SMALL, STAND-ALONE, AND STRUGGLING: THE ADOPTION OF HEALTH INFORMATION TECHNOLOGY BY RURAL HOSPITALS

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Executive Summary

This study reports results of a late spring 2006 survey of rural hospitals regarding their readiness to adopt health IT, their current use of different technologies, their perceptions about the benefits and barriers to health IT adoption, their future implementation plans, their use of Federal programs designed to facilitate IT adoption and their interest in various health IT policy options. The sample is national in scope and includes both critical access hospitals (CAHs) and non-CAHs. Responses were received from 238 of the 800 hospitals sampled, for an overall response rate of 30 percent.

On average, rural hospitals reported spending about 2 percent of their annual operating budget to support information technology activities, for a mean IT budget of about $700,000 per year. This proportion was approximately constant across different types of hospitals, so that smaller hospitals (including most CAHs and stand-alone facilities) devote fewer financial resources to IT. Overall, rural hospitals are fairly confident in the ability of their IT staff to carry out tasks necessary for successful adoption of health IT, but the level of confidence was lower among smaller hospitals. Smaller hospitals were also significantly less likely to have a written IT strategic plan or a full-time Chief Information Officer. Connectivity problems do not appear to be a major stumbling block for health IT implementation, with nearly all hospitals saying that high-speed Internet service is available in their area. Well over three-fourths of hospitals said they use T-1 and/or T-3 lines, and 70 percent reported having wireless capabilities.

Just over one-half of rural hospitals indicated that they have begun implementation of an electronic medical record (EMR). Commonly-available EMR capabilities include access to patient demographic information, integration with hospital billing systems, order entry of lab tests and radiology exams, and electronic review of results from these tests. Computerized order entry for prescription drugs and drug interaction alerts were somewhat less common. EMRs were least likely to be used to support clinical decision making through access to clinical guidelines or through direct clinical decision support software.

Pharmacy management systems, such as drug labeling software, inventory control, and medication administration records (MAR), are used by some 70 percent of rural hospitals overall. While 45 percent of hospitals indicate that they have automated dispensing of their prescription drugs, only 23 percent report having access to off-site pharmacists for review of medication orders.

Use of information technology at the patient's bedside was the least common form of health IT. Just over one-quarter of hospitals report using personal data assistants (PDAs) or other hand-held technologies for patient care, about 15 percent are using bedside barcoding for administration of prescription drugs, and only three in ten are using other bedside charting systems or point-of-care monitoring software. Use of these various technologies was often significantly less widespread in CAHs, in stand-alone hospitals, and in smaller hospitals.

Strikingly, hospitals perceive the most significant benefits of health IT to be improved quality of care and reductions in unnecessary tests (benefits that accrue to patients and payers), and are much less likely to mention factors that can improve the hospital's bottom line as being significant benefits. At the same time, hospitals overwhelmingly cite a lack of financial resources as the largest obstacle to health IT implementation. Financial constraints were more likely to be cited as an obstacle by CAHs, stand-alone hospitals, and smaller facilities.

Given the importance of financial constraints as a barrier to health IT adoption, it is not surprising that respondents expressed the highest level of interest in Federal policies that would provide financial support for hospitals striving to implement new systems. Several Federal grant programs exist that can help hospitals with the cost of health IT investments, and their use has been fairly high among targeted hospitals – specifically, small rural hospitals (including CAHs) are using the Small Rural Hospital Improvement Program (SHIP) grants and CAHs are using the grants awarded under the Medicare Rural Hospital Flexibility (Flex) Program. The average size of the award under these programs is quite small, however, meaning that this source alone will not be sufficient to cover the cost of most health IT projects. Larger grants and loans are available through several other programs, but these programs reach a much more limited group of hospitals.

Looking to the future, beyond hardware upgrades, rural hospitals are most interested in implementing or expanding EMR systems and in developing connected information systems that will permit them to exchange health data electronically with other providers. Smaller hospitals and those that are not part of a hospital system – and, by implication, many CAHs – are less likely to anticipate quick adoption and less confident that implementation will be achieved on schedule, even with their longer anticipated timeframe.

SMALL, STAND-ALONE, AND STRUGGLING: THE ADOPTION OF HEALTH INFORMATION TECHNOLOGY BY RURAL HOSPITALS

Introduction

Recent years have witnessed a rapid growth in interest in the application of information technology (IT) to the health care industry for the purpose of improving quality of care. This interest was spawned, in part, by the two seminal Institute of Medicine (IOM) reports that identified the depth of the problem with medical errors (IOM, 1999) and recommended IT applications within a redesigned health care system as a way to address patient safety concerns (IOM, 2001). A third IOM report re-iterated the links between data standards, health IT, and patient safety improvements (IOM, 2003). More specific to rural health, a 2004 IOM report entitled "Quality through Collaboration: The Future of Rural Health" assigned a pivotal role to health IT as part of a strategy to ensure quality of care in rural areas (IOM, 2004).

Other factors contributing to this interest in health IT include a growing base of scientific evidence regarding the benefits of using these technologies in the health setting (Bates et al., 1999; GAO, 2003); dramatic advances in computer systems and secure wireless communication technologies; declining implementation costs; pressure from large purchasing groups such as Leapfrog, which has made computerized provider order entry (CPOE) systems one of its three "leaps" toward improved patient safety (The Leapfrog Group, 2003); emerging standards for the reporting and exchange of health information; and Federal support for health IT adoption, including among other activities the establishment of a National Coordinator for Health Information Technology, an "e-prescribing" pilot program, several grant programs providing financial assistance, planning and implementation help for providers from the Medicare Quality Improvement Organizations, and the advent of pay-for-performance mechanisms. Many states and other regional entities have also begun focusing significant resources on the development of a health IT infrastructure and the electronic exchange of health information (Schoenman et al., 2006).

Evidence on the use of health IT in hospitals has recently begun to emerge. A national survey of hospitals by the American Hospital Association (2005) included a sample of rural hospitals and permits comparisons of rural and urban hospitals. A second national survey of hospitals conducted by Mathematica examined differences by hospital size and accreditation status rather than urban/rural location (Felt-Lisk, 2006). Findings from these surveys have demonstrated clearly that rural hospitals and smaller non-accredited facilities have less extensive use of health IT. A third recent national survey focused on critical access hospitals (CAHs), and provides insights into the adoption of health IT for this subset of rural hospitals (Flex Monitoring Team and TASC, 2006). Additional evidence is available on a more limited geographic basis from surveys of Florida and Georgia hospitals (Menachemi et al., 2005; Brooks et al., 2005; Culler et al., 2006).

Overview of Survey

In this study, we report on the results of a survey of rural hospitals; the sample is national in scope and includes non-CAHs as well as CAHs. Key survey topics included hospitals' existing health IT infrastructure and readiness to adopt new technologies, current use of different types of health IT applications, perceived benefits from and barriers to health IT adoption, future plans for implementing new IT projects, awareness and use of various Federal programs that might foster health IT adoption, and level of interest in other policy options related to health IT. A copy of the survey instrument is included as Appendix A.

The sampling frame was developed from the universe of Medicare-certified short-term general and critical access hospitals contained on the Provider of Services (POS) file maintained by the Centers for Medicare and Medicaid Services. POS data regarding the hospital's status as a critical access hospital was checked against a list of CAHs maintained by the University of North Carolina (UNC) Sheps Center; for purposes of sampling, a hospital was considered to be a CAH if it was so designated on either the POS file or the UNC list. The urban/rural continuum code from the Area Resource File was added to the hospital listing based on the hospital's county of location, and was used to limit the frame to only those hospitals located in non-metropolitan counties. Further distinctions were made between hospitals in counties adjacent to a metropolitan area and those not adjacent to a metropolitan area. This universe of rural hospitals was stratified by CAH/non-CAH status and by adjacent/not-adjacent status, and 200 hospitals were randomly selected from each of the four sampling strata for a total sample of 800 hospitals. Sampling weights were developed to reflect the differential probability of selection by stratum.

For each hospital, we used American Hospital Association data available through an on-line directory maintained by U.S. News & World Report to identify the hospital CEO and verify or update the mailing address and phone number previously obtained from the sampling frame. In many instances, additional Internet searches were also used to update the mailing address, including a second wave of validation conducted by the data collection subcontractor.

The survey was conducted by mail between late March and early May 2006. We opted for a mail survey because we believe that using a web methodology may overstate the extent of IT use by capturing only the most technologically-savvy hospitals. Additionally, we expected that some facilities might need multiple respondents to complete all sections of the survey, and this situation could be more readily accommodated by a mail survey rather than a phone survey.

Field work began with an advance letter from the National Rural Health Association's Senior Advisor for Quality, who introduced the survey and spoke of the importance of participating. This letter was followed shortly by a complete survey packet, addressed personally to the hospital CEO. Instructions asked the CEO to select the person (or persons) in the hospital best suited to answer the survey questions. Concurrent with these

mailings, we also contacted all Directors of State Offices of Rural Health to seek their assistance in promoting the survey. Each Director was provided with a list of the hospitals sampled from his/her state, and asked to contact these facilities to urge participation.

Approximately one week after the initial mailing of the survey packet, all sampled facilities were sent a reminder/thank you postcard. A second mailing of the survey to non-respondents occurred approximately two weeks later, using priority mail. Finally, the data collection firm contacted non-respondents by telephone to ask for their participation (no data were collected during these calls). When the field period closed in May, we had received complete responses from 238 hospitals, for a 30 percent response rate.

Analysis of Non-Response

Table 1 compares responding hospitals with non-respondents using variables that were available for both sets of hospitals from the sampling frame. We see that respondents are more likely to have been sampled as a CAH, have fewer beds, be non-profit, and be in more sparsely-populated rural counties. Respondents are also less likely to be located in the South, and more likely to be in the Midwest – reflecting the higher concentration of CAHs in that area of the country.

Characteristics of Respondents

From Table 2, we see that 163 of the 238 respondents reported that they were critical access hospitals. This number includes 137 hospitals that were sampled as CAHs based on information available at the time of sampling, plus 26 hospitals not sampled as CAHs that reported being CAHs at the time of the survey. When survey responses are weighted by the sampling weights, this would imply that 54.5 percent of the rural hospitals in the sampling frame are CAHs.

Overall, survey respondents had an average of about 50 beds and a mean total gross revenue of about $50 million in their most recently completed fiscal year. Three-quarters of all respondents reported being a stand-alone hospital (as opposed to part of a multi-hospital system with shared ownership and governance) and three-quarters indicated that they were non-profit facilities. We see a strong correlation between CAH status and stand-alone status, with 59 percent of stand-alone facilities reporting that they were CAHs (vs. 40 percent for system hospitals) and 83 percent of CAHs reporting being stand-alone facilities (vs. 69 percent for non-CAHs). CAHs, and stand-alone facilities, were also much smaller than their counterparts, more likely to be government owned, and had much lower total gross revenue.

Table 1. Comparison of Respondents and Non-Respondents

Characteristic	Respondents (n=238)	Non-Respondents (n=562)
Critical Access Hospital [1]	39.4 *	29.2 *
Adjacent to metropolitan area	53.1	57.2
Total beds (mean) [2]	61.6 *	81.1 *
Voluntary, nonprofit [2]	62.6 *	52.1 *
For-profit	2.1 *	9.4 *
Government	35.3 *	38.6 *
County of location has:		
Urban population ≥ 20,000	18.1 *	28.3 *
Urban population of 2,500-19,999	60.7 *	53.5 *
No urban population or under 2,500	21.3 *	18.2 *
Northeast	9.3 *	8.2 *
South	30.8 *	41.9 *
Midwest	41.9 *	34.2 *
West	18.0 *	15.7 *
New England	4.6 *	3.0 *
Mid Atlantic	4.7 *	5.2 *
South Atlantic	11.1 *	11.0 *
East South Central	7.6 *	11.2 *
West South Central	12.2 *	19.6 *
East North Central	17.8 *	12.0 *
West North Central	24.1 *	22.1 *
Mountain	12.7 *	10.6 *
Pacific	5.3 *	5.1 *

All statistics weighted by sampling weights.

* Difference between respondents and non-respondents is significant with 95% confidence.

[1] For this table, CAH status is as determined using data available at time of sampling, specifically, the CMS Provider of Services File and a list of CAHs maintained by the University of North Carolina Sheps Center. For all subsequent tables, CAH status is determined by survey responses.

[2] For this table, bed size and type of ownership are derived from the CMS Provider of Services File. For all subsequent analyses, this information is determined by survey responses.

Table 2. Characteristics of Respondents

Characteristic	All Respondents (n=238)	CAH (n=163)	non-CAH (n=75)	Stand-Alone Hospital (n=186)	System Hospital (n=49)
Critical Access Hospital	54.5	--	--	59.1 *	40.3 *
Stand-alone hospital	76.8	82.9 *	69.3 *	--	--
Total beds (mean)	51.4	21.2 *	87.3 *	45.1 *	72.9 *
Voluntary, nonprofit	73.2	70.4 *	76.5 *	70.8 *	81.5 *
For-profit	6.8	4.7 *	9.3 *	3.2 *	18.5 *
Government	19.9	24.9 *	14.3 *	26.1 *	0.0 *
Total gross revenue (mean, $millions)	50.3	26.2 *	81.3 *	42.1 *	81.5 *

All statistics weighted by sampling weights.
* Difference (CAH vs. non-CAH or stand-alone vs. system) is significant with 95% confidence.

Readiness to Adopt Health IT

The initial section of the survey asked respondents a series of questions to assess their readiness to adopt health IT, including:

- their annual budget for IT;
- whether they have a written strategic plan for IT, a full-time Chief Information Officer (CIO), and a physician "IT champion";
- the number of full-time equivalent (FTE) IT staff employed by the hospital and through outside vendors or consultants;
- their level of confidence that the IT staff could select an appropriate product and vendor, handle the technical side of the implementation, and maintain the application over the long term;
- whether the area is served by a high-speed Internet service provider;
- the means by which their clinical departments access the Internet; and
- their use of various wireless technologies.

Results for these questions are presented in Tables 3 and 4. All results are weighted by the inverse of the selection probability for the hospital's sampling strata; thus, results represent the population of rural hospitals in the sampling frame. From Table 3, we see that across all hospitals, the mean annual IT budget was approximately $700,000, representing about 2 percent of the total operating budget for the hospital. Bivariate analyses by CAH status and stand-alone/system status indicate that CAHs and stand-alone facilities spend significantly less annually on IT activities: while non-CAHs and system hospitals reported annual IT budgets of around $1.3 million, stand-alone facilities spent less than half that amount, while CAHs spent about $300,000. CAHs also reported significantly fewer in-house IT staff resources, relative to non-CAHs (1.5 FTEs vs. 6.7 FTEs).

