Nail down commitments on initial implementation and technical support from immediate users and vendors.
12. Take advantage of a buyer's market as competition for customers amongst over 200 companies is growing.

As there are numerous similar products, as well as advantages and disadvantages to utilizing an electronic health system with electronic health records, physicians and hospitals have some very important, costly decisions to make.

MANAGEMENT IMPLICATIONS

An electronic health system consisting of a national network of electronic health records would be an amazing accomplishment and hugely important for the entire medical community. If electronic medical records were to be adopted nationally, access to all patient records would be instantly possible. However, it is not likely to make hospitals paperless. The well-known fact that

the medical industry lags in technology is enough evidence to know that the medical community does not and will not, for a very long time, at least, be willing to solely rely on technology: computers and networks. Therefore, this electronic health system with electronic health records will not greatly improve health information management. In fact, it may even make records management even more difficult (Terry, 2003; Sachs, 2005; Walker, 2005).

Electronic medical records may make records management even more difficult because critical medical information will be located "here and there." It is quite likely and possible that records management employees will have a difficult time locating information as needed – and we all know that when physicians "need" the information, they need it "now!" A few foreseeable problems:

1. Some physicians may choose to use electronic medical records in the office while their hospitals do not. The problem here is transferring information between the office and hospital. Printing out entire records is not a feasible alternative (Hennington & Janz, 2007).
2. Contrary to above-mentioned problem 1 hospital keeps electronic records while the physicians would not have access from their offices.
3. Partial electronic record keeping in both the hospital and physician offices. This creates a serious problem in knowing where to quickly and accurately locate the needed information.

If, somehow, a quick transition could occur in every physician office and hospital, electronic medical records on a national electronic health network would be the best thing since sliced bread as every single patient's records could be brought up in any healthcare organization in the entire country. The end results would be priceless for patients, healthcare organizations, records management employees, lawyers, administrators, technology companies, etc.

The management implication of an electronic health system comprised of electronic medical records is simple: EMR system can be the difference between the success and failure of the nation's healthcare reform proposal recently passed by the Congress. There are several areas where EMRs can help. The major ones are listed as follows (Li, Bahensky, Jaana, & Ward, 2008; McLeod, Clark, Warren, & Dietrich, 2008; Ayal & Seidmann, 2009):

Improve efficiency, completeness and accuracy;
Eliminate unneeded procedures and treatments;
Improve diagnosis decision processes and patients' satisfaction;
Increase physician decision efficiency
Reduce hospitalizations, and testing prescriptions.
Free physicians from outrageous law suits
Reduce all healthcare related insurances and overall costs

These benefits will be very limited. If any can actually be realized, with the implementation of each healthcare institutions' stand alone EMR system.

THE NEEDS OF INTEGRATED EMR SYSTEMS

EMR systems as currently implemented can't meet any of these requirements, not mention to meet them all. At present, each healthcare organization implemented the EMR system chose its own vendor with different standard (Li et al., 2008; Bennett, 2009). Consequently, the electronic records transmitted from one organization to another organization may have to be converted to new standard before information can be integrated with the existing patient's records. The problems can become far more serious when EMRs from multiple organizations with mutually different standards are involved.

To compound the problems, not all healthcare organizations have the right personnel to manage the flow of EMRs among involved parties (Bauer & Bozard, 2009). Each institute's EMR system functions like an island, which may or may not have the proper bridge to communicate with other islands. Individual island thus can become easy target for hacking or any authorized use of patient's sensitive data. An appropriate coordination system thus becomes indispensible.

All these problems can only be solved with federal resources. Federal agents don't have to do these jobs directly. However, the resources and legal power to enforce many of important regulations needed for the success of the EMS systems of the federal government can significantly increase the chance that EMR system will be truly useful. Examples of projects that can and should be supported by the federal agencies include:

1. Nation-wide infrastructure to manage the exchange of the EMR information. The proposed infrastructure will not involve any real data stored at each healthcare organization. We will address the conceptual structure of such an infrastructure in a future research report.
2. A data mining mechanism embedded in this proposed infrastructure, which will enable the designated medical professionals (by appropriate Federal agencies) to use data collected through each individual EMR to recommended the appropriate procedures for treating most, if not all known diseases to physicians.
3. The procedures validation system which will stamp the expiration date of most, if not all, of the expensive procedures such that duplicated procedure will never have to be performed for so long as the results of performing such procedures in the augmented EMR system are still valid.
4. Shielding the physicians from unwarranted law suits. The system can set a minimal number of procedures that needed to be performed for each known diagnosed disease. As long as these minimal procedures have been properly performed, the physician's liability should be capped to a reasonable amount. Thus, there will have no needs for further legal actions.
5. A secure yet flexible EMR access system. All exchange of the EMRs must be carried out through the proposed infrastructure. Since a patient's records could be stored at several different healthcare organizations, patient's access code could be stored in a specially designed RFID card. The card will have ID of all healthcare organizations where pieces of this patient's data are kept. It can also store the most current key information about patient's health conditions. This access card together with the access keys of the requested party and provider (where requested patient's data is actually kept) would be the minimal requirements to get the needed EMRs on a timely basis.

