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Analysis of Electronic Health Record Implementation and Usage in Texas Acute Care Hospitals

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Abstract

Despite a consensus that the use of health information technology should lead to more efficient, safer, and higher-quality care, there are no reliable estimates of the prevalence of adoption and physician usage of electronic health records (EHRs). Data from the American Hospital Association was examined for the presence of specific electronic-recorded functionalities. We also examined the differences in implementation and usage of EHRs to specific hospital characteristics.

Keywords: electronic health records, health information technology

1. INTRODUCTION

Electronic health records (EHRs) have been proposed as a sustainable solution for improving quality of medical care. EHRs provide a longitudinal electronic record of patient encounters and patient health information, including patient demographics, progress notes, problems, medications, vital signs, medical history, immunizations, laboratory data and radiology reports (Medicine 2003) . Robust EHRs automate and streamline the clinician's workflow by allowing order entry for medications, laboratory tests, and diagnostic procedures. The highest functioning EHRs provide clinicians with real-time evidence-based decision support and the potential for aggregating and reporting quality and outcome measures (Society 2006).

Promoting the adoption and use of health information technology (HIT) is a major priority for U.S. policy makers as a means of managing health care costs and improving quality. The American Recovery and Reinvestment Act (ARRA) authorized incentive payments through Medicare and Medicaid to providers that implement certified electronic health records and demonstrate their "meaningful use." The U. S. Department of Health and Human Services (HHS) recently finalized the meaningful-use criteria for the first two years of the three-stage incentive program (Services. 2010). These criteria are intended to ensure that doctors and hospitals will use health IT to improve the quality, efficiency, safety, and other aspects of care (Chaudhry, Wang et al. 2006; CM, EG et al. 2010).

Despite the appeal of EHRs, U.S. hospitals have been slow to implement and physicians appear to be reluctant to utilize EHRs. Jaana et. al (2012) reported that 2.7% of acute care hospitals in the United States have a "comprehensive" electronic records system implemented in all clinical units, and 9.2% have a "basic" system present in at least one clinical unit. In contrast, other countries, such as Australia and the United Kingdom, are nearing universal adoptions of EHRs (Simon, Jenter et al. 2008). Available data suggest that in the U.S. the larger, nonprofit, urban hospitals have made more headway than critical-access hospitals, small and medium-size hospitals, and public and rural hospitals (Ashish, DesRoches et al. 2010). Further, and most importantly, a 2003 national survey from the Commonwealth fund suggests that only 27 percent of physicians are utilizing the available EHRs (Audet 2004).

While literature recognizes the potential life-saving benefits of EHR in healthcare, the majority of EHR literature available takes a management perspective and concentrates mainly on adoption, implementation, acceptance and barriers (Overhage, Suico et al. 2001; Ash and Bates 2004; Miller and Sim 2004; Chiang, Boland et al. 2008; Withrow 2008; Zandieh, Yoon-Flannery et al. 2008). Meanwhile, research that examines the actual usage of EHRs by physicians in healthcare systems is sparse. Further, extant literature tends to focus on the EHR system as a whole entity instead of as a composite system that encompasses varying functions (Simon, McCarthy et al. 2008).

The purpose of this study is to examine the availability of electronic health record systems and their usage by physicians in Texas acute care hospitals. Additionally, we advance current research by analyzing hospital EHRs that have been categorized into four functional groups classified by the American Hospital Association:

- *Patient information data*; medications, orders, and clinical notes
- *Results management*; results from laboratory tests, radiology studies, and other tests
- *Order entry*; orders for laboratory tests radiology studies and other tests
- *Decision support*; knowledge sources, drug alerts, reminders, and clinical guidelines/pathways

The breaking down of EHR systems into these four functional categories takes previous research one step further by allowing separate analysis on the differing functions of an EHR system. This knowledge will provide a better understanding of what stage hospitals are in with regard to their adoption of EHRs, which functions of EHRs are most often implemented, and what percentage of physicians are utilizing them. Further, dissecting the data by hospital characteristics (size, teaching status, and ownership) provides insight into the disparity that currently exists between hospitals and gives an improved view of the direction future policies and incentives should take.

2. METHODS

This study is an exploratory study that envelops the implementation and physician usage of electronic health records. Along with descriptive statistics, analysis of variance is performed to determine if any differences exist between hospitals of varying characteristics.

