



Changes in Health Care Financing & Organization (HCFO)

# findings brief

## key findings

- Adoption of a HIT system resulted in increases in two quality measures: pneumococcal vaccine administration for pneumonia patients and the use of the most appropriate antibiotic for pneumonia patients in average hospitals.
- Increases in quality measures were three times higher in academic medical centers than in average hospitals.

## The Effect of Health Information Technology on Quality in U.S. Hospitals

### Overview

Mistakes in the clinical setting are responsible for an estimated \$17 billion of direct costs annually to the health care system. These errors are largely driven by a breakdown in system processes, including failing to provide recommended standard treatments to patients with certain medical conditions. Proponents of health information technology (HIT) believe tools like electronic health records (EHRs) and computerized physician order entry (CPOE) could help reduce these errors and related costs by improving communication between providers and encouraging the implementation of standard guidelines and decision-support tools. The Institute of Medicine (IOM) is a proponent of CPOE, and financial incentives for meaningful use of HIT were included in the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009. However, findings on the effect

of HIT on quality from past studies have been mixed.

In a HCFO-funded study, Jeffrey McCullough, Ph.D., University of Minnesota, and colleagues measured the quality and cost effects of clinical information technology, specifically EHR and CPOE systems. Findings from their quality analyses were published in the April 2010 issue of *Health Affairs*.<sup>1</sup> Findings from the study suggest that the effect of HIT adoption depends on context – meaning the hospital setting.

While the potential for HIT to improve clinical quality is well documented, the benefits of widespread adoption remain uncertain. This study is intended to estimate the expected benefits from a nationwide program and better demonstrate how those benefits will vary across providers.



Robert Wood Johnson Foundation

Changes in Health Care Financing and Organization is a national program of the Robert Wood Johnson Foundation administered by AcademyHealth.

## Methods

Data covering the period 2004–2007 were drawn from the American Hospital Association’s annual survey, the Health Information and Management Systems Society Analytics database and the Center for Medicare and Medicaid Services Hospital Compare database. The researchers created a sample of 3,401 nonfederal, acute care U.S. hospitals; small rural hospitals, including Critical Access Hospitals, were underrepresented.

Focusing on hospitals that had adopted both EHRs and CPOE, the researchers examined changes in six process-quality measures following the implementation of these tools.

For the purposes of the analyses, EHRs were defined as “a set of applications including a computerized patient record with a clinical data repository and some basic clinical decision-support capabilities.” CPOE was defined as “an application that assists physicians in generating and accessing orders for prescriptions, laboratory tests, and other medical services.” The researchers pointed out that while other studies have focused on more sophisticated and comprehensive EHR systems, they instead captured the experiences of the “average adopters” rather than the “leading adopters.” In addition, the researchers noted that their study revealed clear distinctions between academic hospitals, defined as members of the Council of Teaching Hospitals, and nonacademic hospitals.

Recognizing that hospital characteristics could influence process quality, the researchers controlled for the following variables: number of adjusted admissions, the percentage of discharges covered by Medicare, the percentage of discharges covered by Medicaid, the number of registered nurse full-time equivalents per staffed bed, academic status, and multihospital system membership.

The researchers analyzed six process-quality measures, focusing on those that were less likely to be biased by measurement error. The measures included:

- Percentage of heart failure patients given an angiotensin-converting enzyme (ACE) inhibitor or angiotensin II receptor blocker (ARB) for left ventricular systolic dysfunction;
- Percentage of smokers with heart failure and pneumonia who were given smoking cessation advice;
- Percentage of smokers with pneumonia who were given smoking cessation advice;
- Percentage of pneumonia patients assessed and given pneumococcal vaccination if indicated;
- Percentage of pneumonia patients whose initial blood culture in the emergency department preceded their first dose of hospital administered antibiotics; and
- Percentage of pneumonia patients given the most appropriate initial antibiotic.

The researchers utilized multivariate regression to examine the HIT/quality relationship, including both hospital- and time-specific fixed effects to reduce potential selection bias.

## Results

In general, hospitals with EHRs and CPOE reported higher quality rates for nearly all of the six process-quality measures. However, these findings were only statistically significant for pneumococcal vaccine administration (2.1 percent increase) and the use of the most appropriate antibiotic for pneumonia (1.3 percent increase).

Much of the previous literature of HIT has focused on academic hospitals, as they have served as leaders in HIT adoption. The researchers recognized that case mix and organizational differences between

academic and nonacademic hospitals could significantly influence the relative effect of HIT on quality. In fact, in analyses focused solely on academic hospitals, the researchers found a nearly three-fold increase in the two statistically significant process quality measures from the general analyses (6.1 percent increase for pneumococcal vaccine administration, and 3.7 percent increase for the most appropriate initial antibiotic use). While the nonacademic hospitals did see a positive response in quality measures to the introduction of EHRs and COPE, that response was not statistically significant.<sup>2</sup>

## Limitations

The most important empirical concern is that academic hospitals have more sophisticated information systems and that these systems are better used. While their technology measures are imperfect, the researchers found that the conclusion was robust to alternative definitions of HIT adoption that focused on more sophisticated systems. Similarly, this study must understate HIT’s benefits as it only captures the effect on six process quality measures.

As previously noted, the researchers attempted to control for selection bias by accounting for hospital quality prior to HIT adoption. While this empirical strategy addresses the most obvious selection problems, other forms of bias may persist.

## Policy Discussion

The results of these analyses show that the effect of HIT adoption on quality varies across hospital settings. Nearly all the benefits from health IT adoption accrued to large academic medical centers. This could be due to the relative sophistication of HIT systems and their utilization. Alternatively, HIT may be more valuable when treating complex patients with multiple comorbidities.

The HITECH Act provides incentives for all hospitals to follow the example of leading academic medical centers in the adoption and utilization of HIT. This policy is most appropriate if the benefits from IT

are based on the technology, rather than the context. However, if variation in quality improvement is truly based on context, then encouraging widespread HIT adoption should not be expected to produce substantial benefits. In this case, policy-makers should focus on improving the HIT value in non-academic settings. Some features of the HITECH Act may facilitate this objective. Most existing HIT systems, while capable in their individual function, do not communicate or share information well with other HIT systems. Health information exchanges may lead to effective interoperability and increase the HIT value.

The authors' ongoing research suggests that HIT value does depend upon clinical complexity. Within a given hospital, HIT improves quality for the most complex

clinical cases but has no discernible effect on the average patient. This suggests that adoption policies might best be targeted towards hospitals with a complex case mix and that further research is needed to understand how HIT can best serve the average hospital.

### Conclusion

HIT provides a potential opportunity for increased quality in the U.S. health care system. Further development of an evidence base will help researchers and policymakers better understand the drivers of variation in quality improvements and develop strategies and policies for increased efficacy.

### For More Information

Contact Jeffrey McCullough at [mccu0056@umn.edu](mailto:mccu0056@umn.edu).

### About the Author

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### Endnotes

1. For complete findings see McCullough JS et al. The Effect of Health Information Technology on Quality in U.S. Hospitals. *Health Affairs*. April 2010; 29 (4): pp. 647-654.
2. Additional analyses performed subsequent to this publication suggest that IT is more valuable for complicated clinical cases and the variation in IT value is not driven by unobserved HIT sophistication or meaningful use. Publication of these results is pending.