6. Responsible Medicaid system. Unlike Medicare, Medicaid is not an entitlement. Recipients of the Medicaid thus should be more responsible for their own health. The augmented EMR system can include modules to track recipients of Medicaid program to fulfill certain obligations such as quitting smoke, drinks, doing regular exercises as suggested by their doctors, having health meals, etc.

These few possible projects are just the tip of the iceberg that can be supported by the Federal agencies to support a more cost/effective national healthcare program. The few examples mentioned in this comment will need much more elaborated studies to make them happen. Whether Federal government should offer a health insurance options or not is in our view irrelevant. There are many other more important things that the Federal agencies can do to make an effective nation-wide healthcare system a reality.

SOME POLICY ALTERNATIVES

Those groups directly affected by the fabrication and institution of a national health information network for electronic health records are hospitals, clinics, physician offices, pharmacies, other patient-oriented healthcare organizations, and patients. Healthcare organizations will be both positively and negatively influenced by this network. Positive: Complete records on all patients are likely to decrease costs by reducing duplicate testing and some trial-and-error efforts as well as improve the quality of care. Improved quality of care may also lead to greater patient satisfaction, further benefiting healthcare organizations.

However, healthcare organizations are not the only beneficiaries as patients will also benefit from this network. With their entire health history accessible to any and all healthcare providers connected to the electronic health system, medical care is ensured to be personalized no matter where a patient is physically located (example: get sick on vacation but can still see a provider who has access to the individual's history) or the condition of their mental state (example: an individual is unconscious after a motor vehicle accident & is rushed to the nearest hospital). With these incredible benefits, it is apparent why the network comes at such a great financial cost.

The financial costs associated with this electronic health system are, at this point, going to be incurred primarily by healthcare organizations. The government is committed to the research and development of the network (with the four contracts awarded totaling $18.6 million), but plans to take a "hands-off" approach in the future, according to Dr. David Brailer ("U.S. Awards", 2005; Ayal & Seidmann, 2009). As the government is only establishing a minimal framework for the network, it appears as though the healthcare industry will bear the bulk of the costs as they will be responsible for completing the network and purchasing the corresponding electronic health records programs. Although the initial expense is exorbitant, the benefits of the system are so tremendous that the costs will be absorbed in only a few years, according to many experts.

As the electronic health system is a necessity, it is important to find alternatives to absorb the hefty initial expenses. Alternatives may include: 1) donation of network development services backed by financial/tax incentives; 2) substantial financial/tax incentives for healthcare organizations funding network development; 3) state funding; and 4) complete patient financing.

The donation of a network would be ideal; however, this is an unlikely alternative as the costs are so extreme. The only way this effort could even possibly become a reality is if the network developers donating the time, services, and materials were ultimately rewarded financially.

Providing tax breaks or other financial incentives to organizations funding the networks may be a more realistic idea. As healthcare organizations are the daily users of this system, it is more appropriate that they pay for the system so that they may have more control over its development and implementation. Since this system will benefit everyone, it is important for these extensive financial contributions to be recognized. The ability to receive tax breaks or increased Medicaid/Medicare reimbursements may be the most persuasive efforts within this category. As Medicaid and Medicare funds are already limited, the government will have to find additional funding or shuffle some expenses around in order to make this plan a reality.

State funding is another alternative. In order to provide state funding, the states would need to understand and appreciate the benefits of this electronic health system. However, it is unlikely that the states would be willing to fund such an expensive project that is not deemed, in their opinion, an absolute necessity. If the states were to fund this program, they would have to be coerced to do so by the federal government. Although this situation is unlikely, it is important to know that state funding of this system would require an increase in tax revenue for the states. Unfortunately, the surest way the states can increase tax revenue is to increase taxes on state businesses and citizens. As this is viewed negatively by all financially contributing parties, this is not a likely alternative.

The final, and worst, alternative is complete financing by patients. Funding of the electronic health system would be accomplished by increasing charges for healthcare services and/or adding an additional fee (excluded by all insurance) specifically for the system. As this alternative puts the entire burden on the shoulders of those in need, this alternative is unacceptable.