Sample

The American Hospital Association (AHA), funded by the National Coordinator for Health Information Technology, administers a supplement to its annual survey of all acute care hospitals, in the state of Texas, to assess the adoption of electronic health records and their use in each facility. A paper copy of the survey was sent to each hospital's chief executive officer, who asked the person most knowledgeable about the hospital's health IT efforts to complete the survey in its entirety. The health IT expert was also responsible for the collection of physician usage data from the hospital's electronic health record system that logs usage of EHRs broken down by functional category.

The AHA EHR supplement was sent to 500 Texas acute care hospitals. The data from the AHA was analyzed for missing records and this resulted in a final sample of 374 Texas acute care hospitals.

Descriptive Statistics

Classification trees found that 27% of the variation occurring in the data can be attributed to hospitals of varying size. Through partitioning using JMP 7.0 (visual discovery software from SAS) hospitals were grouped into

small, medium, and large size based on general and specialty beds available. The groups were defined as small being all hospitals with less than 100 beds, medium consisting of hospitals with between 100 and 300 beds, and large hospitals categorized as having more than 300 beds. This classification coincides with current nursing literature (Henderson 1965; General 1988; Khuspe 2004; Ward, Diekema et al. 2005).

Table 1 displays the demographic characteristics of hospitals; including facility ownership status, affiliation types, and size.

Survey Instrument

The AHA supplemental survey that was sent to each hospital consisted of three main questions. The first question addressed if the hospital had an EHR. Possible responses where: Yes, fully implemented; Yes, partially implemented; and No. The second question was for respondents that answered yes (partially or fully) to the EHR question. This question pertained to if the EHR that was implemented consisted of specific applications (sorted into the four functional categories described earlier.) Possible responses available to choose from where: Yes, fully implemented; Yes, partially implemented; or No.

Finally, the percentage of treating physicians in each hospital was noted for: 1) Routinely ordering medication electronically and 2) Routinely ordering laboratory or other tests electronically. Response options were: 0%, 1-24%, 25-49%, 50-74%, and 75-100%.

Results

Preliminary analysis of data found that over half of Texas hospitals do not have an electronic health record available for use, one third of the hospitals have only partially implemented EHRs, and only ten percent of the hospitals have a fully implemented EHR (table 2).

Evaluation of the four functions of EHR systems revealed that results management and order entry are the two most often fully implemented components. These two functions have been found to be most beneficial to physicians because of their ability to aid in the capacity to have quick access of past and new test results that support interfaces from labs and permits efficient data entry of all orders and documentation by authorized clinicians (table 2).

Additionally, while patient-level data is not fully implemented often, (15.5%) when combined with partially implemented (23.3%), it totals 38.8% implementation. This is higher than the component of decision support. As hospitals realize the benefit of electronic patient record data and its ability to facilitate a more efficient flow while assisting administrative and physician duties, it is likely that we will see an increase in the implementation of this EHR component. This is an interesting area for future research and is discussed further in said section.

Most importantly, when analyzing EHRs, physician usage is extremely valuable information and often a noted limitation in current literature (Liner, Ma et al. 2007; Kazley and Ozcan 2008). Table 3 presents a breakdown of percentage of time physicians reported actually utilizing the EHR system for electronic ordering of medications and lab/other tests among hospitals with EHRs implemented. Astonishingly, according to our data, over 80% of doctors never use these functions and very few utilize them often.

Analysis of variance was performed on the data to establish if a statistically significant difference exists in mean availability of EHRs and physician usage of EHRs between hospitals of varying characteristics – such as size, ownership, and teaching status. Assumptions of ANOVA were tested using the Shapiro-Wilk test and results showed that we could not reject normality. A modified Levine p-value of .95 along with plots of residuals gives no reason to doubt equal variance or independence.

Results showed that a difference does exist with regard to size, for all four EHR functions (table 4). Further, post-hoc tests revealed the difference lies between small and large hospitals. This makes intuitive sense. Larger hospitals have more resources at their disposal than small hospitals.
Hospital teaching status was shown to also have an impact on two of the EHR functions and both electronic medication ordering/lab tests (table 5). The difference seen between teaching and non-teaching hospitals follows the same reasoning as with size; teaching hospitals have more resources to adopt EHRs and physicians in a teaching environment are more likely to be open to new technologies.

Finally, hospital ownership (public, private, government) was analyzed. Here we see a

statistically significant difference between the majorities of EHR functions, but no difference emerges with regard to electronic ordering of medication/lab tests (table 6).