Table 3. Readiness to Adopt Health IT

	All Respondents	Bivariate Results				Multivariate Results [1]		
		CAH	non-CAH	Stand-Alone Hospital	System Hospital	CAH	Stand-Alone	Total Beds (10s)
						Regression Coefficients		
Annual IT budget (mean, $millions)	0.7	0.3 *	1.3 *	0.6 *	1.3 *	-0.56	-0.56	0.12
IT budget as percent of operating budget (mean, %)	1.9	1.8	2.1	1.7 *	2.7 *		-0.86	
In-house IT staff (mean, FTEs)	3.9	1.5 *	6.7 *	3.7	4.9			0.44
Outsource IT staff (mean, FTEs)	1.0	1.2	0.7	0.8	1.5			
						Odds Ratios		
Has written strategic plan for IT (%)	45.1	34.3 *	57.8 *	39.3 *	68.7 *		0.56	1.12
Has full-time Chief Information Officer (%)	35.9	28.2 *	45.2 *	33.6 *	45.6 *			1.18
Has physician champion for IT initatives (%)	22.2	19.2 *	25.8 *	21.8	25.1			
Percent who are "very confident" their IT staff can:								
Evaluate & select products/vendors	62.5	52.9 *	73.6 *	59.9 *	74.4 *			1.12
Implement selected products	65.9	58.1 *	75.0 *	61.6 *	83.5 *		0.44	1.14
Maintain/upgrade technologies	68.6	61.7 *	76.4 *	64.2 *	86.8 *		0.34	1.15

* Difference (CAH vs. non-CAH or stand-alone vs. system) is significant with 95% confidence.
All statistics weighted by sampling weights.

[1] All regressions also controlled for hospital ownership (non-profit, government, for-profit [reference category]). Only statistically significant results are presented. Logarithmic transformation used for annual IT budget. Results for annual IT budget, IT budget as percent of operating budget, and in-house and outsource IT staff are coefficients from OLS regressions. All other multivariate results are odds ratios derived from logit models.

Due to the fact that CAHs are systematically more likely to be stand-alone facilities (and vice verse) and that both types of facilities are smaller than their non-CAH and system counterparts, we also used multivariate analyses to disentangle the effects of these inter-related factors. In other words, we are trying to determine whether the differences between CAHs and non-CAHs that show up in the bivariate analyses persist once we control for stand-alone/system status and hospital size, or whether they are an artifact of the effect of these other variables. Ordinary least squares (OLS) regression was used to explain the across-hospital variation in annual IT budget (log transformed), IT budget as a percent of operating budget, and in-house and outsource IT staff. Independent variables were indicators of whether the hospital was a CAH (vs. non-CAH), was stand-alone (vs. system), was non-profit or government owned (vs. for-profit), and the total number of beds.

These multivariate results are shown in the final columns of Table 3. We find persistent, independent significant effects of being a CAH, being stand alone, and hospital size on the annual IT budget. That is, even after controlling for stand-alone (CAH) status, ownership, and size, CAHs (stand-alone facilities) have lower IT budgets; likewise, IT budgets are higher for larger facilities, regardless of their CAH status, their ownership, or whether they are part of a hospital system. In contrast, we see that the multivariate approach has provided a different conclusion for our analysis of differences in in-house IT staff: the lower IT staff resources observed for CAHs relative to non-CAHs is due to the smaller size of CAHs, not to the CAH status itself.

In the second portion of Table 3, we see that 45 percent of all hospitals reported having a written strategic plan for IT, 36 percent said they have a full-time CIO, and 22 percent have a physician who champions IT initiatives at the hospital. Once again, CAHs and stand-alone hospitals are less likely than their counterparts to report having these resources. Multivariate logistic regression shows that these impacts are related to hospital size. Odds ratios for significant variables are shown in the far right columns; a ratio above 1 indicates that the independent variable had a positive impact on the dependent variable, while a ratio below 1 indicates a negative relationship. Thus, both the probability of having an IT strategic plan and of having a full-time CIO increase with hospital size, and there is no separate effect from being a critical access hospital. Stand-alone facilities also have a lower probability of having a strategic plan, even after controlling for their smaller size.

The final rows of Table 3 present respondents' ratings of their level of confidence in their IT staff. Overall, rural hospitals are fairly confident in their staff's abilities, with approximately two-thirds of all respondents saying they are "very confident" that their IT staff can evaluate and select products and vendors, configure the hospital infrastructure as required to implement the selected products, and maintain and upgrade the technologies as needed. Multivariate results show that larger hospitals are more likely to be very confident that their IT staff can carry out all tasks, while stand-alone facilities are less likely to give a very confident rating for the implementation and maintenance tasks. There is no separate significant impact for CAHs, independent of the impact of size and stand-alone status.

Table 4. Internet Access and Wireless Connectivity

	All Respondents	Bivariate Results				Multivariate Results [1]		
		CAH	non-CAH	Stand-Alone Hospital	System Hospital	CAH	Stand-Alone	Total Beds (10s)
In area served by ≥ 1 high-speed Internet provider	98.5	98.5	98.4	98.7	97.7			
Have access to Internet	100.0	100.0	100.0	100.0	100.0			
Methods used to access Internet: [2]								
Dial-up modem	10.4	9.3	11.8	12.8 *	3.5 *	0.38	2.86	0.89
Integrated Services Delivery Network (ISDN)	7.7	3.9 *	12.4 *	7.5	8.8	0.17		0.88
Digital Subscriber Line (DSL)	35.8	41.3 *	29.0 *	42.6 *	13.6 *		2.94	0.88
Cable modem	9.5	7.2 *	12.3 *	10.5	6.7		2.59	1.13
T-1 lines	78.1	74.7 *	82.1 *	80.5 *	71.5 *	0.46		
T-3 lines	8.2	4.0 *	13.4 *	4.5 *	20.4 *		0.22	1.09
Have some wireless connectivity	69.7	62.3 *	78.3 *	68.1 *	77.7 *	0.61		
Wireless connectivity technologies used: [2]								
Analog cellular service	6.9	6.5	7.3	6.3	9.4			
Digital cellular service	58.6	48.0 *	71.0 *	56.9 *	68.1 *	0.57		1.07
Wireless local area networks (WiFi)	8.8	6.6 *	11.3 *	9.4	5.8			1.10
Wireless personal area networks (e.g., Bluetooth)	5.8	8.9 *	2.2 *	6.2	4.8		2.89	

All statistics weighted by sampling weights.

* Difference (CAH vs. non-CAH or stand-alone vs. system) is significant with 95% confidence.

[1] Logit regression also controlled for hospital ownership (non-profit, government, for-profit [reference category]). Only statistically significant results are shown. Numbers presented are odds ratios.

[2] Categories not mutually exclusive; hospital may use multiple means.

Contrary to what has been the conventional wisdom regarding rural difficulties in adopting health IT, it appears that connectivity issues are no longer posing a significant problem. As shown in Table 4, almost all rural hospitals report being in a geographic area that is served by at least one broadband (high speed) Internet service provider, and all hospitals currently have access to the Internet. Although 10 percent of hospitals report using dial-up service in at least some of their clinical departments, 36 percent have high speed access through DSL, 78 percent use T-1 lines, and 8 percent use the even faster T-3 lines. Furthermore, 70 percent of hospitals have access to wireless technologies, with digital cellular service being the most prevalent option. In general, larger hospitals have better connectivity options in place. CAHs are less likely to have T-1 and T-3 lines, and less likely to have wireless capabilities.

Current Use of Health IT

Electronic Medical Record Systems

There is tremendous interest currently regarding implementation of electronic medical record or EMR systems. For this survey, we defined an EMR as a "comprehensive computer-based/digital record that includes all documentation of care given to a specific patient within the hospital." As shown in Table 5, just over one-half of all rural hospitals reported having begun implementing an EMR. This probability was lower for smaller hospitals, including CAHs and stand-alone facilities.

EMRs vary in their sophistication, and may include a range of capabilities. Our survey included a list of possible EMR capabilities and asked hospitals that had begun a system implementation whether each functionality was implemented in "all", "some", or "no" clinical departments. Table 5 provides the percent of respondents who had implemented each functionality in at least some clinical departments, and Figure 1 provides further detail on whether the implementation was in all or only some clinical departments. Not surprisingly, some of the most widely implemented capabilities were access to patient demographics (used by 93 percent of hospitals with an EMR) and integration with hospital billing systems (86 percent) – both components of patient management systems. EMRs also appear to be commonly used for order entry of radiology exams and lab tests (87 percent) as well as for electronic review of results from these tests (89 percent). Computerized order entry for prescription drugs and drug interaction alerts were somewhat less common, with 68 and 72 percent of hospitals with EMRs reporting these capabilities, respectively. More than three-quarters of EMR users indicated that their systems provide information on previous contacts between the patient and the hospital as well as on the current episode. EMRs were least likely to be used to support clinical decision making, either by providing access to clinical guidelines or protocols (59 percent) or through direct clinical decision support (CDS) software that integrates clinical and patient information to assist in decisions about treatment (35 percent).

Bivariate analyses revealed that, among EMR implementers, CAHs were significantly less likely to have implemented many of the specific functionalities, and this relationship persisted even after controlling for other hospital characteristics through multivariate

Table 5. Use of Electronic Medical Records

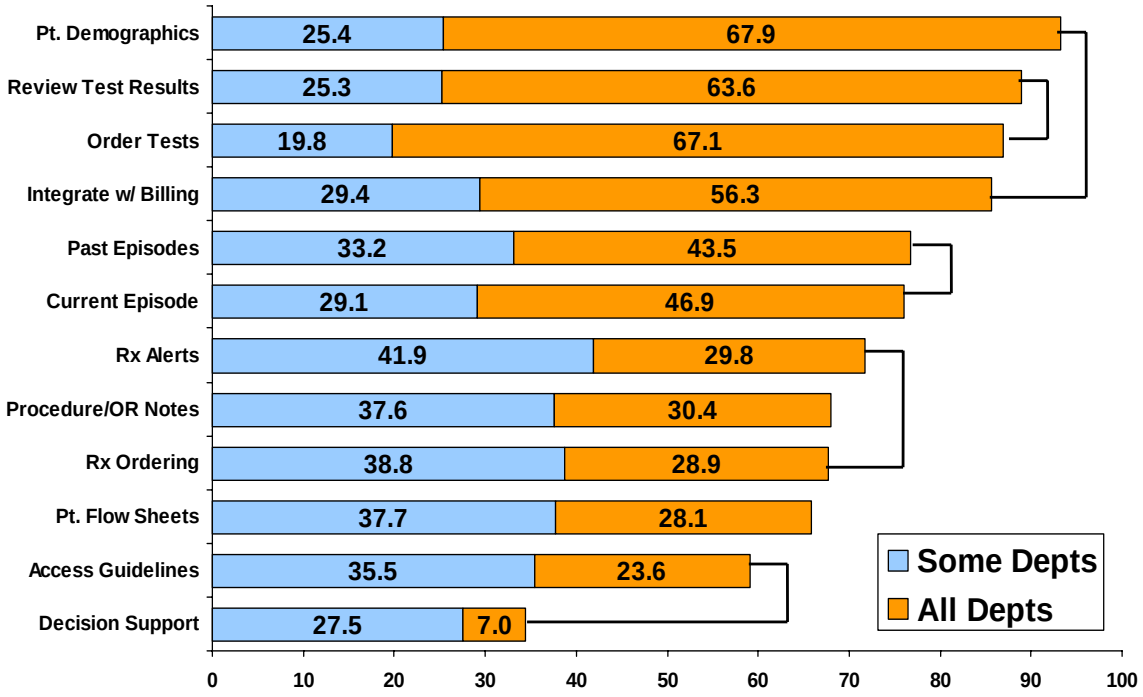
	All Respondents	Bivariate Results				Multivariate Results [1]		
		CAH	non-CAH	Stand-Alone Hospital	System Hospital	CAH	Stand-Alone	Total Beds (10s)
Have begun implementation of an EMR	51.0	45.1 *	57.9 *	47.5 *	64.0 *			1.07
Of those with an EMR, percent using following functionalities in at least some departments:								
Access to patient demographics	93.2	92.3	94.1	96.4 *	87.6 *			
Review lab/radiology results	88.9	85.6	92.0	91.2	84.9			
Order lab tests or radiology exams	86.9	83.7	90.0	88.1	85.7			
Integration with hospital billing system	85.6	86.3	85.0	88.6 *	80.3 *			
Access to past medical records (other stays/visits)	76.7	71.1 *	82.1 *	81.1 *	67.8 *		2.79	
Access to information on current episode	76.0	72.9	79.0	75.0	79.9			
Drug interaction alerts	71.7	64.2 *	78.6 *	69.2	78.8	0.46	0.43	
Procedure/operative notes	68.0	64.8	71.1	66.2	73.6			
Order entry of medications	67.6	58.9 *	76.0 *	68.0	68.0	0.28		
Access to patient flow sheets	65.8	56.9 *	74.4 *	65.9	67.0	0.23		0.92
Access to clinical guidelines and protocols	59.1	42.0 *	75.2 *	57.1	64.8	0.33		
Clinical decision support software	34.5	28.0 *	40.8 *	30.1 *	45.0 *	0.33	0.35	

All statistics weighted by sampling weights.

* Difference (CAH vs. non-CAH or stand-alone vs. system) is significant with 95% confidence.

[1] Logit regression also controlled for hospital ownership (non-profit, government, for-profit [reference category]). Only statistically significant results are shown. Numbers presented are odds ratios.