Judging from the inefficiency and red tape of political systems, the best alternatives would be to leave the state and federal governments out of the picture. Perhaps, a mix between alternatives one and two (donations backed by financial incentives & financial incentives for healthcare organizations that help bear the costs) may prove to be the most appealing, motivating, and effective approach to developing a national electronic health system. In addition, some of the major developers should donate, or substantially discount, the cost of the network infrastructure. By doing so, they can build loyalty from healthcare organizations and are likely to increase their market share of electronic health records software that are necessary for health records be shared on the network. Furthermore, healthcare organizations that will share the burden of expenses of the network and spend additional funds on the electronic health records software should receive a tax break or other financial incentives. The mixing of these two alternatives is likely to prove a win-win-win situation for the technology industry, healthcare organizations, and patients (Coile, 2000; Kleaveland, 2001; Hodge, 2002; Himmeistein & Woolhandler, 2005; Taylor & Hillestad, 2006).

In sum, political feasibility regarding the alternatives are listed below:

- Perception of the role of government

    - Government should be uninvolved.
- Degree to which cost and benefits are concentrated:
    - Costs are incurred by the network and software developers as well as by healthcare organizations
    - Network and software developers, healthcare organizations, and patients will all benefit.
- Comprehensiveness and total costs
    - Although this plan is very comprehensive and costly, the benefits will far outweigh the costs in a short time period.
- Complexity
    - Technologically, an electronic health system is very complex. However, its overriding function of providing individual's health records to any and all physicians is easily understood and well accepted by most.
- Saliency and timing
    - Post-Hurricane Katrina, the need for an electronic health system has become extremely salient. Now is the time to act!
- Role of the policy entrepreneur
    - President Bush is urging the development of this system. He must continue working hard to push the idea and provide incentives for its implementation.

CONCLUDING REMARKS

Information technology within the healthcare industry is several steps behind that of other industries such as retail and banking. This lack of information technology is costly in both time and money. The introduction of a National Health Information Network for electronic health records, which President Bush, and subsequentially President Obama has called for by 2014, is a giant step toward filling the information technology gap (Coile, 2000; Babcock, 2005; Himmeistein & Woolhandler, 2005).

Electronic health records, the main goal necessitating the use of IT, have been around for several years but have only recently begun to garner attention. Although these electronic records have been available, they have not been readily accepted or utilized by healthcare providers – only those who have direct access to the local intranets on which these records are located could even consider the option. With the recent devastation of New Orleans, patient records have been lost, destroyed, or the patients have evacuated or been forced to move elsewhere; thus making the idea of a national health electronic system and electronic health records more appealing and even necessary (Ragbupathi, 1997; Palattao, 2004; McGee, 2005).

As mentioned above, Hurricane Katrina had a severe impact on the entire infrastructure of the Gulf Coast, including the strong medical infrastructure, with the loss of physical and human resources. As healthcare records have been destroyed or lost, as physicians have retired or relocated, and as patients have relocated without their healthcare history, the need for electronic health records has been painfully realized and justified.

There are many important things that Federal government can, and should do to ensure the universal healthcare systems can live up to its expectations. Among those the integration of the EMR systems would be one of the most critical. Without a mecanism to aggregate and

coordinate the exchange of EMRs maintained by the individual healthcare institutions, the movement of medical data from paper to electronic formats will have very limited impact on achieving the goals of the new healthcare system. Federal mandates require all healthcare providers to have their medical records converted to electronic formats by 2014. Perhaps, it the right time for Federal to start paving the foundation to allow all EMRs to freely exchanged without security concerns.

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APPENDIX

Table 1: Barriers to CPR Adoption. (Source: Brailer & Terasawa, 2003)

Barrier to CPR Adoption	MRI, 2002	MGMA, 2001			HIMSS		
		Combine	<10 MDs	10-49 MDs	>50 MDs	2001	2002
Lack of funding or resources	58.5%	48.1%	48.4%	46.9%	49.4%	21%	27%
Lack of support by medical staff	35.4%	29.7%	26.4%	30.6%	41.4%	11%	16%
Achieving end-user acceptance	--	--	--	--	--	11%	16%
Skills and preferences of existing support staff	--	25.3%	43.8%	19.4%	20.7%	11%	16%
Inability to find CPR at affordable cost	31.7%	--	--	--	--	--	--
Difficulty migrating from paper to electronic	31.2%	30.0%	28.7%	32.5%	31.0%	14%	8%
Time and effort to prepare organization for CPR	31.2%	42.5%	43.8%	42.5%	37.9%	14%	8%
Difficulty integrating systems	31.2%	30.0%	28.7%	32.5%	31.0%	14%	8%
Difficulty finding satisfactory CPRsolution not fragmented over several vendors	28.7%	--	--	--	--	--	--
Inadequate/incomplete health care information standards (data, connectivity, etc.)	25.2%	9.9%	7.8%	11.9%	13.8%	--	--
Difficulty evaluating/comparing/ validating capabilities of CPRs in marketplace	24.9%	--	--	--	--	--	--
Unable to find CPR that meets requirements	22.9%	6.2%	5.8%	5.6%	9.2%	14%	17%
Difficulty building a strong business case for a CPR	20.1%	29.7%	26.1%	33.1%	37.9%	15%	13%
Lack of structured medical terminologies	12.4%	--	--	--	--	--	--
Lack of easy way to input data and notes	--	17.9%	17.1%	17.5%	21.8%	--	--
Security concerns	--	11.0%	13.3%	5.0%	5.7%	--	--
Lack of management support	--	9.8%	7.0%	7.5%	1.1%	6%	8%
Recruiting and retaining high quality staff	--	--	--	--	--	6%	4%

Table 2: Topologies of CPR Functions.