3. CONCLUSIONS

In Texas in 2007, only 9.9% of hospitals reported having a fully implemented electronic health record system. With policies and programs set in place by the government (American Recovery and Reinvestment Act of 2009 and Health Information Technology for Economic and Clinical Health Act), these numbers may have increased. However, current research suggests otherwise (Menachemi, Ford et al. 2007; Simon, Jenter et al. 2008; Jha, DesRoches et al. 2009).

There are many barriers to implementation of EHR systems (cost, acceptance, technology proficiency), but change is inevitable. It is an extremely important topic in today's society and continues to be one surrounded by much controversy. This study brings to light the slow adoption of EHRs and more importantly the reluctance of physicians to utilize the available systems.

While having an EHR available is extremely important, if physicians are not utilizing these tools the potential benefits never come to fruition. There are several reasons why hospitals may not invest in EHRs and one of the top reasons is the substantial financial cost that generally sees negative return on investment (Thompson and Brailer 2004). This brings up the question, "Is EHR implementation truly to blame for the negative return on investment or is the lack of physician usage of the EHR system the underlying principle?"

Future research will examine which functionalities of EHRs result in the most improvement in clinical outcomes and how physician usage of EHRs affects patient safety and quality of care. Further, a time series analysis is planned for the years 2006-2010 to investigate when a positive gain is realized for EHR adopters and identify any lag time.

Limitations

This study does have limitations. First and foremost, this research was conducted on a single state, Texas, which is not necessarily representative of the population of hospitals in the entire United States. However, the authors chose the state of Texas as it is one of the largest states and encompasses many distinctly different demographics in varying metropolitan and rural areas.

Further, there is the possibility that hospitals that have better information technology systems, are better managed, or have more resources, are likely to have reported EHR data more accurately.

Finally, the counting of EHRs and their components has limitations. This approach does not account for length of time EHR was in place. This could have an impact on the percentage of physician utilization; as using new technology generally encompasses a learning period.

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Appendix

System Affiliation

	Frequency
No	170
Yes	204
Total	374

Teaching Status

	Frequency
	311
	63
	374

Profit

	Frequency
For Profit	118
Not-For Profit	126
Government	130
Total	374

Size

	Frequency
Small	59
Medium	108
Large	207
Total	374

Table 1 Hospital Demographics

EHR		
	Frequency	**Percentage**
Not Available	213	57
Partially Implemented	124	33.2
Fully Implemented	37	9.9
Patient-Level Data		
Not Available	229	61.2
Partially Implemented	87	23.3
Fully Implemented	58	15.5
Results Management		
Not Available	212	56.7
Partially Implemented	54	14.4
Fully Implemented	108	28.9
Order Entry		
Not Available	229	61.2
Partially Implemented	54	14.4
Fully Implemented	91	24.3
Decision Support		
Not Available	254	67.9
Partially Implemented	76	20.3
Fully Implemented	44	11.8

Table 2 Hospital EHR Availability

Electronic Medication Orders		
Reported % of Use	**Frequency**	**Percentage**
0	322	86.1
1-24	24	6.4
25-49	4	1.1
50-74	7	1.9
75-100	17	4.5
Electronic Ordering of Lab/Other Tests		
0	300	80.2
1-24	30	8.0
25-49	5	1.3
50-74	9	2.4
75-100	30	8.0

Table 3 Physician Usage of EHRs

	F	**Sig**
EHR	4.878	0.028*
Patient Data	6.595	0.011*
Results Mgmt.	3.863	0.050*
Order Entry	3.368	0.067
Decision Support	1.609	0.205
Medication	3.963	0.047*
Labs/Other Tests	5.292	0.022*

Table 4 Hospital Size as Factor

	F	Sig
EHR	15.749	0.000*
Patient Data	20.410	0.000*
Results Mgmt.	18.80	0.000*
Order Entry	11.013	0.000*
Decision Support	16.546	0.000*
Medication	2.6690	0.071
Labs/Other Tests	0.2190	0.804

Table 5 Hospital Teaching Status

	F	Sig
EHR	2.721	0.067
Patient Data	5.793	0.003*
Results Mgmt.	5.740	0.004*
Order Entry	2.002	0.137
Decision Support	5.716	0.004*
Medication	0.336	0.715
Labs/Other Tests	0.254	0.776

Table 6 Hospital by Ownership