Figure 1
Extent to which Various EMR Functions have been Implemented



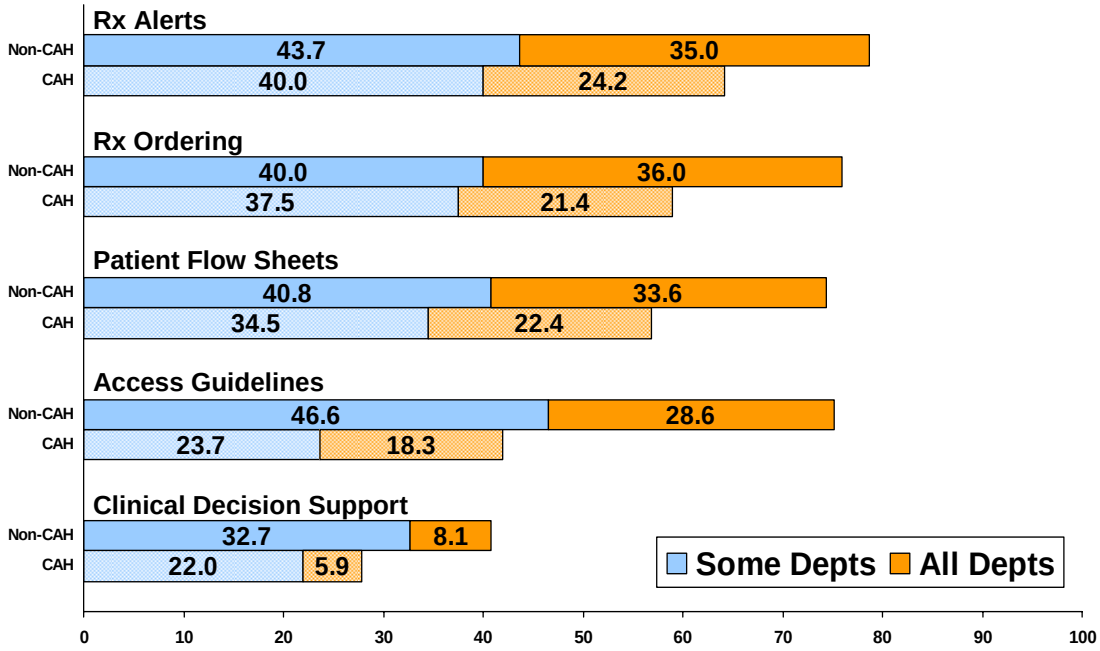
regressions. As shown in Table 5 and Figure 2, CAHs had significantly less extensive implementation of EMRs that incorporate order entry for prescription drugs, drug interaction alerts, access to guidelines or CDS software, or access to patient flow sheets.

Telemedicine Applications

Telemedicine was defined as the transmission of health information to remote sites using telecommunication technology. We queried hospitals regarding their use of this technology for six specific clinical applications:

- video teleconferencing for real-time patient consultations;
- emergency services applications – electronic transmission of clinical data from an ambulance to the hospital or from the hospital ER to a tertiary care center;
- teleradiology applications, including Picture Archiving Communications Systems (PACS);
- telecardiology applications – electronic transmission of cardiac data from the patient site to a consulting site;
- remote monitoring by the hospital of patients at other locations (e.g., from the patient's home); and
- remote monitoring of hospital inpatients (e.g., ICU patients) by tertiary care centers.

Figure 2
Differences between CAHs and non-CAHs
in Use of EMR Functionalities



By far the most common telemedicine application reported was for teleradiology services, with fully two-thirds of respondents indicating that they currently use this technology (Table 6). One-quarter of respondents reported current use of video teleconferencing for patient consultations and electronic transmission of cardiac data. Tele-emergency applications were less common (11 percent of hospitals) as was remote monitoring of patients. Similar patterns were observed for CAHs and non-CAHs. Stand-alone hospitals were significantly less likely to use teleconferencing for patient consultations and to monitor off-site patients remotely.

Other Types of Health IT

Hospitals were next asked whether a variety of health IT applications have been fully implemented in the applicable clinical departments, partially implemented in these departments, or were not in place at all. As shown in Table 7 and Figure 3, the most-commonly implemented application was a Master Patient Index. By providing a unique identifier and basic demographic data for each patient in the facility, a Master Patient Index is the underpinning of many other health IT applications. More than three-fourths of all rural hospitals report full implementation of a Master Patient Index in all applicable departments, and another 12 percent indicate partial implementation.

Use of computerized laboratory and/or radiology information systems is almost as wide-spread as the use of a Master Patient Index, with more than one-quarter of all rural hospitals reporting partial implementation and nearly three in five facilities reporting full

Table 6. Use of Telemedicine Applications

	All Respondents	Bivariate Results				Multivariate Results [1]		
		CAH	non-CAH	Stand-Alone Hospital	System Hospital	CAH	Stand-Alone	Total Beds (10s)
Teleradiology (including PACS)	67.7	66.4	69.3	68.5	64.8			
Video teleconferencing for real-time patient consultations	25.6	24.1	27.3	24.6	30.4		0.58	
Telecardiology	25.3	21.4 *	29.8 *	24.5	29.4			1.06
Emergency services	11.0	9.9	12.3	11.7	9.2			
Remote monitoring of hospital inpatients by other site	8.7	7.2	10.4	7.8	12.0			
Remote monitoring by hospital of off-site patients	7.5	5.0 *	10.4 *	4.8 *	15.4 *		0.33	

All statistics weighted by sampling weights.

* Difference (CAH vs. non-CAH or stand-alone vs. system) is significant with 95% confidence.

[1] Logit regression also controlled for hospital ownership (non-profit, government, for-profit [reference category]). Only statistically significant results are shown. Numbers presented are odds ratios.

Table 7. Implementation of Other Types of Health IT Applications

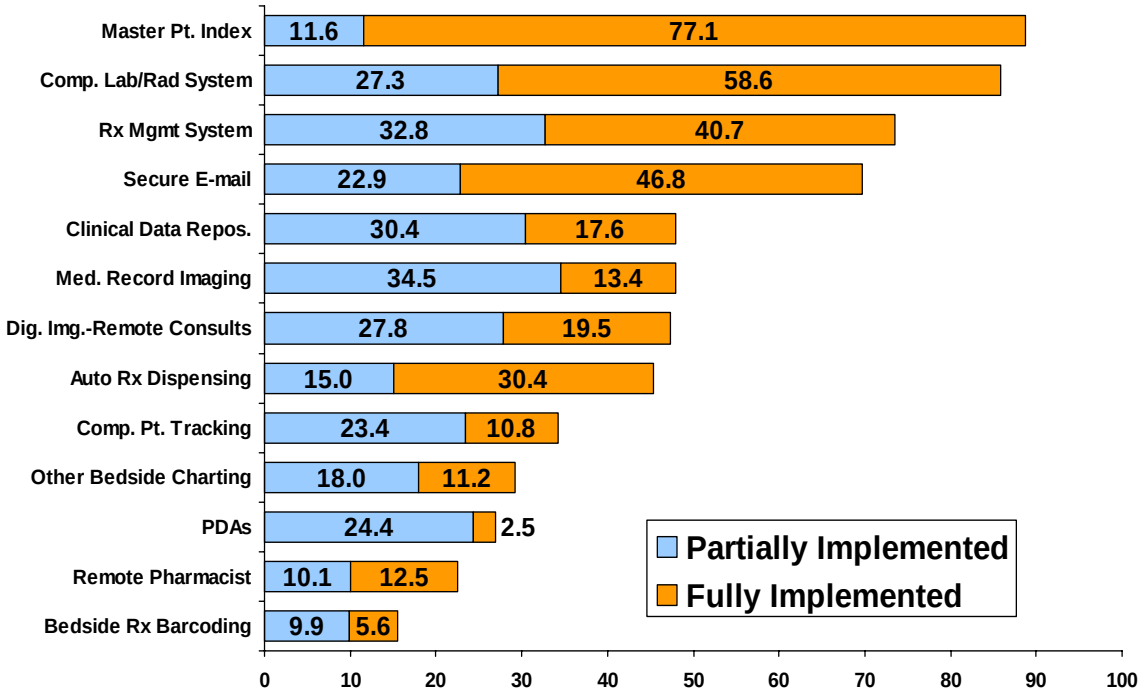
	All Respondents	Bivariate Results				Multivariate Results [1]		
		CAH	non-CAH	Stand-Alone Hospital	System Hospital	CAH	Stand-Alone	Total Beds (10s)
Percent of Respondents who Have Partially or Fully Implemented:								
Master Patient Index	88.7	81.0 *	97.9 *	86.8 *	94.3 *	0.14	0.42	
Computerized lab/radiology systems	85.8	78.6 *	94.5 *	84.7	89.9	0.19		
Pharmacy management systems	73.5	63.9 *	84.9 *	70.0 *	86.7 *		0.46	1.11
Secure email between providers	69.7	66.7	73.3	66.2 *	83.0 *	0.50	0.29	0.95
Clinical data repository	48.0	33.4 *	66.1 *	43.5 *	66.5 *	0.52	0.50	1.18
Medical record imaging	47.8	39.1 *	58.7 *	48.8	47.6		1.75	1.06
Digital imaging for remote consultations	47.3	42.8 *	53.0 *	47.0	48.5			
Automated drug dispensing system	45.5	32.5 *	60.9 *	41.0 *	62.5 *	0.51	0.55	1.10
Computerized patient tracking/reminders	34.2	26.1 *	43.9 *	36.0	29.2	0.47	1.93	
Bedside charting/point-of-care monitoring	29.2	20.3 *	40.6 *	28.7	32.8	0.51		1.05
Personal data assistants (PDAs)	26.9	24.9	29.2	25.5	32.8			1.11
Remote pharmacist access	22.5	21.1	24.3	17.0 *	42.1 *		0.29	
Bedside prescription drug barcoding	15.5	11.3 *	20.6 *	13.7 *	22.3 *			1.12

All statistics weighted by sampling weights.

* Difference (CAH vs. non-CAH or stand-alone vs. system) is significant with 95% confidence.

[1] Logit regression also controlled for hospital ownership (non-profit, government, for-profit [reference category]). Only statistically significant results are shown. Numbers presented are odds ratios.

Figure 3
Extent to which Other IT Applications have been Implemented

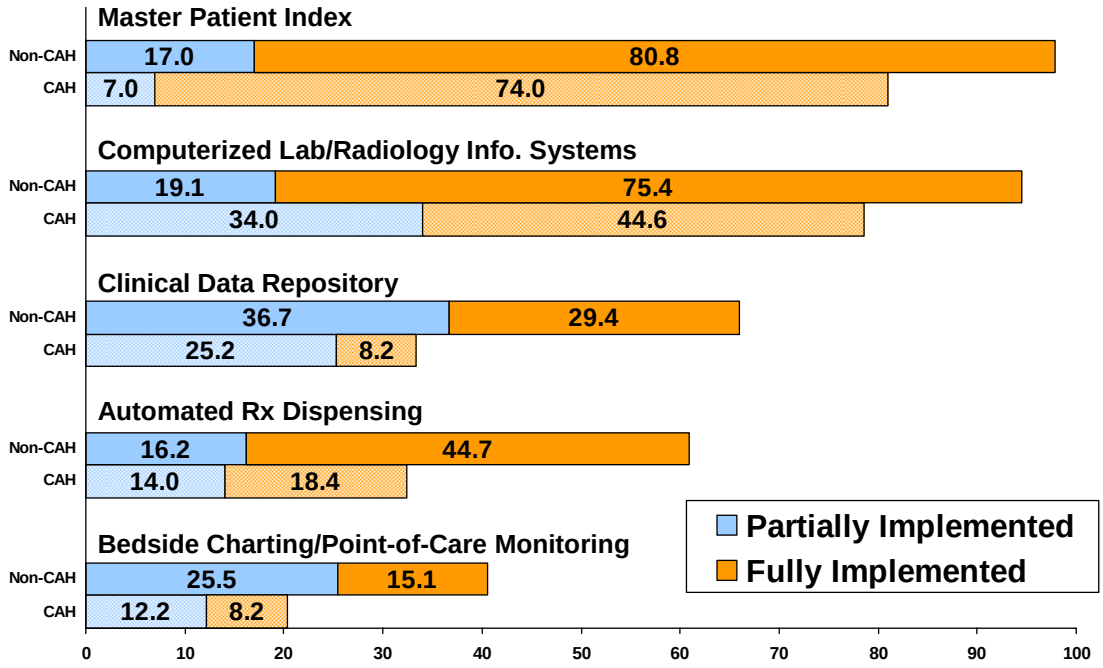


implementation. Pharmacy management systems – such as drug labeling software, inventory control, and medication administration records (MAR) – and secure e-mail between providers (within and outside the hospital) are used by some 70 percent of rural hospitals overall.

Slightly less than one-half of hospitals report having a real-time clinical data repository (CDR) that consolidates data from multiple clinical sources to present a unified view of a given patient. Medical record imaging and digital image capture and transmission of patient information for remote patient consultations are also used by slightly under one-half of rural hospitals. While 45 percent of hospitals indicate that they have automated dispensing of their prescription drugs, only 23 percent report having access to off-site pharmacists for review of medication orders.

Use of information technology at the patient's bedside was the least common form of health IT. Just over one-quarter of hospitals report using personal data assistants (PDAs) or other hand-held technologies, and this application was ten times more likely to be only partially rather than fully implemented in applicable departments of the facility. Likewise, only 15 percent of rural hospitals are using bedside barcoding of prescription drugs, and only three in ten hospitals are using other bedside charting systems or point-of-care monitoring software.

Figure 4
Differences between CAHs and non-CAHs
in Use of Other Health IT Applications



As shown in Table 7, CAHs and stand-alone facilities were often significantly less likely to have implemented these other technologies, relative to their non-CAH and hospital system counterparts. Furthermore, these differences frequently persisted even after controlling for hospital size and ownership. Not surprisingly, larger hospitals were typically more likely to have implemented these technologies, regardless of their CAH or stand-alone status or their ownership. Figure 4 provides additional detail on the significant differences between CAHs and non-CAHs for selected technologies.

Significant Benefits and Barriers to Health IT Adoption

Respondents were provided with a list of items that have frequently been advanced as benefits arising from the use of health IT, and asked to indicate whether each item was perceived as a "significant" benefit, a "moderate" benefit, a "small" benefit, or "not a benefit" realized by the hospital through its use of health IT. A separate list contained items often perceived as being barriers to health IT adoption, and respondents were asked to give similar ratings of the extent to which each item had impeded the successful implementation of health IT by the facility.