Waegemann 2002	BPHC, 2002[2]	Rehm and Kraft, 2001	Dick, Steen and Detmer, 1991	CPRI, 1996[3]	Tang and Hammond, 1991
Recording information	Data capture (data elements, entry devices, data import, data definition, input)	Data capture (data elements, entry devices, data definition)	Storage	Data capture (sources of data, entry devices, data import, data definition)	Integrated view of patient data
Accessing information	Data access (search, accessibility, security)	Data access (search, accessibility, security)	Access	Storage functions and information presentation	Data access
Order entry	Order entry	Order entry	Order entry	Information processing (comprehensive record of care, patient care processes, administrative processes)	Physician order entry (clinician data entry)
Decision support	Practitioner Support (clinical decision support, clinical registries, alerts, clinical practice guidelines, quality assurance, cost measuring)	Practitioner Support (records management, case management, clinical decision support, administrative reports, CQI and COPC)	Practitioner Support (clinical decision support, data analysis, information management, implementing quality and cost policies)	Operational processes; related data and knowledge bases; legal and administrative characteristics	Clinical decision support; access to knowledge resources
Sharing of information and Interoperability	Communication Features; Interoperable	Communication Features	Connectivity	Information (interoperability, integration of data across multiple sites, communication protocols)	Integrated communications support
Unique patient Identification		Identification	Identification		
Security and Authentication			Security	Security functions, access control, data protection integrity	
Auditing	Patient Features (educational resources)	Patient Feature (reminders, access to personal data, educational resources)			
	Validation	Validation	Validation	Validation	

(Source: Brailer & Terasawa, 2003).

Table 3: Current and Planned Inpatient CPR Adoption.

Source	Inpatient CPR Use Current	Inpatient CPR Use Planned
Wall Street Journal, June 25, 2002	5%	--
HIMSS Survey 2002 (taken from 13th Annual HIMSS Leadership Survey)	13%	23%
HIMSS Survey 2001 (taken from 13th Annual HIMSS Leadership Survey)	13%	24%

(Source: Brailer & Terasawa, 2003).

Table 4: Current and Planned Physician Office CPR Adoption.

Source	Outpatient CPR Use Current	Outpatient CPR Use 1 Year	Outpatient CPR Use 2 Years
Modern Physician/PWC, 2002	39%	15%	28%
HIMSS/AstraZeneca, 2002	28%	--	--
MediNetwork, 2002	23%	31%	--
HarrisInteractive, 2002	17%	--	--
Loomis, Ries et al, 2002	14.4%	--	--
Modern Physician/PWC, 2001	27.3%	--	--
HarrisInteractive, 2001	22%	20%	--
MGMA, 2001	21.6%	33%	34.9%
Modern Physician/PWC, 2000	21%	--	--
Lippman, 2000	~5%	--	--
HarrisInteractive for BCG, 2000	17%	--	--
Modern Physician/PWC, 1999	11%	--	--
Modern Physician/PWC, 1998	2%	--	--

(Source: Brailer & Terasawa, 2003).

Table 5: Physician Office CPR Adoption by Specialty.

Specialty	Outpatient CPR Use Rate
Internal Medicine Practices	42%
Multi-specialty Practices	33%
Family Practices	30%
Specialty Practices	27%
Pediatric Practices	8%

(Source: Brailer & Terasawa, 2003).

Table 6: International CPR Adoption Rates

	Primary Care Phys. Use, 2002	Primary Care . Phys. Use 2000	Specialist Use, 2000
Canada	-	14%	16%
Australia	-	25%	13%
New Zealand	-	52%	14%
Portugal	5%	-	-
France	6%	-	-
Spain	9%	-	-
United States	17%	17%	12%
Greece	17%	-	-
Ireland	28%	-	-
Luxembourg	30%	-	-
Italy	37%	-	-
Belgium	42%	-	-
Germany	48%	-	-
Austria	55%	-	-
Finland	56%	-	-
United Kingdom	58%	59%	22%
Denmark	62%	-	-
Netherlands	88%	-	-
Sweden	90%	-	-

(Source: Brailer & Terasawa, 2003).

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