Table 8 shows, for each potential benefit and by type of hospital, the percent of IT users who indicated that the item had been a significant benefit to their facility attributable to the use of health IT. Figure 5 depicts the same information graphically for all hospitals

Table 8. Perceived Significant Benefits from Adoption of Health IT (Among IT Users)

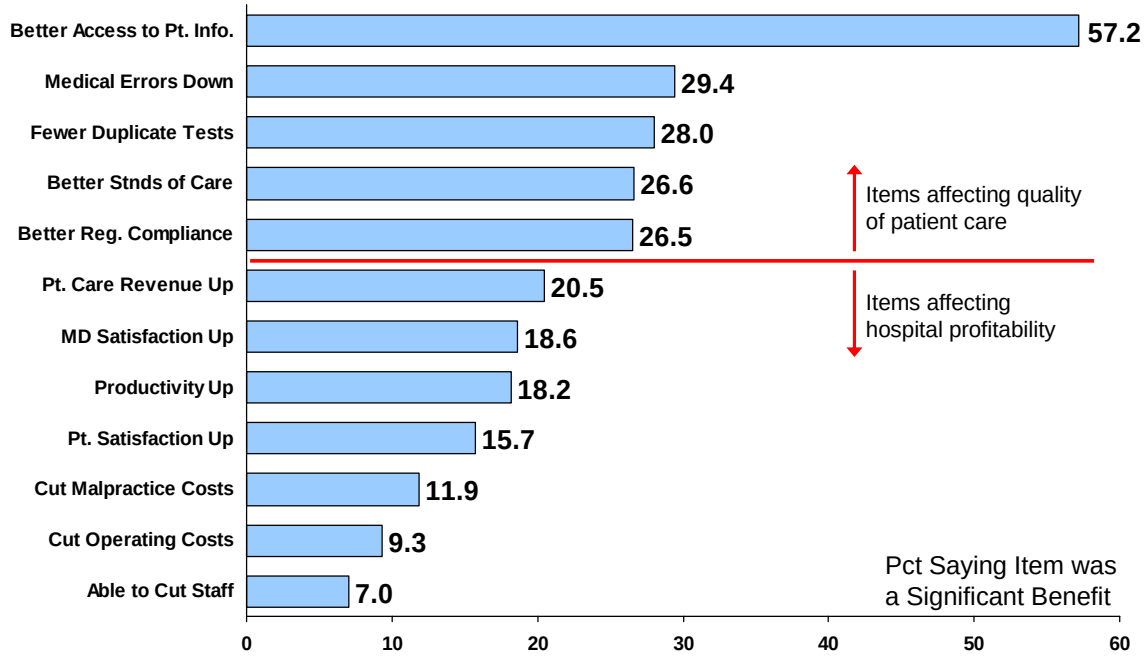
	All IT Users	Bivariate Results				Multivariate Results [1]		
		CAH	non-CAH	Stand-Alone Hospital	System Hospital	CAH	Stand-Alone	Total Beds (10s)
Improved access to patient health information	57.2	44.3 *	70.3 *	53.4 *	69.9 *			1.10
Reduced medical errors	29.4	24.9 *	34.0 *	26.4 *	38.6 *			
Reduced unnecessary/duplicate tests/procedures	28.0	25.9	30.2	26.0	34.5			
Improved adherence to standards of care	26.6	19.5 *	33.9 *	24.6 *	33.2 *	0.49		
Increased compliance with regulatory/accrediting bodies	26.5	24.2	28.8	26.9	26.1			
Increased patient care revenue	20.5	13.2 *	27.9 *	22.0	16.9	0.37	1.97	
Improved provider satisfaction	18.6	16.2	21.1	19.6	16.3			
Increased productivity	18.2	18.4	18.1	21.6 *	9.0 *		3.88	
Improved patient satisfaction	15.7	12.5 *	18.9 *	15.2	17.6			
Reduced liability insurance costs	11.9	9.9	14.0	13.6	7.5		3.24	1.10
Reduced operating costs	9.3	4.9 *	13.8 *	11.4 *	3.6 *	0.20	4.07	0.92
Enabled reductions in hospital staffing	7.0	3.4 *	10.7 *	9.5 *	0.0 *	0.27		

All statistics weighted by sampling weights.

* Difference (CAH vs. non-CAH or stand-alone vs. system) is significant with 95% confidence.

[1] Logit regression also controlled for hospital ownership (non-profit, government, for-profit [reference category]). Only statistically significant results are shown. Numbers presented are odds ratios.

Figure 5
Perceptions Regarding Significant Benefits from Health IT



combined. By far the most important benefit seen as arising from health IT applications was "improved access to patient health information." Fifty-seven percent of all hospitals using some form of health IT indicated that this was a significant benefit realized by their facility. Four additional items were closely clustered, with approximately one-quarter of respondents indicating that each item was a significant benefit. Reductions in medical errors (a significant benefit for 29 percent of health IT users) and reductions in unnecessary or duplicate tests and procedures (28 percent) are both benefits that flow directly from the improved access to patient health information. Twenty-seven percent of health IT users also felt that their health IT applications had enabled them to realize significant benefits in the form of improved adherence to standards of care and compliance with regulatory and accrediting bodies. All of these benefits speak to the impact of health IT on the quality of patient care, and are grouped above the line in Figure 5.

Importantly, all other potential benefits accruing directly to the hospital or its physicians – such as higher patient care revenue, lower operating and liability insurance costs, higher productivity, and gains in physician satisfaction – were less likely to be rated as a significant benefit by respondents. These items are grouped below the red line in Figure 5. Either these impacts did not occur or they are not viewed as being a significant benefit for the hospital. Regardless of the reason for their lower ranking, these results show that hospitals believe the largest benefits to adopting health IT will be gains to the patient (and insurers) rather than improvements in the hospital's bottom line.

Table 9. Perceived Significant Barriers to Adoption of Health IT

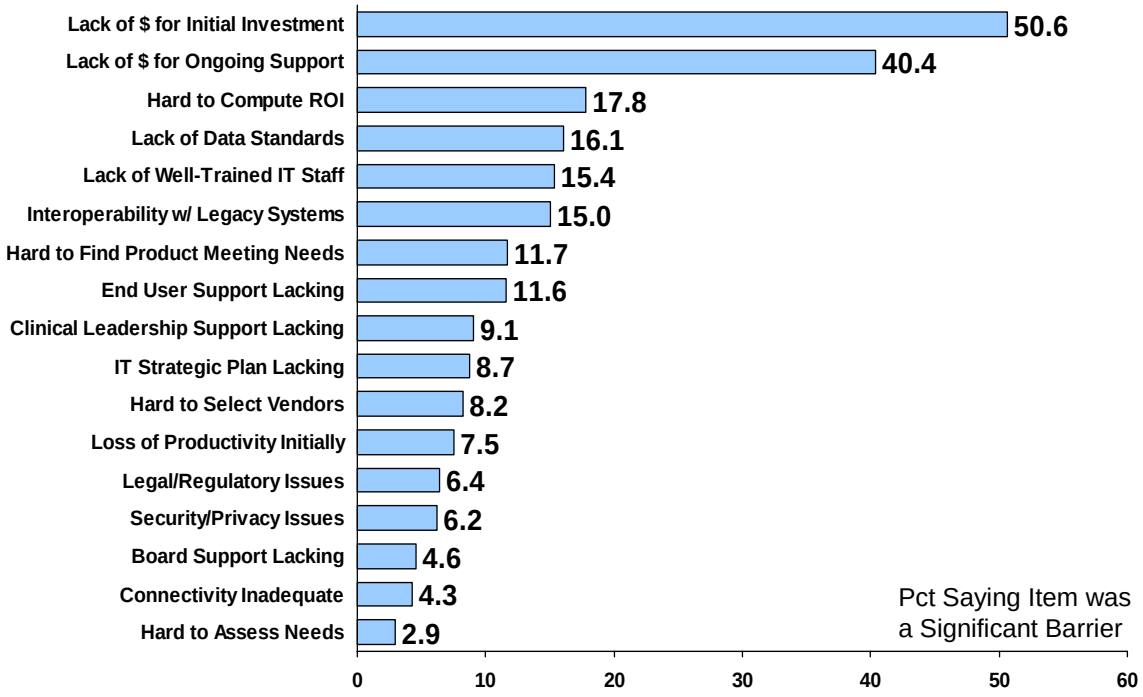
	All Respondents	Bivariate Results				Multivariate Results [1]		
		CAH	non-CAH	Stand-Alone Hospital	System Hospital	CAH	Stand-Alone	Total Beds (10s)
Inadequate funding for initial infrastructure investments	50.6	60.1 *	38.9 *	53.0 *	41.6 *	2.40		
Inadequate funding for ongoing support of new technologies	40.4	51.8 *	26.5 *	42.9 *	31.1 *	2.06		0.92
Difficulty quantifying benefits/return on investment	17.8	18.3	17.2	18.3	16.7			
Lack of common data standards	16.1	17.3	14.7	19.6 *	5.4 *		7.32	
Unavailability of well-trained IT staff	15.4	15.5	15.2	17.3 *	8.3 *	0.23	2.09	0.70
Lack of interoperability with systems now used in hospital	15.0	14.5	15.5	18.8 *	3.3 *		11.63	0.92
Difficulty identifying technology/product to meet needs	11.7	12.2	11.1	11.8	10.3			
Lack of acceptance from end users/clinical staff	11.6	10.6	12.7	14.3 *	3.3 *		4.80	
Lack of support from clinical leadership	9.1	6.9 *	11.6 *	8.3	11.8	0.45		
Lack of strategic plan for health IT	8.7	11.9 *	5.0 *	8.8	8.6	3.32		
Difficulty of vendor selection process	8.2	10.4 *	5.6 *	8.3	6.7			
Loss of productivity during implementation period	7.5	6.7	8.4	8.1	4.5	0.38		
Legal/regulatory concerns	6.4	8.4 *	3.9 *	8.0 *	0.0 *			0.76
Security/privacy concerns	6.2	7.2	5.1	7.6 *	2.1 *			
Lack of support from top management or Board	4.6	4.8	4.4	4.8	4.2			
Inadequate access to connectivity	4.3	6.8 *	1.1 *	2.9 *	8.8 *	38.29	0.26	1.14
Difficulty completing needs assessment	2.9	4.5 *	1.1 *	3.2	2.1			0.20

All statistics weighted by sampling weights.

* Difference (CAH vs. non-CAH or stand-alone vs. system) is significant with 95% confidence.

[1] Logit regression also controlled for hospital ownership (non-profit, government, for-profit [reference category]). Only statistically significant results are shown. Numbers presented are odds ratios.

Figure 6
Perceptions Regarding Significant Barriers to Health IT



When significant differences were observed between categories of hospitals, CAHs were less likely to rate factors as being a significant benefit, while stand-alone hospitals were more likely to feel that an item was a significant benefit. Again, these differences in ratings may be related to whether the effect was realized at all by the hospital as well as to differences in how beneficial the hospital perceives the effect to have been.

Table 9 and Figure 6 present similar analyses for barriers to health IT adoption. It is immediately obvious that the most important obstacle perceived as standing in the way of health IT adoption is a lack of financial resources, both for the initial investment and for the long-term operating and maintenance costs. Financial considerations are also reflected in the third most frequently selected significant barrier, difficulty quantifying benefits and computing a return on investment. Other items perceived as significantly impeding progress in the adoption of health IT relate to interoperability concerns – including the lack of data standards and problems interfacing new systems with the hospital's existing systems – and a lack of well-trained IT staff.

At the other end of the spectrum, a number of items commonly advanced as barriers to health IT adoption do not appear to be posing significant barriers to rural hospitals. Specifically, only a small proportion of respondents felt that difficulty completing a needs assessment, inadequate connectivity, lack of support from the Board or executive management, security and legal concerns, decreased productivity during system implementation, and difficulty of the vendor selection process were serious obstacles.

One survey respondent, CEO of a small frontier CAH, provided additional feedback on implementation barriers that reiterates the larger survey findings regarding the importance of financial constraints and interoperability concerns. According to this respondent, financial obstacles – specifically, inconsistent cash flow – pose the greatest barrier to implementation. Although this facility has an electronic laboratory system, digital X-ray capabilities, and a computerized financial system, these systems are not integrated. With these stand-alone systems and no capability to capture and transmit other relevant patient information electronically, the facility is not prepared to take part in any of the several nearby regional health information organizations that are in the early developmental stages. As this administrator asks, "With cash flow a problem, what practical sense is there in replacing [functioning] lab and x-ray systems [just] to have one system? I have put patient care above IT and will continue to do so."

With a few exceptions, both CAHs and stand-alone facilities were more likely than their counterparts to perceive these factors as posing significant barriers, and these differences often persisted after controlling for hospital size and ownership through multivariate analyses. Larger hospitals, on the other hand, were less likely to view these items as significant barriers.

Future Plans for Adoption of Health IT

Priority IT Projects

Respondents were asked to indicate whether specified health IT projects are a priority for their hospital in the foreseeable future, and those answering in the affirmative were asked about the anticipated timeframe for adoption and the likelihood of implementing on schedule.

The proportion of respondents saying that a particular health IT project was a future priority varied from a high of 88 percent of hospitals that planned to add or upgrade hardware to 28 percent that planned to implement faster connectivity options (Table 10). Roughly 60 percent of hospitals were hoping to add or upgrade their network or wireless systems.

With regard to clinical applications, the leading technology of interest is the electronic medical record, with more than four of five hospitals saying this is a priority for the near term. Hospitals expressing an interest in EMRs for the future were divided approximately evenly between hospitals that have not yet begun implementing an EMR in any way and those that have started EMR implementation (data not shown); presumably, members of this latter group are planning to expand EMR use to other clinical departments and/or add EMR functionalities to their existing systems.

Table 10. Priorities for Future Health IT Projects

	All Respondents	Bivariate Results				Multivariate Results [1]		
		CAH	non-CAH	Stand-Alone Hospital	System Hospital	CAH	Stand-Alone	Total Beds (10s)
New or upgraded hardware	87.8	83.8 *	92.8 *	87.9	87.1			
Electronic Medical Record (EMR) system	82.2	85.9 *	77.7 *	86.6 *	66.6 *	4.82	6.18	1.21
Connecting clinical information systems of hospital and other locations	63.6	59.1 *	69.1 *	62.6	67.1			
Digital imaging for remote interpretation or consultation	63.4	66.8 *	59.3 *	62.7	66.2			
New or upgraded network and/or wireless systems	57.7	56.4	59.4	56.0 *	65.2 *		0.64	
Video teleconferencing for remote, real-time patient consultation	36.8	47.0 *	24.3 *	36.0	39.2	2.98		
Remote patient monitoring	36.4	46.4 *	24.3 *	35.5	39.2	2.91		
Faster connectivity	28.4	25.9	31.6	24.9 *	40.9 *		0.61	

All statistics weighted by sampling weights.

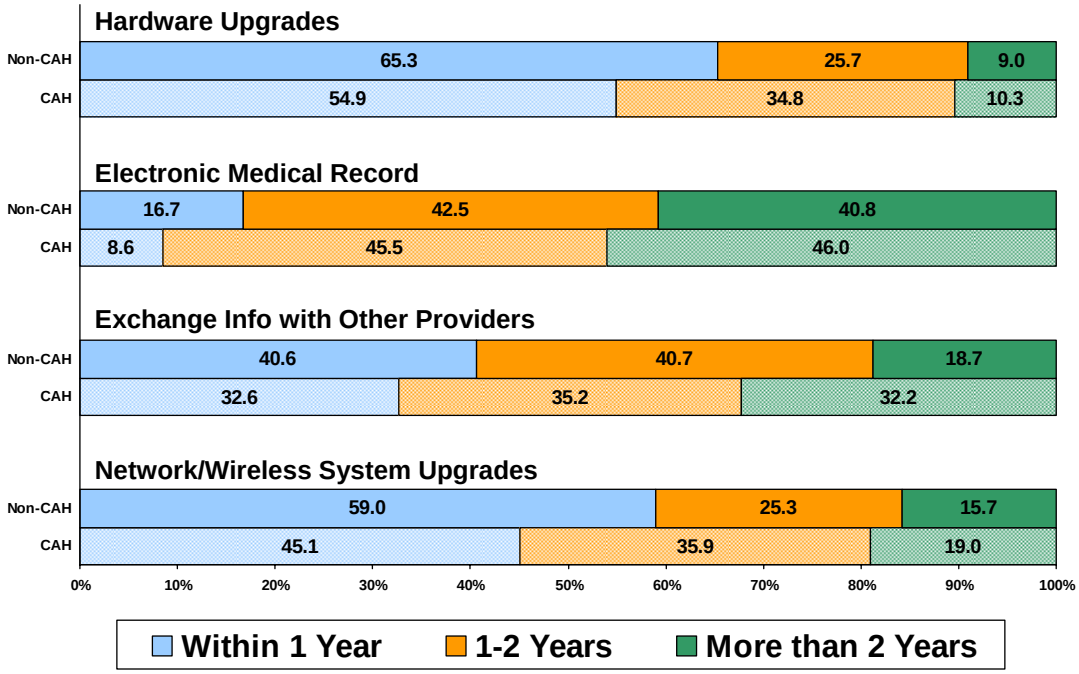
* Difference (CAH vs. non-CAH or stand-alone vs. system) is significant with 95% confidence.

[1] Logit regression also controlled for hospital ownership (non-profit, government, for-profit [reference category]). Only statistically significant results are shown. Numbers presented are odds ratios.

Almost two-thirds of respondents expressed interest in connecting the hospital's clinical information system with systems at other remote locations (for the regional exchange of health information) and in using digital image capture and transfer of patient information for remote interpretation or consultation. Slightly more than one-third of respondents felt that using video teleconferencing capabilities for remote real-time patient consultations and remote monitoring of patients were priorities for their future health IT investments.

Multivariate results show that interest in EMRs is strong across CAHs, stand-alone facilities, and larger hospitals. CAHs are also more likely than non-CAHs to be interested in video teleconferencing and remote patient monitoring, whereas stand-alone facilities are less likely to indicate that upgrading their connectivity or wireless capabilities is of interest for the near future. For several technologies (EMRs, digital imaging for remote consultations, video teleconferencing, and remote patient monitoring) the logit regressions for future interest were also estimated with an additional explanatory variable to indicate whether the hospital already had that technology in place, based on other information collected through this survey. This new variable was insignificant in three of the four equations, and had little impact in any of the four equations on the odds ratios for the other explanatory variables. The variable was significant and negative in the EMR equation (odds ratio = 0.57), indicating that – after controlling for other hospital characteristics – facilities that have already begun implementation of an EMR are less likely to report that an EMR is an IT priority for the future.

Figure 7
Differences in Expected Timing of Adoption of New Technologies by CAH Status



Expected Timing of Future Projects

Respondents indicating a future interest in a specific technology project were asked whether they felt adoption would occur "within one year," "between one and two years," or was "more than two years away."

Figures 7 and 8 show differences in the distribution of responses by CAH status and by stand-alone status, respectively, for those IT projects in which a sufficient number of respondents indicated an interest and for which the implementation schedule distributions are significantly different according to CAH or stand-alone status. Table 11 presents a similar analysis for the two extreme points of the distribution, for those projects with a sufficient number of hospitals planning to implement. Bivariate results show that CAHs and stand-alone hospitals are less likely to believe they will adopt the technology within one year, and correspondingly more likely to estimate that adoption is more than two years away. When controlling for the simultaneous effect of a variety of hospital characteristics, however, we see that there is no independent impact associated with CAH status. Rather, the patterns observed for CAHs are related to hospital size (with larger hospitals believing implementation will occur sooner) and to being a stand-alone facility.

Figure 8
Differences in Expected Timing of Adoption of New Technologies by Stand-Alone/System Status

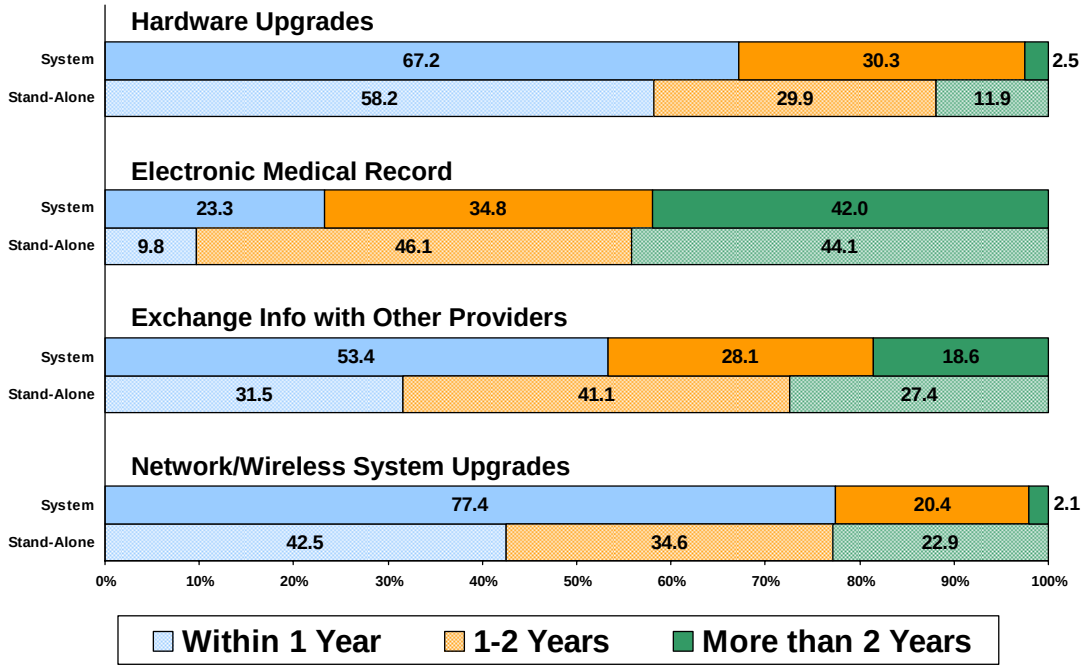


Table 11. Expected Timing of Implementation, for those Considering a Project

	All Considering a Project	Bivariate Results				Multivariate Results [1]		
		CAH	non-CAH	Stand-Alone Hospital	System Hospital	CAH	Stand-Alone	Total Beds (10s)
Percent who think implementation will occur within 1 year:								
New or upgraded hardware	59.8	54.9 *	65.3 *	58.2	67.2			1.09
Electronic Medical Record (EMR) system	12.1	8.6 *	16.7 *	9.8 *	23.3 *			1.06
Connecting clinical information systems of hospital and other locations	36.5	32.6 *	40.6 *	31.5 *	53.4 *		0.46	
Digital imaging for remote interpretation or consultation	48.2	44.0 *	54.0 *	46.8	53.6			1.06
New or upgraded network and/or wireless systems	51.6	45.1 *	59.0 *	42.5 *	77.4 *		0.28	1.16
Percent who think implementation will be more than 2 years away:								
New or upgraded hardware	9.7	10.3	9.0	11.9 *	2.5 *		4.48	
Electronic Medical Record (EMR) system	43.8	46.0	40.8	44.1	42.0			0.92
Connecting clinical information systems of hospital and other locations	25.6	32.2 *	18.7 *	27.4	18.6			
Digital imaging for remote interpretation or consultation	23.1	25.2	20.0	22.5	23.4			
New or upgraded network and/or wireless systems	17.5	19.0	15.7	22.9 *	2.1 *		13.20	

All statistics weighted by sampling weights.

* Difference (CAH vs. non-CAH or stand-alone vs. system) is significant with 95% confidence.

[1] Logit regression also controlled for hospital ownership (non-profit, government, for-profit [reference category]). Only statistically significant results are shown. Numbers presented are odds ratios.

Table 12. Expected Probability of Implementing Project on Schedule, for those Considering a Project

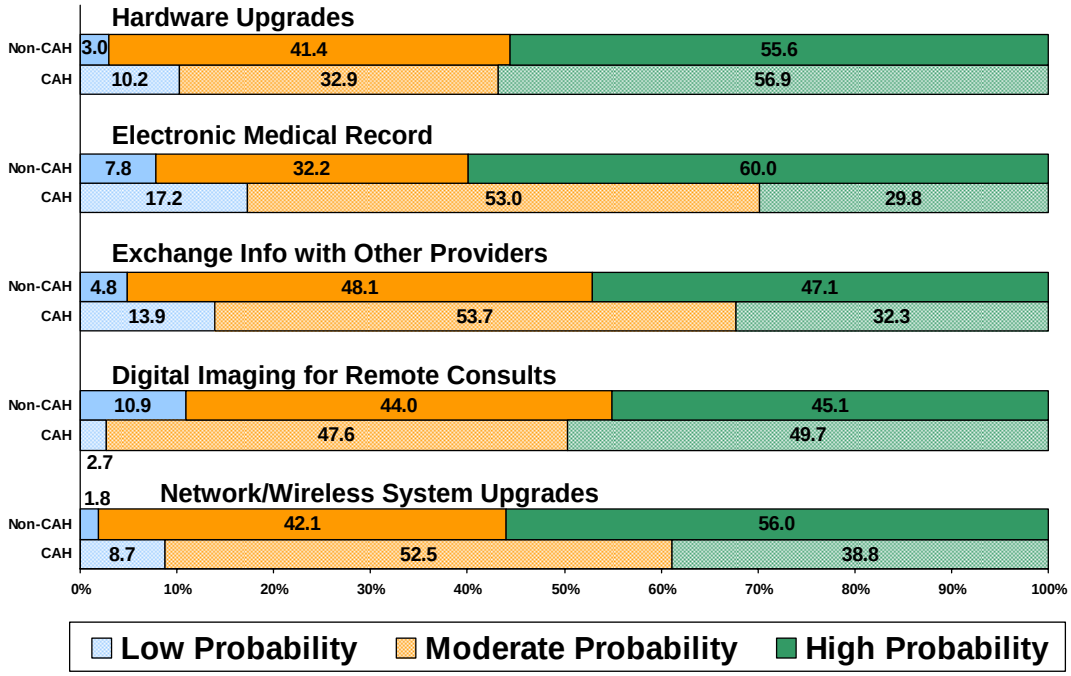
	All Considering a Project	Bivariate Results				Multivariate Results [1]		
		CAH	non-CAH	Stand-Alone Hospital	System Hospital	CAH	Stand-Alone	Total Beds (10s)
Percent who think on-time implementation is high probability:								
New or upgraded hardware	56.3	56.9	55.6	51.8 *	72.7 *	2.06	0.56	1.06
Electronic Medical Record (EMR) system	42.8	29.8 *	60.0 *	36.6 *	72.1 *	0.39	0.24	1.07
Connecting clinical information systems of hospital and other locations	39.6	32.3 *	47.1 *	38.8	42.8	0.51		
Digital imaging for remote interpretation or consultation	47.8	49.7	45.1	44.6 *	58.7 *	2.86	0.43	1.11
New or upgraded network and/or wireless systems	47.0	38.8 *	56.0 *	37.3 *	74.2 *		0.29	
Percent who think on-time implementation is low probability:								
New or upgraded hardware	6.8	10.2 *	3.0 *	8.2 *	1.6 *	3.87	5.02	
Electronic Medical Record (EMR) system	13.1	17.2 *	7.8 *	13.9	9.9			0.80
Connecting clinical information systems of hospital and other locations	9.5	13.9 *	4.8 *	12.4 *	0.0 *			
Digital imaging for remote interpretation or consultation	6.2	2.7 *	10.9 *	7.1	3.5	0.12		
New or upgraded network and/or wireless systems	5.5	8.7 *	1.8 *	7.4 *	0.0 *			

All statistics weighted by sampling weights.

* Difference (CAH vs. non-CAH or stand-alone vs. system) is significant with 95% confidence.

[1] Logit regression also controlled for hospital ownership (non-profit, government, for-profit [reference category]). Only statistically significant results are shown. Numbers presented are odds ratios.

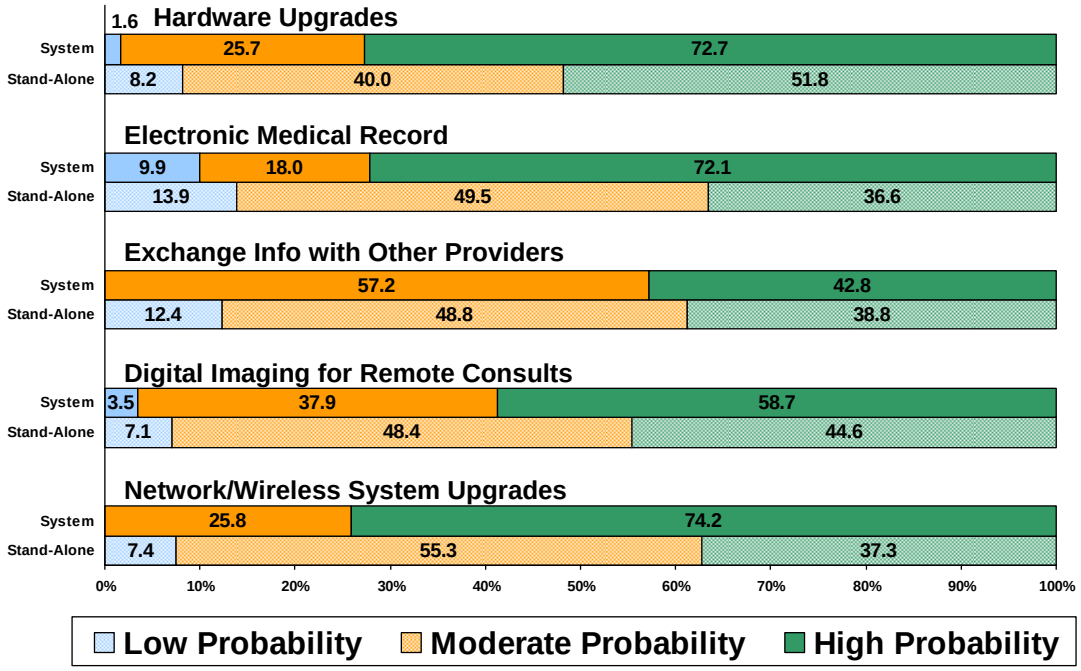
Figure 9
Differences in Expected Probability of Implementing on Schedule by CAH Status



Likelihood of Implementing on Schedule

Those expressing a future interest in IT projects were also asked to estimate the probability (low, moderate, high) that the technology would be in place and fully utilized on the schedule anticipated by the hospital. Figures 9 and 10 show the distribution of responses by CAH and stand-alone status for those projects having a sufficient number of hospitals planning to adopt and exhibiting significant differences in on-time adoption probabilities by type of hospital. Table 12 examines differences across hospitals at either extreme of the distribution. For most projects considered, the bivariate results indicate that CAHs were more likely to say the probability of on-time implementation was low, and less likely to say it was high. Likewise, stand-alone facilities were consistently less confident than their system counterparts that implementation would proceed on schedule. Multivariate results reveal the positive association between hospital size and confidence in the ability to implement selected projects on schedule and the negative impact on implementation confidence of being a stand-alone hospital. Results for the impact of CAH status were more mixed, with CAHs being more certain of on-time implementation for their digital imaging projects and less confident of implementing EMRs or regional health information exchange projects on the schedule they set out for themselves.

Figure 10
Differences in Expected Probability of Implementing on Schedule by Stand-Alone/System Status



Use of Federal Programs Designed to Facilitate Health IT Adoption

The Federal government is sponsoring several programs that are either explicitly designed to foster the adoption of health information technology or that can be used for that purpose. Because these resources are available to hospitals, it was of interest in this survey to learn whether respondents are aware of and have made use of the programs. Six programs were considered:

1. ORHP's Small Rural Hospital Improvement Program (SHIP), which provides small grants to non-Federal short-term general acute-care hospitals with less than 50 beds that are located in a rural area, and to CAHs regardless of their location. Funds are distributed through State Offices of Rural Health; in FY2006 more than 1,600 hospitals received an average of approximately $9,000 each. The grants are intended to help the hospital improve its internal infrastructure, and many hospitals use these funds for health IT projects.

2. ORHP's Medicare Rural Hospital Flexibility (Flex) Program, which provides funds to State Offices of Rural Health for the purpose of implementing the Flex Program. The central feature of the Flex Program has been the designation of critical access hospitals. As the program has evolved and CAH conversions have stabilized, attention has increasingly moved to rural network development, quality of care improvements, and EMS initiatives. SORHs generally distribute the

majority of their Flex Program funds to CAHs and other entities within their state through a series of small grants or other distributional mechanisms, and these funds could be used to support health IT investments.

3. ORHP's Rural Health Network Development Program, which provides a small number of new grants annually to consortia of rural providers comprising at least three partner organizations. These competitive grants are intended to further clinical, administrative, and technical integration across collaborating partners, and can total up to $540,000 for a three-year project.

4. Federal Communications Commission's Universal Services Fund, which provides subsidies to rural health care providers (among others) to ensure that these providers can access telecommunications services at rates that are no higher than those paid by urban counterparts. Public and non-profit health care providers are eligible, as are some departments in for-profit hospitals under special circumstances.

5. USDA's Distance Learning and Telemedicine (DLT) Program, which provides financial support for telemedicine projects for rural providers and residents through various grant and loan programs. Grants range from $50,000 to $500,000 and are used to purchase the necessary end-user hardware and software. Loan funds, and funds obtained through a combination grant-loan program, can be used for a wider range of purposes related to telemedicine projects (such as training personnel, updating the facility); these loans range from $50,000 to $10 million.

6. AHRQ's Transforming Health Care Quality through IT Program, which provided more than $100 million in grants during 2004 and 2005 to support the planning, implementation, and evaluation of health IT projects. A large portion of these grants were earmarked for rural applicants.

Table 13 shows the percent of respondents who indicated that they are aware of each of these programs. Awareness of the SHIP and Flex grant programs is generally high among rural hospitals, with more than 70 percent of respondents saying they know of these programs. Not surprisingly given the focus of these programs, CAHs are much more likely to declare awareness of the programs – an effect that persisted even after controlling for other hospital characteristics. Larger hospitals were less likely to know about the SHIP program, as would be expected since these hospitals are not targeted by this program. Somewhat fewer hospitals (54 percent) were familiar with ORHP's Rural Health Network Development program, with awareness lower among stand-alone facilities.

More than three-fifths of rural hospitals are aware of the FCC's Universal Services Fund and more than half are aware of the USDA's Distance Learning and Telemedicine grants, with no significant differences in program awareness by type of hospital. Finally, 44 percent of rural hospitals said they know about the AHRQ health IT grants.

Table 13. Awareness of Federal Programs that Could Facilitate Health IT Adoption

	All Respondents	Bivariate Results				Multivariate Results [1]		
		CAH	non-CAH	Stand-Alone Hospital	System Hospital	CAH	Stand-Alone	Total Beds (10s)
ORHP's Small Rural Hospital Improvement Program	72.9	88.5 *	53.9 *	74.3	67.2	3.64		0.91
ORHP's Rural Hospital Flexibility Program	70.6	85.6 *	52.7 *	70.4	73.3	6.05	0.39	
FCC's Universal Services Fund	63.1	65.6	60.1	64.0	61.7			
USDA's Distance Learning and Telemedicine Program	54.7	57.0	51.9	54.0	57.3			
ORHP's Rural Health Network Development Program	54.0	56.7	50.7	52.2	60.1		0.46	
AHRQ's Transforming Health Care Quality through IT Program	43.8	44.4	43.2	41.4 *	53.2 *		0.62	

All statistics weighted by sampling weights.

* Difference (CAH vs. non-CAH or stand-alone vs. system) is significant with 95% confidence.

[1] Logit regression also controlled for hospital ownership (non-profit, government, for-profit [reference category]). Only statistically significant results are shown. Numbers presented are odds ratios.

Table 14. Use of Federal Programs that Could Facilitate Health IT Adoption

	All Respondents	Bivariate Results				Multivariate Results [1]		
		CAH	non-CAH	Stand-Alone Hospital	System Hospital	CAH	Stand-Alone	Total Beds (10s)
ORHP's Small Rural Hospital Improvement Program	59.7	82.4 *	32.2 *	63.3 *	46.2 *	3.90		0.85
ORHP's Rural Hospital Flexibility Program	40.7	66.0 *	10.5 *	44.0 *	30.1 *	26.06		
FCC's Universal Services Fund	35.3	41.5 *	27.7 *	39.8 *	20.5 *	1.70	1.93	
USDA's Distance Learning and Telemedicine Program	14.1	19.6 *	7.3 *	12.8	18.8	4.83	0.51	
ORHP's Rural Health Network Development Program	12.6	17.2 *	6.9 *	11.9	15.1		0.47	0.86
AHRQ's Transforming Health Care Quality through IT Program	7.6	8.7	6.3	6.7	10.9		0.41	

All statistics weighted by sampling weights.

* Difference (CAH vs. non-CAH or stand-alone vs. system) is significant with 95% confidence.

[1] Logit regression also controlled for hospital ownership (non-profit, government, for-profit [reference category]). Only statistically significant results are shown. Numbers presented are odds ratios.

Table 14 presents similar information regarding the percent of respondents who said their facility had taken part in each program. Consistent with their focus and the fairly non-competitive nature of the programs, participation was highest for the SHIP and Flex programs (60 and 41 percent, respectively). As expected, participation in these programs was dramatically more likely for CAHs, and less likely for larger hospitals. More than one-third of all rural hospitals have participated in the Universal Services Fund, with participation being more likely for both CAHs and stand-alone facilities. Participation in the remaining three programs, which are more competitive and make larger awards to a smaller number of grantees, was reported to be much lower, from 14 percent for the DLT grants to 8 percent for the AHRQ health IT grants.

Interest in Policy Options Intended to Spur Health IT Adoption

In light of the high level of national attention given to health IT in recent years, a range of policy options have been advanced to foster adoption of these new technologies. Respondents were asked to rate their level of interest in a list of specific policy options.

As shown in Table 15 and Figure 11, the option most frequently rated as being of "high" interest was financial help in the form of low-interest loans, loan guarantee programs, grants, or direct subsidies. This finding is wholly consistent with respondents' assessment that financial constraints were the leading barrier to health IT implementation. Both CAHs and stand-alone facilities were significantly more likely than non-CAHs and members of hospital systems to have a high level of interest in financial assistance. Furthermore, when respondents were asked to select the top three policy options of greatest interest (data not shown), 52 percent said the top option would be financial assistance, and another 11 percent gave this as their second or third choice.

The second most popular policy option was the development of interoperability standards for communicating and interpreting health care data, with 45 percent of all rural hospitals saying this was of high interest. This finding is also consistent with earlier findings, which placed the lack of data standards near the top of the list of health IT adoption obstacles.

Approximately one-third of respondents were interested in expansions of safe harbors from anti-kickback legislation (which would make it easier for hospitals to share information systems and other technology with physicians in their community) and in receiving guidance on privacy and data security issues. The relatively high level of interest in these two options is, perhaps, a little unexpected given that few respondents had previously rated legal/regulatory and security/privacy issues as being significant barriers to adoption of health IT. It is worth noting that data collection for this survey occurred at the same time that changes to Federal regulations were being considered to expand safe harbors, and that this policy change has since been implemented.

Slightly more than one-quarter of respondents favored support for research to improve clinical IT applications and demonstrate the value of these technologies, education targeted to providers and consumers about the benefits of health IT, implementation

Table 15. Interest in Policy Options Intended to Spur Health IT Adoption

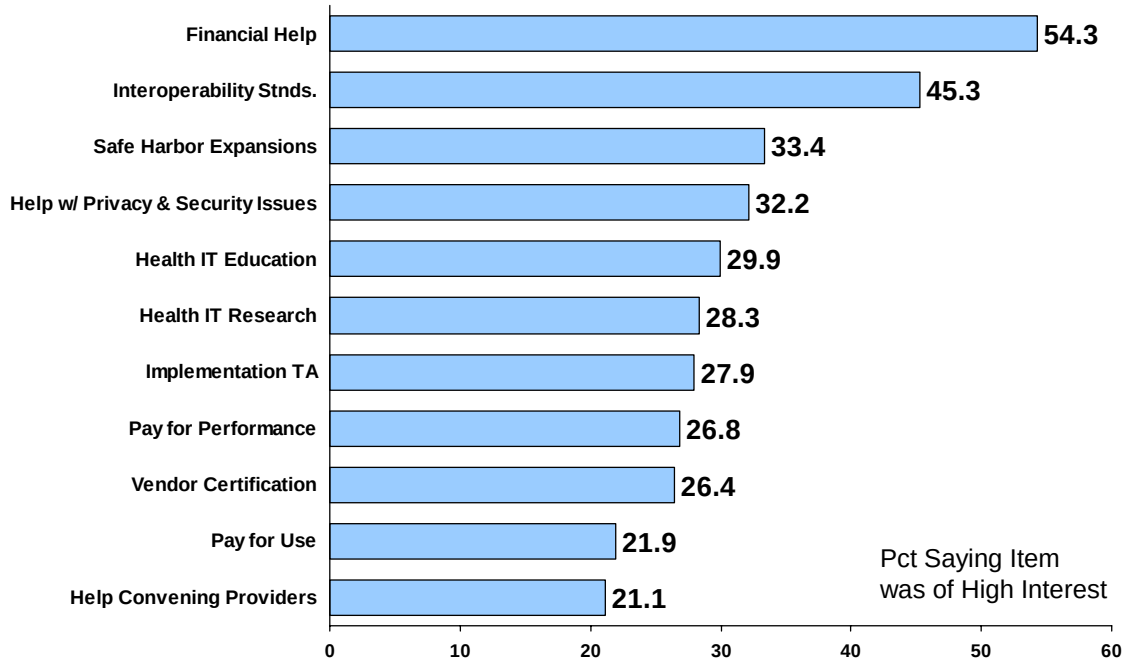
	All Respondents	Bivariate Results				Multivariate Results [1]		
		CAH	non-CAH	Stand-Alone Hospital	System Hospital	CAH	Stand-Alone	Total Beds (10s)
Percent Expressing a "High" Level of Interest in:								
Financial help	54.3	60.6 *	46.7 *	60.9 *	31.8 *	1.74	2.68	
Development of interoperability standards	45.3	46.8	43.4	49.8 *	30.8 *		2.04	
Expansion of 'safe harbors' from anti-kickback statutes	33.4	33.0	33.9	34.1	32.0			
Guidance on privacy, security, and data confidentiality issues	32.2	35.4 *	28.3 *	34.7 *	25.0 *		1.59	
Educate providers/consumers about health IT benefits	29.9	33.6 *	25.4 *	33.3 *	19.7 *	2.59	2.82	1.07
Research to improve clinical IT applications and document IT value	28.3	26.8	30.0	27.6	31.3			1.05
Technical assistance on implementation issues	27.9	30.7	24.4	31.7 *	16.1 *		2.41	0.92
Pay-for-performance programs	26.8	24.2	30.0	28.5	22.2			1.09
Certification of vendors and products	26.4	28.8	23.3	28.0	20.5	1.64		
Pay-for-use programs	21.9	17.7 *	27.0 *	22.4	20.8			1.10
Help convening groups of providers (e.g., for shared purchasing)	21.1	21.0	21.1	22.9 *	15.5 *			

All statistics weighted by sampling weights.

* Difference (CAH vs. non-CAH or stand-alone vs. system) is significant with 95% confidence.

[1] Logit regression also controlled for hospital ownership (non-profit, government, for-profit [reference category]). Only statistically significant results are shown. Numbers presented are odds ratios.

Figure 11
Level of Interest in Possible IT Policy Options



technical assistance, vendor/product certification, and pay-for-performance (P4P) programs that would tie payment to quality of care. Interest in P4P programs was greater than interest in less stringent pay-for-use programs, which would give higher payments to providers using specified technologies, regardless of the ability to demonstrate improved quality of care. Finally, there was only modest interest in help convening groups of providers so that they could more easily collaborate on joint implementation projects or partake in joint purchasing arrangements.

Discussion

Findings from several other surveys of hospitals' use of health IT have been released recently, and are largely consistent with the findings reported here. Despite sometimes important differences between surveys in question wording, the specific technologies studied, the hospitals targeted, and the mode of data collection, certain key findings are appearing consistently. Most notably, the collective results indicate that rural hospitals have less extensive use of health IT relative to their urban counterparts, as do smaller facilities and those that are not part of hospital systems (AHA, 2005; Brooks et al., 2005; Culler et al., 2006, Felt-Lisk, 2006; Menachemi et al., 2005). In the present study of rural hospitals, we also see strong evidence of similar impacts related to size and stand-alone status.

In contrast to the other studies cited above, our survey permitted us to compare the experiences of critical access hospitals and non-CAHs. As a rule, whenever significant differences were detected in bivariate comparisons, CAHs lagged behind non-CAHs in their readiness to adopt health IT, their current use of various technologies (other than telemedicine), their expectations regarding swift implementation in the future, and their confidence of reaching their implementation goals on time. Many, but not all, of these differences persisted even after controlling for the fact that CAHs tend to be smaller and are more likely to be stand-alone facilities.

With regard to IT readiness, both this survey and the recent survey of CAHs conducted by the Flex Monitoring Team and TASC (2006) suggest that connectivity to the Internet is no longer the stumbling block it has been historically. Both studies found that all of the rural hospitals surveyed had Internet access, with 98 percent having high-speed Internet access. Well over three-quarters of the respondents in our survey used T-1 or T-3 lines, and 70 percent had some type of wireless connectivity. This relatively high level of connectivity is undoubtedly the result of continued improvements to the nation's telecommunications infrastructure overall; the FCC's Universal Services Fund, which subsidizes connection costs and has been used by 35 percent of respondents, has also likely played a role.

We also found that rural hospitals reported spending approximately 2 percent of their annual operating budget on IT expenses, regardless of size. The AHA survey reported a similar 2 percent figure for urban and rural hospitals combined, suggesting that it is the smaller operating size of rural hospitals (and of smaller hospitals within the group of rural facilities) that is responsible for their lower levels of health IT investment, rather than devoting proportionately fewer resources to health IT.

Cross-survey comparisons of the extent of adoption for specific technologies are difficult due to differences in the technologies considered, their exact definitions (or lack thereof), and how they were asked about in the survey. Nonetheless, some patterns appear to be emerging. In all surveys considered, computerized lab and radiology systems are typically among the most widely used technologies; these systems include electronic review of results and – possibly, to a somewhat lesser degree – computerized order entry of tests. Regardless of the exact level of use estimated by a particular survey for these computerized lab/radiology systems, each survey found correspondingly lower use of e-prescribing or computerized order entry for prescription drugs. Systems that provide either real-time or back end alerts about drug interactions seem to be even less common, as is electronic access to clinical guidelines or use of decision support software. Depending on the survey, between one-quarter and one-third of hospitals indicated that their clinicians use PDAs for patient care in the hospital.

Hospitals that use barcoding of medications for administration to patients are also very much in the minority. For example, the AHA survey found this technology used by 23 percent of hospitals nationwide, while our survey found approximately 16 percent of rural hospitals using this technology. When considering only CAHs, both this survey and the Flex/TASC survey report similar levels of use of telepharmacy, defined as the review

of medication orders by a pharmacist at a remote location (21 and 24 percent, respectively). Both surveys also found that one-third of CAHs use automated medication dispensing systems.

Strikingly, hospitals perceive the most significant benefits of health IT to be improved quality of care and reductions in unnecessary tests (benefits that accrue to patients and payers), and are much less likely to mention improvements to factors that can improve the hospital's bottom line as being significant benefits. This result could occur because these latter outcomes are not perceived as commonly associated with IT adoption, or because hospitals judge the quality aspects to be more significant. At the same time, hospitals overwhelmingly cite a lack of financial resources as the largest obstacle to health IT implementation. Together, these findings point to the oft-noted disconnect between the entity that bears the cost of implementation and parties to which most benefits accrue. While hospitals can also benefit by providing better patient care and may be placing great intrinsic value on this outcome, until gains from health IT translate into financial rewards for the investors it may be difficult to make a compelling business argument for many large IT investments.

Given the importance of financial constraints as a barrier to health IT adoption, it is not surprising that respondents expressed the highest level of interest in Federal policies that would provide financial support for hospitals striving to implement new systems. Our bivariate analyses showed that both CAHs and stand-alone hospitals were more likely than non-CAHs and system hospitals to name a lack of financial resources as an implementation obstacle; Menachemi et al. (2005) found a similar result for system-affiliated vs. stand-alone rural hospitals in Florida. It is likely that hospitals that are part of a chain are able to draw upon resources of system partners. Consistent with the AHA survey, we also found that smaller hospitals were more likely to indicate that difficulty meeting the ongoing operating costs for new systems inhibited adoption of these systems.

Several Federal grant programs exist that can help hospitals with the cost of health IT investments, and their use has been fairly high among targeted hospitals – specifically, small rural hospitals (including CAHs) are using the SHIP grants and CAHs are using the Flex grants. The average size of the award under these programs is quite small, however, meaning that this source alone will not be sufficient to cover the cost of most health IT projects. Larger grants and loans are available through several other programs, but these programs are more competitive and necessarily reach a much more limited group of hospitals.

System interoperability was also cited as being a significant barrier to health IT adoption by the rural hospitals we surveyed, including both the lack of common data standards that would permit the seamless exchange of health data and problems interfacing new systems with hospitals' legacy systems. This result is consistent with findings from the AHA's survey of both urban and rural hospitals, which found "interoperability with existing systems" to be second only to financial concerns as a leading obstacle to health IT adoption. These concerns led our rural respondents to rate Federal assistance with the development of standards as the second most important policy initiative.

Looking to the future, beyond hardware upgrades, rural hospitals are most interested in implementing or expanding EMR systems and in developing connected information systems that will permit them to exchange health data electronically with other providers. Smaller hospitals and those that are not part of a hospital system – and, by implication, many CAHs – are less likely to feel that these projects will be implemented within one year and more likely to think it will take at least two years. They are also less confident that implementation will be achieved on the schedule they have in mind.

Given the Federal emphasis on the adoption of health IT and the electronic exchange of health information, combined with the contribution these technologies can make to improving patient care, it seems certain that the U.S. health care system will continue to evolve toward increasingly widespread use of health IT. This study and others have shown, however, that the pace of adoption is uneven across different types of hospitals, with the average rural hospital lagging behind its urban counterpart, and smaller, stand-alone rural facilities lagging behind larger and system-affiliated rural hospitals. Many CAHs (which frequently are stand-alone facilities and are, by definition, smaller) are also lagging behind non-CAHs in their readiness for and actual use of health IT. These struggling facilities will likely benefit from additional assistance in the form of improved access to capital and from technical assistance with health IT planning and implementation. Current national efforts to establish data standards, certify products and vendors, and link payment to the quality improvements that can result from health IT use are also steps that are expected to help all providers to adopt health IT more efficiently and effectively.

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Appendix A

Copy of Survey Instrument

NORC

A national organization for research

at the University of Chicago

Survey of Health Information Technology in Rural Hospitals

Spring 2006

This survey is being conducted by NORC at the University of Chicago for the Federal Office of Rural Health Policy (ORHP) to collect information on health information technology use in rural hospitals.

Your hospital was randomly selected for participation as part of a nationally-representative sample of rural hospitals; thus, your participation in this data collection effort is extremely valuable. Your responses will remain completely confidential and results for individual hospitals will not be released or published.

We estimate that it will take about 20 minutes to complete this survey, and you may decline to answer any questions that you do not wish to answer.

Directions: Please "X" the appropriate boxes that correspond to your answers. This questionnaire may be completed by more than one hospital staff member, if necessary to obtain complete answers to all questions.

Using the pre-paid envelope provided, **please return this questionnaire by April 10th** to:

John Lavin
Synovate
PO Box 5030
Chicago, IL 60680

If you have questions about the study, please contact
Dr. Julie Schoenman at 301-951-5074 or schoenman-julie@norc.uchicago.edu

Survey of Health Information Technology in Rural Hospitals

I. Health IT Readiness

1. For the current fiscal year, what is your hospital's approximate budget for information technology (IT)?

$_____

2. What percentage of your hospital's operating budget does this amount represent? _____**%**

3. Does your hospital currently have…

		Yes	No
a.	a written strategic plan for IT?	☐	☐
b.	a full-time Chief Information Officer (CIO)?	☐	☐
c.	a physician champion who spearheads health IT initiatives at your hospital?	☐	☐

4. Approximately how many full-time equivalent (FTE) personnel support your hospital's IT infrastructure for each of the following?
[One FTE = 40 hours of work per week.]

a. hospital employees: _____FTEs b. outsourced (e.g., vendors, consultants): _____FTEs

5. Please indicate your level of confidence that your hospital's IT staff is able to do each of the following: Please "X" only one box for each item.

		Not Very Confident	Somewhat Confident	Very Confident	Don't Know
a.	Evaluate vendors and products, and select ones most appropriate to the needs at hand	☐	☐	☐	☐
b.	Configure infrastructure required to implement selected products	☐	☐	☐	☐
c.	Maintain technologies and applications, including upgrading as necessary	☐	☐	☐	☐

6. Is your hospital's geographic area currently served by at least one broadband (high-speed) Internet service provider?

Yes ..... ☐
No ..... ☐

7. What types of Internet access does your hospital currently have in place in its clinical departments? Select all that apply.

None ..... ☐
Dial-up modem ..... ☐
ISDN (Integrated Services Digital Network) ..... ☐
DSL (Digital Subscriber Line) ..... ☐
Cable modem ..... ☐
T-1 lines ..... ☐
T-3 lines ..... ☐
Don't know ..... ☐

8. What wireless connectivity technologies is your hospital using? Select all that apply.

None ..... ☐

Analog cellular service: WWAN (wireless wide area networks) ..... ☐
Digital cellular service: WWAN ..... ☐
WiFi (wireless local area networks): 802.11a, b, g .... ☐
WPAN (wireless personal area networks): e.g., Infrared, Bluetooth ..... ☐
Don't know ..... ☐

Survey of Health Information Technology in Rural Hospitals

I. Health IT Readiness

1. For the current fiscal year, what is your hospital's approximate budget for information technology (IT)?

$_____

2. What percentage of your hospital's operating budget does this amount represent? _____**%**

3. Does your hospital currently have…

		Yes	No
a.	a written strategic plan for IT?	☐	☐
b.	a full-time Chief Information Officer (CIO)?	☐	☐
c.	a physician champion who spearheads health IT initiatives at your hospital?	☐	☐

4. Approximately how many full-time equivalent (FTE) personnel support your hospital's IT infrastructure for each of the following?
[One FTE = 40 hours of work per week.]

a. hospital employees: _____FTEs b. outsourced (e.g., vendors, consultants): _____FTEs

5. Please indicate your level of confidence that your hospital's IT staff is able to do each of the following: Please "X" only one box for each item.

		Not Very Confident	Somewhat Confident	Very Confident	Don't Know
a.	Evaluate vendors and products, and select ones most appropriate to the needs at hand	☐	☐	☐	☐
b.	Configure infrastructure required to implement selected products	☐	☐	☐	☐
c.	Maintain technologies and applications, including upgrading as necessary	☐	☐	☐	☐

6. Is your hospital's geographic area currently served by at least one broadband (high-speed) Internet service provider?

Yes ☐
No ☐

7. What types of Internet access does your hospital currently have in place in its clinical departments? Select all that apply.

None ☐
Dial-up modem ☐
ISDN (Integrated Services Digital Network) ☐
DSL (Digital Subscriber Line) ☐
Cable modem ☐
T-1 lines ☐
T-3 lines ☐
Don't know ☐

8. What wireless connectivity technologies is your hospital using? Select all that apply.

None ☐

Analog cellular service: WWAN (wireless wide area networks) ☐
Digital cellular service: WWAN ☐
WiFi (wireless local area networks): 802.11a, b, g ☐
WPAN (wireless personal area networks): e.g., Infrared, Bluetooth ☐
Don't know ☐

II. Current Use of Health IT

1. Has your hospital begun to implement an Electronic Medical Record (EMR) system?

An electronic medical record (EMR) is a comprehensive computer-based/digital record that includes all documentation of care given to a specific patient within the hospital. EMRs may include a variety of functions, such as computerized provider order entry (CPOE) and clinical decision support tools, and may include information on the patient from providers outside the hospital.

Yes ..... ☐
No **(skip to Question 3, below)**..... ☐

2. For each of the following EMR functions, please indicate if it is currently implemented in no clinical departments, some but not all clinical departments, or all clinical departments in your hospital. Please "X" only one box for each item.

	EMR Function	No Clinical Departments	Some Clinical Departments	All Clinical Departments
a.	Access to current medical records (current episode)	☐	☐	☐
b.	Access to past medical records (other hospital stays/visits)	☐	☐	☐
c.	Access to patient flow sheets	☐	☐	☐
d.	Access to patient demographics	☐	☐	☐
e.	Order entry of radiology and/or laboratory tests	☐	☐	☐
f.	Results review for radiology reports and/or laboratory tests	☐	☐	☐
g.	Order entry of medications	☐	☐	☐
h.	Drug interaction alerts (real time and/or back end)	☐	☐	☐
i.	Access to clinical guidelines and protocols	☐	☐	☐
j.	Clinical decision support (CDS): software that integrates clinical and patient information to support making patient care decisions	☐	☐	☐
k.	Procedure/operative notes	☐	☐	☐
l.	Integration with hospital billing system	☐	☐	☐

3. For each of the following telemedicine applications, please indicate if your hospital is currently using the application. Please "X" only one box for each item.

Telemedicine, also known as telehealth, is the transmission of health information to remote sites using telecommunication technology.

	Application	Currently Using	Not Currently Using
a.	Video teleconferencing for real-time patient consultations	☐	☐
b.	Tel-emergency (electronic transmission of clinical data from ambulance to your hospital or from your ER to tertiary care center)	☐	☐
c.	Teleradiology (Picture Archiving Communication Systems – PACS)	☐	☐
d.	Telecardiology (electronic transmission of cardiac data from patient site to consulting site)	☐	☐
e.	Remote monitoring of patients off-site to collect clinical data via interactive technology	☐	☐
f.	Remote monitoring of patients in your hospital units by tertiary care centers, via interactive technology	☐	☐
g.	Other (specify): _____	☐	☐

The following is a list of other types of IT applications. For each of the applications listed on the left, please answer Question 4, and Question 5 if applicable. Please "X" only one box for each item.

		4.	5.
	Application	In the applicable departments in your hospital, is this application currently fully implemented, partially implemented, or not in place at all?	In the departments in which this application is implemented, approximately what percent of clinical staff routinely use the application?
a.	Master Patient Index (MPI): Database that contains a unique identifier and basic demographic data for every patient in the hospital	Fully implemented ☐→ Partially implemented ☐→ Not in place **(skip to b.)** ☐	1-49% ☐ 50-99% ☐ 100% ☐
b.	Clinical Data Repository (CDR): Real-time database that consolidates data from multiple clinical sources to present a unified view of a single patient	Fully implemented ☐→ Partially implemented ☐→ Not in place **(skip to c.)** ☐	1-49% ☐ 50-99% ☐ 100% ☐
c.	Medical record imaging	Fully implemented ☐→ Partially implemented ☐→ Not in place **(skip to d.)** ☐	1-49% ☐ 50-99% ☐ 100% ☐
d.	Digital image capture and transmission of patient information for remote consults	Fully implemented ☐→ Partially implemented ☐→ Not in place **(skip to e.)** ☐	1-49% ☐ 50-99% ☐ 100% ☐
e.	Computerized lab/radiology information systems	Fully implemented ☐→ Partially implemented ☐→ Not in place **(skip to f.)** ☐	1-49% ☐ 50-99% ☐ 100% ☐
f.	Computerized patient tracking and reminders	Fully implemented ☐→ Partially implemented ☐→ Not in place **(skip to g.)** ☐	1-49% ☐ 50-99% ☐ 100% ☐
g.	PDAs (or other hand-held technologies), e.g., for prescribing and drug referencing	Fully implemented ☐→ Partially implemented ☐→ Not in place **(skip to h.)** ☐	1-49% ☐ 50-99% ☐ 100% ☐
h.	Bedside bar coded medication management systems, including electronic medication administration records (EMARs), electronic medication administration program (EMAP), etc.	Fully implemented ☐→ Partially implemented ☐→ Not in place **(skip to i.)** ☐	1-49% ☐ 50-99% ☐ 100% ☐
i.	Other bedside charting systems / point-of-care monitoring software	Fully implemented ☐→ Partially implemented ☐→ Not in place **(skip to j.)** ☐	1-49% ☐ 50-99% ☐ 100% ☐
j.	Pharmacy management systems, e.g., labeling software, inventory control, MARs	Fully implemented ☐→ Partially implemented ☐→ Not in place **(skip to k.)** ☐	1-49% ☐ 50-99% ☐ 100% ☐
k.	Automated medication dispensing systems/machines	Fully implemented ☐→ Partially implemented ☐→ Not in place **(skip to l.)** ☐	1-49% ☐ 50-99% ☐ 100% ☐
l.	Remote pharmacist access: Medication order review by an off-site pharmacist	Fully implemented ☐→ Partially implemented ☐→ Not in place **(skip to m.)** ☐	1-49% ☐ 50-99% ☐ 100% ☐
m.	Secure email communications between providers (within and outside hospital)	Fully implemented ☐→ Partially implemented ☐→ Not in place **(Go to Section III)** ☐	1-49% ☐ 50-99% ☐ 100% ☐

III. Benefits and Barriers of Implementing Health IT

1. Please rate the extent to which each of the following has been a benefit realized by your hospital through the use of health information technology. Please "X" only one box for each item.

If your hospital has no health IT currently in use, check this box ☐ and **skip to Question 3, below.**

		Not a Benefit	Small Benefit	Moderate Benefit	Significant Benefit
a.	Improved access to patient health information	☐	☐	☐	☐
b.	Reduced unnecessary or duplicate tests/procedures	☐	☐	☐	☐
c.	Improved adherence to standards of care	☐	☐	☐	☐
d.	Reduced medical errors	☐	☐	☐	☐
e.	Reduced liability insurance costs	☐	☐	☐	☐
f.	Increased productivity (after initial implementation period)	☐	☐	☐	☐
g.	Enabled reductions in hospital staffing	☐	☐	☐	☐
h.	Reduced operating costs	☐	☐	☐	☐
i.	Increased patient care revenue (via better documentation and coding, and fewer rejected/delayed claims)	☐	☐	☐	☐
j.	Increased compliance with regulatory/accrediting bodies	☐	☐	☐	☐
k.	Improved patient satisfaction	☐	☐	☐	☐
l.	Improved provider satisfaction	☐	☐	☐	☐
m.	Other (Specify):	☐	☐	☐	☐

2. Of the factors listed in Question 1 above, please rank the **top three benefits** your hospital has realized from health IT applications currently in use, by writing the corresponding letters below.

(1) _____ letter of benefit above (2) _____ letter of benefit above (3) _____ letter of benefit above

3. Please indicate the extent to which each of the following factors creates a barrier to the successful implementation of health IT in your hospital. Please "X" only one box for each item.

		Not a Barrier	Small Barrier	Moderate Barrier	Significant Barrier
a.	Difficulty completing needs assessment	☐	☐	☐	☐
b.	Lack of/failure to implement a strategic plan for health IT	☐	☐	☐	☐
c.	Difficulty quantifying benefits/return on investment	☐	☐	☐	☐
d.	Lack of support from top management or Board	☐	☐	☐	☐
e.	Lack of support from clinical leadership	☐	☐	☐	☐
f.	Difficulty identifying technology/product to meet needs	☐	☐	☐	☐
g.	Difficulty of vendor selection process	☐	☐	☐	☐
h.	Inadequate funding for initial infrastructure investments	☐	☐	☐	☐
i.	Inadequate funding for ongoing support of new technologies	☐	☐	☐	☐
j.	Unavailability of well-trained IT staff	☐	☐	☐	☐
k.	Inadequate access to connectivity (e.g., broadband, wireless)	☐	☐	☐	☐
l.	Lack of interoperability with systems now used in hospital	☐	☐	☐	☐
m.	Lack of common data standards	☐	☐	☐	☐
n.	Security and/or privacy concerns	☐	☐	☐	☐
o.	Legal or regulatory concerns (e.g., anti-kickback, HIPAA)	☐	☐	☐	☐
p.	Lack of acceptance from end users/clinical staff	☐	☐	☐	☐
q.	Loss of productivity during transition/implementation period	☐	☐	☐	☐
r.	Other (specify):	☐	☐	☐	☐

4. Of the factors listed in Question 3 above, please rank the **top three barriers** to the successful implementation of health IT in your hospital, by writing the corresponding letters below.

(1) _____ letter of barrier above (2) _____ letter of barrier above (3) _____ letter of barrier above

IV. Future Plans

The following three questions ask about your hospital's plans for future health IT adoption. For each technology or application on the left, answer Question 1, then Questions 2 and 3 if applicable. Please "X" only one box for each item.

	Project	1. Is this an IT priority for your hospital in the foreseeable future?	2. **If yes to question 1:** How soon do you anticipate your hospital's adoption of this technology?	3. **If yes to question 1:** Rate the probability of having the technology in place and fully utilized on schedule.
a.	New or upgraded hardware (e.g., PCs, servers, printers, PDAs)	Yes ☐ → No **(skip to b.)** ☐	Within 1 year ☐ Between 1 and 2 years ☐ More than 2 years away ☐	Low ☐ Moderate ☐ High ☐
b.	Faster connectivity (e.g., DSL, modem, T1)	Yes ☐ → No **(skip to c.)** ☐	Within 1 year ☐ Between 1 and 2 years ☐ More than 2 years away ☐	Low ☐ Moderate ☐ High ☐
c.	New or upgraded network and/or wireless systems (e.g., LANs, WANs)	Yes ☐ → No **(skip to d.)** ☐	Within 1 year ☐ Between 1 and 2 years ☐ More than 2 years away ☐	Low ☐ Moderate ☐ High ☐
d.	Digital imaging for remote interpretation or consultation	Yes ☐ → No **(skip to e.)** ☐	Within 1 year ☐ Between 1 and 2 years ☐ More than 2 years away ☐	Low ☐ Moderate ☐ High ☐
e.	Video teleconferencing for remote, real-time patient consultation	Yes ☐ → No **(skip to f.)** ☐	Within 1 year ☐ Between 1 and 2 years ☐ More than 2 years away ☐	Low ☐ Moderate ☐ High ☐
f.	Remote patient monitoring (of off-site patients by your hospital or of your inpatients by off-site providers)	Yes ☐ → No **(skip to g.)** ☐	Within 1 year ☐ Between 1 and 2 years ☐ More than 2 years away ☐	Low ☐ Moderate ☐ High ☐
g.	Electronic Medical Record (EMR) system	Yes ☐ → No **(skip to h.)** ☐	Within 1 year ☐ Between 1 and 2 years ☐ More than 2 years away ☐	Low ☐ Moderate ☐ High ☐
h.	Connecting clinical information systems at your hospital and remote locations	Yes ☐ → No **(skip to i.)** ☐	Within 1 year ☐ Between 1 and 2 years ☐ More than 2 years away ☐	Low ☐ Moderate ☐ High ☐
i.	Other (specify): _____	Yes ☐ → No **(Go to Q4.)** ☐	Within 1 year ☐ Between 1 and 2 years ☐ More than 2 years away ☐	Low ☐ Moderate ☐ High ☐

4. Of the possible projects listed in Question 1 above, please rank the **top three priorities** for your hospital, by writing the corresponding letters below.

(1) _____ letter of project above (2) _____ letter of project above (3) _____ letter of project above

V. Exchange of Clinical Data with Other Providers

1. Does your hospital currently exchange patient-specific clinical data with providers outside of the hospital, such as ambulatory care settings, laboratories, and skilled nursing facilities?

Yes ☐

No **(skip to Question 3, below)**..... ☐

2. Do you exchange patient-specific clinical data with the following types of providers?
Please "X" only one box for each item.

		Yes	No
a.	Private physician offices or clinics	☐	☐
b.	Laboratories	☐	☐
c.	Other hospitals	☐	☐
d.	Public health departments	☐	☐
e.	Long-term care facilities/Skilled nursing facilities	☐	☐
f.	Freestanding imaging centers	☐	☐
g.	Retail pharmacies	☐	☐
h.	Other (specify): _____	☐	☐

3. Please indicate the extent to which each of the following factors creates a barrier to exchanging clinical data with providers outside of the hospital. Please "X" only one box for each item.

		Not a Barrier	Small Barrier	Moderate Barrier	Significant Barrier
a.	Security concerns	☐	☐	☐	☐
b.	Liability concerns	☐	☐	☐	☐
c.	No providers willing/able to exchange data	☐	☐	☐	☐
d.	Interoperability/Data system incompatibility	☐	☐	☐	☐
e.	Anti-kickback statutes (Stark legislation)	☐	☐	☐	☐
f.	Other (specify): _____	☐	☐	☐	☐

VI. Federal Programs/Actions

1. Please indicate your awareness and use of the following Federal programs that might be used to facilitate adoption of health IT. Please "X" only one box for each item.

	Program	Unaware of program	Aware of program but have not used	Participate(d) in program
a.	Universal Service Fund (subsidies for access to telecommunication services, e.g., Internet access)	☐	☐	☐
b.	Rural Hospital Flexibility Program grants (available to Critical Access Hospitals through State Offices of Rural Health)	☐	☐	☐
c.	ORHP's Small Rural Hospital Improvement Program (SHIP) grants	☐	☐	☐
d.	ORHP's Rural Health Network Development grants	☐	☐	☐
e.	USDA's Distance Learning and Telemedicine (DLT) Program (grants and loans for telemedicine projects)	☐	☐	☐
f.	AHRQ's Transforming Health Care Quality through IT grants (for planning, implementing, or evaluating health IT projects)	☐	☐	☐

2. In addition to the Federal programs listed above, policy makers have discussed other avenues that might be used to facilitate health IT adoption. How interested would you be in the following possible policy offerings? Please "X" only one box for each item.

	Possible Policy Offering	No Interest	Moderate Interest	High Interest
a.	Financial help in the form of low-interest loans, loan guarantee programs, grants, or direct subsidies	☐	☐	☐
b.	Development of (interoperability) standards (for communicating and interpreting health care data)	☐	☐	☐
c.	Certification of vendors and products	☐	☐	☐
d.	Pay-for-use programs (higher payments to providers using health IT, regardless of ability to document impact on quality of care)	☐	☐	☐
e.	Pay-for-performance programs (higher payments for documented higher quality care)	☐	☐	☐
f.	Assistance in convening groups of providers interested in implementation of a common system, shared purchasing, etc.	☐	☐	☐
g.	Expansion of 'safe harbors' from anti-kickback laws (to permit hospitals to subsidize community adoption of technologies and facilitate health information exchange)	☐	☐	☐
h.	Educating providers and consumers about health IT benefits	☐	☐	☐
i.	Providing technical assistance on a range of implementation issues	☐	☐	☐
j.	Providing guidance on issues of privacy, security, and data confidentiality	☐	☐	☐
k.	Supporting research to improve clinical IT applications and document their value	☐	☐	☐

3. Of the possible policy offerings listed in Question 2 above, please rank the **three of most interest** to your hospital, by writing the corresponding letters below.

(1) _____ letter of policy offering (2) _____ letter of policy offering (3) _____ letter of policy offering

VII. Hospital Characteristics

1. Which of the following best describes your hospital?

Stand-alone hospital ..... ☐

Part of a multi-hospital system with shared ownership and governance ..... ☐

2. What is your hospital's tax status?

Not-for-profit ..... ☐
For-profit ..... ☐
Government-owned ..... ☐

3. In the last completed fiscal year, approximately what was your hospital's total gross revenue (from all activities)?

$_____

4. In the last completed fiscal year, approximately what was your hospital's overall margin?
[Margin = (total revenue-total costs)/total revenue]

_____ %

5. How many staffed inpatient beds does your hospital have?

_____ beds

6. Is your hospital certified as a critical access hospital (CAH) under the Medicare program?

Yes ☐ → Year of certification: _____
No ☐

Thank you for your help with this important study!

Please return the completed survey in the pre-paid envelope provided to:

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